JNCC (2)

Sand Dune Vegetation Survey of Great Britain

A national inventory

Part 3: Wales

T.C.D. Dargie Ecological Consultant



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Summary

1. Vegetation surveys covering 49 sand dune systems are collated for Wales. Vegetation surveys are based on the National Vegetation Classification (NVC) and survey techniques included the mapping of all vegetation types in each site. The area of each vegetation or other land cover polygon was calculated and results aggregated. Mapping covered 6,406 ha, a dune area excluding large extents of afforested sand. Adding afforested dune area, vegetated dune in Wales totalled 8,101 ha and this probably represents almost all of the vegetated dune resource of Wales.

2. Field survey also recorded geomorphological characteristics of sites and the impact of human activities. This information was used to classify dune systems into types of dune, summarise erosion/accretion data and describe human impacts. Look-up tables are provided to allow rapid selection of individual sites.

3. The general characteristics of Welsh dune vegetation and rare dune species are described.

A full table of NVC communities and sub-communities found in sand dune surveys in Wales is presented, plus tables listing nationally rare and scarce species.

4. Most of the report describes NVC sand dune vegetation, other NVC types recorded on dunes, plus other land cover types marked in mapping. Look-up tables are used to summarise the areas of NVC communities and sub-communities for each site, with data aggregated to give NVC areas for the administrative regions of the Countryside Council for Wales.

5. The nature conservation value of Welsh dunes is discussed in terms of its naturalness, diversity, rarity, fragility, typicalness, ecological/geographical groupings, recorded history, educational value, potential value and intrinsic appeal. Dune size is shown to be an important control of site diversity in vegetation types, naturalness and intrinsic appeal.

site reports and vegetation maps for each of

1. Introduction

1.1 Coastal dunes

Sand dunes are one of a series of terrestrial habitats that in Britain are almost entirely restricted to the coast. The others are saltmarshes, maritime cliffs and grasslands, vegetated shingle and strandlines.

Sand dunes can form along the coast wherever there is a sufficient supply of sand in the intertidal zone to form a beach plain whose surface dries out between tides. The dry sand can then be blown landward and deposited above the high tide mark. In temperate areas such as Britain this blowing sand can be trapped by specialised grasses. These grow up through successive layers of sand to form characteristically steep, vegetated dunes. Such dunes differ markedly in shape from those formed where vegetation is not important as a stabilising force.

Sand dunes support many specialised plant species and plant communities which are confined to this habitat. They also contain a large number of species and communities with a wider distribution. The diversity of plant life reflects the range of soil chemistry, aspect, water regime and other physical conditions found on dune systems in Britain. To an ecologist, dune vegetation illustrates the ecological principles of zonation and succession with great clarity, and dunes are invaluable for ecological teaching and research.

1.2 Coastal ecology research by the Nature Conservancy Council and the Joint Nature Conservation Committee

This survey is one of a series of coordinated botanical surveys of major British coastal habitats. These have been planned and executed up to 1991 by the coastal section of the Nature Conservancy Council (NCC) Chief Scientist's Directorate (CSD) as part of an integrated programme of research and survey (Galvin 1990). The work has been continued since April 1991 by the Joint Nature Conservation Committee (JNCC). The other surveys in this series to date are the Saltmarsh Survey (Burd 1989) and the Vegetated Shingle Survey (Sneddon & Randall 1992).

The overall aims of this research programme are:

- to establish the size, location and quality of the main terrestrial coastal habitats in Great Britain;

- to allow the impact of development proposals to be assessed on sites of national importance, and on the resource as a whole;

- to provide guidance on the management of major coastal habitats;

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

1.3 The Sand Dune Survey of Great Britain

The specific objectives of the sand dune survey are:

- to review existing knowledge of British dune vegetation;

- to compile an inventory of the range and extent of dune vegetation throughout Britain;

- to allow the national and regional importance of each individual site to be assessed;

- to provide vegetation maps and descriptions for each site in sufficient detail to support sitespecific casework and conservation management planning, and to act as a baseline for future monitoring.

The end products from this survey consist of:

- a bibliography of literature relating to British dunes and their vegetation;

- site reports and vegetation maps for each of the sites visited;

- national reports for each of the three countries, summarising the resource of each country;

- a computer database to hold the results of the survey.

1.4 The dune vegetation survey of Wales

This report is the Welsh component of three national reports comprising the Great Britain survey. It is based upon 47 reports relating to 49 sites or groups of sites (Annex 1). The location of site/site groups is shown in Figure 1.1 and site details are listed in Table 1.1. All site surveys use the National Vegetation Classification (NVC – see Chapter 2) and the report set is made up of two NCC Welsh Field Unit surveys conducted in 1986 and 1987, twelve NCC sand dune surveys completed between 1987 and 1988, plus 33 reports based on survey in 1991 with JNCC support.

The total Welsh dune area covered by these surveys is 8,145.63 ha (Table 1.1). This probably represents virtually all of the Welsh vegetated dune resource apart from *c*. 100 ha unsurveyed on Ministry of Defence land between Laugharne Burrows and Pendine Sands, uncertain areas unsurveyed on the edges of dune systems at Merthyr Mawr (Ogwr) and Valley (Ynys Mon), and two small areas of wind-blown sand on cliff sites at Creigau Traeth y Mwnt SSSI (SN 194519) and Creigau Penbryn SSSI (SN 286520). The latter two sites are both in Ceredigion.

The report is structured to present survey methods (Chapter 2), a summary of site physical characteristics (Chapter 3), a detailed account of vegetation types which places each site in the national context (Chapters 4–12), and human impacts (Chapter 14)

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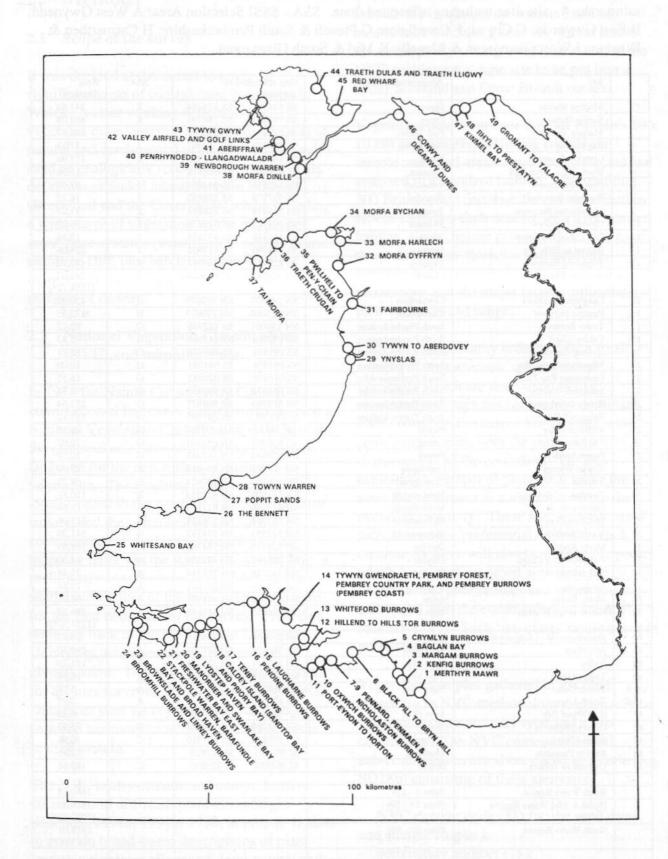


Figure 1.1 Location of dune survey sites in Wales. Site names, district, coordinates and survey area are given in Table 1.1.

Table 1.1 Dune sites surveyed in Wales. Site areas include transitions to saltmarsh but not saltmarsh. * - site area including afforested dune. SSA - SSSI Selection Area: A West Gwynedd; B East Gwynedd; C Clwyd; F Ceredigion; G Preseli & South Pembrokeshire; H Carmarthen & Dinefwr; J West Glamorgan & Llanelli; K Mid & South Glamorgan.

	Site	Administrative District	Grid references of site limits	SSA	Area (hectares)
1	Merthyr Mawr	Ogwr	SS 846787 SS 874784	K	341.88
2	Kenfig Dunes	Ogwr	SS 790834 SS 786796	K	602.08
3	Margam Burrows	Port Talbot	SS 783831 SS 776847	J	101.47
4	Baglan Bay	Port Talbot	SS 724927 SS 734907	J	77.81
5	Crymlyn Burrows	Neath	SS 698922 SS 731936	J	117.96
6	Black Pill to Bryn Mill	Swansea	SS 629907 SS 646918	1	15.96
7	Pennard Burrows	Swansea	SS 542876 SS 544891	J	87.02
8	Penmaen Burrows	Swansea	SS 527878 SS 538882	J	16.75
9	Nicholaston Burrows	Swansea	SS 516878 SS 524878	J	17.27
0	Oxwich Burrows	Swansea	SS 503865 SS 513878	J	76.20
1	Port-Eynon to Horton	Swansea	SS 469849 SS 477857	J	18.86
2	Hillend to Hills Tor	Swansea	SS 429940 SS 413901	J	224.06
3	Whiteford Burrows	Swansea	SS 429940 SS 448967	J	142.92
4	Pembrey Coast	Llanelli	SN 358063 SN 436004	J	591.67
4	remotey coast	Liaiem	311 338003 311 450004		(1558.72*)
5	Laughame Burrows	Carmarthen	SN 240077 SN 333079	Н	430.81
6	Pendine Burrows	Carmarthen	SN 233080 SN 270073	H	172.55
7	Tenby Burrows	South Pembrokeshire	SN 131001 SS 122986	G	92.12
8		South Pembrokeshire	SS 132966 SS 141969	G	2.83
	Caldey Island	NAME OF TAXABLE PARTY OF TAXABLE PARTY OF TAXABLE PARTY.		G	
9	Lydstep Haven	South Pembrokeshire			22.71
0	Manorbier/Swanlake	South Pembrokeshire	SS 063976 SS 044981	G	10.00
1	Freshwater Bay East	South Pembrokeshire	SS 016976 SS 020983	G	16.55
2	Stackpole Warren	South Pembrokeshire	SR 959938 SR 990953	G	178.98
3	Brownslade/Linney	South Pembrokeshire	SR 888987 SR 908977	G	252.54
4	Broomhill Burrows	South Pembrokeshire	SM 893012 SR 887995	G	183.12
5	Whitesand Bay	Preseli	SM 741270 SM 733267	G	28.19
6	The Bennett	Preseli	SN 057407 SN 052401	G	20.02
7	Poppit Sands	Preseli	SN 158484 SN 149487	G	10.59
8	Towyn Warren	Ceredigion	SN 167493 SN 160485	F	29.90
9	Ynyslas	Ceredigion	SN 608946 SN 607921	F	68.22
0	Tywyn to Aberdovey	Meirionnydd	SN 581998 SN 612959	В	110.81
1	Fairbourne	Meirionnydd	SH 617150 SH 611119	В	15.46
2	Morfa Dyffryn	Meirionnydd	SH 553264 SH 576218	В	313.06
3	Morfa Harlech	Meirionnydd	SH 572353 SH 574297	В	341.20
4	Morfa Bychan	Dwyfor	SH 524375 SH 554369	A	168.59
5	Pwllheli/Pen-y-Chain	Dwyfor	SH 383347 SH 432354	A	44.50
6	Traeth Crugan	Dwyfor	SH 341328 SH 389344	A	22.44
7	Tai Morfa	Dwyfor	SH 278268 SH 287260	A	19.84
8	Morfa Dinlle	Arfon	SH 432582 SH 449607	A	66.61
39	Newborough Warren	Ynys Mon	SH 386655 SH 443613		529.32
	ivewbolough wallen	Thys Mon	SH 380633 SH 443013	A	(1257.32*
0	Penhrhynoedd - Llangadwaladr	Ynys Mon	SH 370650 SH 373664		24.92
41	Aberffraw	Ynys Mon		<u>A</u>	the second se
2	Valley	and the second design of the second se		A	248.30
		Ynys Mon	SALESATOR SELENGTED	A	191.70
3	Tywyn Gwyn	Ynys Mon	SH 293818 SH 294811	A	16.64
IAA	Traeth Dulas	Ynys Mon	SH 488885	A	3.72
4B	Traeth Lligwy	Yana Ma	SH 494873	<u>A</u>	2.97
5	Red Wharf Bay	Ynys Mon	SH 561805 SH 573809	A	6.28
16	Conwy/Deganwy	Aberconwy	SH 768789 SH 775807	B	75.23
7	Kinmel Bay	Colwyn	SH 979803 SH 997810	C	10.96
8	Rhyl to Prestatyn	Rhuddlan	SJ 057835 SJ 027825	С	52.85
9	Gronant to Talacre	Delyn	SJ 068839 SJ 125850	С	189.61
_		1000000			
_	South Wales Region	(Sites 1 - 13)			1840.24
	Dyfed & Mid-Wales Region	(Sites 14 - 29)	the second s		2110.80
	Contraction and the second second			and the second second	(3077.85*
	North Wales Region	(Sites 30 - 49)			2455.01
				1	(3183.01*
	Totals	A STREAM PROVIDE A	of dupo souvey saids of b	NO MEDO	6406.05
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2. Methods

2.1 Scope of the survey

It was decided at the outset to cover all significant areas of coastal dune vegetation in Wales. A clear working definition of a vegetated dune system was adopted: all areas of natural and semi-natural vegetation on blown sand of geologically recent marine origin. This definition excluded inland dunes in England (Breckland and the Coversands) whilst including a wide range of vegetation on the margins of some dune systems (transitions to saltmarsh and maritime cliff, plus habitats with only slight maritime influence found towards the inland margins of dunes).

2.2 National Vegetation Classification (NVC) and mapping units

In 1975 the Nature Conservancy Council commissioned Lancaster University to develop a National Vegetation Classification (NVC), with the principal objective of providing a common language for the description of British vegetation. The resulting system appeared ideally suited to the needs of a nationwide dune survey, and the communities and subcommunities of the NVC were adopted as mapping units. At the start of the survey only a preliminary conspectus was available for the sand dune chapter of the NVC. This was used for the first two years of the survey. Field data were fed back to the NVC unit at Lancaster University, who then compiled a revised classification. The new classification was used for all sites surveyed after 1st September 1988. Data from sites surveyed before that date required harmonisation to convert them to the revised system.

The NVC is a systematic and comprehensive classification of British plant assemblages (Rodwell 1991a, 1991b, 1992, in prep.). It aims to provide broad-based descriptions of plant communities from all natural, semi-natural and major artificial habitats throughout Britain. It is intended to be a means of classifying vegetation into types that can be identified in the field and mapped on the ground. It can, in this way, provide the language, the measure and the means with which to assess vegetation across the country. By setting a national standard the NVC enables each dune site to be put into a wider Scotland and Great Britain context.

Vegetation data from over 80% of Britain's 10 x 10 km grid squares, including islands and remote mainland areas, have been collected and analysed in a standard fashion. The resulting 300 British plant communities are described in eleven chapters, each dealing with a recognised habitat. Each chapter provides descriptions of the communities' floristics and structure, together with their habitat, zonations and successions and the major factors influencing their variation and range.

Each NVC community is defined by a small number of characteristic species called 'constants' which are diagnostic of that community, though not necessarily dominant. These communities can be divided into subcommunities, each with the suite of species characteristic of the community but also exhibiting a number of plants that make the assemblage distinct as a variation within the overall community. These species are termed sub-community 'preferentials'. Within each community there will also be a range of species which have been recorded alongside the constants and preferentials and which are associated with the community but are not indicative of it. Such 'associates' rarely occur in great abundance.

Vegetation samples gathered in the field according to NVC methodology can usually be allocated to a community type and a subcommunity. The NVC communities and sub-communities are abbreviated as a code (e.g. SD18b) consisting of three elements:

- NVC chapter code (SD for the sand dune and shingle chapter);

- community number (18);
- sub-community letter (b).

Accompanying the NVC code is the full title of the community and sub-community as stated in the NVC. This is intended to provide an outline of the vegetation assemblage present but the relevant NVC chapter should be consulted for a full description of the community, its distribution and affinities.

The following volumes were all required to classify the vegetation in this national survey of Welsh dunes:

SD	Shingle, strandline and sand dune
	communities
Η	Heaths

- M Mires
- MG Mesotrophic grasslands
- CG Calcicolous grasslands
- S Swamps and tall-herb fens
- A Aquatics
- SM Saltmarsh communities
- MC Maritime cliff communities U Calcifugous grasslands and upland communities
- W Woodlands and scrub

2.3 Locating the sites to survey

Sand dune systems were located principally by identification on a series of 1:50,000 Ordnance Survey maps held by the coastal section of the Chief Scientist Directorate of the NCC. From these maps a list of dune sites was compiled with the site name and the approximate grid reference. This list was then checked with regional staff of the NCC and with a list of dune sites afforded statutory protection supplied from the NCC's COREDATA system. Two sites surveyed by the Welsh Field Unit of NCC (Laugharne Burrows, Tenby Burrows) were included, though both were based on an early version of the NVC sand dune chapter and required harmonisation with the current version. Sites in West Glamorgan and Mid-Glamorgan were surveyed before NCC reorganisation in 1991 as part of the Great Britain survey, with all remaining sites being covered in an intensive exercise in the summer of 1991.

2.4 Review of existing sources of information

Prior to this survey there had been no systematic vegetation survey of the dunes of Wales. There were published and unpublished descriptive works on particular sites, mostly covering dune wetland habitats (slacks, plus swamp and tall-herb fens). A literature review of all British dune studies was produced early in the Great Britain project (Radley & Woolven 1990) and these sources were consulted, together with with additional information from site files held in NCC regional offices. The literature search revealed that only a few dune systems had been described in detail and that the methodologies of these surveys varied enormously. Most surveys of whole sites were also rather old. Experience from monitoring projects and reserve management has also shown that vegetation can change significantly over periods as short as ten years and it was therefore decided to use 1981 as a cut-off date for survey inclusion. In the event there were no sites in Wales, other than Laugharne Burrows and Tenby Burrows, where existing recent surveys existed and which were compatible with NVC. Fresh survey work was therefore required for the bulk of the Welsh vegetated dune resource.

2.5 Field survey

2.5.1 Vegetation recording

After an initial inspection of the site to assess the overall range and pattern of variation, the vegetation was divided by the surveyor into homogeneous stands. Within each stand type, typical sample areas were chosen and the vegetation recorded from inside 2 x 2 metre quadrats.

The NVC manual recommends that a minimum of five quadrats should be recorded from each stand type at each site. The time constraints of a wide ranging national survey did not allow this recommendation to be followed in all sites, but care was taken to ensure that at least one full quadrat was taken from each major stand type at each dune system surveyed. In practice, surveyors rapidly became familiar with NVC vegetation types and there was less need to use the recommended number of quadrats for all vegetation stands.

Within the quadrats all vascular plants, bryophytes and macrolichens were identified and recorded using the Domin cover/abundance scale. In the majority of surveys this information was supplemented with data on aspect, soil pH, slope, bare ground, litter layer, vegetation height and grazing. A brief written description was also made of the quadrats and any other relevant features were noted.

Extensive use was made of target notes. These were used for two distinct purposes:

- to note particular features or to comment on land use;

- to supplement quadrat records particularly in areas subject to local disturbance or modification, in the more localised or restricted plant communities and in vegetation mosaics and transitions which are difficult to describe purely by means of quadrats.

The target notes consisted of a written description of the feature or vegetation type(s), with or without a list of species found. In a few cases approximate Domin scores were given to the species recorded. Target note information is often very valuable to site managers and others concerned with site conservation.

2.5.2 Vegetation mapping

The larger sand dune systems posed special problems for vegetation mapping because of their complex terrain and absence of artificial, mapped features. Many Ordnance Survey maps show only the inland boundary and the high water mark. Under these circumstances vegetation boundaries sketched directly onto an Ordnance Survey base map would have been wildly inaccurate. Conventional topographic surveying techniques could produce very accurate results, but would have been too costly and time-consuming. No very accurate topographic map existed at the time of survey for any Welsh site and an alternative mapping method was required.

An approach using aerial photographs was devised which allowed vegetation boundaries on large dune systems to be drawn in the field quickly, and with reasonable accuracy. The prints were taken into the field and vegetation boundaries drawn upon drafting film overlays using the features and changes in texture on the photographs as landmarks. Experience showed that satisfactory results could be obtained from colour or black and white prints at scales of between 1:10,000 and 1:5,000. An effort was made to obtain the most recent coverage that met these criteria. In no case was photography more than fifteen years old used for mapping.

The boundaries of each apparently uniform stand were sketched on to the aerial photograph, taking advantage of viewpoints such as high dunes and adjacent hills wherever possible. Small areas with a complex mosaic of vegetation types were mapped using the '+' symbol to indicate a mosaic. These mosaics were very common in sand dune systems and mosaics make up c. 25% of the area of some Welsh sites. Areas with transitional vegetation were marked with a '/' symbol. The locations of all quadrats were marked and the stands or features to which target notes referred were clearly labelled. Artificial boundaries and prominent landmarks were drawn in. Fiducial marks (calibration marks on the edge of vertical air photos) were drawn on air photograph overlays to ensure exact re-alignment. All overlays were labelled with the site name, date, recorder and, where applicable, the aerial photograph print number.

2.6 Analysis of survey data

Quadrat data for each site were entered into a microcomputer database using the VESPAN II suite of programs devised by Andrew Malloch of Lancaster University (Malloch 1988). The TABLE program was used to produce quadrat tables, whilst the keys, tables and written descriptions provided in the various chapters of the National Vegetation Classification (NVC) (Rodwell 1991a, 1991b, 1992, in prep.), were used to allocate each quadrat to an NVC group. However, in several cases non-NVC terms were used to describe the vegetation.

For the larger and more complex sites a TWINSPAN (Hill 1979) analysis was performed on these data as an aid to the classification of the quadrats. The end groups resulting from these analysis were compared with the keys, tables and written descriptions provided in the various chapters of the NVC. In most cases these end groups did correspond to an NVC group. Occasionally the TWINSPAN analysis split to a different level and some reinterpretation of the end groups was necessary to place all the quadrats in their correct NVC categories. It should be emphasised that the TWINSPAN analysis was performed primarily as a means of grouping like quadrats together to aid their manual classification, though the relationship between the end groups did sometimes give insights into the classification of intermediate stands.

Towards the end of the project the MATCH program became available (Malloch 1990). This calculates coefficients of similarity between sample data and the vegetation tables used to define each of the NVC types. This program was used to check some of the manual classifications and to help with the conversion of the data from those sites originally classified using the preliminary version of the sand dune NVC chapter.

2.7 Preparation of vegetation maps

Where aerial photographs are used as the base for mapping there is always some distortion of the image due to tilt and relief displacement. Accurate transfer of information to a map base therefore requires the use of specialised optical equipment. High accuracy can be obtained using stereoplotters but these are slow and require trained operators. In practice sufficient accuracy can be obtained using simpler instruments (Grant Enlarger, Bausch and Lomb stereo zoom transferscope, Zeiss Sketchmaster). The latter two machines can compensate for differences in scale and for distortions due to tilting. The Grant Enlarger can compensate only for differences in scale. In both cases the procedure was similar: the images of the field overlay and the print to which it relates were super-imposed on the map base and adjusted to fit it using identifiable fixed points. The vegetation boundaries and other features drawn on the field overlay were then transferred on to the map base. Occasionally the distortions on the aerial photographs could not be entirely compensated for. In these cases the boundaries were transferred a piece at a time using local scaling to match sections of the photograph image to sections of the base map. A final map was then prepared using the results of the vegetation analysis to determine the mapping units.

2.8 Collation of other information

Additional information on the sites was obtained from the files of the regional offices of the Nature Conservancy Council, from field observation and from people with local knowledge. For most sites a standard summary form was completed with a series of fields giving details of the type of dune system, land use, management, use by the public and dynamic state.

In the sections where grazing was recorded, the form provided a series of options. The surveyor could select either moderate, light or heavy grazing and grazing in spring, summer, autumn or winter. If an option was selected then a 'Y' was entered; otherwise it was left blank. A similar system was used to record erosion and vehicle damage with the difference that selected options could be recorded as either localised 'L' or widespread 'W'.

In a few cases such as the fields dealing with fires, forestry and golf courses, the surveyors were asked to estimate the area affected. If the feature did not occur then a zero value was recorded. In these fields a blank meant that the information was not recorded. A distinction was drawn on the form between marine erosion, the term used to describe the removal of dune by the sea, and erosion damage. This second term was used to describe instability within a dune system, normally resulting from human or animal activity, but including the removal of sand by wind.

2.9 Organisation of survey work in Wales

The field survey work was carried out over three field seasons: 1987, 1988 and 1991. In each of these seasons surveyors carried out field surveys between late April and the end of September. External contracts were let for Mid-Glamorgan and West Glamorgan sites in 1987 (P.S. Jones and J.R. Etherington) and 1988 (to P.S. Jones and T.C.D. Dargie). Initial training of contractors was provided by G.P. Radley. Supervision ensured that information was collected in a consistent manner, with one individual (G.P. Radley) remaining in overall control of the Great Britain project for most of its duration. The bulk of 1991 survey was achieved by a team of trained surveyors under the supervision of C. Holder (JNCC), with one site (Brownslade and Linney Burrows) completed by a team from the Field Studies Council.

Quality control was ensured by the following means:

Training in survey methodology

At the start of each field season a field training course was run for the directly employed surveyors. The survey methodology was also demonstrated to the external contractors. Both contractors and directly employed staff were visited in the field at intervals to ensure that their methods remained consistent. Particular attention was paid to the definition of uniform stands and the drawing of boundaries, to the estimation of Domin scores and to the identification of NVC types.

Species identification

Species identification was a major part of the training courses. During the survey samples were taken of any vascular plants that could not

be confidently identified in the field, to allow them to be fully keyed out. In cases where uncertainty remained, specimens were pressed and taken back to base for checking. Only the most unmistakable lichens and bryophytes were identified in the field. In all other cases specimens were collected and identified later in the laboratory or by lower plant specialists.

2.10 Presentation of survey results for individual sites

In order to ensure that the results of the site surveys were available to NCC regional staff as soon as possible after the work was done, the results of each site survey were published separately in either the Contract Surveys or CSD Reports series of NCC, or in JNCC publications. These reports each contain a summary of the methodology, a list of vegetation types, a description of the site, a vegetation map and the field data. Area data for each NVC vegetation type were included for West Glamorgan sites. A full list of these reports is given in Annex 1.

2.11 Area calculation

Before the national inventory of dune vegetation could be compiled it was necessary to measure the area occupied at each site by each of the vegetation types. Funds were made available to digitise maps from 1991 Welsh surveys and the 1985 survey of Tenby Burrows, allowing the calculation of area for each map polygon from vector coordinate data. Area values from digitised polygon data could not be assembled easily into areas for a particular vegetation type, largely due to a very large number of mosaic and transitional types. Polygon areas were therefore imported into a spreadsheet and sorted into vegetation/mosaic/transition types. The total area of each mosaic type was then divided by the number of mosaic elements (ranging from two to seven components) and this value was then added to each mosaic element. This approach assumes that a mosaic is made up of components of equal area.

Alternative approaches were used for measuring areas from the remaining surveys. Mid-Glamorgan sites and Laugharne Burrows (Carmarthen) were sampled by intense line intercept grids (lines spaced at 100 metre intervals parallel with national grid lines) and the percentage cover of large vegetation types estimated as a proportion of total line length (Nature Conservancy Council 1990a). These values were then converted to hectares by estimating total map area using a Romer dot grid. The line intercept approach should produce area estimates within 5% of the precise value for large vegetation types (Canfield 1941). Very small vegetation types were measured individually using a Romer dot grid. West Glamorgan sites had areas that were calculated by weighing vegetation types cut from a copy of the vegetation map.

2.12 Summary tables and maps for the national report

As a final step all vegetation areas per site were assembled into a set of spreadsheets to generate tables for use in this national report for Wales. These tables were also used to prepare maps at the national scale for Wales for NVC communities. Sites of low, moderate and high area are identified at NVC community level, varying the limits for low/moderate/high extent according to the number of sites involved and the area, in hectares, of the vegetation type. The usual map used in this report therefore includes sites without the NVC type, sites with the type present in only small quantity, sites with a moderate area, and sites with large extents. The combination of detailed tabular data for communities and sub-communities, together with a four-class summary map, allows a rapid appraisal of sites in the national context for Wales.

3. Physical nature of the dune resource

3.1 Dune system classification

During the field survey the geomorphological structure of each dune system was recorded using the classification system of Ranwell & Boar (1986). This recognises five main types of coastal dune system: offshore island; prograding dune, ness or cuspate foreland; spit; bay; and hindshore. In addition, an extreme form of hindshore dune, hindshore machair, was recognised due to its importance on the western and northern coasts of Scotland, plus two other features of geomorphological interest: the presence of climbing dunes and tombolos. The dune types encountered are recorded on a site basis in Table 3.1. Many sites are composite systems, made up of more than one dune type, though the majority of these have one form predominant. Bay dunes, spits and climbing dunes are the most frequent types.

Classic offshore island dunes tend to develop as linear features in the direction of longshore drift, based on sand or shingle. These are not found in Wales and are largely restricted to eastern England.

Prograding dunes, nesses and cuspate forelands build out (prograde) from the coast due to abundant sand supply from longshore drift in two directions to form a foreland, most notably at Morfa Harlech and at the mouth of the Afon Nedd (Crymlyn Burrows and Baglan Burrows). These are rare in Wales and, apart from Morfa Harlech, are comparatively small dune systems. The dunes between Tywyn and Aberdovey might have originated as a prograding system but they are currently eroding for most of their length, possibly as a result of coastal defences further north. The erosion has obscured dune origin and separation between a possible former spit and prograding dune is not possible.

Spit dunes are common in Wales and are well developed at the mouths of several estuaries. The largest spit system, by far, is that at Morfa Dyffryn (313 ha). Some are comparatively simple structures formed over shingle deposited by storm waves, as at Morfa Dyffryn and Tywyn Gwendraeth at the north end of the Pembrey dunes. The most dynamic processes operate at the distal end and the apex of spit systems show several small recurved spits. Other spit dunes are more complex and imbricate spits are present at Pendine (where a younger spit with its base at Pendine is laid up against an older structure forming the adjacent Laugharne Burrows) and between Gronant and Talacre. The status of Whiteford Burrows is uncertain. It is frequently cited as a classical spit at the entrance to the Burry Inlet but it might instead be a tombolo formed upon shingle deposited between the hard rock shore and a boulder clay island now forming the north (distal) end of the dune system (Baye 1981). Elsewhere spits are very small, again developing at the mouths of streams or small rivers flowing through dunes.

Bay dunes are also common in Wales and are developed upon sand trapped within the shelter of rock headlands, forming a half-moon shape in the beach and outer dune zones. These are very frequent on irregular, rocky coasts with an offshore sand supply (e.g. the bay dune between Port-Eynon and Horton on the south coast of the Gower Peninsula). Relatively small bays on Ynys Mon (Anglesey), the Lleyn Peninsula, Pembrokeshire and the Gower coast account for all Welsh examples.

Hindshore systems usually develop initially as bay types but abundant sand supply and onshore prevailing winds drive the sand inland for considerable distances as a series of dune ridges or mobile parabolic dunes, often leaving depressions to windward which develop into slacks. These form the largest and most complex dune systems in Wales, with successive periods of stabilisation and then erosion creating a very varied topography. In some cases mobile sand has been carried over considerable distances inland or deposited as a mantle on adjacent cliff slopes and cliff tops, forming climbing dunes. The largest system is found at Pembrey (1,559 ha), though other hindshore dunes are also very large in a Welsh and British

context, e.g. Newborough Warren (1,257 ha), the Kenfig Dunes (602 ha) and Aberffraw (248 ha). A small hindshore dune system might have been present between Black Pill and Bryn Mill in Swansea but development for housing, education, recreation and a transport corridor has largely destroyed the site, leaving an outer fragmentary line which operates as a bay dune.

Climbing dunes represent sand areas blown up on to terrain inland of a main dune system (e.g. the inner sectors at Merthyr Mawr Warren) or via bay dunes which act as feeder routes for the sand (e.g. the bay dunes of Barafundle Bay and Broad Haven as the most likely sources of sand for Stackpole Warren). Very little sand is being input to climbing dune systems at present and they represent a dune feature created by periods of dune instability during very stormy climatic periods in the past. The extensive climbing dunes of South Wales are known to have inundated settlements in the 14th and 15th centuries, suggesting that these dune types are comparatively recent. Sand was probably derived from the remobilisation of existing stable dunes in the vicinity of settlements.

3.2 Retreat and progradation at the beach/dune interface

The accurate measurement of marine erosion and of dune progradation is complex and requires repeated visits to monitor changes. In its most sophisticated form it involves construction of a beach sediment budget and such work is not available for Welsh dunes. However, an attempt was made during this survey to obtain a rough idea of the processes at work at the time the sites were visited. The surveyors were asked to record signs of current marine erosion or progradation and to estimate the percentage of the active shoreline that was affected.

The main feature used to indicate marine erosion was a steep cliff at the front of the dunes, combined with an absence of embryo dunes. Additional confirmation was sought from signs such as the exposure of marram *Ammophila arenaria* roots in the cliff face or the presence on it of slumped sections of previously stable dune turf.

Signs used to indicate progradation included series of parallel dune ridges supporting vegetation that became progressively younger towards the sea and the presence at the top of the beach of well developed embryo dune vegetation, often dominated by sand couchgrass *Elymus farctus*.

Aerial photographs used for vegetation mapping, compared with older photography, could sometimes be used to check these interpretations by looking for changes in the position of the shoreline relative to the fixed structures between the date of the photographs and that of the survey.

The results of this survey have been summarised by recording the proportion of beach eroding and prograding, dividing the survey sites into four categories (Table 3.2):

- Sites with net marine erosion: those where the percentage of the shoreline recorded as actively eroding was >10% greater than the percentage recorded as prograding;

- Sites with net progradation: those where the percentage of the shoreline recorded as prograding was >10% greater than that recorded as eroding;

 Sites in approximate equilibrium: those where the percentage of the shoreline in the two categories defined above differed by 10% or less;

- Sites of uncertain status: survey data not available (an estimate made based on map patterns).

A majority of sites (27) show net erosion, six suggest approximate equilibrium, and sixteen show progradation. Two sites lack data and are of uncertain status. This summary of erosion and accretion is based on very crude data and considerably simplifies the complexities occuring within individual sites. Despite such **Table 3.1** Distribution of dune types in Welsh dune systems. FP? = formerly present? P = present.T = trace (small feature). ? = possibly present.

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tackpole Warren			P		P	
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Aorfa Harlech	Р	Р				
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complexities (which can involve seasonal and short- to long-term cycles in erosion/ progradation balance), the overall conclusion is that there are considerably more sites that are retreating than are advancing. This is consistent with the findings from dune systems surveyed in England and Scotland. **Table 3.2** Erosion and progradation condition of Welsh dune systems. Percentage data refer only to sand beach length at interface zone with vegetated dunes, not to complete site coastline. ? - no erosion/progradation survey, other survey data inadequate for estimate.

	Site	Percentage beach length eroding	Percentage beach length prograding	Site condition
1	Merthyr Mawr	70	30	Net erosion
2	Kenfig Dunes	40	60	Net progradation
3	Margam Burrows	80	20	Net erosion
4	Baglan Burrows	5	95	Net progradation
5	Crymlyn Burrows	5	95	Net progradation
6	Black Pill to Bryn Mill	90	10	Net erosion
7	Pennard Burrows	50	50	Approximate equilibrium
8	Penmaen Burrows	50	50	Approximate equilibrium
9	Nicholaston Burrows	10	90	Net progradation
10	Oxwich Burrows	90	10	Net erosion
11	Port-Eynon to Horton	95	5	Net erosion
12	Hillend to Hills Tor	100	0	Net erosion
13	Whiteford Burrows	40	60	Net progradation
14	Pembrey Coast	80	20	Net erosion
15	Laughame Burrows	?	?	?
16	Pendine Burrows	70	30	Net erosion
17	Tenby Burrows	?	?	?
18	Caldey Island	100	0	Net erosion
19	Lydstep Haven	100	0	Net erosion
20	Manorbier/Swanlake	80	20	Net erosion
21	Freshwater Bay East	25	75	Net progradation
22	Stackpole Warren	40	60	Net progradation
23	Brownslade/Linney	95	5	Net erosion
24	Broomhill Burrows	100	0	Net erosion
25	Whitesand Bay	100	0	Net erosion
26	The Bennett	60	40	Net erosion
27	Poppit Sands	40	60	Net progradation
28	Towyn Warren	90	10	Net erosion
29	Ynyslas	20	80	Net progradation
30	Tywyn to Aberdovey	90	10	Net erosion
31	Fairbourne	50	50	Approximate equilibrium
32	Morfa Dyffryn	100	0	Net erosion
33	Morfa Harlech	0	100	Net progradation
34	Morfa Bychan	95	5	Net erosion
35	Pwllheli/Pen-y-Chain	30	40	Uncertain - prograding?
36	Traeth Crugan	70	30	Net erosion
37	Tai Morfa	95	5	Net erosion
38	Morfa Dinlle	95	5	Net erosion
39	Newborough Warren	20	80	Net progradation
40	Penhrhynoedd - Llangadwaladr	0	100	Net progradation
41	Aberffraw	10	90	Net progradation
42	Valley	60	40	Net erosion
43	Tywyn Gwyn	40	60	Net progradation
44A	Traeth Dulas	50	50	Approximate equilibrium
44B	Traeth Lligwy	50	50	Approximate equilibrium
45	Red Wharf Bay	40	60	Net progradation
46	Conwy(C)/Deganwy(D)	C - 50 D - 100	C - 50 D - 0	C - Approximate equilibrium D - Net erosion
47	Kinmel Bay	60	40	Net erosion
48	Rhyl to Prestatyn	100	0	Net erosion
49	Gronant to Talacre	70	30	Net erosion

4. General characteristics of Welsh dune vegetation and rare dune species

4.1 Introduction

The vegetation of sand dunes is shaped by a combination of physical, chemical, biotic and human factors. Within even a small dune system there can be marked gradients of instability, soil pH, moisture content, grazing pressure and trampling. This wide range of conditions is reflected in the diversity of dune vegetation.

In north-west Europe coastal sand dunes are created and maintained by vegetation. The crucial factor in the initiation of dune formation is the ability of certain plant species to grow in, and stablise, wind-blown sand by growing up through it. In Wales there are three main species, all grasses, which do this: sand couchgrass (Elymus farctus), sea lyme-grass (Leymus arenarius) and, most important, marram grass (Ammophila arenaria). Sand couch-grass has only a modest ability to withstand burial, but its comparative tolerance of salt water (Gimingham 1964) means that it often initiates dune formation in the form of an embryo dune close to the strand line. Sea lyme-grass is a bigger plant, with a greater ability to grow up through fresh sand. It is a predominantly northern species but even in surveyed Scottish dunes it is perhaps less important than might be expected. In Wales it is largely restricted to northern dunes and it is not an important dune former (see section 6.2) – marram thus remains the main dune-building species. It can keep pace with up to 1 metre of fresh sand deposition per annum, as well as producing far-spreading horizontal rhizomes (Gemmell, Greig-Smith & Gimingham 1953; Ranwell 1972). By binding the dune together, and by maintaining the aerodynamic roughness of the surface, marram allows dunes to build up to a considerable height.

Actively growing dunes provide an extremely hostile environment for most plants. Not only is

there constant burial by fresh sand, but the loose sand is also very free-draining and therefore subject to severe drought. Dunes are also poor in nitrogen and phosphorus. Consequently the vegetation is normally composed of only a few, highly specialised species. However, as the rate of sand deposition declines, conditions start to ameliorate. Smaller grasses, annual and perennial herbs start to appear in greater number and these are then joined by sandbinding mosses capable of growing up through a few millimetres of accumulating sand (e.g. Ceratodon purpureus and Tortula ruralis ssp. ruraliformis) (Birse, Landsberg & Gimingham 1957), followed by various pleurocarpous mosses which are intolerant of sand deposition, and then by lichens. Simultaneously the vigour of the marram declines as the rate of burial decreases (Willis et al. 1959; Hope-Simpson & Jefferies 1966).

The subsequent course of the succession depends on several factors. In Britain as a whole most dunes have been grazed until relatively recently. Under the influence of grazing some form of dune grassland is likely to develop. The nature and species-richness of this grassland is greatly influenced by the type of sand on which it has developed. Where the sand contains a substantial proportion of calcium, generally in excess of 3% weight, dune grassland can be maintained for long periods. Where the initial calcium content is lower, leaching will, in time, reduce the pH (Wilson 1960) and under these circumstances dune heath can develop.

Very different vegetation develops where the sand is within reach of the freshwater table. This can happen either because the deflation floor of a blowout is close to the water table, or where the water table rises up towards an existing surface as the dune system extends. Under both these conditions dune slacks can develop, often characterised by a marked annual fluctuation in water level. In prograding dune systems the hollows between low dune ridges also develop into slacks, passing through saltmarsh and swamp phases in the process. Water levels in slacks normally reach a peak in early spring, when many are flooded for periods of several months. They then fall sharply through the summer, reaching up to 2 metres below ground level before starting to rise again in autumn (Ranwell 1959). The vegetation of these areas has had to adapt to these unusual conditions and is largely unique to sand dunes. Not all wet areas on dunes can be described as slacks. Some systems also contain areas of more consistently wet ground, especially where the sand overlies an impermeable substrate. The vegetation of these areas is likely to consist of mire, fen or swamp vegetation, with strong similarities to vegetation of equivalent habitats inland.

Under continued grazing the vegetation of the older parts of dune systems will continue to develop and on some sites it can be seen to grade into grassland and heath communities that are very similar to inland types. This resemblance can be increased further by agricultural or recreational management, promoting the growth of productive or wear-resistant grasses.

If grazing is relaxed then the succession enters a new phase. Existing dune grassland swards can change their composition and appearance, becoming rank and less species-rich. Simultaneously woody species start to invade and scrub starts to develop. In time this scrub will develop into woodland. One scrub species, sea buckthorn Hippophae rhamnoides, is especially associated with British sand dunes, though it is not widely distributed on Welsh systems and is probably native only in the southeast of England. Where present sea buckthorn can invade almost as rapidly as marram grass, even in foredune vegetation a few metres from the tideline. There may never be, under these circumstances, a dune grassland stage. A wide range of other shrub and tree species can also grow on dunes, at least in the more stable areas. Semi-natural scrub and dune woodland is virtually absent in Scotland but it is found in dunes of the Dutch coast and appears to be developing in older stands of scrub at some English and Welsh sites.

In practice vegetation very seldom entirely follows the orderly succession outlined above. Areas of dune frequently become destabilised and then gradually revegetate by secondary succession. Sometimes the original sequence is repeated, at other times a distinctly different succession occurs. Sand sedge *Carex arenaria* and colonising mosses, especially *Tortula ruralis* ssp. *ruraliformis*, play key roles in such secondary successions.

4.2 Dune vegetation in the National Vegetation Classification

Table 4.1 lists the communities and subcommunities covered by the sand dune chapter, plus those communites from other chapters that are most frequently encountered on dunes. Information is included on the distribution of dune communities and sub-communities found in Wales, England and Scotland, plus other nondune NVC types which occur on Welsh dunes. Ninety NVC communities are found on Welsh dunes, with the list of all communities and subcommunities recorded extending to 156 types. The dune chapter encompasses shingle and strandline, mobile dunes, semi-fixed dunes, dune grasslands, slacks and dune scrub - a sequence which closely approximates a simple dune succession. The mobile dunes are divided into three communities SD4, SD5 and SD6, according to which of the major sand-binding grasses is dominant. The marram-dominated community (SD6) is further subdivided into a series of sub-communities that represent different degrees of mobility. None of the mobile dune types possess more than a fragmentary bryophyte layer. Most of the semifixed dune types are grouped together in one community, SD7. Here the sub-communities show geographical differences in distribution and differing degrees of fixation.

Dune grasslands are divided into two communities and these reflect the major division between the grasslands of calcareous sands (SD8) and those of acidic sands (SD12). The sub-communities here reflect variations in base status and soil moisture, along with regional differences. A third community, SD9, is found mainly on neutral to calcareous sand but contains the taller and possibly somewhat eutrophic grasslands in which false oat-grass *Arrhenatherum elatius* is dominant.

Slacks are represented by five communities: SD13, SD14, SD15, SD16 and SD17. Each of these is in turn divided into sub-communities. All of these types represent different combinations of physical factors such as soil pH, water regime and successional change. The SD13 and SD14 communities represent the earlier stages of successional development.

The only scrub community included within the dune chapter (SD18) is that dominated by sea buckthorn *Hippophae rhamnoides*. This is divided into two sub-communities according to the stage in the succession that has been reached.

Vegetation in which sand sedge *Carex arenaria* is dominant is recognised as a distinct community, SD10. It is also a component of a rather specialised 'grey dune' SD11 community in which lichens dominate the sward.

Outside the sand dune chapter, only the heathlands section includes a community (H11) that is more or less confined to dunes. This is again characterised by sand sedge, together with ling Calluna vulgaris, and it is divided into a series of sub-communities. Several other heath communities can also occur within dune systems. Wet heaths, which are found in dune slacks at several acidic sites, are to be found in the mires chapter. There are examples of a number of different calcicolous, mesotrophic and acidic grassland communities. Some of these fit well with the existing sub-communities, others appear to represent slight variations not fully described in the NVC. Bracken-dominated vegetation is found not infrequently on sand dunes. Most Welsh samples can be referred to the woodland and scrub chapter (W25).

The scrub on dry dunes, apart from that dominated by sea buckthorn, can mostly be referred to the scrubs section of the woodlands chapter (W21 to W24). That which develops in dune slacks is normally dominated by species of willow *Salix* spp., birch *Betula* spp. and alder *Alnus glutinosa* can be found in communities W1 to W4, plus W6.

The more permanently damp areas on dunes mostly fall either into the mires (on base-poor sites) or into the swamp and tall-herb fen chapters. Permanent open water is less common. It does occur (e.g. Kenfig Pool, Laugharne Burrows, Brownslade/Linney Burrows), but was not tackled in any detail during this survey.

Transitions to other coastal habitats are commonly encountered. Saltmarshes frequently abut dunes, especially in association with prograding types or sectors. There are some communities (SM16, SM18, SM24, SM28) that are particularly characteristic of the transition zone. Where sand has been blown up over nearby cliffs there can also be transitions to maritime cliff grassland communities.

A full vegetation description is not given here for standard NVC communities and subcommunities and readers are referred to NVC chapters for such detail if it is required. This report concentrates more on extent and distribution patterns within surveyed Welsh dunes.

4.3 Nationally rare and scarce plants on Welsh dunes

Nationally rare plants are defined as those occurring in 1–15 of the 10 x 10 km squares of the National Grid. Nationally scarce plants are those found in 16–100 of the 10 x 10 km squares. Throughout Great Britain saltmarshes, shingle, maritime grasslands, cliffs, open areas, dunes and dune slacks taken together support 48 nationally rare and 66 nationally scarce species of higher plant. These represent about 8% of the total British higher plant flora. Nationally rare bryophytes (e.g. *Petalophyllum ralfsii*) and lichens (e.g. *Fulgensia fulgens*) also occur on dunes in Wales but these are not treated in any detail in this account which is restricted to higher plants. The majority of the nationally rare species characteristic of dunes are found in southwestern, southern or western Britain, whilst most of the nationally scarce species have a predominantly southern, south-eastern or scattered distribution. This is because most of these plants belong to the Continental and the Mediterranean elements of the British flora and are reaching the northern and western limits of their range. The dunes of England and Wales therefore support a disproportionate number of nationally rare and scarce plants. Scotland, as a result, has relatively few of these rare and scarce British species.

It is also important to note that many nationally rare and scarce plants found on the coast are not confined to coastal habitat, since some are plants of unstable, ever-changing conditions and others require a strong maritime influence (Table 4.2). Dunes in Wales are locations for purple broomrape Orobanche purpurea (a recent discovery, its only current Welsh record), fen orchid Liparis loeselii (slacks in South Wales dunes) and early sand-grass Mibora minima (dunes in North Wales), all of which are nationally rare species. Five nationally rare and thirteen nationally scarce plants are wholly or mainly confined to dunes and dune slacks (Table 4.3). Two nationally rare dune plants are found in Wales, with dune gentian Gentianella uliginosa confined, in Britain, to dunes in South Wales. Dune helleborine Epipactis dunensis is found on dunes in North Wales and northern England. Eight nationally scarce dune species are found in Wales: variegated horsetail Equisetum variegatum, sea stork's-bill Erodium maritimum, sea buckthorn Hippophae rhamnoides (introduced, not native), fragrant evening primrose Oenothera stricta, Portland spurge Euphorbia portlandica, sea spurge Euphorbia paralias, seaside centaury Centaurium littorale and dune fescue Vulpia membranacea. One further nationally scarce species, grey hair-grass Corynephorus canescens, was present in South Wales before 1930 but has since not been recorded and might have been lost as a result of industrial development on the dunes around Swansea Bay.

1.1.1

Strandline

SD1a	*	Rumex crispus-Glaucium flavum shingle community,
		Typical sub-community.
SD2	*	Honkenya peploides-Cakile maritima strandline community.

SD3 * Matricaria maritima-Galium aparine strandline community.

Mobile dunes

SD4	*	Elymus farctus ssp. boreali-atlanticus foredune community.
SD5a	*	Leymus arenarius mobile dune, species-poor sub-community.
SD5b	*	Leymus arenarius mobile dune,
		Elymus farctus sub-community.
SD5c	*	Leymus arenarius mobile dune,
		Festuca rubra sub-community.
SD6a	*	Ammophila arenaria mobile dune,
		Elymus farctus sub-community.
SD6b	*	Ammophila arenaria mobile dune,
		Elymus farctus-Leymus arenarius sub-community.
SD6c	*	Ammophila arenaria mobile dune,
		Leymus arenarius sub-community.
SD6d	*	Ammophila arenaria mobile dune,
		Typical sub-community.
SD6e	*	Ammophila arenaria mobile dune,
		Festuca rubra sub-community.
SD6f	*	Ammophila arenaria mobile dune,
		Poa pratensis sub-community.
SD6g	*	Ammophila arenaria mobile dune,
		Carex arenaria sub-community.

Semi-fixed dunes

SD7a	*	Ammophila arenaria-Festuca rubra semi-fixed dune,
		Typical sub-community.
SD7b	*	Ammophila arenaria-Festuca rubra semi-fixed dune,
		Hypnum cupressiforme sub-community.
SD7c	*	Ammophila arenaria-Festuca rubra semi-fixed dune,
		Ononis repens sub-community.
SD7d	*	Ammophila arenaria-Festuca rubra semi-fixed dune,
		Tortula ruralis ssp. ruraliformis sub-community.
SD7e	*	Ammophila arenaria-Festuca rubra semi-fixed dune,
•		Elymus pycnanthus sub-community.
SD7?f	**	Ammophila arenaria-Festuca rubra semi-fixed dune,
		provisional Galium verum sub-community.
SD7?g	**	Ammophila arenaria-Festuca rubra semi-fixed dune,
		provisional Heracleum sphondylium sub-community.

Dune grasslands

SD8a	*	<i>Festuca rubra-Galium verum</i> fixed dune grassland, Typical sub-community.
SD8b	*	<i>Festuca rubra-Galium verum</i> fixed dune grassland, <i>Luzula campestris</i> sub-community.
SD8c	*	Festuca rubra-Galium verum fixed dune grassland, Tortula ruralis ssp. ruraliformis sub-community.
SD8d	*	Festuca rubra-Galium verum fixed dune grassland, Bellis perennis-Ranunculus acris sub-community.
SD8e	*	Festuca rubra-Galium verum fixed dune grassland, Prunella vulgaris sub-community.
SD9a	*	Ammophila arenaria-Arrhenatherum elatius dune grassland, Typical sub-community.
SD9b	*	Ammophila arenaria-Arrhenatherum elatius dune grassland, Geranium sanguineum sub-community.
SD12a	*	Carex arenaria-Festuca ovina-Agrostis capillaris grassland, Anthoxanthum odoratum sub-community.
SD12b	*	Carex arenaria-Festuca ovina-Agrostis capillaris dune grassland, Holcus langus sub-community

Neutral grassland

MG1a *	Arrhenatherum elatius coarse grassland,
	Festuca rubra sub-community.
MG1b*	Arrhenatherum elatius coarse grassland,
	Urtica dioica sub-community.
MG1d*	Arrhenatherum elatius coarse grassland,
	Pastinaca sativa sub-community.
MG1e *	Arrhenatherum elatius coarse grassland,
	Centaurea nigra sub-community.
MG2 *	Filipendula ulmaria-Arrhenatherum elatius tall-herb grassland.
MG5a *	Cynosurus cristatus-Centaurea nigra meadow,
	Lathyrus pratensis sub-community.
MG5b*	Cynosurus cristatus-Centaurea nigra meadow,
	Galium verum sub-community.
MG6a *	Lolium perenne-Cynosurus cristatus pasture,
	Typical sub-community.
MG6b*	Lolium perenne-Cynosurus cristatus pasture,
	Anthoxanthum odoratum sub-community.
MG7a *	Lolium perenne leys,
	Lolium perenne-Trifolium repens leys.
MG7e *	Lolium perenne leys,
	Plantago lanceolata sub-community.
MG9a *	Holcus lanatus-Deschampsia cespitosa coarse grassland,
	Arrhenatherum elatius sub-community.

Neutral grassland (continued)

MG10a*	Holcus lanatus-Juncus effusus rush pasture,
	Typical sub-community.
MG10b*	Holcus lanatus-Juncus effusus rush pasture,
	Juncus inflexus sub-community.
MG10c*	Holcus lanatus-Juncus effusus rush pasture,
	Iris pseudacorus sub-community.
MG11a*	Festuca rubra-Agrostis stolonifera-Potentilla anserina inundation grassland,
	Lolium perenne sub-community.
MG12a*	Festuca arundinacea coarse grassland,
	Lolium perenne-Holcus lanatus sub-community.
MG12b*	Festuca arundinacea coarse grassland,
	Oenanthe lachenalii sub-community.

Calcicolous grassland

CG6a	*	Avenula	pubescens	grassland.

CG7b *	Festuca ovina-Hieracium pilosella-Thymus praecox grassland,
	Cladonia spp. sub-community.

CG7c * Festuca ovina-Hieracium pilosella-Thymus praecox grassland, Fragaria vesca-Rumex acetosa sub-community.

Acidic grassland

U1c	*	Festuca ovina-Agrostis capillaris-Rumex acetosella grassland,
		Erodium cicutarium-Teesdalia nudicaulis sub-community.
U4a	*	Festuca ovina-Agrostis capillaris-Galium saxatile grassland,
		Typical sub-community.
U4b	*	Festuca ovina-Agrostis capillaris-Galium saxatile grassland,
		Holcus lanatus-Trifolium repens sub-community.
U5	*	Nardus stricta-Galium saxatile grassland, undifferentiated.
U6	*	Juncus squarrosus-Festuca ovina grassland, undifferentiated.
U20	*	Pteridium aquilinum-Galium saxatile community, undifferentiated.

Sand sedge and 'grey' dunes

Carex arenaria dune,

SD10a *

		Festuca rubra sub-community.
SD10t)*	Carex arenaria dune,
		Festuca ovina sub-community.
SD11	*	Carex arenaria-Cornicularia aculeata community, undifferentiated.
Heath	1	
H1	*	Calluna vulgaris-Festuca ovina heath, undifferentiated.
H7e	*	Calluna vulgaris-Scilla verna heath,
		Calluna vulgaris sub-community.
H8	*	Calluna vulgaris-Ulex gallii heath, undifferentiated.
H10a	*	Calluna vulgaris-Erica cinerea heath,
		Typical sub-community.

Heath (continued)

H11a	*	Calluna vulgaris-Carex arenaria dune heath,
		Erica cinerea sub-community.
H11c	*	Calluna vulgaris-Carex arenaria dune heath,
		Hypnum cupressiforme sub-community.

Wet heaths and mires

M5	*	Carex rostrata-Sphagnum squarrosum mire.
M10c	*	Carex dioica-Pinguicula vulgaris mire,
		Gymnostomum recurvirostrum sub-community.
M11	*	Carex demissa-Saxifraga aizoides mire, undifferentiated.
M23	*	Juncus effusus/acutiflorus-Galium palustre rush pasture, undifferentiated.
M25b	*	Molinia caerulea-Potentilla erecta mire, Anthoxanthum odoratum sub-community.
M27b	*	Filipendula ulmaria-Angelica sylvestris mire, Urtica dioica-Vicia cracca sub-community.
M28a	*	Iris pseudacorus-Filipendula ulmaria mire, Juncus spp. sub-community.
M28b	*	Iris pseudacorus-Filipendula ulmaria mire, Urtica dioica-Galium aparine sub-community.

Dune slacks

SD13b*	Salix repens-Bryum pseudotriquetrum dune slack,
	Holcus lanatus-Festuca rubra sub-community.
SD14a *	Salix repens-Campylium stellatum dune slack,
	Carex serotina-Drepanocladus sendtneri sub-community.
SD14b*	Salix repens-Campylium stellatum dune slack,
	Rubus caesius-Galium palustre sub-community.
SD14c*	Salix repens-Campylium stellatum dune slack,
	Bryum pseudotriquetrum-Aneura pinguis sub-community.
SD14d*	Salix repens-Campylium stellatum dune slack,
	Festuca rubra sub-community.
SD15a*	Salix repens-Calliergon cuspidatum dune slack,
	Carex nigra sub-community.
SD15b*	Salix repens-Calliergon cuspidatum dune slack,
	Equisetum variegatum sub-community.
SD15c *	Salix repens-Calliergon cuspidatum dune slack,
	Carex flacca-Pulicaria dysenterica sub-community.
SD15d*	Salix repens-Calliergon cuspidatum dune slack,
	Holcus lanatus-Angelica sylvestris sub-community.
SD16a *	Salix repens-Holcus lanatus dune slack,
	Ononis repens sub-community.
SD16b*	Salix repens-Holcus lanatus dune slack,
	Rubus caesius sub-community.
SD16c *	Salix repens-Holcus lanatus dune slack,
	Prunella vulgaris-Equisetum variegatum sub-community.

Dune slacks (continued)

SD16d *	Salix repens-Holcus lanatus dune slack,
	Agrostis stolonifera sub-community.
SD17a*	Potentilla anserina-Carex nigra dune slack,
	Festuca rubra-Ranunculus repens sub-community.
SD17b*	Potentilla anserina-Carex nigra dune slack,
	Carex flacca sub-community.
SD17c *	Potentilla anserina-Carex nigra dune slack,
	Caltha palustris sub-community.
SD17d*	Potentilla anserina-Carex nigra dune slack,
	Hydrocotyle vulgaris-Ranunculus flammula sub-community.

Swamps and tall-herb fens

S4a	*	Phragmites australis swamp,
		Phragmites australis sub-community.
S4d	*	Phragmites australis swamp,
		Atriplex hastata sub-community.
S5	*	Glyceria maxima swamp.
S6	*	Carex riparia swamp.
S7	*	Carex acutiformis swamp.
S8a	*	Scirpus lacustris ssp. lacustris swamp,
		S. lacustris ssp. lacustris sub-community.
S10	*	Equisetum fluviatile swamp, undifferentiated.
S12b	*	Typha latifolia swamp,
		Mentha aquatica sub-community.
S14	*	Sparganium erectum swamp, undifferentiated.
S18a	*	<i>Carex otrubae</i> swamp,
		Carex otrubae sub-community.
S19a	*	Eleocharis palustris swamp,
		Eleocharis palustris sub-community.
S19c	*	Eleocharis palustris swamp,
		Agrostis stolonifera sub-community.
S20a	*	Scirpus lacustris ssp. tabernaemontani swamp,
		Scirpus maritimus sub-community.
S20b	*	Scirpus lacustris ssp. tabernaemontani swamp,
		Agrostis stolonifera sub-community.
S21a	*	Scirpus maritimus swamp,
		Scirpus maritimus sub-community.
S21c	*	Scirpus maritimus swamp,
Ments		Potentilla anserina sub-community.
S25	*	Phragmites australis-Eupatorium cannabinum tall-herb fen.
S26d	*	Phragmites australis-Urtica dioica tall-herb fen,
		Epilobium hirsutum sub-community.
S28c	*	Phalaris arundinacea tall-herb fen,
		Elymus repens-Holcus lanatus sub-community

Scrub	and	woodland	
SD18a	*	Hippophae rhamnoides scrub,	
		Festuca rubra sub-community.	
SD18b	*	Hippophae rhamnoides scrub,	
		Urtica dioica-Arrhenatherum elatius sub-community.	
W1	*	Salix cinerea-Galium palustre woodland, undifferentiated.	
W2	*	Salix cinerea-Betula pubescens-Phragmites australis woodland, undiffere	ntiated.
W4	*	Betula pubescens-Molinia caerulea woodland, undifferentiated.	
W6	*	Alnus glutinosa-Urtica dioica woodland, undifferentiated.	
W8	*	Fraxinus excelsior-Acer campestre-Mercurialis perennis woodland, undif	ferentiated.
W10c	*	Quercus robur-Pteridium aquilinum-Rubus fruticosus agg. woodland,	
		Hedera helix sub-community.	
W21a	*	Crataegus monogyna-Hedera helix scrub,	
		Hedera helix-Urtica dioica sub-community.	
W21b	*	Crataegus monogyna-Hedera helix scrub,	
		Mercurialis perennis sub-community.	
W22a	*	Prunus spinosa-Rubus fruticosus agg. scrub,	
		Hedera helix-Silene dioica sub-community.	
W22b	*	Prunus spinosa-Rubus fruticosus agg. scrub,	
		Viola riviniana-Veronica chamaedrys sub-community.	
W22c	*	Prunus spinosa-Rubus fruticosus agg. scrub,	
		Dactylis glomerata sub-community.	
W23a	*	Ulex europaeus-Rubus fruticosus agg. scrub,	
		Anthoxanthum odoratum sub-community.	
W23b	*	Ulex europaeus-Rubus fruticosus agg. scrub,	
		Rumex acetosella sub-community.	
W23c	*	Ulex europaeus-Rubus fruticosus agg. scrub,	
		Teucrium scorodonia sub-community.	
W24a	*	Rubus fruticosus aggHolcus lanatus underscrub,	
		Cirsium arvense-Cirsium vulgare sub-community.	
W24b	*	Rubus fruticosus aggHolcus lanatus underscrub,	
		Arrhenatherum elatius-Heracleum sphondylium sub-community.	
W25	*	Pteridium aquilinum-Rubus fruticosus agg. underscrub, undifferentiated.	
W?	**	Provisional Juniperus communis dune scrub community.	

Transitions to other habitats

Maritime cliff (from SD8 dune grassland)

MC5b *	Armeria maritima-Ceratium diffusum ssp. diffusum maritime therophyte community, Anthyllis vulneraria sub-community.
MC5d *	Armeria maritima-Ceratium diffusum ssp. diffusum maritime therophyte community, Arenaria serpyllifolia sub-community.
MC8a *	Festuca rubra-Armeria maritima maritime grassland, Typical sub-community.
MC8e *	Festuca rubra-Armeria maritima maritime grassland, Plantago coronopus sub-community.

Maritime cliff (from SD8 dune grassland) (continued)

Festuca rubra-Armeria maritima maritime grassland,	
•	- 4
Festuca rubra-Plantago spp. maritime grassland, undifferentiated.	
Festuca rubra-Hyacinthoides non-scripta bluebell community,	
Silene vulgaris ssp. maritima sub-community.	
(from various strandline, dune grassland, dune slack and swamp type saltmarsh types mapped in Wales as part of the dune survey are not i	
Juncus maritimus-Triglochin maritima saltmarsh, undifferentiated.	
Festuca rubra saltmarsh,	
Puccinellia maritima sub-community.	
Festuca rubra saltmarsh,	
sub-community with Juncus gerardi dominant.	
Festuca rubra saltmarsh,	
Festuca rubra-Glaux maritima sub-community.	
Festuca rubra saltmarsh,	
sub-community with tall Festuca rubra dominant.	
Juncus maritimus saltmarsh,	
Plantago maritima sub-community.	
Juncus maritimus saltmarsh,	
Oenanthe lachenalii sub-community.	
Eleocharis uniglumis saltmarsh.	
Elymus pycnanthus saltmarsh.	
Elymus repens saltmarsh.	
	Anthyllis vulneraria sub-community.Festuca rubra-Holcus lanatus maritime grassland,Dactylis glomerata sub-community.Festuca rubra-Plantago spp. maritime grassland, undifferentiated.Festuca rubra-Hyacinthoides non-scripta bluebell community,Silene vulgaris ssp. maritima sub-community.(from various strandline, dune grassland, dune slack and swamp typesaltmarsh types mapped in Wales as part of the dune survey are not ifJuncus maritimus-Triglochin maritima saltmarsh, undifferentiated.Festuca rubra saltmarsh,Puccinellia maritima sub-community.Festuca rubra saltmarsh,Puccinellia maritima sub-community.Festuca rubra saltmarsh,sub-community with Juncus gerardi dominant.Festuca rubra saltmarsh,Sub-community with all Festuca rubra dominant.Juncus maritimus saltmarsh,Plantago maritima sub-community.Festuca rubra saltmarsh,Sub-community with tall Festuca rubra dominant.Juncus maritimus saltmarsh,Plantago maritima sub-community.Juncus maritimus saltmarsh,Plantago maritima sub-community.Juncus maritimus saltmarsh,Denanthe lachenalii sub-community.Liecocharis uniglumis saltmarsh.Eleocharis uniglumis saltmarsh.Elymus pycnanthus saltmarsh.

 Table 4.2 Nationally rare and nationally scarce plants primarily associated with other habitats but which were recorded on British dunes during the national sand dune survey.

Nationally rare plants

Dryopteris cristata crested buckler-fern Matthiola sinuata sea stock Viola kitaibeliana dwarf pansy Silene conica striated catchfly Petrorhagia nantuellii childing pink Polycarpon tetraphyllum four-leaved allseed Geranium purpureum ssp. purpureum little robin Geranium purpureum ssp. forsteri little robin Ornithopus pinnatus orange bird's-foot Rumex rupestris shore dock Limonium bellidifolium matted sea-lavender Scrophularia scorodonia balm-leaved figwort Orobanche caryophyllacea clove-scented broomrape Orobanche purpurea purple broomrape Valerianella eriocarpa Allium ampeloprasum wild leek Allium babingtonii Babington's leek Romulea columnae sand crocus Liparis loeselii fen orchid Himantoglossum hircinicum lizard orchid Poa infirma early meadow-grass Mibora minima early sand-grass

Nationally scarce plants

Asplenium trichomanes maidenhair spleenwort Ophioglossum azoricum small adder's tongue Ranunculus baudotii brackish water crowfoot Rhynchosinapis monensis Isle of Man cabbage Raphanus maritimus sea radish Hornungia petraea rock hutchinsia Frankenia laevis sea-heath Silene nutans Nottingham catchfly Dianthus deltoides maiden pink Moenchia erecta upright chickweed Scilla autumnalis autumn squill Suaeda fruticosa shrubby sea-blite Epipactis phyllanthes Medicago minima small medick Trifolium ornithopoides bird's-foot clover Trifolium glomeratum clustered clover Trifolium suffocatu suffocated clover Cicuta viros cowbane Oenanthe pimpinelloides Thesium humifusum bastard toadflax

Main habitat

Wet heaths Sea cliffs Coastal grassland Sandy pastures Waste ground Sandy places Shingle Shingle Open, sandy soil Beaches Upper saltmarsh Hedgebanks Dry grassland Dry grassland Banks and walls Rocks Rocks Coastal grassland Fens Inland Sandy places Wet sandy places

Rocks

Coastal grassland Saltmarshes, flats & creeks Shores and waste places Waste places Limestone rock Upper saltmarsh Dry slopes Inland Gravelly pastures Coastal grassland Shingle Woods Heaths Shores and waste places Shores and waste places Sandy grassland Shallow water Meadows Calcareous grassland

Polygonum raii Ray's knotgrass Pyrola rotundifolia larger wintergreen Primula scotica Scottish primrose Verbascum virgatum twiggy mullein Parentucellia viscosa yellow bartsia Orobanche hederae ivy broomrape Goodyera repens creeping lady's tresses Coralorhiza trifida coralroot orchid Orchis ustulata burnt orchid Aceras anthropophorum man orchid Arum italicum Eleocharis acicularis slender spike-rush Juncus acutus sharp rush Carex punctata dotted sedge Vulpia ambigua bearded fescue Poa bulbosa bulbous poa Hordeum marinum sea barley Apera interrupta Parapholis incurva curved hard-grass

Sandy shores, shingle Fens, woods Coastal grassland Waste places Coastal grassland Coastal districts Pine woods Woods Calcareous grassland. Chalk Stony ground Lakes and pools Coastal grassland Rocks Open and sandy places Coastal grassland Coastal grassland Sandy fields Sandy upper saltmarshes

Table 4.3 Nationally rare and nationally scarce plants found mainly or exclusively on dunes in Britain. * = present on dunes in Wales; ** confined to dunes in Wales; *** = formerly present before 1930 on dunes in Wales; + = introduced into Wales, not native.

Nationally rare species characteristic of dunes	Number of 10 x 10 km squares in GB	
Orobanche caryophyllacea bedstraw broomrape		2
Gentianella uliginosa dune gentian	**	5
Teucrium scordium water germander		3
Gnaphalium luteoalbum Jersey cudweed		1 be fleres frami
Epipactis dunensis dune helleborine	*	9
es i filotes and wante blaces		
Nationally scarce species characteristic of dunes		
Equisetum variegatum variegated horsetail	*	89
Erodium maritimum sea stork's-bill	*	77
Hippophae rhamnoides sea buckthorn	*+	36
Oenothera stricta fragrant evening primrose	*+	32
Euphorbia portlandica Portland spurge	*	74
Euphorbia paralias sea spurge	*	92
Centaurium littorale seaside centaury	*	42
Juncus balticu Baltic rush		47
Carex maritima curved sedge		26
Festuca juncifolia rush-leaved fescue		27
Vulpia membranacea dune fescue	*	44
Corynephorus canescens grey hair-grass	***	16

5. Shingle, strandline and foredune communities, transitions to saltmarsh

5.1 NVC communities and rare species

Four shingle, strandline and foredune communities are recognised by the NVC, with only the SD1 Rumex crispus-Glaucium flavum shingle community divided into subcommunities. All are associated with the upper beach (shingle or sand), detritus deposited on the strandline, or with sand which has buried strand materials. They thus occur as a narrow but often very lengthy line on the upper beach. Total area (38.5 ha) of all types is low (Table 5.1). All communities become discontinuous and restricted as visitor trampling or coastal erosion increase, with many sites having only small extents of these communities which are short-lived in many cases and easily destroyed by storms and human impact. Significant sites with moderate and large extents of SD2/SD3 strandline and SD4 foredune are shown in Figures 5.1 and 5.2 respectively. The only nationally rare species associated with these communities in Wales is sea stock Matthiola sinuata, found occasionally on SD4 foredunes in a few sites in South Wales (it is commoner on mobile dunes further inland).

5.2 SD1a Rumex crispus-Glaucium flavum shingle community Typical sub-community

This community is rare in association with sand dunes in Wales and was mapped in only five sites (Table 5.1). It is of very low extent on sand dunes in Wales (0.9 ha) and the site with the largest area, Kenfig Dunes, is anomalous since the community has invaded a fossilised, stable storm beach disturbed by extraction of shingle for building purposes. The community must be regarded as rare when shingle has a sand cover.

5.3 SD2 Honkenya peploides-Cakile maritima strandline community

This community is found in small quantities on dunes around all of the Welsh coast (Table 5.1) and is generally absent from eroding sites and those dominated by climbing dunes. The constant species sea sandwort Honkenya peploides and sea rocket Cakile maritima are often not found together. H. peploides tends to be found on flat sand or fine gravel (where it can persist over winter on sheltered beaches), with C. maritima preferring very low dunes formed over the strandline during the summer growing season. Species of orache (Atriplex spp.) also tend to be commonly associated with each of the main constants. Total extent is only 21 ha and is thus low, reflecting the narrow beach zone to which it is restricted. Its presence in sites around Swansea is so patchy and small in size that it is only recorded as present in surveys of these dunes. Small extents of anomalous types (Other SD2, Table 5.1) and transitions to SD4 foredune are recorded in a few localities. This is the commonest and most extensive strandline community. It is generally very species-poor.

5.4 SD3 Matricaria maritima-Galium aparine strandline community

This community is very rare in Wales and was recorded in only two widely separated sites (Merthyr Mawr, Pwllheli to Pen-y-Chain), both with very low extents (Table 5.1, total area 0.7 ha). It is also very uncommon in England and Scotland. It seems to require mats of rotting organic debris which are not covered by blown sand, a rare condition for a full summer in most strand environments upon dunes.

5.5 Other strand types

A distinct strand type was recorded in six sites, all of them in South Wales (Other strand, Table 5.1; the Traeth Dulas record in North Wales is an anomalous type difficult to place in relation to the NVC apart from maritime cliff communities). It is rich in species compared to other strand communities and composition Table 5.1 Shingle (SD1 Rumex crispus-Glaucium flavum) and strandline (SD2 Honkenyapeploides-Cakile maritima, SD3 Matricaria maritima-Galium aparine, Other strand) vegetation inWales. Areas in hectares. T = trace, present in very low quantity. P = probably present but notmapped, extent unknown.

ten.	Site	SD1	SD1a	All SD1	SD2	SD2/ SD4	Other SD2	All SD2
1	Merthyr Mawr			1	0.06			0.06
2	Kenfig Dunes	0.49	000	0.49	Т	3.22	Ansala	3.22
3	Margam Burrows			1				
4	Baglan Bay	001212 1/310101		11.12.94 A	and an an a	Co Column 18	a start starters	A PERSONAL PROPERTY AND INC.
5	Crymlyn Burrows	Child Libra et	- the second	Sharp's St	Т	- Vales Inc.	Contra St. 1	Т
6	Black Pill to Bryn Mill	and the second						
7	Pennard Burrows	SALARDA PARTING	a de la companya de la			a collection of	and a second	chauna sa
8	Penmaen Burrows		183			1.11.11.11.11	983 I.A	2010.000
9	Nicholaston Burrows	internet and the		and the set	T	a land a set	to or any	Т
10	Oxwich Burrows			and services	Т			Т
11	Port-Eynon to Horton			100000	10.1018.20	in bars.	NA DO VA	100033
12	Hillend to Hills Tor	in the section		in mane		description of	The sheet	feringer h
13	Whiteford Burrows				Т			T
14	Pembrey Coast	filled to day of		102201-2	Т	A STREET	Contraction of the	T
15	Laughame Burrows	and mela her d	1000	- defailing	P	Serve Hiller	1 (n. 2 8)	P
16	Pendine Burrows				2.03			2.03
17	Tenby Burrows	LET & LEGUE LE		Carry Press	The sector of	ACCESSION OF	- COLUMN AT	1
18	Caldey Island	Continuos do	151	Reach	0.04	COLOCI IN	Terriber 1	0.04
19	Lydstep Haven	12. 4			-			
20	Manorbier/Swanlake	0.06	19.00	0.06	e capit iper	- Cranto	1.00	
21	Freshwater Bay East	LIS I LISSIN	199	ALL ALL	1/ 20111	107003000	0.05	0.05
22	Stackpole Warren				0.12			0.12
23	Brownslade/Linney			1	0.14		CO. Comment	0.14
24	Broomhill Burrows		-		0.23	CONTRACT/		0.23
25	Whitesand Bay	State and State		Service.			A Same and	0.20
26	The Bennett				0.48			0.48
27	Poppit Sands	the million in	100	FILL F	1.16	000101	10000	1.16
28	Towyn Warren		0.02	0.02	0.03	and the second of	1 2 2 1	0.03
29	Ynyslas	0.22	0.02	0.22	0.05		1	0.00
30	Tywyn to Aberdovey	0.02	2.7	0.66	0.76	1000000	alle segle to	0.76
31	Fairbourne	0.04		0.04	0.70	10000	Love ne	0.70
32	Morfa Dyffryn	0.04		0.04	0.64	1		0.64
33	Morfa Harlech	State of the local state of the		or and the second	0.04	0.69	10000 31	1.67
34	Morfa Bychan	2 6 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	1111111111	1.44	0.07	0.07 10 7	1.44
35	Pwllheli/Pen-y-Chain		0.32	0.32	0.55	1. 1		0.55
36	Traeth Crugan	0.08	0.54	0.08	1.33	-		1.33
37	Tai Morfa	0.08	17	0.00	1.55			1.55
38	Morfa Dinlle		0.37	0.37	-	1000	1.	1.1712
39	Newborough Warren	and the second of the	0.57	0.51	0.68	0.12	1.03	1.83
40	Penhrhynoedd - Llangadwaladr		10		0.00	0.12	1.05	1.03
40	Aberffraw				0.56	-	Contrast 1	0.56
42	Valley		-		0.50	-	and the second second	0.30
42	Tywyn Gwyn	to a start	-		0.70		0.92	1.62
45 44A	Traeth Dulas			120 000	0.70	20.000	0.92	1.02
44A 44B	Traeth Lligwy	CON NEWSTRONIAL		TOP LATER		Acres 199 / S	and the first	
440	Red Wharf Bay	Contra Contra Contra	0.34	0.34	200 BT 10	10000	2010 200	-
			0.34	0.34	1.24	-	1	1.24
46	Conwy/Deganwy		1000	CONTRACTOR STATE	1.24	1000	10.000	1.24
47	Kinmel Bay	1.0.000.0000	-	-	0.34	000 000	pala la	0.34
48	Rhyl to Prestatyn		-	-	1.07	-	0.01	1.07
49	Gronant to Talacre		-	Contraction of the	0.77	-	0.01	0.89
-			2	-	-		Charmen .	
	South Wales Region	0.49		0.49	0.06	3.22		3.28
	Dyfed & Mid-Wales Region	0.28	0.02	0.30	4.23	0.04	0.05	4.28
	North Wales Region	0.12	1.03	1.15	11.06	0.81	1.96	13.94
					1		1	

Table 5.1 (continued) Shingle (SD1 Rumex crispus-Glaucium flavum) and strandline (SD2Honkenya peploides-Cakile maritima, SD3 Matricaria maritima-Galium aparine, Other strand)vegetation in Wales. Areas in hectares. T = trace, present in very low quantity. P = probablypresent but not mapped, extent unknown.

	Site	SD3	SD3/SD4	Other strand	All strand types
1	Merthyr Mawr	0.30	and the second second	ferrar and see a	0.36
2	Kenfig Dunes	321 10 10 1 1 1 1 1 1	Phase and the g	and tables on	3.71
3	Margam Burrows	Carlos N	and the second second	Standard Street	and the second
4	Baglan Bay			6.20	6.20
5	Crymlyn Burrows	and the stand		2.56	2.56
6	Black Pill to Bryn Mill	Sell The Minne			and the second second
7	Pennard Burrows	1	The second second		
8	Penmaen Burrows	100		THE REAL REAL REAL	en anno cura
9	Nicholaston Burrows	Con Marine	Augentine (all)	0.64	0.64
10	Oxwich Burrows	NUMBER OF STREET		0.51	0.51
11	Port-Eynon to Horton				and the second second
12	Hillend to Hills Tor			01 AS 235 DITES	n at Minutes
13	Whiteford Burrows	STREET, STREET	1. milling Pres	1.86	1.86
14	Pembrey Coast			1.92	1.92
15	Laughame Burrows	A Dise of the second		A. A. M. B. (185)	Р
16	Pendine Burrows	No.	S. Colorado and	1. Charles Intelling	2.03
17	Tenby Burrows				
18	Caldey Island				0.04
19	Lydstep Haven	15-11	a standard	- the second s	
20	Manorbier/Swanlake	and animal states			0.06
21	Freshwater Bay East	and a start of the		The second second	0.05
22	Stackpole Warren		at contrain 5 5		0.12
23	Brownslade/Linney				0.14
24	Broomhill Burrows	COLUMN TRUE			0.23
25	Whitesand Bay	Mark Brench	A		
26	The Bennett	and the second second			0.48
27	Poppit Sands				1.16
28	Towyn Warren	a line and a line of the			0.05
29	Ynyslas	Augent - france			0.22
30	Tywyn to Aberdovey			in the	0.76
31	Fairbourne		0.56		0.60
32	Morfa Dyffryn	of the substance	10224-101	13 H	0.64
33	Morfa Harlech		E-SWEE	11 5	1.67
34	Morfa Bychan	CLAP ADVID DA			1.44
35	Pwllheli/Pen-y-Chain	0.41			1.28
36	Traeth Crugan			100	1.41
37	Tai Morfa	and a constant			
38	Morfa Dinlle				0.37
39	Newborough Warren	1.2	S & Z		1.83
40	Penhrhynoedd - Llangadwaladr				C. A. A. P. T.
41	Aberffraw				0.56
42	Valley			T. CASE	
43	Tywyn Gwyn				1.62
44A	Traeth Dulas		and the second	0.27	0.27
44B	Traeth Lligwy		7 161 28	182836	1 2 8 M 2
45	Red Wharf Bay		1. 1. B.S.	Mar Caller	0.34
46	Conwy/Deganwy		21 22 3		1.24
47	Kinmel Bay	Sector Contraction	Se all all all	6 6 6 6 7 5 1	0.34
48	Rhyl to Prestatyn		28.29	C. C. S. S. S.	1.07
49	Gronant to Talacre	11.00	1	0 8888	0.89
125				1 8 8 1	
	South Wales Region	0.30		11.77	15.84
	Dyfed & Mid-Wales Region			1.92	6.50
	North Wales Region	0.41	0.56	0.27	16.33
36	in a strate to ender any state				
	National Totals	0.71	0.56	13.96	38.67

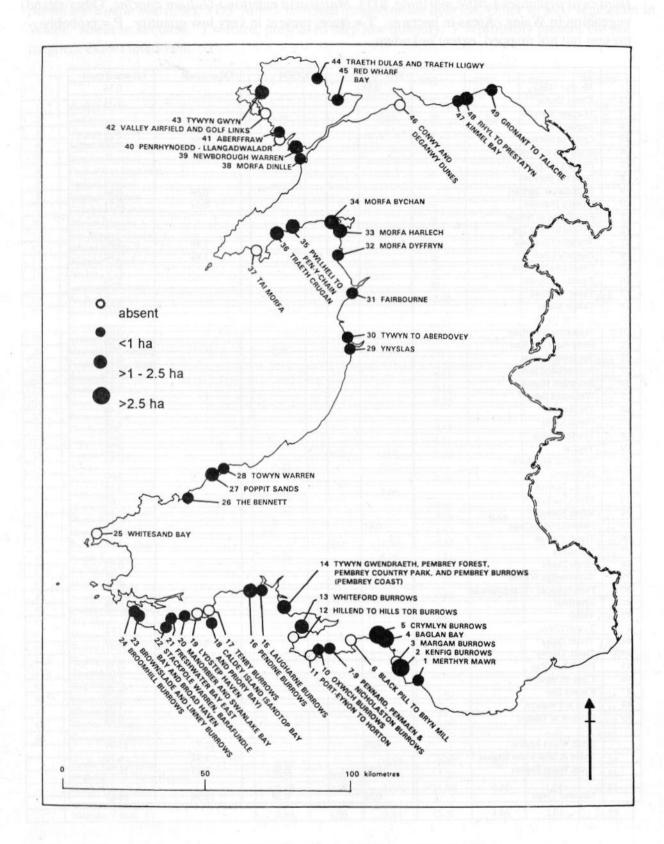


Figure 5.1 Location of sites with strandline (SD2, SD3) vegetation in Wales.

suggests a type transitional between SD2 strandline, SD4 foredune and SM16/SM24 saltmarsh types (e.g. Elymus farctus Honkenva peploides, Festuca rubra Limonium binervosum and Agrostis stolonifera as constants). The habitat requirements are unusual for the strand environment and involve a sheltered, extensive and very gently shelving strandline zone above saltmarsh, receiving moderate amounts of sand to bury small quantities of tidal litter. The type is clearly transitional in character but is extensive (14 ha), representing an important regional variant for Welsh strandline vegetation. It largely replaces SD2 strandline in south-east Wales and approaches the extent of that community in size at the national scale. It is much larger in area than SD3 strandline.

5.6 SD4 *Elymus farctus* foredune community

Sand couch-grass Elymus farctus forms low dunes (generally <0.5 m high) on or above high water mark (springs) around all the Welsh coast (Table 5.2, Figure 5.2) but the community is often rare on exposed and eroding beaches. The community is very species-poor, reflecting extreme environmental conditions of instability. Total extent in Wales is 97.8 ha, with most of the total area derived from three sites (Figure 5.2): Newborough Warren (24.3 ha), Baglan Bay (24.3 ha) and the Pembrey Coast (14.5 ha, most of it from Pembrey Burrows). Sites with moderate extents (>2 ha) include Whiteford Burrows, Laugharne Burrows, Morfa Harlech, Morfa Bychan and Gronant to Talacre. The dunes can migrate up a beach and can thus show a transition to SD5 and SD6 mobile dune types, especially at Newborough Warren. In very sheltered zones it can grade into saltmarsh at lower levels and these types are common in south-east Wales (see section 5.5).

5.7 Transitions to saltmarsh

Saltmarsh is a relatively common habitat in association with sand dunes and some Welsh dune surveys include detailed mapping of large areas of saltmarsh habitat (Table 5.3) – other dune surveys, however, record a transitional

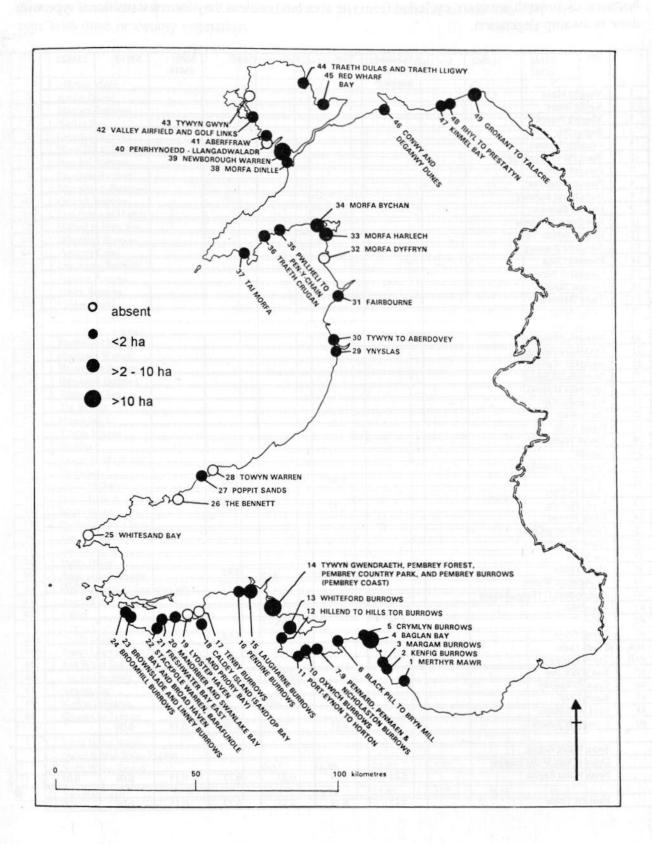
zone only if it is present. Seventeen dune sites were recorded with measured saltmarsh area but this is an underestimate and saltmarsh is also present adjacent to dunes in a further seven sites, giving a total of 24 sites with saltmarsh adjacent to sand dunes. Transitions to saltmarsh are recorded in tables covering other vegetation types, particularly dune slacks (see Table 10.5) and swamp habitats (see Table 10.7). Transitions are in fact comparatively rare and of low extent, indicating a very sharp change from dune to saltmarsh conditions in most cases of co-existence. Relatively small but important transition zones are present at Whiteford and Tywyn Gwendraeth (Pembrey Coast), but the only large area is a slack/saltmarsh SD17/SM18 transition (14.7 ha) in the prograding dune system of Morfa Harlech. The strand/foredune/ saltmarsh transition important in south-east Wales also deserves mention here (see section 5.5).

Table 5.2 SD4 *Elymus farctus* foredune vegetation in Wales. Areas in hectares. T = trace, present in very low quantity. ? = uncertain, probably not mapped.

	Site	SD4	SD4 transitions	All SD4
1	Merthyr Mawr	0.12		0.12
2	Kenfig Dunes	0.64	A SAME OF SAME SAME	0.64
3	Margam Burrows	0.34	Than the addines into	0.34
4	Baglan Bay	24.29		24.29
5	Crymlyn Burrows	1.28		1.28
6	Black Pill to Bryn Mill	1.03	CALLE STEPS WITH ALL ST	1.03
7	Pennard Burrows	0.64		0.64
8	Penmaen Burrows	0.26		0.26
9	Nicholaston Burrows	Т	THE SHE SHE A	T
10	Oxwich Burrows	T	21 511/4-00	Т
11	Port-Eynon to Horton	Т		T
12	Hillend to Hills Tor	0.90	and the second second second	0.90
13	Whiteford Burrows	2.88		2.88
14	Pembrey Coast	14.54		14.54
15	Laughame Burrows	2.00		2.00
16	Pendine Burrows	0.28	C harden and the party of the party	0.28
17	Tenby Burrows	?		?
18	Caldey Island	0.04		0.04
19	Lydstep Haven	0,07	P Shitesta	0.04
20	Manorbier/Swanlake	0.08	The second second	0.08
20	Freshwater Bay East	0.08		0.13
22	Stackpole Warren	0.13	2010/01/2010	0.13
23	Brownslade/Linney	0.07		0.07
23	Brownstade/Linney Broomhill Burrows	0.03		0.33
25	Whitesand Bay	0.55		0.35
25	The Bennett			
26		0.28	WID TOTUD AND	0.28
	Poppit Sands	0.28	ting of provide the real	0.28
28	Towyn Warren	0.08	The second second second	0.00
29	Ynyslas		120 NO LINES W. OLA 18	0.08
30	Tywyn to Aberdovey	0.12		0.12
31	Fairbourne	0.67		0.67
32	Morfa Dyffryn		Segnolisiti alatta	6.00
33	Morfa Harlech	6.89	galandba sanas	6.89
34	Morfa Bychan	4.04		4.04
35	Pwllheli/Pen-y-Chain	1.24	All rearranti recenter	1.24
36	Traeth Crugan	1.20	in transition is	1.20
37	Tai Morfa	0.07		0.07
38	Morfa Dinlle	0.33	The Bray dance of	0.33
39	Newborough Warren	20.68	3.63	24.31
40	Penhrhynoedd - Llangadwaladr	La Young	and the first of the second second	and and the Barreline
41	Aberffraw	0.71		0.71
42	Valley	1.31	0.03	1.34
43	Tywyn Gwyn		and the second second second	design of the Stationers
44A	Traeth Dulas	0.23	4 18 - March State provinces and	0.23
44B	Traeth Lligwy	0.02	A CALLE DESCRIPTION OF	0.02
45	Red Wharf Bay	0.48	0.11	0.59
46	Conwy/Deganwy	1.76		1.76
47	Kinmel Bay	1.05		1.05
48	Rhyl to Prestatyn	0.60	E Berth Plat h Stirley	0.60
49	Gronant to Talacre	2.38		2.38
			A TOWN ALL ALLONG	BAR TABLED MADE OF CA
	South Wales Region	32.38	S. A. Santhawat	32.38
	Dyfed & Mid-Wales Region	17.86	10.3	17.86
-	North Wales Region	43.78	3.77	47.55
		10110		

nations to saturat

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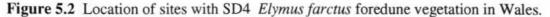


Table 5.3 Saltmarsh vegetation types recorded from dune vegetation surveys in Wales. Areas in hectares. Saltmarsh areas are excluded from site area totals unless they form a transitional type with dune or swamp vegetation.

	Site	Saltmarsh (no NVC mapping)	SM6	SM8	SM9	SM9/ SM16	SM10	SM12
1	Merthyr Mawr	1.1.1.1			1.1.2	1.1.1		
2	Kenfig Dunes	2	1.		101			
3	Margam Burrows	a contraction of the			10000	1.449 7.5		
4	Baglan Bay			-		0.000 0.00		
5	Crymlyn Burrows	1.1		-	-	-		
6	Black Pill to Bryn Mill				-	1		-
7	Pennard Burrows			1				
8	Penmaen Burrows			1				-
9	Nicholaston Burrows			-	-			-
				-			1000	
10	Oxwich Burrows				-		-	-
11	Port-Eynon to Horton					1	10.00	
12	Hillend to Hills Tor	A STATISTICS			-			
13	Whiteford Burrows	A DEPART ADDRESS	1		1.00			
14	Pembrey Coast		6					
15	Laughame Burrows		1.56.77	1.00	and the second second	and a state of the		
16	Pendine Burrows							
17	Tenby Burrows	and the second						
18	Caldey Island						1.	-
19	Lydstep Haven				-			-
20	Manorbier/Swanlake				-		L.S. D.C.	-
21	Freshwater Bay East						-	-
22							-	-
	Stackpole Warren						12000	
23	Brownslade/Linney							-
24	Broomhill Burrows		0.0				1.0.08	-
25	Whitesand Bay				_			-
26	The Bennett			-		1.11	100	-
27	Poppit Sands							
28	Towyn Warren			1			1.1.1	
29	Ynyslas							
30	Tywyn to Aberdovey				The second		C. C. M.	
31	Fairbourne		. 0.99		1.32	and the second second	1.1.1	
32	Morfa Dyffryn				AND CONTRACTOR OF A	1000		
33	Morfa Harlech		1.37		0.07		1000	
34	Morfa Bychan	and the second second						
35	Pwllheli/Pen-y-Chain					Via.		
36	Traeth Crugan		-					
37	Tai Morfa				-			
38	Morfa Dinlle			-	3.45		-	-
39	Newborough Warren		3.70		0.13			0.03
			3.70	-	0.15	-	-	0.03
40	Penhrhynoedd - Llangadwaladr			-	-	-	-	-
41	Aberffraw			-		1000		-
42	Valley	5.25	1	0.05		-		-
43	Tywyn Gwyn	AND LODD NO.	1.1.1.1	1.1.1	0.04		1. C.S.A.	-
44A	Traeth Dulas	and and a set	1.72	Sec. S.		1.3.2.2	1. 1. 1.	
44B	Traeth Lligwy	astrict of Nulls	1.1.1	1.1	1 1 1			
45	Red Wharf Bay			0.18	2 3 5 8		1.1.1.1	
46	Conwy/Deganwy	1. 19- 2	1.35		1. 1. 1. 1.		1000	
47	Kinmel Bay	111111111			10.20			
48	Rhyl to Prestatyn	10.18	-		1		1 1 1 1 1	
49	C:onant to Talacre	1.	0.41		1.76	0.15	0.06	
		1000		1.1.1		1		
	South Wales Region				1 1 1			
	Dyfed & Mid-Wales Region				-			-
	North Wales Region	5.25	8.19	0.23	6.77	0.15	0.06	0.03
	Horur Wales Region	5.25	0.19	0.43	0.77	0.15	0.00	0.03
	National Totals	5.25	8.19	0.23	6.77	0.15	0.06	0.03

Table 5.3 (continued) Saltmarsh vegetation types recorded from dune vegetation surveys in Wales. Areas in hectares. Saltmarsh areas are excluded from site area totals unless they form a transitional type with dune or swamp vegetation.

-	Site	SM13	SM13a	SM13b	SM13c/d	SM13d	SM13/ SM18
1	Merthyr Mawr						SMI8
2	Kenfig Dunes	1	-				-
3	Margam Burrows		-				
4	Baglan Bay		-				-
5	Crymlyn Burrows				-		-
6	Black Pill to Bryn Mill		-				-
7	Pennard Burrows		-			-	-
8	Penmaen Burrows		-				-
9	Nicholaston Burrows		-				
10	Oxwich Burrows		-				-
11	Port-Eynon to Horton		-				
12	Hillend to Hills Tor		-	-			-
13	Whiteford Burrows		-				
14	Pembrey Coast		-		-		
15	Laughame Burrows				-		-
16	Pendine Burrows						-
17	Tenby Burrows		-	-	-	-	-
18	Caldey Island		-		-		
19	Lydstep Haven			-			
20	Manorbier/Swanlake						
21	Freshwater Bay East		-	-			11.000
22	Stackpole Warren			-			-
23	Brownslade/Linney			-	-		-
24	Broomhill Burrows		-		-		-
25	Whitesand Bay		-	-	-		-
26	The Bennett				-		-
27	Poppit Sands				-	-	-
			-				-
28	Towyn Warren			-		-	-
29	Ynyslas			-	-	-	
30	Tywyn to Aberdovey		-		0.70		-
31	Fairbourne		-		2.72		-
32	Morfa Dyffryn					0.11	
33	Morfa Harlech		-	_		9.11	
34	Morfa Bychan	-		-			
35	Pwllheli/Pen-y-Chain				-	-	-
36	Traeth Crugan		-		-		-
37	Tai Morfa		-	-	-	-	1 1 1
38	Morfa Dinlle				-		
39	Newborough Warren	0.06	16.88	15.87	-	-	-
40	Penhrhynoedd - Llangadwaladr		-	-		-	
41	Aberffraw	and the second second	-	-			-
42	Valley		-	-			0.3
43	Tywyn Gwyn	0.23	-				
44A	Traeth Dulas	100000					
44B	Traeth Lligwy		-	-			
45	Red Wharf Bay		-	-		-	-
46	Conwy/Deganwy		-	-		-	-
47	Kinmel Bay			-	-	-	-
48	Rhyl to Prestatyn	0.26		-	-	-	-
49	Gronant to Talacre		-	-	-	-	-
					-	-	
	South Wales Region		-	-	-		-
	Dyfed & Mid-Wales Region						
	North Wales Region	0.55	16.88	15.87	2.72	9.11	0.3
				15.87	2.72	9.11	0.3

Table 5.3 (continued) Saltmarsh vegetation types recorded from dune vegetation surveys in Wales. Areas in hectares. Saltmarsh areas are excluded from site area totals unless they form a transitional type with dune or swamp vegetation.

	Site	SM14a	SM14c	SM15	SM16	SM16a	SM16b	SM16c	SM16d
1	Merthyr Mawr	1.157							
2	Kenfig Dunes							1.56	
3	Margam Burrows				2.52		0.73		
4	Baglan Bay				0.59			and the second second	
5	Crymlyn Burrows							dille a	June
6	Black Pill to Bryn Mill								
7	Pennard Burrows						in the second	on Ronald	
8	Penmaen Burrows			15.53				and the second second	
9	Nicholaston Burrows								
10	Oxwich Burrows	1.23						mell units	
11	Port-Eynon to Horton								and a
12	Hillend to Hills Tor							ALC: NOT	1.1.1
13	Whiteford Burrows								
14	Pembrey Coast	1.1							10121
15	Laughame Burrows	1.1.1							Santas
16	Pendine Burrows							1.12	1.0.1
17	Tenby Burrows							e complete	
18	Caldey Island							in the second	
19	Lydstep Haven							L. Bestal	
20	Manorbier/Swanlake								
21	Freshwater Bay East						1	CON ZARA	1019
22	Stackpole Warren							E ALL SALL	1.00
23	Brownslade/Linney	/							1000
24	Broomhill Burrows	1						and had a	
25	Whitesand Bay								
26	The Bennett								
27	Poppit Sands								
28	Towyn Warren					1			
29	Ynyslas				-				
30	Tywyn to Aberdovey								
31	Fairbourne			1		2.50			1
32	Morfa Dyffryn			1	-				
33	Morfa Harlech			3.31	and the second	1		7.13	
34	Morfa Bychan			0.01					
35	Pwllheli/Pen-y-Chain		1		-	-			
36	Traeth Crugan				-				
37	Tai Morfa								-
38	Morfa Dinlle				-	-			-
39	Newborough Warren			-	-			1.28	-
40	Penhrhynoedd - Llangadwaladr		-	-	-			1.20	-
40	Aberffraw		-		-				0.12
42	Valley			-	-				0.12
42									-
	Tywyn Gwyn		1.77		1.70				-
44A	Traeth Dulas	Section of the sector	1.77		1.72			and the party	and the second
44B	Traeth Lligwy		-	-	1.00			1000	-
45	Red Wharf Bay		-		1.08			-	
46	Conwy/Deganwy		- 1	-	-				
47	Kinmel Bay	-		-	0.45			1101010	100
48	Rhyl to Prestatyn		0.07		0.47	-	0.01	849	0.05
49	Gronant to Talacre	5.26	0.37				0.01	1726-11	0.35
				-					
	South Wales Region		10.81		3.11	-	0.73	1.56	-
	Dyfed & Mid-Wales Region	1					0	and ashed	1
	North Wales Region	5.26	2.14	3.31	3.27	2.50	0.01	8.41	0.47
11		1. 12.7						Pro Tomas	Const.
	National Totals	5.26	2.14	3.31	6.38	2.50	0.74	9.97	0.47

Table 5.3 (continued) Saltmarsh vegetation types recorded from dune vegetation surveys in Wales. Areas in hectares. Saltmarsh areas are excluded from site area totals unless they form a transitional type with dune or swamp vegetation. P = present, extent not mapped. T = trace, extent not mapped.

Vipel	Site	SM18	SM18a	SM18b	SM20	SM24	SM28	Total saltmarsh
1	Merthyr Mawr	CH LODGE LODG	1202	1	Anite 34	C.P. Astrony	hidari	P
2	Kenfig Dunes	Will no		1.56		and an and a second		3.12
3	Margam Burrows	0.15	1.	1. 2. 11. (2	10000	1.80	Country.	5.20
4	Baglan Bay	I CARA ALCONT	Reifer alle	Lisate 19	1000	EL DEPEND		0.59
5	Crymlyn Burrows	The Second	1011 1/5	0.85	1	2.77	Same.	3.62
6	Black Pill to Bryn Mill	No.			1.	1000		
7	Pennard Burrows			1238	No. Contraction	1723122	1010	
8	Penmaen Burrows	and Marker a					1.115.15	P
9	Nicholaston Burrows	2 2.12	In Bern					P
10	Oxwich Burrows			0.96	DUCCERS	VIELEN S.	A SHIPPY	0.96
11	Port-Eynon to Horton		1 17 34 14				Owner	a mission
12	Hillend to Hills Tor	and the second						T
13	Whiteford Burrows	+	1000					P
14	Pembrey Coast	State of the part of the	CARL SHO	1.28		27.93	Second La Const	29.21
15	Laughame Burrows	are design	and the	112 112	Contraction of the		1.2.	P
16	Pendine Burrows			STATISTICS IN		in star and		
17	Tenby Burrows	THE SOLEDIT		molori	0.0000.11			nel se by
18	Caldey Island							
19	Lydstep Haven							
20	Manorbier/Swanlake	and the second	2	10.850.0	and the	L. Ditte II	D. OK	DEG HO
21	Freshwater Bay East	15.51 001.6721		A second the		and the set		and and and
22	Stackpole Warren	and the second						
23	Brownslade/Linney			1911 1930				a salle e
24	Broomhill Burrows		10.10	and no	- Contraction	a land they		
25	Whitesand Bay	they would be	La contra					
26	The Bennett		1		1.0.2.0.2.1	5121.018	Treat i	
27	Poppit Sands	5-27-67 (D.C.M.)	116 / .	Detrine	0.0010-000	i conie a se	adz UA	- Contraction
28	Towyn Warren	1111 V2 5111	ender an	and the set			1	
29	Ynyslas			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	10 10 10 10 10 10 10 10 10 10 10 10 10 1	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	21 - 2 - 2 - 2 - 4 - 4 - 4 - 4 - 4 - 4 - 4	P
30	Tywyn to Aberdovey		1000	- 19 N M	1.	a scol m	A Date	
31	Fairbourne	entre zischet n		1.3.352.5	- Andrewski -	- and a		7.53
32	Morfa Dyffryn	The second						
33	Morfa Harlech	and a second data	3.76	19.55	0.03	1 1 1 1 1		44.33
34	Morfa Bychan	1922 1022 2020	0.0103		in Carden	1 Stan	and in the	a stranger
35	Pwllheli/Pen-y-Chain	C.S. CTERS						-
36	Traeth Crugan			1122513	1014-01-325	C CORC 1	0.01100.120	Se tanta, p
37	Tai Morfa	and the Source of	STATE .	La entre la		A Policity	ALC: NO.	Tendere 1
38	Morfa Dinlle	0.32	1026					3.77
39	Newborough Warren	2.49	2.59	1.69	1. 21 2 1 1	13 11041 14	100.000	44.72
40	Penhrhynoedd - Llangadwaladr	at the state					1000	
41	Aberffraw	Intro Rotter						0.12
42	Valley	10.19	1	100000000	an second	0000212	1 10 COL 10	15.8
43	Tywyn Gwyn		1.0.0		and and and a	1.1.4 16 0		0.2
44A	Traeth Dulas	1.72			contraction of the	1		6.9
44B	Traeth Lligwy	ALL DOWNER	16-5	Superior S		24.5 KB 101 C 4.0	CONTRACTOR OF	
45	Red Wharf Bay	0.36		1.25				1.6
46	Conwy/Deganwy	0.30 106.000		1. 6	an krow			
47	Kinmel Bay	all and the	0.0	1. 2.				
48	Rhyl to Prestatyn	1. S. S. S. S. S.		1000		1000	State State	0.7
49	Gronant to Talacre	110 1203		1.1	and the second	Constitution in	0.81	9.2
		13. The second						
	South Wales Region	0.15		3.37	1 24 27	4.57	CONTRACTOR DA	13.4
	Dyfed & Mid-Wales Region	0.1.0	T I E	1.28		27.93	B Trollin	29.2
-	North Wales Region	15.08	6.35	21.24	0.03		0.81	135.0
1	total transport							
	National Totals	15.23	6.35	25.89	0.03	32.50	0.81	177.7

6. Mobile dune communities

6.1 NVC communities and rare species

Two NVC communities (SD5, SD6) are recognised as mobile dune types, with a total of ten sub-communities. Three rare species are associated with this habitat in Wales: sea stock *Matthiola sinuata*, sea spurge *Euphorbia paralias* and Portland spurge *E. portlandica*.

6.2 SD5 *Leymus arenarius* mobile dune community

Sea lyme-grass Leymus arenarius, a tall and tussocky perennial grass, dominates this type of dune vegetation. It forms either open or closed stands and can colonise and fix mobile sand, keeping pace with substantial sand accumulation (though not to the same extent as marram grass Ammophila arenaria). It is probably more tolerant of occasional saltwater inundation than marram grass. There are three NVC subcommunities. All show a similar geographical distribution which is largely restricted to North Wales (Figure 6.1), with low total extent (7.0 ha) making the community a rare type of Welsh dune vegetation (Table 6.1). Only two sites have extents which exceed 1 ha: Gronant to Talacre and Red Wharf Bay. Sea lyme-grass is found further south in Wales as scattered, small patches which are too small to consider as mappable SD5 examples. Some stands could not be allocated to a sub-community and remain undifferentiated. In a few cases mapping recorded SD5 transitions to other mobile dune types.

SD5a Species-poor sub-community

In this type *Leymus arenarius* can be the only species present. It is restricted to six sites and total extent is only 0.44 ha.

SD5b Elymus farctus sub-community

Leymus arenarius remains dominant in this subcommunity but sand couch *Elymus farctus* is also consistently present, along with occasional marram grass and some strandline species. It is found in only five sites and total extent is only 1.3 ha.

SD5c Festuca rubra sub-community

This sub-community is marked by the consistent presence of red fescue *Festuca rubra* and a range of herbs, including strandline and weedy species such as creeping thistle *Cirsium arvense*. This type is usually associated with locations rich in buried organic matter, forming upon buried strandlines. It is found in only five Welsh sites and total extent is only 3.4 ha.

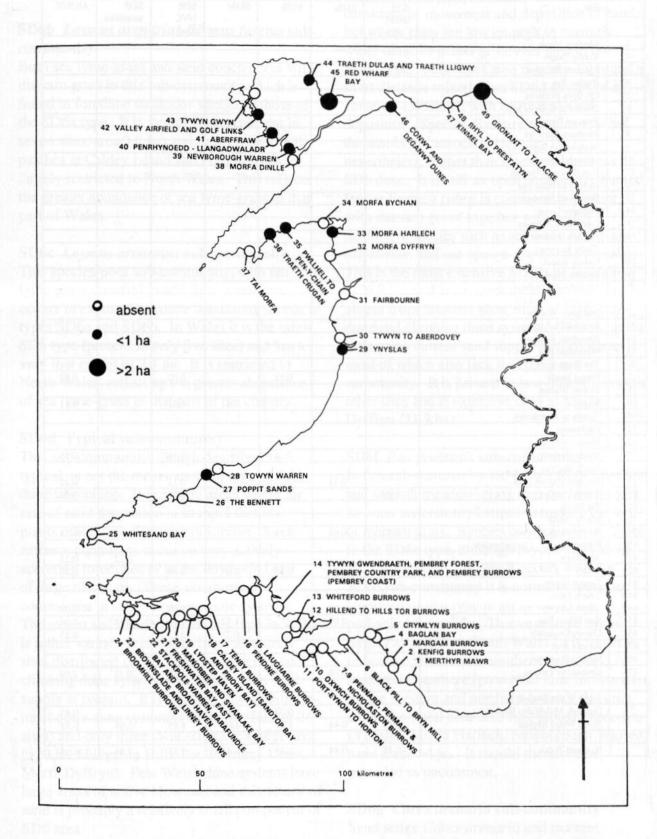
6.3 SD6 Ammophila arenaria mobile dune community

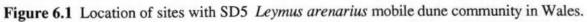
Marram grass Ammophila arenaria dominates most Welsh mobile dunes that are high enough to be removed from the risk of salt-water flooding. The community is widespread (Figure 6.2) and is absent from only three sites (Whitesand Bay, Lydstep Haven, Tenby Burrows), all relatively small bay dune systems altered by recreational developments which might have reduced or eliminated sand supply. Sites with low extent (<10 ha) tend to be small bay dune systems with limited sand supply. Moderate and large areas are found on spit dune, hindshore and prograding systems, suggesting that sand supply is still plentiful. One exception is Oxwich Burrows with a small extent (3.3 ha) for a hindshore system, suggesting a problem with sand supply. The largest extent (73.2 ha) is found at Morfa Dyffryn, with further substantial areas (>30 ha) at Kenfig Dunes, Pembrey Coast and Newborough Warren.

Seven NVC sub-communities are recognised. Extents are given in Table 6.2 and total area is 476.2 ha for NVC types and transitions (mainly to the SD7 community).

SD6a Elymus farctus sub-community

This is normally a very open type of foredune in which small amounts of sand couch *Elymus farctus* are a constant feature with marram *Ammophila arenaria*. It can grade into strandline and SD4 foredune types, with other salt-tolerant plants such as *Honkenya peploides* occurring frequently but with low cover. It is associated with considerable sand mobility and





	Site	SD5 undiff.	SD5a	SD5b	SD5c	SD5 NVC total	SD5 transition	All SD5
1	Merthyr Mawr	Alternation and and the				and the state	A DECEMBER OF	1-1-2-2
2	Kenfig Dunes							
3	Margam Burrows				Territoria and	Printing of		
4	Baglan Bay		1155		1.015.050		0 193600	
5	Crymlyn Burrows	110 222			14.2			
6	Black Pill to Bryn Mill					1000 State	Contraction of the second	area l'area i
7	Pennard Burrows	and Billion	1	1000	A CANA	2202.24	Le strong	
8	Penmaen Burrows							A States
9	Nicholaston Burrows	New Workship		C. All Com	a long theory	11.0010907	WAT THE	1
10	Oxwich Burrows			10,000	CAN HELSE	Sector Sector		
11	Port-Eynon to Horton	E. J.				white as		abiliti.
12	Hillend to Hills Tor	4		1.	1.1.2			
13	Whiteford Burrows	to former and		1	a and a set of the			
14	Pembrey Coast				14			
15	Laughame Burrows			1 Carlo				
16	Pendine Burrows					and the		
17	Tenby Burrows							
18	Caldey Island							
19	Lydstep Haven							27-32-32 O
20	Manorbier/Swanlake						a structure of	
21	Freshwater Bay East	Contraction of the second second	1.1.1.1	a sure of			a strange	
22	Stackpole Warren						10520.8	
23	Brownslade/Linney	and a suble of	1 10 2			AVGESTIN	ANY COLUMN	
24	Broomhill Burrows		10000	La come sans	hall men	and a sure	and the second	ne cor
25	Whitesand Bay	10.00						
26	The Bennett		i no k			and the second	A Contractor	PADICE FLIC
27	Poppit Sands	mark the state		0.02	A restor	0.02		0.02
28	Towyn Warren					A Standy		
29	Ynyslas				0.41	0.41	A DA CALLER	0.41
30	Tywyn to Aberdovey	Sector A			in the state of th		12/14/01	(denational)
31	Fairbourne			Sandanian .	and the second			
32	Morfa Dyffryn							
33	Morfa Harlech	Contract of the		0.16	PUPERDIG T	0.16	10.017.230	0.16
34	Morfa Bychan			a state of the	A PARTES	and second at	a second la	
35	Pwllheli/Pen-y-Chain	ay 15 8 10 2000	0.11			0.11		0.11
36	Traeth Crugan	0.04				0.04		0.04
37	Tai Morfa			Materia Sta			1000 20033	100
38	Morfa Dinlle						1	
39	Newborough Warren	0.12	0.08	0.54		0.74	1776.84	0.74
40	Penhrhynoedd - Llangadwaladr	19 19 19 19		1.28.11		Libel G.	Lunder	
41	Aberffraw			an and the second			0.25	0.25
42	Valley	Contraction of the second	0.04	0.13	0.63	0.80	and the second	0.80
43	Tywyn Gwyn	- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10	or a company of the			STOL SA	1.020	
44A	Traeth Dulas	13 BANG	C. Certain	and and		100	in the second	
44B	Traeth Lligwy	a la serie de la serie	0.09	12.22		0.09		0.09
45	Red Wharf Bay	and a standard and a standard	0.04	1 have	1.32	1.36	0.68	2.04
46	Conwy/Deganwy	1940 AL 1527	-	1.5.63	0.23	0.23		0.23
47	Kinmel Bay	and the second	Mas	-	1.1.1.1		and the	
48	Rhyl to Prestatyn	CS2 1 1683	14					19481
49	Gronant to Talacre	STI DO	0.08	0.44	0.84	1.36	0.73	2.09
	South Wales Region					-		
	Dyfed & Mid-Wales Region	1	-	0.02	0.41	0.43		0.43
	North Wales Region	0.16	0.44	1.27	3.02	4.89	1.66	6.55
	National Totals	0.16	0.44	1.29	3.43	5.32	1.66	6.98

Table 6.1 SD5 Leymus arenarius mobile dune community in Wales. Areas in hectares.

is found on dune systems around all of the Welsh coast, with a total area of 88.5 ha.

SD6b Leymus arenarius-Elymus farctus subcommunity

Both sea lyme-grass and sand couch occur with marram grass in this sub-community which is found in foredune situations similar to those of the SD6a type. It is rare in Wales (present in seven sites, area 3.0 ha) and, apart from small patches at Caldey Island and Poppit Sands, is largely restricted to North Wales. This reflects the greater abundance of sea lyme-grass in that part of Wales.

SD6c Leymus arenarius sub-community

This species-poor sub-community, with sea lyme-grass constant in addition to marram, occurs in exposed foredune conditions similar to types SD6a and SD6b. In Wales it is the rarest SD6 type (present in only five sites) and has a very low extent of 2.1 ha. It is restricted to North Wales, reflecting the greater abundance of sea lyme-grass in that part of the country.

SD6d Typical sub-community

This sub-community, though described as typical, is not the most extensive type of SD6 dune vegetation. It occurs in areas where the rate of sand deposition is so rapid that few plants other than marram can survive. Such extreme conditions occur on very actively accreting foredunes or at the downwind end of large blowouts. These situations are commonest in large, exposed dune systems. The extent and distribution of this type in Wales is rather varied. It is absent from seventeen sites distributed on all coasts, mostly bay and climbing dune systems which have little sand supply at present. It is found in low quantity in most other dune systems (<5 ha in a further 24 sites) and only three locations have a large area (>20 ha, Hillend to Hills Tor, Pembrey Coast, Morfa Dyffryn). Few Welsh dune systems have large areas of active blowouts and this source of sand is probably a relatively small component of SD6 area.

SD6e Festuca rubra sub-community

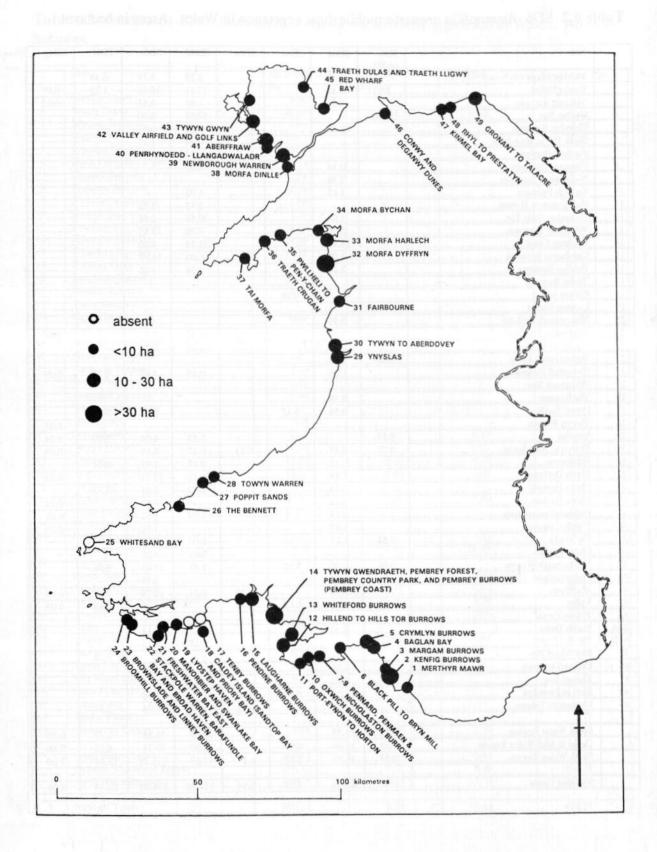
This sub-community is found where there is still considerable movement and deposition of sand, but where rates are low enough to permit a wider range of plants to survive than in the SD6d type. This vegetation is generally found a short distance inland from SD6d as part of a zonation associated with decreased sand deposition. Species diversity remains low but the number of associated species is, nevertheless, higher than more mobile areas of SD6 dune. It is still an open community but red fescue Festuca rubra is consistently present with marram grass, together with highly distinctive species such as sea holly Eryngium maritimum and sea spurge Euphorbia paralias. This is the most extensive SD6 type in Wales (176.9 ha) and is frequent on all coasts. It is absent from fourteen sites, most of them bay dune and climbing dune systems. This suggests little or no current sand supply in such sites, most of which also lack the SD6d subcommunity. It is present in low quantity in most other sites and is extensive only at Morfa Dyffryn (31.3 ha).

SD6f Poa pratensis sub-community

In this sub-community red fescue Festuca rubra and smooth meadow-grass Poa pratensis form an open understorey beneath a tussocky cover of marram grass. Species composition is similar to the SD6e type, although bryophytes can be locally abundant. Where it occurs with the SD6e sub-community it is normally found to landward of that type in areas which are probably less mobile. This vegetation type is largely absent from South Wales (it is found in only three sites on the southern coast) and is scattered elsewhere (present in nine further sites on the western and northern coasts). It is not extensive (total area 20.3 ha), though three sites (Ynyslas, Morfa Harlech, Newborough Warren) have areas >4 ha. It should therefore be regarded as uncommon.

SD6g Carex arenaria sub-community

Sand sedge *Carex arenaria* and marram *Ammophila arenaria* are often the only species to occur in any quantity in this sub-community. It is particularly associated with areas of secondary instability such as blowouts, especially near the margins of slacks where the ground is a little moister. It is of low extent (8.4 ha total area) and has a scattered distribution in thirteen sites, most of them on the western coast of Wales. Only one site has a large extent (Aberffraw, 6.1 ha) where it might be associated with sand mobilised by rabbit grazing, scraping and burrowing.



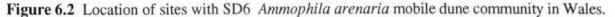


Table 6.2 SD6 Ammophila arenaria mobile dune vegetation in Wales. Areas in hectares.

2 K 3 M 4 B 5 C 6 B 7 P 8 P 9 N 10 O 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 30 T 31 F 32 M 33 M 34 N 35 P 36 T 37 T 38 N 3	Merthyr Mawr Kenfig Dunes Margam Burrows Baglan Bay Crymlyn Burrows Black Pill to Bryn Mill Pennaen Burrows Penmaen Burrows Penmaen Burrows Oxwich Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Pendine Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay Che Bennett Poppit Sands	1.93 0.74	0.42 0.43 0.84 8.33 0.13 2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.59 0.18 0.03 1.36	0.08		2.38 15.11 1.95 17.01 1.92 0.38 1.54 1.15 1.92 2.43 20.50 7.70 23.59 6.00 0.56	5.78 10.66 2.53 2.90 0.51 1.15 1.92 2.56 3.85 3.20 11.97 5.01	0.48 1.29	0.07 0.63
3 M 4 B 5 CC 6 B 7 P 9 N 10 O 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 CC 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 31 F 32 M 33 M <	Margam Burrows Baglan Bay Crymlyn Burrows Black Pill to Bryn Mill Pennard Burrows Penmaen Burrows Penmaen Burrows Oxwich Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pendine Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	0.74	0.84 8.33 0.13 2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		15.11 1.95 17.01 1.92 0.38 1.54 1.15 1.92 2.43 20.50 7.70 23.59 6.00 0.56 0.56	10.66 2.53 2.90 0.51 1.15 1.92 2.56 3.85 3.20 11.97 5.01		-
4 B 5 CC 6 B 7 Pi 8 Pi 9 N 10 O 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 CC 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 30 T 33 M 34 M	Baglan Bay Crymlyn Burrows Black Pill to Bryn Mill Pennard Burrows Penmaen Burrows Penmaen Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett		8.33 0.13 2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		17.01 1.92 0.38 1.54 1.15 1.92 2.43 20.50 7.70 23.59 6.00 0.56 0.56	2.53 2.90 0.51 1.15 1.92 2.56 3.85 3.20 11.97 5.01		0.63
5 CC 6 B 7 Pi 8 Pi 9 N 00 O 11 Pi 2 H 3 W 4 Pi 5 L 66 Pi 77 T 78 CC 90 L 60 Pi 70 T 78 CC 90 L 90 L 90 L 91 F 822 S 823 B 824 B 825 V 826 T 833 M 834 M 835 P 836 T 737 T 738 M 90 N 40 P	Crymlyn Burrows Black Pill to Bryn Mill Pennard Burrows Penmaen Burrows Nicholaston Burrows Oxwich Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett		0.13 2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.59 0.18 0.03	0.08		1.92 0.38 1.54 1.15 2.43 20.50 7.70 23.59 6.00 0.56	0.51 1.15 1.92 2.56 3.85 3.20 11.97 5.01		
6 B 7 Pi 8 Pi 9 N 10 O 11 Pi 13 W 14 Pi 15 L 16 Pi 17 T 18 CC 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 33 M 33 M 333 M 334 M 335 P 36 T 37 T 38 M 39 N 39 N 40 P 41 A 42 V	Black Pill to Bryn Mill Pennard Burrows Penmaen Burrows Nicholaston Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Penby Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.13 2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.59 0.18 0.03	0.08		1.92 0.38 1.54 1.15 2.43 20.50 7.70 23.59 6.00 0.56	1.15 1.92 2.56 3.85 3.20 11.97 5.01		
7 P. 8 P. 9 N 10 O 11 P. 12 H 13 W 14 P. 15 L. 16 P. 17 T 18 CC 19 L. 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 29 Y 30 T 33 M 34 M 35 P 36 T 37 T 38 M 39 N 39 N 39 N 33 N 33 M 3	Pennard Burrows Penmaen Burrows Penmaen Burrows Port-Eynon to Horton Fillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		1.54 1.15 2.43 20.50 7.70 23.59 6.00 0.56	1.92 2.56 3.85 3.20 11.97 5.01		
8 P 9 N 10 O 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 CC 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 N 39 N 39 N 39 N 39 N	Penmaen Burrows Nicholaston Burrows Dawich Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Pendy Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		1.15 1.92 2.43 20.50 7.70 23.59 6.00 0.56 0.07	2.56 3.85 3.20 11.97 5.01		
9 N 10 O 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 CC 19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 Y	Vicholaston Burrows Dxwich Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	2.56 1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		1.92 2.43 20.50 7.70 23.59 6.00 0.56	2.56 3.85 3.20 11.97 5.01		
10 O 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 W	Dxwich Burrows Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	1.41 1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		2.43 20.50 7.70 23.59 6.00 0.56	2.56 3.85 3.20 11.97 5.01		
11 P 11 P 12 H 13 W 14 P 15 L 16 P 17 T 18 CC 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 V 43 T	Port-Eynon to Horton Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	1.03 3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		2.43 20.50 7.70 23.59 6.00 0.56	2.56 3.85 3.20 11.97 5.01		
12 H 13 W 14 P 15 L 16 P 17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 P 41 A 42 W	Hillend to Hills Tor Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		20.50 7.70 23.59 6.00 0.56	2.56 3.85 3.20 11.97 5.01		
13 W 14 Pi 14 Pi 15 L 16 P 17 T 18 CC 19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 P 40 P 41 A 42 V	Whiteford Burrows Pembrey Coast Laughame Burrows Pendine Burrows Cenby Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	3.20 13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		7.70 23.59 6.00 0.56	3.85 3.20 11.97 5.01		
14 P 14 P 15 L 16 P 17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Pembrey Coast Laughame Burrows Pendine Burrows Cenby Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	13.48 4.00 2.49 0.59 0.59 0.59 0.18 0.03	0.08		23.59 6.00 0.56 0.07	3.20 11.97 5.01		
15 L 16 P 17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 P 40 P 41 A 42 V 43 T	Laughame Burrows Pendine Burrows Cenby Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	4.00 2.49 0.59 0.59 0.18 0.03	0.08		6.00 0.56 0.07	11.97 5.01		
16 P 17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 V 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Pendine Burrows Fenby Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	2.49 0.59 0.59 0.18 0.03	0.08		0.56	5.01		
17 T 18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 W 43 T	Tenby Burrows Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.59 0.59 0.18 0.03	0.08		0.07		. 0	
18 C 19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 34 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Caldey Island Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.59 0.18 0.03	0.08				e 0	
19 L 20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Lydstep Haven Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.59 0.18 0.03	0.08			inse 0.72	8 0	
20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.59 0.18 0.03				inse	s Ø	
20 M 21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Manorbier/Swanlake Freshwater Bay East Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.59 0.18 0.03				0.70	15 9	
21 F 22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 35 P 36 T 37 T 38 M 40 P 41 A 42 V 43 T	Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.18				0.72	1	
22 S 23 B 24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 35 P 36 T 37 T 38 M 39 N 39 N 40 P 41 A 42 V 43 T	Stackpole Warren Brownslade/Linney Broomhill Burrows Whitesand Bay The Bennett	2.08	0.03			2.2.1	0.73		0.08
24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 340 P 41 A 42 V 43 T	Broomhill Burrows Whitesand Bay The Bennett	2.08	and the second se			0.84	0.27		
24 B 25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 39 M 40 P 41 A 42 V 43 T	Broomhill Burrows Whitesand Bay The Bennett		1.36						
25 W 26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 39 P 41 A 42 V 43 T	The Bennett					0.10	4.97	0.28	0.09
26 T 27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 P 40 P 41 A 42 V 43 T	The Bennett	1							
27 P 28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 P 40 P 41 A 42 V 43 T	Donnit Sanda		0.38						
28 T 29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 P 40 P 41 A 42 V 43 T	opph Sands		0.56	0.12			0.67	0.84	
29 Y 30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 V 43 T	Fowyn Warren								0.05
30 T 31 F 32 M 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 V 43 T	Ynyslas	3.13		1		3.53	6.96	5.00	0.24
31 F 32 N 33 N 34 N 35 P 36 T 37 T 38 N 39 N 40 P 41 A 42 N 43 T	Tywyn to Aberdovey	0.27	9.37	1000	0.14	0.17	0.19		0.08
32 N 33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 X 43 T	Fairbourne		0.31		1	0.18	1.93	0.04	
33 M 34 M 35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 N 43 T	Morfa Dyffryn		5.18			30.42	31.31		0.52
34 N 35 P 36 T 37 T 38 N 39 N 40 P 41 A 42 N 43 T	Morfa Harlech		5.39			2.72	6.21	4.57	
35 P 36 T 37 T 38 M 39 N 40 P 41 A 42 N 43 T	Morfa Bychan		0.01				4.53		0.14
36 T 37 T 38 M 39 N 40 P 41 A 42 V 43 T	Pwllheli/Pen-y-Chain		2.18			0.09	3.02		0.01
37 T 38 M 39 N 40 P 41 A 42 V 43 T	Traeth Crugan		1.47				1.50	200	0.29
38 N 39 N 40 P 41 A 42 N 43 T	Tai Morfa	0.21	1.17			0.03	0.46	10-01	
39 N 40 P 41 A 42 V 43 T	Morfa Dinlle					0.61	4.20	1000	1
40 P 41 A 42 V 43 T	Newborough Warren	0.06	10.90	0.95	1	4.47	17.03	4.86	1
41 A 42 V 43 T	Penhrhynoedd - Llangadwaladr	0.00	0.34	1			2.33		1
42 V 43 T	Aberffraw	1.00040	0.90	1	0.09	0.51	18.74	0.66	6.13
43 T	Valley	diam'r ar an	3.01	0.62	0.90		5.70	0.48	0.03
-	Tywyn Gwyn	success and as in-				00			1
44A T	Traeth Dulas	and and and a little	0.20	1.5.26		745.37	0.14		
	Traeth Lligwy	and the second		0.01		0.15	0.13		
	Red Wharf Bay				19.00	1.5		0.24	
	Conwy/Deganwy	one of Scatters	0.14	1.49	12 8	12000	0.58		
	Kinmel Bay	1000	0.42	1.1.1.1	1	1000	2.39		
	Rhyl to Prestatyn	1000	0.85	0.19	0.29	2.44	1.96	1	
		7 8 4	4.69	1.06	0.72	1.88	8.94	1.59	
			100			100			1
S	Gronant to Talacre	2.67	18.35			73.99	31.86	1.77	0.70
	Gronant to Talacre	/.0/	23.66	0.20	1.5	34.69	33.78	6.12	0.40
	Gronant to Talacre South Wales Region			2.83	2.14	43.67	111.29	12.44	7.20
N	Gronant to Talacre	5.21	46.53	4.03					

	Site	Total of SD6 NVC types	SD6/SD7 transition	All SD6 transitions	Total of all SD6 types
1	Merthyr Mawr	9.06	transmon		9.06
2	Kenfig Dunes	29.49	0.62	0.62	30.11
3	Margam Burrows	5.95	0.02	0.02	5.95
4	Baglan Bay	20.65			20.65
5	Crymlyn Burrows	10.76			10.76
6	Black Pill to Bryn Mill	1.53			1.53
7	Pennard Burrows	1.54			1.54
8	Penmaen Burrows	1.28	1000	CONTRACTOR OF T	1.28
9	Nicholaston Burrows	2.56			2.56
10	Oxwich Burrows	3.33			3.33
11	Port-Eynon to Horton	4.35	CARTON CONTRACT		4.35
12	Hillend to Hills Tor	24.09	and a state loan	A CONTRACTOR OF THE CONTRACT	24.09
13	Whiteford Burrows	14.75			14.75
14	Pembrey Coast	40.27	1		40.27
15	Laughame Burrows	21.97			21.97
16	Pendine Burrows	8.06			8.06
17	Tenby Burrows	0100			0.00
18	Caldey Island	0.08		The second second	0.08
19	Lydstep Haven	0.00			0.00
20	Manorbier/Swanlake	0.59		0.14	0.73
21	Freshwater Bay East	1.47		0.14	1.47
22	Stackpole Warren	1.29	1	1 1000000000000000000000000000000000000	1.29
23	Brownslade/Linney	2.11			2.11
24	Broomhill Burrows	6.80	1.		6.80
25	Whitesand Bay	0.00	1	Contraction of the second	0.00
26	The Bennett	0.38			0.38
27	Poppit Sands	2.19	0.15	0.15	2.34
28	Towyn Warren	0.05	0.15	0.01	0.06
29	Ynyslas	18.86	0.16	0.16	19.02
30	Tywyn to Aberdovey	10.22	0.26	0.26	10.48
31	Fairbourne	2.46	0.20	0.20	2.46
32	Morfa Dyffryn	67.43	5.25	5.80	73.23
33	Morfa Harlech	18.89	5.45	5.00	18.89
34	Morfa Bychan	4.68	100 100 100	the providence and	4.68
35	Pwllheli/Pen-y-Chain	5.30	- Sector	3.12	8.42
36	Traeth Crugan	3.26	0.46	0.75	4.01
37	Tai Morfa	1.87	0.10	0.15	1.87
38	Morfa Dinlle	4.81	0.57	0.57	5.38
39	Newborough Warren	38.27	0.19	1.60	39.87
40	Penhrhynoedd - Llangadwaladr	2.67	0.17	1.36	4.03
40	Aberffraw	27.03	1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	0.06	27.09
41 42	Valley	10.74		0.00	10.74
42	Tywyn Gwyn	10.74	0.61	0.61	0.61
44A	Traeth Dulas	0.34	0.01	0.01	0.34
44A 44B	Traeth Lligwy	0.34		Pro Constantino and	0.34
440	Red Wharf Bay	0.29			0.24
45	Conwy/Deganwy	0.72	10000000000	1 10 10 10 10 10 10	0.72
40	Kinmel Bay	2.81	100000000000000000000000000000000000000	The second second	2.81
47	Rhyl to Prestatyn	5.73			5.73
40	Gronant to Talacre	18.88	0.90	0.90	19.78
49	Oronant to Talacre	10.00	0.90	0.90	19.76
	South Woles Paging	129.34	0.62	0.62	129.96
	South Wales Region	129.34	0.82	0.46	129.96
10.00	Dyfed & Mid-Wales Region		8.24	15.03	The local design of the lo
-	North Wales Region	226.64	0.24	13.05	241.67
	National Totals	460.10	9.17	16.11	476.21

Table 6.2 (continued) SD6 Ammophila arenaria mobile dune vegetation in Wales. Areas in hectares.

7. Semi-fixed (SD7) and fixed (SD8) dune grasslands

7.1 NVC communities and rare species

Semi-fixed dunes (SD7) in the NVC system are characterised by marram grass Ammophila arenaria and red fescue-grass Festuca rubra as constant species. They represent a zone inland from SD6 types in which sand deposition decreases and A. arenaria declines in importance, eventually to be replaced by a short sward grassland (SD8) in which F. rubra and lady's bedstraw Galium verum are constant. The SD7 community is the main habitat for four rare species in Wales: dune helleborine Epipactis dunensis, sea spurge Euphorbia paralias, early sand-grass Mibora minima and dune fescue Vulpia fasciculata.

7.2 Harmonisation problems

These two NVC communities are treated together here because there are slight problems in harmonising results for these vegetation types mapped in NVC surveys since 1988 and the earlier site studies at Laugharne and Tenby Burrows. Vegetation classification and mapping in the latter two sites were based on an early version of the NVC sand dune chapter. Revision of that chapter in 1988 produced no clear correlation between sub-communities in the SD8 community and its equivalent pre-1988 type (SD10), nor was there any equivalent in the pre-1988 types to the current SD7 community. Results were harmonised as far as possible by comparing the quadrat groups in Laugharne and Tenby results (both derived from TWINSPAN analysis) with current NVC types. It was not possible to identify sub-communities for either the SD7 or the SD8 community and separation was made only at community level. Only the SD7 community was present at Tenby, apart from an SD8/MG6 transition. Both SD7 and SD8 were present in Laugharne results but their relative extents were unclear upon the vegetation map. The balance between these two types was made by dividing their total area by their relative proportions in the contiguous Pendine site. The SD7 and SD8 results for

Laugharne Burrows must therefore be regarded as approximate.

7.3 SD7 Ammophila arenaria-Festuca rubra semi-fixed dune community

The total area of semi-fixed SD7 dune in Wales is 1477.5 ha (Table 7.1) and the community is found in all sites (Figure 7.1) except Kinmel Bay where sufficient sand supply and succession from SD6 vegetation might be interrupted by a continuous sea wall. It is present in small quantities (<25 ha) in 32 Welsh sites, most of which are small bay dune and climbing dune systems which have restricted sand supply. It is much more extensive in the larger spit, hindshore and prograding dune systems where sand supply has been sufficient to produce SD6 mobile dunes and there has been no interruption of succession to SD7 types. Thirteen sites have areas between 25 and 100 ha, with three (Merthyr Mawr, Laugharne Burrows, Newborough Warren) even larger (>100 ha). Much of the Merthyr Mawr area is mapped as transitional SD7/SD8 vegetation. The large 190.8 ha extent at Laugharne Burrows is only approximate due to the treatment of harmonised results (see section 7.2).

Five SD7 sub-communities are recognised and all are present in Wales. Undifferentiated SD7 vegetation is common at Brownslade/Linney, as it is at Laugharne Burrows. Transitions are recorded in several locations but these are of small extent apart from the SD7/SD8 type mapped at Merthyr Mawr.

SD7a Typical sub-community

This sub-community is found where the succession from mobile dune to stable dune grassland is still at an early stage, close to SD6 types. It is less species-rich than others and in Wales is not the commonest SD7 type. It has a total area of 76.6 ha and is rare in South Wales, occurring in small quantities in the west and north. Only one site has a large extent (Newborough Warren, 40.4 ha).

SD7b Hypnum cupressiforme subcommunity

This sub-community is marked by the abundance of the moss *Hypnum cupressiforme* which forms an extensive carpet over the sand. Winter annuals are another feature of this type which is found on more stable areas than the SD7a sub-community. Total area is 49.0 ha and it is rare in Wales, recorded in only seven sites. The only large extent is at Merthyr Mawr (39.8 ha). Quadrat records from that site show that restharrow *Ononis repens* is at least as common as *H. cupressiforme* and much of the mapped area might be considered as an SD7b/SD7c transition.

SD7c Ononis repens sub-community

In this sub-community restharrow Ononis repens is abundant and several other plants with a southern distribution occur, such as sea bindweed Calystegia soldanella. Neither annuals nor bryophytes are abundant in this type which is found in areas which are still partly unstable. It is the most widespread and extensive (520.3 ha) SD7 type on Welsh dunes. It is absent from only eight sites (excluding Laugharne Burrows), all of which are small bay dune or climbing dune systems with little or no fresh sand supply. Large extents (>40 ha) are present at four sites (and probably Laugharne Burrows in addition): Pembrey Coast, Pendine Burrows, Morfa Dyffryn and Newborough Warren. The abundance of this type, together with large extents of some SD6 types, suggests that the commonest succession pathway in mobile and semi-fixed Welsh dunes is the sequence SD6a-SD6d-SD6e-SD7c.

SD7d Tortula ruralis ssp. ruraliformis subcommunity

This sub-community is found on areas more stable than those occupied by the SD7a and SD7c types, particularly within areas of stable dune on steep, south-facing slopes. Here a combination of harsh microclimate, rabbit scuffing and instability due to soil creep suppresses the vigour of perennial plants and maintains relatively open conditions. This type is characterised by the occurrence of a group of drought-avoiding winter annuals and by extensive carpets of bryophytes which invade bare sand patches, notably *Tortula ruralis* ssp. *ruraliformis*. It is both widespread and extensive in Wales (total area 433.6 ha). It is present on all coasts but is absent from twenty sites, all of which are small bay dune and climbing dune types. Extensive (>40 ha) areas are found at two sites (and perhaps Laugharne Burrows): Kenfig Dunes and Newborough Warren.

SD7e Elymus pungens sub-community

This sub-community is marked by the occurrence within semi-fixed dune vegetation of sea couch *Elymus pungens*. This grass is associated with upper saltmarshes and with sea walls, but can also occur in dunes. Apart from the presence of sea couch there is little to distinguish this type which is often rather species-poor. It is rare in Wales (present in only four sites) and of low extent (3.5 ha). The only site with a large proportion of total area is at Morfa Bychan (2.4 ha).

7.4 SD8 Festuca rubra-Galium verum fixed dune grassland community

Red fescue *Festuca rubra* and a variety of other grasses, dicotyledons (notably lady's bedstraw *Galium verum*) and mosses form the usual closed turf of this community. It occupies areas of stable, calcareous dune where sand accretion is no longer significant and where there has usually been some soil development. Marram grass may be present but is rarely a major component of the vegetation. Lichens and mosses become particularly important in areas with some leaching of dune soil and heavy grazing.

The total area of SD8 fixed dune grassland in Wales is 1344.2 ha (Table 7.2). It is widespread (Figure 7.2) and absent from only one site, Lydstep Haven, where it has probably been replaced by improved grassland as part of caravan park development. It is present as small areas (<25 ha) in 35 sites, as moderate extents (25–100 ha) in a further ten sites, and as large areas (>100 ha) in three sites (Kenfig Dunes 214.9 ha, Brownslade/Linney 137.5 ha, Morfa

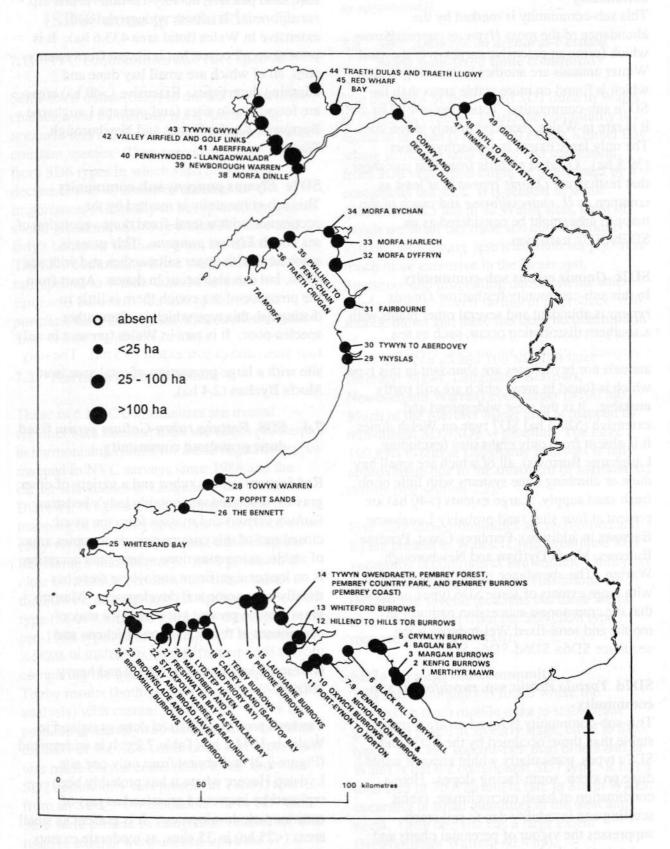


Figure 7.1 Location of sites with SD7 Ammophila arenaria-Festuca rubra semi-fixed dune community in Wales.

	Site	SD7a	SD7b	SD7c	SD7d	SD7e
1	Merthyr Mawr	and the second second	39.81	12.95	3.68	
2	Kenfig Dunes		0.12	39.29	48.67	
3	Margam Burrows	3.48		2.36	0.81	0.56
4	Baglan Bay			0.49	5.51	0.00
5	Crymlyn Burrows			26.92	5.77	
6	Black Pill to Bryn Mill	10.0 (10.1) ST		1.54	5.11	12.003.713
7	Pennard Burrows			1.03		
8	Penmaen Burrows			0.38		
9	Nicholaston Burrows			0.50	4.49	
10	Oxwich Burrows	and the first of		24.68	10.26	
11	Port-Eynon to Horton			2.56	2.05	
12	Hillend to Hills Tor			31.41	33.97	
13	Whiteford Burrows			27.75	29.75	
14	Pembrey Coast			65.39	33.26	
15	Laughame Burrows			03.39	33.20	-
16	Pendine Burrows		11178	42.73	24.29	10.0
17	Tenby Burrows			44.15	24.29	
18	Caldey Island	0.31				
19	Lydstep Haven	0.51		0.50	-	
20	Manorbier/Swanlake		-		-	-
20	Freshwater Bay East	0.15	-	0.25	0.90	-
22	Stackpole Warren	0.15	-	0.18	0.89	
		1		5.24	0.06	-
23	Brownslade/Linney	0.00		1.09	6.00	-
24	Broomhill Burrows	0.22		0.46	6.30	
25	Whitesand Bay	0.58		2.80		
26	The Bennett	0.60	2.03	0.88		
27	Poppit Sands	0.23	-	-	0.04	
28	Towyn Warren	1.05				0.37
29	Ynyslas	0.22	0.01	5.73	14.57	
30	Tywyn to Aberdovey	1.67	0.07	11.98	0.28	
31	Fairbourne		1.1.1	0.02		
32	Morfa Dyffryn	5.16	1	46.71	30.51	
33	Morfa Harlech	5.85	0.39	17.60	16.63	Contraction of
34	Morfa Bychan	3.92		17.27		2.43
35	Pwllheli/Pen-y-Chain	0.63	1.2.1.2		A CONTRACT OF A DESCRIPTION OF A DESCRIP	
36	Traeth Crugan			1.88		
37	Tai Morfa	1.32		0.39		
38	Morfa Dinlle	0.35		6.64	13.35	
39	Newborough Warren	40.38		58.83	89.48	0.18
40	Penhrhynoedd - Llangadwaladr	3.88			-	
41	Aberffraw		6.61	11.18	27.72	
42	Valley	2.41	1.	30.57	8.65	14.1.4.0.72
43	Tywyn Gwyn			2.81	0.05	
44A	Traeth Dulas	0.39			0.16	
44B	Traeth Lligwy		1 110	0.25		13 10 22
45	Red Wharf Bay	ada astronom	and all all all all all all all all all al	1.13	a la se la se se	
46	Conwy/Deganwy	0.56		1.67	2.01	
47	Kinmel Bay					
48	Rhyl to Prestatyn		1.	4.87	A STATE OF A	
49	Gronant to Talacre	3.23		9.92	20.40	
12	Stolidik to Talacić	5.405		1.76	20.10	
112.0	South Wales Region	3.48	39.93	171.36	144.96	0.56
-		3.36	2.04	125.25	79.41	0.30
199	Dyfed & Mid-Wales Region		7.07			
-	North Wales Region	69.75	1.07	223.72	209.24	2.61
	No. 170 and	76.50	10.04	520.22	422.61	250
53100	National Totals	76.59	49.04	520.33	433.61	3.54

 Table 7.1 SD7 Ammophila arenaria-Festuca rubra semi-fixed dune community in Wales. Areas in hectares.

	Site	SD7 undiff.	SD7b/d	SD7/SD8	Other SD7 transitions	Total SD7
1	Merthyr Mawr		2.85	76.36	1.54	137.19
2	Kenfig Dunes					88.08
3	Margam Burrows	and the set of the set				7.21
4	Baglan Bay					6.00
5	Crymlyn Burrows				1	32.69
6	Black Pill to Bryn Mill					1.54
7	Pennard Burrows					1.03
8	Penmaen Burrows					0.38
9	Nicholaston Burrows		Contraction of the second	1		4.49
10	Oxwich Burrows			-		34.94
11	Port-Eynon to Horton					4.61
12	Hillend to Hills Tor					65.38
13	Whiteford Burrows					57.50
14	Pembrey Coast		1			98.65
15	Laughame Burrows	190.82*				190.82
16	Pendine Burrows		0.84			67.86
17	Tenby Burrows	2.93	0.01			2.93
18	Caldey Island	w.73		-	0.91	1.30
19	Lydstep Haven				0.71	0.50
20	Manorbier/Swanlake	0.04		-		0.29
21	Freshwater Bay East	0.04	1	0.50	0.19	1.91
22	Stackpole Warren	3.50		0.95	0.68	10.43
23	Brownslade/Linney	69.49	1	0.95	0.00	70.58
24	Broomhill Burrows	0.09		3.23	0.85	11.15
25	Whitesand Bay	0.07		3.43	0.02	3.40
26	The Bennett		-	0.69	0.02	4.20
27	Poppit Sands			0.09	0.03	0.30
28	Towyn Warren	0.12		-	0.03	1.76
29	Ynyslas	0.12	-	0.89	0.18	21.60
30	Tywyn to Aberdovey			0.09	1.55	17.10
31	Fairbourne		-	-	1.55	0.02
32	Morfa Dyffryn	1.81		-		84.19
33	Morfa Harlech	0.07	13.06		1.31	54.91
and the local division of the local division		the second se	13.00			24.87
34	Morfa Bychan	0.10			1.15	0.76
35	Pwllheli/Pen-y-Chain	0.15		-	0.13	2.15
36	Traeth Crugan	0.15			0.12	
37	Tai Morfa	0.12	2.00			1.71
38	Morfa Dinlle	0.17	3.26		1.04	23.77
39	Newborough Warren	0.06	-	-	1.04	189.97
40	Penhrhynoedd - Llangadwaladr	0.00		1.00	1.04	4.92
41	Aberffraw	0.03		1.57	0.00	47.11
42	Valley	0.58		-	0.09	42.30
43	Tywyn Gwyn		-	-	0.04	2.90
44A	Traeth Dulas	1 1 1 1 1 1 M			0.32	0.87
44B	Traeth Lligwy					0.23
45	Red Wharf Bay					1.13
46	Conwy/Deganwy		-			4.24
47	Kinmel Bay			-	1000	and and a
48	Rhyl to Prestatyn		-			4.8
49	Gronant to Talacre	0.04	3.89	4.92		42.4
				-		- A CALLER
	South Wales Region		2.85	76.36	1.54	441.0
120	Dyfed & Mid-Wales Region	266.99	0.84	6.26	3.08	487.68
	North Wales Region	3.01	20.21	6.49	6.79	550.4
			1			1
	National Totals	270.00	23.90	89.11	11.41	1479.10

Table 7.1 (continued) SD7 Ammophila arenaria-Festuca rubra semi-fixed dune community inWales. Areas in hectares. * = approximate extent (see section 7.2).

Harlech 110.3 ha). Some large sites, notably Newborough Warren (23.9 ha) and Gronant to Talacre (8.3 ha) have surprisingly low areas given the extent of their SD7 vegetation, suggesting they have more instability than other comparable dune systems.

Five NVC sub-communities are recognised (Table 7.2). The first three are variants found on free-draining soils, the last two are characteristic of damper conditions. A large number of transitional types are mapped in addition, both between SD8 sub-communities and between SD8 and other vegetation. Most transitions are not extensive and total area is generally <10 ha, but those involving change to neutral grasslands (MG1 31.1 ha, MG6 40.3 ha, MG7 25.1 ha) are important in the overall transition total of 179.9 ha (13.4% of all SD8 extent). The transitions to neutral grassland illustrate both reduced grazing (SD8/MG1) and grassland improvement (SD8/MG6, SD8/MG7). A large amount of the SD8 total (513.2 ha, 38.2%) is not allocated to a sub-community, notably at Kenfig Dunes, Pennard Burrows, Hillend to Hills Tor, Pembrey Coast, Brownslade/Linney and Broomhill Burrows (all >25 ha). Most of this undifferentiated area is confined to South Wales and probably reflects reduced grazing in recent decades, allowing rank SD8 types to develop which are not easily allocated to SD8 sub-communities or transitions. Further evidence of a grazing role is found in the very frequent presence of dewberry Rubus caesius in SD8 records from many sites in South Wales. This species invades readily when stock grazing is relaxed and it is not eaten by rabbits.

SD8a Typical sub-community

This type is usually less species-rich than other sub-communities. Mosses tend not to be very prominent and coarse grasses may occur. It is often found on sites, or parts of sites, which are rather undergrazed. This sub-community is the most frequent and extensive (346.4 ha) type in Wales. It is found on all coasts but there is a major gap in the south-east between Baglan Bay and Laugharne Burrows where mapped undifferentiated SD8 probably approximates this type.

SD8b Luzula campestris sub-community This sub-community is generally species-rich. Field woodrush Luzula campestris is frequent, with the grasses common bent Agrostis capillaris, sweet vernal grass Anthoxanthum odoratum and sheep's fescue Festuca ovina present in many records. Wild thyme Thymus praecox is constant and abundant in some samples. Moss cover can be high, with Rhytidiadelphus squarrosus common and generally accompanied by R. triquetrus, Brachythecium albicans and

Pseudoscleropodium purum. Some species are also characteristic of stable grasslands on acidic dunes and the sub-community can be regarded as a leached, well-grazed SD8 type. It is rare in South Wales (present in only three sites, but with large extents at Kenfig Dunes and Stackpole Warren) and on the north coast (present only at Rhyl to Prestatyn in sites further north and east of Aberffraw). On the west coast and the south-western shores of Ynys Mon (Anglesey) it is widespread, with large extents at Tywyn to Aberdovey, Morfa Dyffryn, Morfa Harlech and Aberffraw. This geographical distribution might be the result of heavier grazing than other sites and perhaps sand of a lower carbonate content.

SD8c Tortula ruralis ssp. ruraliformis subcommunity

Local, unstable conditions in SD8 grasslands can occur on steep slopes or areas subject to rabbit scuffing. The bare sand exposed is generally colonised by this sub-community which has a high cover of the moss *Tortula ruralis* ssp. *ruraliformis*. The mosses *Homalothecium lutescens* and *Rhytidiadelphus squarrosus* are often present, annual species can be abundant and marram grass can be present. It is rare in Wales and is present in only eight sites. Total extent is small (40.5 ha) and large areas are confined to two dune systems: Brownslade/Linney (15.0 ha) and Aberffraw (22.4 ha).

SD8d Ranunculus acris-Bellis perennis subcommunity

This sub-community is more typical of northern and western Britain where it is the dominant vegetation of much Scottish machair dune. Cool, oceanic conditions are typical of such areas, combined with grazing. In drier regions of Britain it tends to be found in depressions and around slacks where the water table can provide moisture at times of drought. It is rare in Wales (present in six sites) and of low extent (37.2 ha). The largest areas are found at Tywyn to Aberdovey (17.1 ha) and Morfa Dyffryn (11.0 ha).

SD8e Prunella vulgaris sub-community

The British distribution of this sub-community is very similar to the SD8d type. Self-heal *Prunella vulgaris* is a constant species in Scottish samples (it is only relatively frequent in Wales). The sub-community occurs in wetter conditions than the SD8d type and in Wales is confined to slack margins. It is rare (present in only five sites) and of low total extent (23.6 ha). The only sites with areas >5 ha are Brownslade/Linney and Broomhill Burrows, possibly the most oceanic of Welsh dune sites.

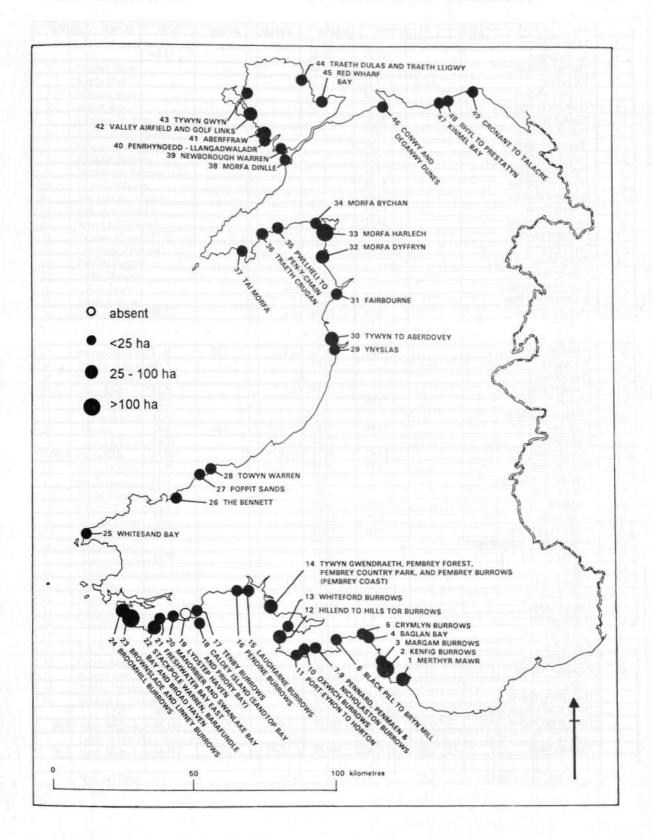


Figure 7.2 Location of sites with SD8 *Festuca rubra-Galium verum* fixed dune community in Wales.

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24 Broomhill 25 Whitesand 26 The Benne 27 Poppit Sar 28 Towyn W 29 Ynyslas 30 Tywyn to 31 Fairbourn 32 Morfa Dyf 33 Morfa Dyf 34 Morfa Dyf 35 Pwilheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/D 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 9 South Wa Dyfed & P			18.09			22.79	1000	
25 Whitesand 26 The Benne 27 Poppit Sar 28 Towyn Wi 29 Ynyslas 30 Tywyn to 31 Fairbourn 32 Morfa Dyf 33 Morfa Dyf 34 Morfa Byg 35 Pwillheli/P 36 Traeth Cnf 37 Tai Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/Dy 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to		97.71	26.67					
26 The Benne 27 Poppit Sar 28 Towyn Wi 29 Ynyslas 30 Tywyn to 31 Fairbourn 32 Morfa Dyl 33 Morfa Dyl 34 Morfa Byg 35 Pwllheli/P 36 Traeth Crn 37 Tai Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/Dy 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to	and the second	39.07	35.57		2.02	0.10		
27 Poppit Sar 28 Towyn W. 29 Ynyslas 30 Ty wyn to 31 Fairbournd 32 Morfa Dyf 33 Morfa Dyf 34 Morfa Byd 35 Pwllheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Dir 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red Whar 46 Conwy/Dw 47 Kinmel B: 48 Rhyl to Pr 49 Gronant to 20 South Wa		0.84	3.32		2.92	0.10		
28 Towyn W. 29 Ynyslas 30 Tywyn to 31 Fairbournd 32 Morfa Dyf 33 Morfa Dyf 34 Morfa Byd 35 Pwllheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red What 46 Conwy/D 47 Kinmel B: 48 Rhyl to Pr 49 Gronant to 50uth Wa Dyfed & 1		and the second	0.07			8.06		-
29 Ynyslas 30 Tywyn to 31 Fairbourne 32 Morfa Dyf 33 Morfa Dyf 34 Morfa Bye 35 Pwllheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Dir 39 Newborou 40 Penhrhyno 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red Whar 46 Conwy/Db 47 Kinmel Bx 48 Rhyl to Pr 49 Gronant to 50uth Wa Dyfed & 1								
30 Tywyn to 31 Fairbourne 32 Morfa Dyf 33 Morfa Dyf 34 Morfa Bye 35 Pwllheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Dir 39 Newborou 40 Penhrhyno 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red Whar 46 Conwy/D 47 Kinmel B 48 Rhyl to Pr 49 Gronant to 5 South Wa	Varren		0.26			0.19	0.12	
31 Fairbournd 32 Morfa Dyf 33 Morfa Hat 34 Morfa Byd 35 Pwllheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Dir 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red Whar 46 Conwy/Db 47 Kinmel B: 48 Rhyl to Pr 49 Gronant to 5 South Wa	and the second strength	4.38	2.37			6.22	GBTS 1	1
32 Morfa Dyf 33 Morfa Hat 34 Morfa Byd 35 Pwllheli/P 36 Traeth Cm 37 Tai Morfa 38 Morfa Dir 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red What 46 Conwy/DD 47 Kinmel B: 48 Rhyl to Pr 49 Gronant to 5 South Wa			7.50		-	14.34	-	-
33 Morfa Har 34 Morfa Byo 35 Pwllheli/P 36 Traeth Cm 37 Tai Morfa 38 Morfa Dir 39 Newborou 40 Penhrhyno 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 45 Red What 46 Conwy/Db 47 Kinmel B: 48 Rhyl to Pr 49 Gronant to 5 South Wa		2.46	1.93	0.27	0.86	1.72		-
34 Morfa Byg 35 Pwllheli/P 36 Traeth Cri 37 Tai Morfa 38 Morfa Din 39 Newborout 40 Penhrhyng 41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 44B Traeth Lli 45 Red What 46 Conwy/De 47 Kinmel B: 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & P		11 Control 22	15.86			17.43	3.17	
35 Pwllheli/P 36 Traeth Cn 37 Tai Morfa 38 Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red What 46 Conwy/De 47 Kinmel B 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1	arlech	14.43	24.05	0.04		44.54	0.77	9.60
36 Traeth Cn 37 Tai Morfa 38 Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/De 47 Kinmel B: 48 Rhyl to Pr 49 Gronant te South Wa Dyfed & 1		0.31	8.89	0.12	118.	8.23		
37 Tai Morfa 38 Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/De 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1	Pen-y-Chain		2.55			0.30		
38 Morfa Din 39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/De 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1	Crugan		2.06	A COLOR		0.85		
39 Newborou 40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/De 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 50 South Wa Dyfed & 1	fa	1.39	4.18		100 Mar 100 Mar 100 Mar	3.15	1. 1	
40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red What 46 Conwy/Dd 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 50000 South Wa 50000 Dyfed & 1	inlle	0.25	12.68			1.57	1. 199	
40 Penhrhynd 41 Aberffraw 42 Valley 43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red What 46 Conwy/Dd 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 50000 South Wa 50000 Dyfed & 1	ough Warren	0.06	10.66			3.40	and and	
41 Aberffraw 42 Valley 43 Tywyn Gw 44A Traeth Du 44B Traeth Lli 45 Red Whar 46 Conwy/De 47 Kinmel Ba 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1	noedd - Llangadwaladr		3.17				1.1.1	
43 Tywyn Gy 44A Traeth Du 44B Traeth Lli 45 Red What 46 Conwy/Du 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant tu South Wa Dyfed & 1			9.51			23.75		
44A Tracth Du 44B Tracth Lli 45 Red What 46 Conwy/De 47 Kinmel Ba 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1	Contraction of the second	4.07	38.19					
44A Tracth Du 44B Tracth Lli 45 Red What 46 Conwy/De 47 Kinmel Ba 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1	Gwyn	10000	2.36	1. 1.	1		1.1.1	1000
44B Traeth Lli 45 Red What 46 Conwy/Dd 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 500th Wa Dyfed & 1		and the second se	0.19	1.1.1		1 Marine	1.	
45 Red What 46 Conwy/Dd 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 50000 South Wa Dyfed & 1			0.18	1		tona -	1.28	
46 Conwy/D0 47 Kinmel Bi 48 Rhyl to Pr 49 Gronant to 500th Wa Dyfed & 1			1.		1. 74			
47 Kinmel Ba 48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1		1.1.1.1.20	21.85	2018	1.1.1	1.1746		
48 Rhyl to Pr 49 Gronant to South Wa Dyfed & 1		12.12	0.14	1	12000	10.00	1.2	
49 Gronant to South Wa Dyfed & 1		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	6.04		1 6 7 5	2.03	2.2	
South Wa Dyfed & 1			8.31		1	2105		
Dyfed & 1	is address	1000	0.01	1.1.1	1.000			1
Dyfed & 1	ales Region	249.18	101.14	12.00	-	14.04	-	-
	Mid-Wales Region	249.18	64.94		2.92	41.09	0.12	
I INORM WA		22.97	180.30	0.43	0.86	121.31	3.94	9.60
	ales Region	22.91	160.50	0.45	0.80	121.31	3.94	9.00
National	Tatala	513.16	346.38	0.43	3.78	176.44	4.06	9.60

Table 7.2 SD8 Festuca rubra-Galium verum fixed dune grassland vegetation in Wales. Areas inhectares. * = approximate extent (see section 7.2).

	Site	SD8c	SD8c/e	SD8d	SD8e	Total SD8 NVC
1	Merthyr Mawr			1.36	-	types 84.98
2	Kenfig Dunes		1	4.49		178.24
3	Margam Burrows			4.45	1	6.94
4	Baglan Bay				-	4.23
5	Crymlyn Burrows			-	1010	1.28
6	Black Pill to Bryn Mill			-	-	1.20
7	Pennard Burrows				-	26.92
8	Penmaen Burrows				-	0.13
9	Nicholaston Burrows					1.92
10	Oxwich Burrows			-	-	3.21
11	Port-Eynon to Horton					3.21
12	Hillend to Hills Tor					49.54
13	Whiteford Burrows		-			9.61
14	Pembrey Coast		-			73.33
15	Laughame Burrows			-	-	24.91
16	Pendine Burrows			-	1.62	9.76
17	Tenby Burrows				1.02	2.10
18	Caldey Island	0.47				0.56
19	Lydstep Haven	0117				0.50
20	Manorbier/Swanlake	0.76			-	1.26
21	Freshwater Bay East		-			0.44
22	Stackpole Warren					41.47
23	Brownslade/Linney	14.99			9.69	122.39
24	Broomhill Burrows			2.05	7.20	83.89
25	Whitesand Bay					7.18
26	The Bennett	0.07	10.111			8.2
27	Poppit Sands					
28	Towyn Warren					0.57
29	Ynyslas					12.97
30	Tywyn to Aberdovey	0.64		17.09	4.05	43.62
31	Fairbourne	0.97				8.21
32	Morfa Dyffryn			10.96		47.42
33	Morfa Harlech				1.08	94.51
34	Morfa Bychan					17.55
35	Pwllheli/Pen-y-Chain			1.28		4.13
36	Traeth Crugan					2.91
37	Tai Morfa					8.72
38	Morfa Dinlle					14.5
39	Newborough Warren					14.12
40	Penhrhynoedd - Llangadwaladr					3.17
41	Aberffraw	22.42				55.68
42	Valley		9.11			51.37
43	Tywyn Gwyn					2.36
44A	Traeth Dulas				-	0.19
44B	Traeth Lligwy					0.18
45	Red Wharf Bay					
46	Conwy/Deganwy					21.85
47	Kinmel Bay					0.14
48	Rhyl to Prestatyn	0.15				8.22
49	Gronant to Talacre					8.31
	THE REPORT OF A DESCRIPTION OF A					
21.5	South Wales Region			5.85	A CARE IN	370.21
1000	Dyfed & Mid-Wales Region	16.29		2.05	18.51	386.93
	North Wales Region	24.18	9.11	29.33	5.13	407.16
112		A REAL PROPERTY AND A REAL				

 Table 7.2 (continued)
 SD8 Festuca rubra-Galium verum fixed dune grassland community in Wales. Areas in hectares.

Table 7.2 (continued)SD8 Festuca rubra-Galium verum fixed dune grassland community inWales. Areas in hectares.

	Site	SD8/ SD9	SD8/ SD10	SD8/ SD12	SD8/ SD16	SD8/ MG1	SD8/ MG5	SD8/ MG6	SD8/ MG7
1	Merthyr Mawr	1.11	1.	1-	45		191.1		1
2	Kenfig Dunes	2.93				31.05	1.1	Manhor 12	
3	Margam Burrows	3.06			1.1		1 1 15	and solution	
4	Baglan Bay						in administra	Minder	1.10
5	Crymlyn Burrows							ell milled	
6	Black Pill to Bryn Mill						information of the second	9.84	1.00
7	Pennard Burrows						116 808	124 1-10	1.5.6
8	Penmaen Burrows						in the second	of beached	1
9	Nicholaston Burrows						interna in	1 Section 1	
10	Oxwich Burrows						and the	Stall Shirt	0
11	Port-Eynon to Horton							Statement	1.00
12	Hillend to Hills Tor							14.20	
13	Whiteford Burrows							our teach di	1
14	Pembrey Coast								
15	Laughame Burrows							The second	
16	Pendine Burrows								1
17	Tenby Burrows							0.36	
18	Caldey Island								
19	Lydstep Haven								1
20	Manorbier/Swanlake	1 1 1 1 1							1
21	Freshwater Bay East	100						1.000001/	
22	Stackpole Warren		1.76	2.92					14.35
23	Brownslade/Linney							13.33	1 3
24	Broomhill Burrows	1 1 1 2 3 4	0.01		1111		0.36	1.26	0.29
25	Whitesand Bay							C. Gradest	0.21
26	The Bennett							1	1
27	Poppit Sands		0.04						1
28	Towyn Warren	11.812							1
29	Ynyslas		1						
30	Tywyn to Aberdovey						0.08		
31	Fairbourne	the second second							
32	Morfa Dyffryn								
33	Morfa Harlech		-			0.04		1.31	10.25
34	Morfa Bychan				-				
35	Pwllheli/Pen-y-Chain		-						
36	Traeth Crugan					-			-
37	Tai Morfa		-		-			-	
38	Morfa Dinlle		1	6.17	-				1
39	Newborough Warren			JAI	9.78				
40	Penhrhynoedd - Llangadwaladr		1	1.	1 200				
41	Aberffraw				0.04				
42	Valley				-				
43	Tywyn Gwyn							1	
44A	Traeth Dulas					-		1.5	
44B	Traeth Lligwy								
45	Red Wharf Bay		1111					and the last	0.04
46	Conwy/Deganwy								1
47	Kinmel Bay	and the second	-		-		123 1.3		
48	Rhyl to Prestatyn								-
49	Gronant to Talacre								
47			-		-	-			
	South Wales Region	5.99				31.05		24.04	-
	Dyfed & Mid-Wales Region	3.99	1.81	2.92	-	51.05	0.36	14.95	14.8
	North Wales Region		1.01	6.17	9.82	0.04	0.38	14.95	14.8.
	North wales Region		-	0.17	9.82	0.04	0.08	1.51	10.25
	National Totals	5.99	1.81	9.09	9.82	31.09	0.44	40.30	25.14

	Site	SD8/ CG6	SD8/ MC8	SD8/ W21	SD8/ W25	Other SD8	All SD8 trans.	All SD8 types
1	Merthyr Mawr	TO KAN AN			1.	trans.		84.98
2	Kenfig Burrows				2.66		36.64	214.88
3	Margam Burrows	Contraction of the		1.5	2.00		3.06	10.00
4	Baglan Bay	No. 1882 222	1.52 7.0	100000			0.00	4.23
5	Crymlyn Burrows	1		10171010	1.19142		1021248	1.28
6	Black Pill to Bryn Mill	10.0	1 1 1				9.84	9.84
7	Pennard Burrows		1	-			2.04	26.92
8	Penmaen Burrows				1/51 10/11	2.09.2	1112275	0.13
9	Nicholaston Burrows	12.00 C		1				1.92
10	Oxwich Burrows	1003 410 38 0.0						3.21
11	Port-Eynon to Horton	and fill and all	1. 1.		131000	11000		3.21
12	Hillend to Hills Tor	2.2	17		and the second	Contract of the	14.20	63.74
13	Whiteford Burrows						11.20	9.61
14	Pembrey Coast						0.0000000	73.33
15	Laughame Burrows	124 31 21						24.91
16	Pendine Burrows					-		9.76
17	Tenby Burrows	5.40			-		5.76	5.76
18	Caldey Island	0.14		1111		1000	0.14	0.70
19	Lydstep Haven		1				via 1	0110
20	Manorbier/Swanlake							1.26
21	Freshwater Bay East					0.17	0.17	0.61
22	Stackpole Warren	0.76	11.01	14.37	2.42	1.40	48.99	90.46
23	Brownslade/Linney			C. C		1.80	15.13	137.52
24	Broomhill Burrows	200 0 - 32.0	1		23312-314	4.55	6.47	90.36
25	Whitesand Bay			115118	26123.34	Contraction and the	0.21	7.39
26	The Bennett	10.00 00 023 133			4.47		4.47	12.67
27	Poppit Sands	15102.00					0.04	0.04
28	Towyn Warren			1-10-11	111111	10010000	1201019	0.57
29	Ynyslas	uffer a conservable						12.97
30	Tywyn to Aberdovey	1.20 11.20.00			1 1 1 1 1 1 1 1		0.08	43.70
31	Fairbourne	and a second			in Intern		No INCO	8.21
32	Morfa Dyffryn							47.42
33	Morfa Harlech		4.21			-	15.81	110.32
34	Morfa Bychan		100		a state and	STOCE OF	The second	17.55
35	Pwllheli/Pen-y-Chain	10 M 10 M		and a second	11110	2.88	2.88	7.01
36	Traeth Crugan							2.91
37	Tai Morfa	neter action		Contractor of the	A LUMBER	mande no	1 1 1 1 1 1	8.72
38	Morfa Dinlle	1.11.11.11.11.11		MONTRY	111 1111	dat bee	6.17	20.67
39	Newborough Warren						9.78	23.90
40	Penhrhynoedd - Llangadwaladr	ning beingen						3.17
41	Aberffraw	all marked	C HERBORN	1922		10.255 11	0.04	55.72
42	Valley			A States				51.37
43	Tywyn Gwyn							2.36
44A	Traeth Dulas	NO REPORT						0.19
44B	Traeth Lligwy		1 month	and the second second	and a state of the	in the factor		0.18
45	Red Wharf Bay	5. S. 1. S. S. S. S.					0.04	0.04
46	Conwy/Deganwy	12/10/10/10/10	1	1000		010101	1.	21.85
47	Kinmel Bay	5. 1 Star 1		1		1.000	(and the	0.14
48	Rhyl to Prestatyn	STOL AND INCOME	1	1		1.1.1		8.22
49	Gronant to Talacre	and an instant			1000 011	1000	a salar	8.31
					1 Bernie	12/2010	1 1 1 1 1	11/100
	South Wales Region		-	-	2.66		63.74	433.95
0.1	Dyfed & Mid-Wales Region	6.30	11.01	14.37	6.89	7.92	81.38	468.31
	North Wales Region	11	4.21	1871B	100.00.0	2.88	34.80	441.96
-	National Totals	6.30	15.22	14.37	9.55	10.80	179.92	1344.22

 Table 7.2 (continued)
 SD8 Festuca rubra-Galium verum fixed dune grassland community in Wales. Areas in hectares.

8. Other dry grassland communities on dunes

8.1 NVC communities and rare species

This chapter covers communities ranging from other dry dune grasslands and lichen-rich communities (SD9, SD10, SD11, SD12) to several mesotrophic (MG1, MG5, MG6, MG7), calcicolous (CG2, CG6, CG10), calcifugous (U1, U2, U4, U5, U13) and maritime cliff (MC5, MC8, MC9, MC10, MC12) types which tend to be found on the edge of dune systems, forming either transition zones over bedrock or areas modified by agricultural improvement and golf course maintenance. Bracken communities (U20, W25) are discussed in Chapter 11. No rare species are generally associated with these vegetation types on sand dunes in Wales.

8.2 Dune grasslands featuring Arrhenatherum elatius (SD9, MG1)

These vegetation types, featuring high cover and constancy for false oat-grass *Arrhenatherum elatius*, represent neutral grasslands which might also have had some slight soil enrichment from past grazing. Under moderate and heavy grazing conditions they become rare and their presence, especially in large extents, is a good indicator of reduced grazing in the last one or two decades (also often associated with scrub expansion - see Chapter 11).

Species-poor mixes of false oat-grass and marram grass, with no clear SD9 Ammophila arenaria-Arrhenatherum elatius dune grassland sub-community associates, are common in South Wales and quite extensive at Hillend to Hills Tor and Merthyr Mawr (Table 8.1, Figure 8.1). The undifferentiated SD9 type is in transition to bracken at Kenfig Burrows. The SD9a Typical sub-community is recorded on all coasts and large extents are present at Newborough Warren and Pendine Burrows. It is the commonest mapped type. The SD9b *Geranium sanguineum* sub-community is infrequent and most sites are found in North Wales. The only large extent is at Morfa Harlech. The total extent of all SD9 types (301.3 ha) is much more extensive than MG1 *Arrhenatherum elatius* coarse grassland (142.9 ha, Table 8.2) which lacks marram grass, suggesting that false oat grass entry into open SD6 and SD7 marram communities is more prevalent than into SD8 or other closed grassland types.

Undifferentiated MG1 Arrhenatherum elatius coarse grassland is the only common MG1 type and is moderately frequent in West and North Wales, though the only large extents are confined to South Wales (Figure 8.2; Kenfig Burrows, Pembrey Coast). Clear subcommunities are of very low extent and frequency, as are transitions to saltmarsh, dune wetland and scrub (Table 8.2).

8.3 Calcifugous dune grasslands (SD12)

Stable dunes low in calcium carbonate content can be leached over time to produce an acidic type, SD12 Carex arenaria-Festuca ovina-Agrostis capillaris dune grassland. This is uncommon in Wales (Table 8.3, Figure 8.3) and suggests that high carbonate levels and dune instability are the norm in most sites. The undifferentiated SD12 type and the SD12a Anthoxanthum odoratum sub-community have similar extents and moderate frequency, but the SD12b Holcus lanatus sub-community is very rare and confined to a small area of Stackpole Warren. The largest covers are at Pennard Burrows and Aberffraw, but total extent is low (124.3 ha). Transitions are rare and the only site with a large extent is Pennard Burrows (19.2 ha), where grazing and winter feeding of stock have probably created a transition to semi-improved grassland (SD12/MG6).

8.4 Other calcifugous grasslands (U1, U4, U5, U6)

Very small areas of various calcifugous (acidic) grassland are also present around the inland edge of some Welsh dune systems, mainly on thin acidic sand overlying bedrock (Table 8.4). These vegetation types (U1c Festuca ovina-Agrostis capillaris-Rumex acetosella grassland,

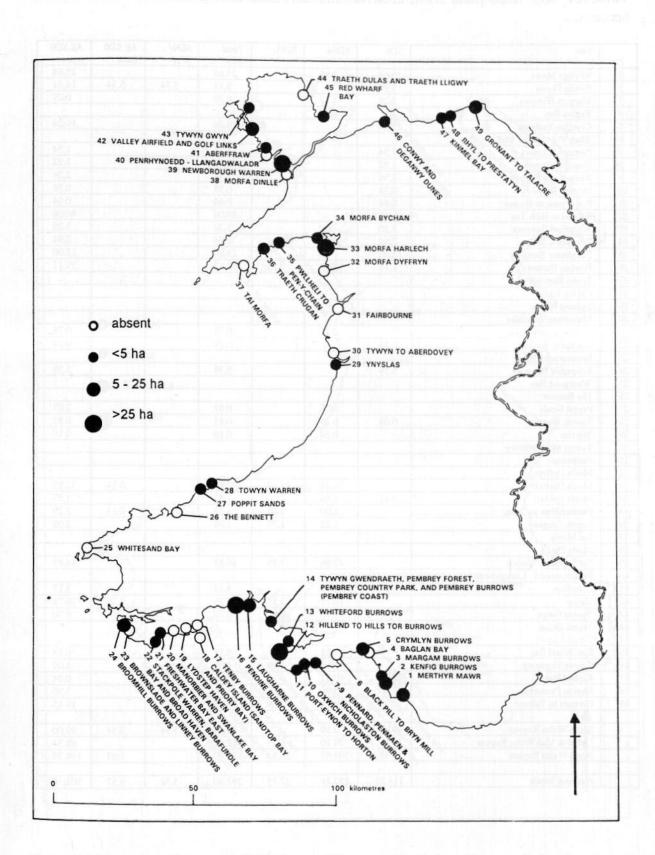
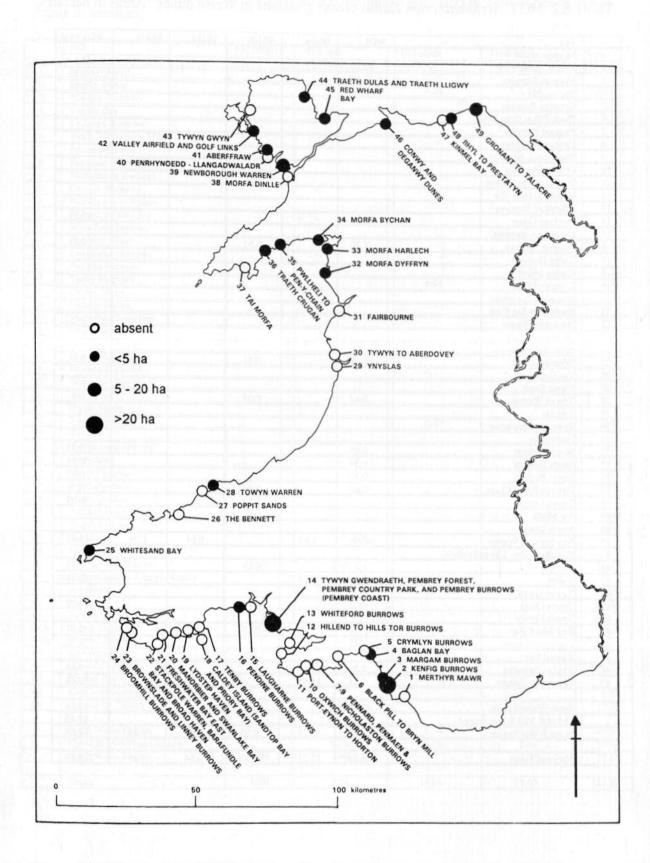


Figure 8.1 Location of sites with SD9 Ammophila arenaria-Arrhenatherum elatius dune grassland in Wales.

 Table 8.1
 SD9 Ammophila arenaria-Arrhenatherum elatius dune grassland in Wales. Areas in hectares.

1	Site	SD9	SD9a	SD9b	Total SD9	SD9/ W25	All SD9 trans	All SD9 types
1	Merthyr Mawr	20.65	2.99		23.64	a start Sec	1.1.1.1.1.1.1	23.64
2	Kenfig Dunes	9.17	100.00		9.17	5.34	5.34	14.51
3	Margam Burrows	0.29	1991 11	Sec. Law	0.29	CONTROL OF		0.29
4	Baglan Bay	AN STALL	Contraction of the					- 1X -
5	Crymlyn Burrows	10.26			10.26			10.26
6	Black Pill to Bryn Mill	224 242 12			C COLLEG	CONTRACT.		
7	Pennard Burrows	1.54		1. A. R.	1.54			1.54
8	Penmaen Burrows	1.92			1.92	1. 201800		1.92
9	Nicholaston Burrows	2.56		a fait and	2.56		CONTRACTO	2.56
10	Oxwich Burrows	0.38		A. 44	0.38			0.38
11	Port-Eynon to Horton	0.64	12		0.64	Contraction of the		0.64
12	Hillend to Hills Tor	40.06	1		40.06		Cessien I	40.06
13	Whiteford Burrows	3.20			3.20	1.		3.20
14	Pembrey Coast	2.94	1. No.	1 N. 18	2.94			2.94
15	Laughame Burrows	13.00		10.000	13.00	0.071583.		13.00
16	Pendine Burrows	1.15	37.49	0.53	39.17			39.17
17	Tenby Burrows	a contraction of	1.1.1.7					1
18	Caldey Island		1.7.58		10000	11010000		1.1
19	Lydstep Haven		The state		1 see the	The start		
20	Manorbier/Swanlake	-	1 1 1					
21	Freshwater Bay East		0.78		0.78			0.78
22	Stackpole Warren	0.24	0.10		0.24	-		0.24
23	Brownslade/Linney	0.21	1.20		0.21		00.02	0.21
24	Broomhill Burrows	5.39	-		5.39			5.39
25	Whitesand Bay	5.57	1 3 5		5.57	100000000	a track a set	0.07
26	The Bennett	CO. 0159.87						
27	Poppit Sands		0.07		0.07			0.07
28	Towyn Warren	0.09	0.76	100000	0.85	10000000	199911	0.85
29	Ynyslas	0.05	0.10		0.10			0.10
30	Tywyn to Aberdovey		0.10		0.10			0.10
31	Fairbourne				1.11.11.11.11	C C C C C C C C C C C C C C C C C C C	1000	
32	Morfa Dyffryn	000000000					1	
33	Morfa Harlech		19.28	13.33	32.61		0.14	32.89
34	Morfa Bychan	0.41	19.26	15.55	1.57		0.14	1.57
35	Pwllheli/Pen-y-Chain	0.41	1.10	1.03	2.03	-	0.13	2.29
36	Traeth Crugan	COLUMN TO MANAGEMENT	1.22	1.03	2.03		0.15	2.29
37	Tai Morfa		1.22	1.77	2.99			2.99
38	Morfa Dinlle			11111	1111 1111	The state of the	CO/ACTO	1.1
39	Newborough Warren		42.96	3.89	46.85	-	-	46.85
40	Penhrhynoedd - Llangadwaladr		42.90	3.09	40.05	-	-	+0.83
40	Aberffraw		3.13	-	3.13		-	3.13
41 42	Valley		16.75	2.51	19.26	-	0.76	20.78
42	Tywyn Gwyn		0.70	2.51	0.70		0.70	0.70
43 44A	Traeth Dulas		0.70	-	0.70			0.70
44A 44B	Traeth Lligwy		1	Con Cas		1949	L.S.A.L.	
4415	Red Wharf Bay	ALC: NOT ALC: NO	0.18	1	0.18		-	0.18
45	Conwy/Deganwy		0.18	4.09	4.09	-	-	4.09
40	Kinmel Bay	0.63	0.31	4.09	0.94			0.94
47		0.03	the second se	-			-	
	Rhyl to Prestatyn	0.07	3.90	-	3.90	-	-	3.90
49	Gronant to Talacre	0.07	19.38	-	19.45	-	-	19.45
1	0 AWA D	00.77	0.00	-	00.00	1	1 1 1	00.00
	South Wales Region	90.67	2.99	0.50	93.66	5.34	5.34	99.00
-	Dyfed & Mid-Wales Region	22.81	39.20	0.53	62.54	-	1.00	62.54
	North Wales Region	1.11	109.97	26.62	137.70		1.03	139.70
	and the state of t			L LIS.				



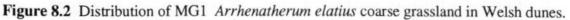


Table 8.2 MG1 Arrhenatherum elatius coarse grassland in Welsh dunes. Areas in hectares.

	Site	MG1	MG1a	MG1b	MG1d	MG1e	MG1 tota
1	Merthyr Mawr						
2	Kenfig Dunes	40.10				1	40.1
3	Margam Burrows	0.38	1.196.0	10.12			0.38
4	Baglan Bay	2.16				1.1	2.16
5	Crymlyn Burrows		1.1.1.1.1.1.1	1000			
6	Black Pill to Bryn Mill	16 6	100				
7	Pennard Burrows	199		102.3			
8	Penmaen Burrows				A COLORADO	-	
9	Nicholaston Burrows			Service of the	1.1.1.1		
10	Oxwich Burrows	242 1 2 2 1			100000000000000000000000000000000000000	A TRACT	
11	Port-Eynon to Horton						
12	Hillend to Hills Tor				0.03	1	
13	Whiteford Burrows				Logi I		
14	Pembrey Coast	43.59		1.1	1.04	1. 20. 1	43.59
15	Laughame Burrows		1.5.1	100		1	
16	Pendine Burrows	2.20		0.51	1.00		2.71
17	Tenby Burrows	2.20	1 1				
18	Caldey Island			191240			
19	Lydstep Haven		17.57	1			
20	Manorbier/Swanlake	-	1.5				1
21	Freshwater Bay East			-		1	
22	Stackpole Warren			-			
23	Brownslade/Linney						0
24	Broomhill Burrows						
25	Whitesand Bay	0.09	-	0.51		816.21	0.6
26	The Bennett	0.03		0.51	-		0.0
27	Poppit Sands						-
28	Towyn Warren	0.42		0.08	-		0.5
29	Ynyslas	0.42		0.06			0.5
30	Tywyn to Aberdovey					2.000000	0.050.0
31	Fairbourne					-	1
32	Morfa Dyffryn	0.85			-		0.85
33	Morfa Harlech	0.34		1.1			0.34
34	Morfa Bychan	0.45		-			0.34
35	Pwllheli/Pen-y-Chain	0.45		0.01	1.000	-	0.43
36	Traeth Crugan	0.08		0.01	-		0.09
37	Tai Morfa			0.04	-		0.04
38	Morfa Dinlle			-	-		
39		10.08	1.64	-	0.64	1.20	12.65
40	Newborough Warren Penhrhynoedd - Llangadwaladr	10.08	1.64		0.64	1.29	13.65
40	Aberffraw	1.7	-	0.28		-	1.00
		the second se	2.10	0.28			1.98
42	Valley	0.16	2.18				2.34
43	Tywyn Gwyn	0.05		-	-		0.00
44A 44B	Traeth Dulas	0.02	and the second	1.21 5.28	-	1	0.02
44B 45	Traeth Lligwy Red Wharf Bay			0.17	-	1200	0.17
45		1.25		0.17	- Prove	1	
40	Conwy/Deganwy	1.35		-			1.35
	Kinmel Bay	0.00		-	1	1	0.00
48	Rhyl to Prestatyn	0.89	11.45	-	1	1	0.89
49	Gronant to Talacre	1.23	11.45	-		-	12.68
	C d WIL D		-	-	-	-	10.01
	South Wales Region	42.64	-		-	-	42.64
	Dyfed & Mid-Wales Region	46.30	1000	1.10	0.01	1.00	47.40
-	North Wales Region	17.15	15.27	0.50	0.64	1.29	34.85
	National Totals	106.09	15.27	1.60	0.64	1.29	124.89

 Table 8.2 (continued) MG1 Arrhenatherum elatius coarse grassland in sand dunes of Wales.

 Areas in hectares.

	Site	MG1/SM18	MG1 wet transitions	MG1 scrub transitions	Total MG1 transitions	Total MG1
1	Merthyr Mawr				titulisiti olis	
2	Kenfig Dunes		CONTRACTOR	6.56	6.56	46.66
3	Margam Burrows		100 1 100	0.50	0.50	0.38
4	Baglan Bay	1 2 2	10000			2.16
5	Crymlyn Burrows	1 32 3		1.467 5. 1.1.1		2.10
6	Black Pill to Bryn Mill	1.5.10	and the second s			6
7	Pennard Burrows	100				
8	Penmaen Burrows	1.	1000			
9	Nicholaston Burrows				-	
10	Oxwich Burrows	3			-	-
11	Port-Eynon to Horton					
12	Hillend to Hills Tor	Charles In				
13	Whiteford Burrows			-		-
14	Pembrey Coast					42.50
15	Laughame Burrows					43.59
16	Pendine Burrows		0.58		0.50	2.00
17	Tenby Burrows		0.58	< 00	0.58	3.29
18	Caldey Island	-		6.98	6.98	6.98
19	Lydstep Haven	-	A A A A			
20	Manorbier/Swanlake	-		-		-
	Freshwater Bay East	-				-
21						
22 23	Stackpole Warren Brownslade/Linney					
				0.7	0.7	
24	Broomhill Burrows	-		0.7	0.7	0.7
25	Whitesand Bay		-			0.6
26	The Bennett					
27	Poppit Sands	-				
28	Towyn Warren	-		0.4	0.4	0.9
29	Ynyslas	-				
30	Tywyn to Aberdovey	-				
31	Fairbourne					
32	Morfa Dyffryn	_				0.8
33	Morfa Harlech			and a second second second second		0.34
34	Morfa Bychan		1126	and an substant		0.4:
35	Pwllheli/Pen-y-Chain			a second and here	10 A. C. C. C. L. C.	0.0
36	Traeth Crugan					0.0
37	Tai Morfa					
38	Morfa Dinlle				and productions are	
39	Newborough Warren	0.09	2.56		2.65	16.3
40	Penhrhynoedd - Llangadwaladr	CRASH STREET	200 879-1 20			
41	Aberffraw					1.9
42	Valley	1 1 1 6 1	1 06.55	1200	1.	2.3
43	Tywyn Gwyn	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		STOL NOT 2	The second s	1.1
44A	Traeth Dulas	and the second second	a program with	2111111	205 63	0.0
44B	Traeth Lligwy	18 - 17 Adres 7			TIMEST	
45	Red Wharf Bay		Marca and		3 2 2 3 3 3 3 3	0.1
46	Conwy/Deganwy	Collars a North	1.75-1025	2 3 8 81	33 3.5.1.2.8	1.3
47	Kinmel Bay		12 11 11		11 - 1 - 1 - S	
48	Rhyl to Prestatyn	1 15 2 3	1 . F		8. 6. 8. 8	0.8
49	Gronant to Talacre	1.	0.1		0.1	12.7
		T They a	19.2.2	1.	S. C.	
	South Wales Region			6.56	6.56	49.2
1	Dyfed & Mid-Wales Region	ST STAT	0.58	8.08	8.66	56.0
1	North Wales Region	0.09	2.66		2.75	37.6
	Service Street Street Street		1. 12.25	5/22.5	1 6.25	
	Totals	0.09	3.24	14.64	17.97	142.8

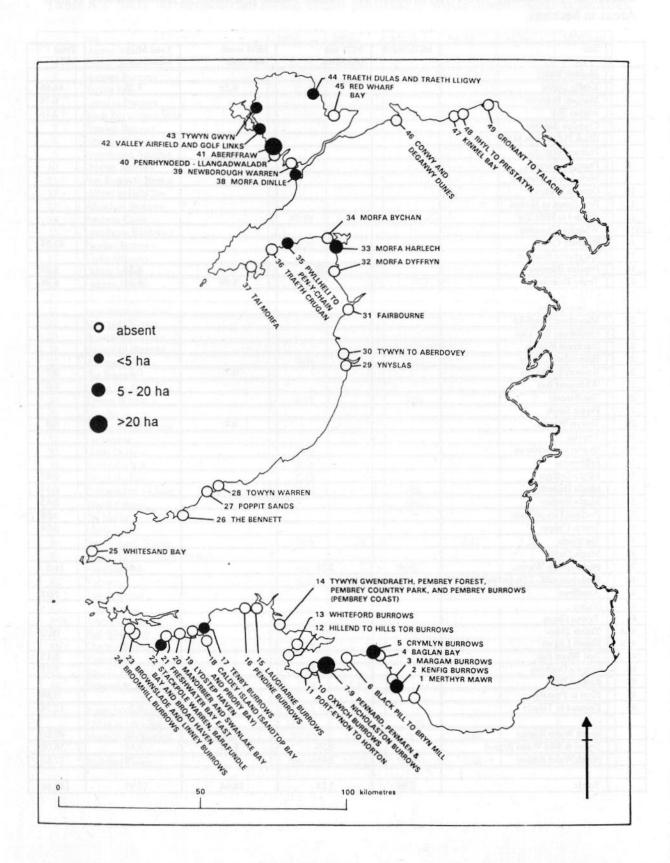


Figure 8.3 Distribution of SD12 Carex arenaria-Festuca ovina-Agrostis capillaris dune grassland community in Welsh dunes.

Table 8.3 SD12 Carex arenaria-Festuca ovina-Agrostis capillaris dune grassland community inWales. Areas in hectares.

19-8	Site	SD12	SD12a	SD12b	All SD12	SD12/ MG6	Other SD12 trans.	All SD12 trans.	SD12 total
1	Merthyr Mawr			1. 200.04					
2	Kenfig Dunes	10.05	111	-	10.05				10.05
3	Margam Burrows	Server Contraction	100	10000	C1669				131634
4	Baglan Bay	A land		1.1.1					
5	Crymlyn Burrows	11.54		1.1.1.1.1.1.1.1	11.54	5.13		5.13	16.67
6	Black Pill to Bryn Mill			1/12/11			11. 1940		TU ASK
7	Pennard Burrows	16.02		Carlines had	16.02	19.23	and the second second	19.23	35.25
8	Penmaen Burrows	3.85		10	3.85				3.85
9	Nicholaston Burrows	13, 4010035, 41	1.1	120	2011711				
10	Oxwich Burrows	ale the star	16	anartan	- 11 to 1	CONTRACT.	na en e	117 10	1.1.1.1.1.1.1
11	Port-Eynon to Horton	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.1	100000					
12	Hillend to Hills Tor	CALCULATION OF	100					194.	1.1.1.1.1.1.1.1
13	Whiteford Burrows	PLACE REAL PARTY	10. 1991						
14	Pembrey Coast			and the state		a later of		and a second	13 8.
15	Laughame Burrows	FLA DE TELEVISION DE LA							
16	Pendine Burrows	10 6 700 59				111	10 2024	0.0001	
17	Tenby Burrows	0.47			0.47				0.47
18	Caldey Island								
19	Lydstep Haven	ALL MARKED CONTROL		1.11	11111120	17.2 (13) PC	12112	10110	1. 5. 91
20	Manorbier/Swanlake			The state of the	Londor	unaing -		1.5 C 1.0 (4)	
21	Freshwater Bay East								
22	Stackpole Warren	0.000101		0.02	0.02	1.1.1.1.1.1.1		1.1.1.1	0.02
23	Brownslade/Linney				0.02	nen proc	117 990	10000	
24	Broomhill Burrows								
25	Whitesand Bay	1000	12			THE PARTY			
26	The Bennett	And a second second	1.2	1.0	NI ST	2512 11	11 73 51 1	CONTROL V	1000100
27	Poppit Sands								
28	Towyn Warren	- 1 C - 113 - 112 -	1.1.1		-				
29	Ynyslas	to gardenus		-9163.97	CI TOULLY	1.07277	DHI CO		0.0.107
30	Tywyn to Aberdovey			10.00					
31	Fairbourne								-
32	Morfa Dyffryn			2011010	1000	100.775	1 112 1 1214	steption	1110 111
33	Morfa Harlech		14.85	111111	14.85				14.85
34	Morfa Bychan		14.05	-	14.05				14.05
35	Pwllheli/Pen-y-Chain		0.05		0.05				0.05
36	Traeth Crugan		0.05	-	0.05	-		1.17	0.03
37	Tai Morfa						-		-
38	Morfa Dinlle	2.55	0.21		2.76	-	-	-	2.76
39	Newborough Warren	2.33	0.21	-	2.70	-	11000		2.70
40	Penhrhynoedd - Llangadwaladr		-	1013200					
40	Aberffraw	6.19	27.60		33.79		-		33.79
41	Valley	0.67	0.72		1.39	1.1.1.1.1.1.1	0.22	0.22	1.61
42		0.07	4.86		4.93	-	0.22	0.22	
	Tywyn Gwyn Traeth Dulas	0.07	4.80		4.95	-	0.04	0.04	4.93
44A 44B	Traeth Lligwy	Bour Police	1.5	1-36.20	in the state	10.1.10	0.04	0.04	0.04
440	Red Wharf Bay		-	-	-	-	-		11/1
46			-	-		-			-
40	Conwy/Deganwy Kinmel Bay			The Color	-	-	-		-
47	Rhyl to Prestatyn		-	-	1	-		1.0.10	1 1 1 1
48	Gronant to Talacre		-	-	-	-		1 1 1 1 1 1	-
49	Oronant to Taracre	The second second		10000	-	1000		-	-
	Courth William Daw?	41.40		-	11.12	24.26		21.26	1000
121	South Wales Region	41.46	1	0.02	41.46	24.36	1.000	24.36	65.82
-	Dyfed & Mid-Wales Region	0.47	10.00	0.02	0.49	-	0.00	0.07	0.49
-	North Wales Region	9.48	48.29		57.77	-	0.26	0.26	58.03
1111		51.41	48.29	0.02	99.72	24.36	0.26	24.62	124.34

Erodium cicutarium-Teesdalia nudicaulis subcommunity; U4a Festuca ovina-Agrostis capillaris-Galium saxatile grassland, Typical sub-community; U4b Holcus lanatus-Trifolium repens sub-community; U5 Nardus stricta-Galium saxatile grassland; U6 Juncus squarrosus-Festuca ovina grassland) are very rare and five occurrences (one for each type) total only 2.1 ha. All are confined to northern Wales where acidic rocks and soils on the edges of dunes are much commoner than further south. The sites are not mapped at the national scale.

8.5 Other dry mesotrophic grasslands (MG5, MG6, MG7)

Stock grazing, together with re-seeding of recreational areas, or the unintentional sowing of seed in hay from improved grasslands elsewhere, produce various mesotrophic grassland types which vary considerably in their frequency and extent in Wales. The MG5 Cynosurus cristatus-Centaurea nigra meadow (8.9 ha, Table 8.5) and MG6 Lolium perenne-Cynosurus cristatus pasture (10.8 ha, Table 8.6) are uncommon and of low cover. These reflect heavy grazing on dune swards, probably with winter feed in some cases (Tywyn to Aberdovey, Newborough Warren, Morfa Dyffryn), but their rarity and low extent suggests that such impacts are not severe. Neither type is mapped at national scale. MG7 Lolium perenne leys are much commoner (total extent 200.5 ha), with most types undifferentiated except for a concentration of the MG7e Plantago lanceolata sub-community (characteristic of mown and trampled areas) in North Wales (Table 8.6, Figure 8.4). Such grasslands are all improved by re-seeding and fertiliser addition, with low species diversity resulting from the strong growth of the competitive dominant perennial rye-grass (L. perenne). The largest extent (65.4 ha) is found in restored grasslands of Pembrey Country Park where there is heavy recreational pressure requiring a resistant type of grass cover. Other moderate extents are often associated with improved fairways of golf courses (most notably at Conwy and Deganwy). Relatively few cases seem to involve grassland improvement for

grazing, hay or silage (examples include Broomhill Burrows and Morfa Bychan), though it is possible that improved agricultural grassland on sand (beyond the main tracts of natural and semi-natural dune grassland) was not mapped in its entirety.

8.6 Calcicolous grasslands (CG2, CG6, CG7)

Calcareous grasslands are rare upon dunes in Wales (Table 8.7) and are largely confined to thin sand covers in climbing dune systems overlying outcrops of limestone. Total extent is 25.8 ha and only Tenby Burrows (19.9 ha) has a large area, of CG6 Avenula pubescens grassland. At Lystep Haven a small area of this community is in transition to W22 Prunus spinosa-Rubus fruticosus agg. scrub. All other types (CG7b Festuca ovina-Hieracium pilosella-Thymus praecox grassland, Cladonia spp. sub-community, CG7c Fragaria vesca-Rumex acetosa sub-community) are rare and occur in only small extents. Sites with calcicolous grasslands are not mapped at the national scale.

8.7 Dunes dominated by *Carex arenaria* and lichens (SD10, SD11)

The bulk of these communities are established either as small patches of sand sedge *Carex arenaria* invading bare sand on the edges of blowouts and parabolic dunes (SD10 types), or on sands where heavy grazing opens up the turf to allow lichens to colonise (SD11).

The SD10 *Carex arenaria* dune community (Table 8.8, Figure 8.5) is made up of two subcommunities. Small areas of undifferentiated SD10 vegetation are scattered on all coasts, with low total extent (2.7 ha). The SD10a *Festuca rubra* type is probably characteristic of calcareous mobile dune and is more frequent and has a higher, but still small, total cover (11.7 ha). On more acidic mobile sand the SD10b *Festuca ovina* sub-community is recorded and this is very rare, recorded only for two Ynys Mon (Anglesey) sites at Newborough Warren and Aberffraw. In the latter it occurs

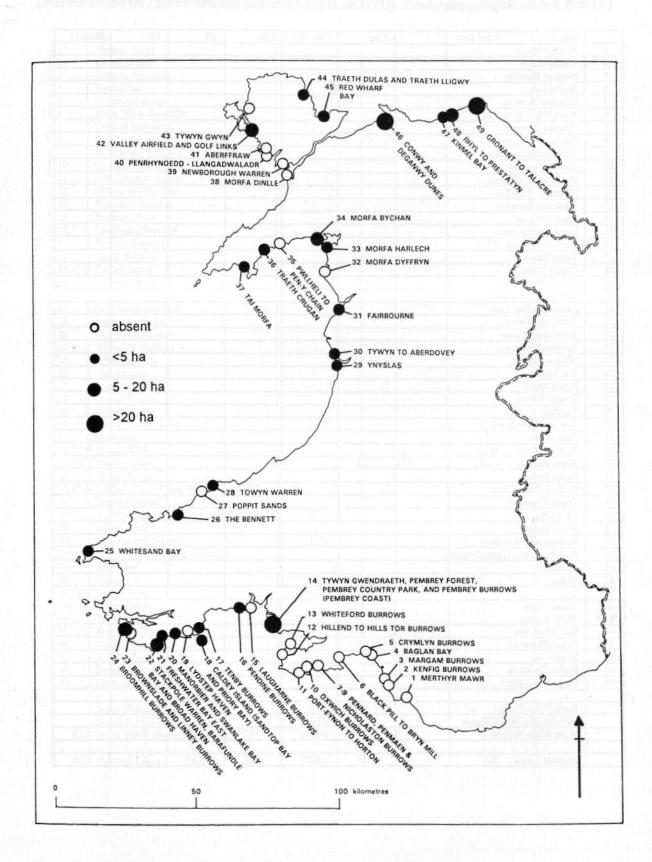


Figure 8.4 Distribution of MG7 Lolium perenne leys in Welsh dunes.

Table 8.4 Calcifugous grasslands (U1, U4, U5, U6) in Welsh sand dunes. Areas in hectares.

1 History	Site	Ulc	U4a	U4b	U5	U6	Total U
1	Merthyr Mawr					Constant and a	
2	Kenfig Dunes						
3	Margam Burrows	and the second second	C. M. Stand	C. Colorado I.			
4	Baglan Bay	0K-10V.01	and the second				
5	Crymlyn Burrows		A States		201020		
6	Black Pill to Bryn Mill	C. Carlos C. C.	1	1000			
7	Pennard Burrows			1.000			
8	Penmaen Burrows		Contraction of the local distance	1	10.000	1999 - C.	1.423.423.3
9	Nicholaston Burrows				Autoria en		
10	Oxwich Burrows	1		C. C. Market	PERSONAL PROPERTY AND	a historication of	1. 1827-
11	Port-Eynon to Horton			and the second s			
12	Hillend to Hills Tor	The State of	1.				
13	Whiteford Burrows		A SEAL	-			
14	Pembrey Coast	and the substant		-			-
15	Laughame Burrows		1.00	-		TRANSPORT	1. SV 522
16	Pendine Burrows		-		-		1
17	Tenby Burrows	1			-	1.	
17	Caldey Island		1.0%	-		1907-0	11111
18	Lydstep Haven		1 2 2 3		-		
20	Manorbier/Swanlake					-	
20	Freshwater Bay East		1	-	1	10.000	115000-001
22	Stackpole Warren			-		-	
23	Brownslade/Linney		-	-		-	0
			-	-	-		-
24	Broomhill Burrows	Contra Contra Contra	-			- Contraction	Contraction of the
25	Whitesand Bay		-		-	-	
26	The Bennett		-			100 0 00 0 0	-
27	Poppit Sands				-		
28	Towyn Warren						1 1 1 1 1 1 1
29	Ynyslas				-	Contraction in the	-
30	Tywyn to Aberdovey				-		- apple -
31	Fairbourne		3				
32	Morfa Dyffryn		-	-	2	0.17	0.17
33	Morfa Harlech	1.13		100		-	1.13
34	Morfa Bychan	-			-	-	
35	Pwllheli/Pen-y-Chain	1. The second second	1	0.07	0.68	-	0.75
36	Traeth Crugan	han baryon		A CONTRACTOR	1 Sugar	and the second	
37	Tai Morfa					and the first of	
38	Morfa Dinlle					A POLY AND	
39	Newborough Warren						1
40	Penhrhynoedd - Llangadwaladr	1 mar 1				STATE AND A PARTY	
41	Aberffraw					6 1278 0 12 O Y	
42	Valley	NIE SE DENNE IN IN	West Las			a fall seased	
43	Tywyn Gwyn		0.03				0.03
44A	Traeth Dulas		10000	27730		a second second	and the second
44B	Traeth Lligwy	1330 101-1001					
45	Red Wharf Bay	In All Plant and	1 1 P. C. A.	1 1 1 1		the second second	
46	Conwy/Deganwy	and the second			1.000		
47	Kinmel Bay	The second second			19 6 6 10 00	10000	
48	Rhyl to Prestatyn	the first and the second	1 July 2	1 38	12. 21.0	1.35 2.2	
49	Gronant to Talacre		1.13	6.8.1	1 8 1 8 1	1 3.8.8	
	South Wales Region				-		
	Dyfed & Mid-Wales Region				1.1.1.1.1.1.1.1		12000
	North Wales Region	1.13	0.03	0.07	0.68	0.17	2.08
1150						0.10	0.00
	National Totals	1.13	0.03	0.07	0.68	0.17	2.08

Table 8.5 MG5 mesotrophic grassland types in Welsh sand dunes. Areas in hectares.

1.1.1	Site	MG5	MG5a	Total MG5
1	Merthyr Mawr	6 J.		05
2	Kenfig Dunes			
3	Margam Burrows			
1	Baglan Bay			
5	Crymlyn Burrows			
5	Black Pill to BrynMill			
7	Pennard Burrows			
8	Penmaen Burrows			
9	Nicholaston Burrows			
10	Oxwich Burrows			
11	Port-Eynon to Horton			
12	Hillend to Hills Tor			
13	Whiteford Burrows			
14	Pembrey Coast			
15	Laughame Burrows			
16	Pendine Burrows	0.38		0.38
17	Tenby Burrows			
18	Caldey Island			
19	Lydstep Haven			
20	Manorbier/Swanlake			
21	Freshwater Bay East			
22	Stackpole Warren			
23	Brownslade/Linney			
24	Broomhill Burrows		-	
25 *	Whitesand Bay			
26	The Bennett			
26	Poppit Sands			
28	Towyn Warren			
28	Ynyslas			
30		5.69		5.69
30	Tywyn to Aberdovey Fairbourne	3.09		3.69
31	and the second se		0.29	0.20
	Morfa Dyffryn Maefa Uadach		0.38	0.38
33	Morfa Harlech		0.43	0.43
34	Morfa Bychan			
35	Pwllheli/Pen-y-Chain			
36	Traeth Crugan			
37	Tai Morfa			
38	Morfa Dinlle	1.00		1.00
39	Newborough Warren	1.99		1.99
40	Penhrhynoedd - Llangadwaladr			
41	Aberffraw			Comparis
42	Valley			-
43	Tywyn Gwyn			
44A	Traeth Dulas			
44B	Traeth Lligwy	1 1 10 11 50		
45	Red Wharf Bay			
46	Conwy/Deganwy			
47	Kinmel Bay			
48	Rhyl to Prestatyn			
49	Gronant to Talacre			
			1.200	
1.11	South Wales Region			
	Dyfed & Mid-Wales Region	0.38		0.38
	North Wales Region	7.68	0.81	8.49
		1 19 18 9 18 83		
1.1.1	National Totals	8.06	0.81	8.87

	Site	MG6	MG6a	MG6b	All MG6	MG7	MG7a	MG7e	All MG7
1	Merthyr Mawr						1.19	- India L	1.62
2	Kenfig Dunes								1.01.
3	Margam Burrows						1	alg(B)	1.201
4	Baglan Bay								
5	Crymlyn Burrows					100		1.000	11911-
6	Black Pill to Bryn Mill						I COMENC		1.2.5
7	Pennard Burrows							1.6653	- S
8	Penmaen Burrows						2012		
9	Nicholaston Burrows						Augustant		1154.1
10	Oxwich Burrows								
11	Port-Eynon to Horton						A STATE OF	ANALIH S	510
12	Hillend to Hills Tor								1111
13	Whiteford Burrows						- 1944 A 3	1000	1117
14	Pembrey Coast					65.38	1000	Population 1	65.38
15	Laughame Burrows						Contemp 1	1243	01.1
16	Pendine Burrows		1.32	111	1.32	0.08	. PROTOR	0.32	0.40
17	Tenby Burrows					0.59	in the state		0.59
18	Caldey Island					0.09		100	0.09
19	Lydstep Haven	1					1000	- ofeld	192
20	Manorbier/Swanlake						0.42	Prese la	0.42
21	Freshwater Bay East					0.10	10197	Send.	0.10
22	Stackpole Warren					5.41	1.	1000	5.41
23	Brownslade/Linney						in the second		1531
24	Broomhill Burrows					13.00		4.22	17.22
25	Whitesand Bay					3.12	200		3.12
26	The Bennett					0.31	1. 1. 1.	Street L	0.31
27	Poppit Sands							(cherry)	7.11
28	Towyn Warren					0.52			0.52
29	Ynyslas		0.49		0.49	0.59			0.59
30	Tywyn to Aberdovey					1.26		and the literature	1.26
31	Fairbourne					0.79			0.79
32	Morfa Dyffryn	8.12			8.12		1. 1977		
33	Morfa Harlech					1.59		0.02	1.61
34	Morfa Bychan					10.92	011-075	2.36	13.28
35	Pwllheli/Pen-y-Chain				-		1000	Addies 111	0.1
36	Traeth Crugan					2.59	10		2.59
37	Tai Morfa		0.56		0.56	0.74		and the bull of	0.74
38	Morfa Dinlle		1 1					Care V. 1	
39	Newborough Warren			1.1.1.1		1.2.115.00	L. UNST	1.1.1	0.001
40	Penhrhynoedd - Llangadwaladr						1.1.1.1	1000	10015
41	Aberffraw							1914	10011
42	Valley					9.19	1. 200	1000	9.19
43	Tywyn Gwyn			1.1.2.11			1		A.M.
44A	Traeth Dulas		0.02	0.17	0.19	0.01	No.	Shints	0.01
44B	Traeth Lligwy					0.24	Long Bar	MAR I	0.24
45	Red Wharf Bay	1 1 0				0.47	in enters	1000	0.47
46	Conwy/Deganwy					0.13	0.06	20.99	21.18
47	Kinmel Bay	1.				1.82	in the second	0.63	2.45
48	Rhyl to Prestatyn					10.73		8.51	19.24
49	Gronant to Talacre	0.14			0.14	29.46		3.83	33.29
	South Wales Region			1		10,000			
1	Dyfed & Mid-Wales Region	3.6.1.1-	1.81		1.81	89.19	0.42	4.54	94.15
	North Wales Region	8.26	0.58	0.17	9.01	69.94	0.06	36.34	106.3
	National Totals	8.26	2.39	0.17	10.82	159.13	0.48	40.88	200.4

Table 8.6 MG6 and MG7 mesotrophic grasslands in Welsh sand dunes. Areas in hectares.

Table 8.7 Calcicolous grassland types (CG6 and CG7) on Welsh sand dunes. Areas in hectares.

	Site	CG6	CG6/W22	CG7	CG7b	CG7c	Total CG types
1	Merthyr Mawr		- dore	0.42	in the second	1. Complex	0.42
2	Kenfig Dunes		A 19 19 19 19		0.28		0.28
3	Margam Burrows			182.201.202	C DULL KO	A PAPER DI LI S	10 W 101
4	Baglan Bay		1.1.1.1.1.0	Children of the		Second Second	
5	Crymlyn Burrows						-
6	Black Pill to Bryn Mill	74	10000	11112205	1005,201	10000000	0.000
7	Pennard Burrows		1000		11000	-	-
8	Penmaen Burrows		-	0.38	-		0.38
9	Nicholaston Burrows		-	0.58	-	-	0.51
10	Oxwich Burrows		1000000	0.51	-	-	0.51
10	Port-Eynon to Horton						-
12	Hillend to Hills Tor		-	0001 000	-		-
	Whiteford Burrows				the second second		-
13			-				-
14	Pembrey Coast	-	-	13 0/03 0/0		-	10000
15	Laughame Burrows		-		-	-	
16	Pendine Burrows						10.00
17	Tenby Burrows	19.92	1.1.1.1		11.4		19.92
18	Caldey Island		1				
19	Lydstep Haven		0.75	1. 201 2. 201			0.75
20	Manorbier/Swanlake		NS SERIO	1.435.000	201 21 G33	18. PL (021	101.00
21	Freshwater Bay East	2.96			1 Same		2.96
22	Stackpole Warren		11.1	1 1 1 1 1 1 V			
23	Brownslade/Linney		1.1.0.0863	1/11/01/11	neo la sen	0.53	0.53
24	Broomhill Burrows		Contraction of the second		Least of this	- Harris	
25	Whitesand Bay						
26	The Bennett		1.11	DELCI COL	I COST VI	POU SUDA	192.11
27	Poppit Sands		-		A DECK	the second second	Contraction of
28	Towyn Warren				-		-
29	Ynyslas		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	a karti sa re	1.1.12.21	the second	1 1 1 1 1
30	Tywyn to Aberdovey		1.1.2	Constant of the second		-	-
31	Fairbourne		-		-		-
32			-				-
	Morfa Dyffryn						1
33	Morfa Harlech		100000	22111	a contraction of		19 19 19 19 19 19 19 19 19 19 19 19 19 1
34	Morfa Bychan			0.01		- ANG	0.01
35	Pwllheli/Pen-y-Chain			0.01			0.01
36	Traeth Crugan	and the second second	-	and the second second			1000
37	Tai Morfa			trans at-	a data ta ta	11112-3	17.00
38	Morfa Dinlle	2.6					
39	Newborough Warren		2.00	201010-00	1030003	1.	12.15
40	Penhrhynoedd - Llangadwaladr			Di ti	usdi on	Ze had set	
41	Aberffraw					S. A. S.	
42	Valley		2 Second		1 1 1 2 1 4 2	Participation and	11.5
43	Tywyn Gwyn		a maintena	-			
44A	Traeth Dulas	100	Contraction of				
44B	Traeth Lligwy		10.1	100.00	S CONTRACT	1910/01/01/2	30.00 10.03
45	Red Wharf Bay		-		31.350	R 334 X	11.21
46	Conwy/Deganwy	1000	10.00	1000			
47	Kinmel Bay	3		1000			
48	Rhyl to Prestatyn		2 2 2 2 1			CO VER ST	1 1 1 1 1
49	Gronant to Talacre	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1000				-
49			-				
-	South Woles Paging	-	-	1.21	0.28	D D Drine	1.50
1-11	South Wales Region	22.00	0.75	1.31	0.28	0.52	1.59
	Dyfed & Mid-Wales Region	22.88	0.75	0.01	1202	0.53	24.16
	North Wales Region	-	-	0.01	-	-	0.01
	The second s						

commonly and total area is 7.4 ha, most of the Welsh resource. It is mainly associated with bare sand in the region of heavy rabbit grazing.

Stands with prominent lichens and low vascular plant cover were mapped as the SD11 Carex arenaria-Cornicularia aculeata community but quadrat records suggest that such vegetation is a poor fit to this community. This vegetation type is present in only two sites (Stackpole Warren and Morfa Dinlle) and is associated with local heavy rabbit grazing pressure on thin soils over bedrock. Stands at Stackpole Warren are often a mix of patches dominated by the rare southern lichen Fulgensia fulgens or the common Cladonia impexa, with some resemblance to the SD11b Festuca ovina subcommunity (though F. rubra is recorded from the single quadrat record in the NVC survey). Total extent is small (1.2 ha). A larger area is recorded at Morfa Dinlle (9.9 ha) but all is anomalous, with very heavy rabbit grazing in areas of shingle and sand allowing an assemblage of annual plants and some lichens, notably Cladonia rangiformis, to be developed. These stands contain no Cornicularia aculeata or most other SD11 lichen associates: they are mapped as non-NVC vegetation but their character places them as a very anomalous SD11 type. True SD11 vegetation is therefore very rare in Wales and is probably confined to Stackpole Warren, and even there it is somewhat atypical in character.

8.8 Maritime cliff communities on dunes (MC5, MC8, MC9, MC10, MC12)

The edges of some bay dune and climbing dune systems have sand thinning over other soil and rock which is within a zone of heavy salt spray deposition. These areas, all very small in size apart from two larger zones at Kenfig Dunes and Tenby Burrows, support maritime cliff vegetation (Table 8.9). The only extensive type is the MC8 *Festuca rubra-Armeria maritima* community. Most maritime cliff vegetation is only mapped at NVC community level and probably represents spray modification of SD8 *Festuca rubra-Galium verum* dune grassland, particularly the addition of sea thrift Armeria maritima.

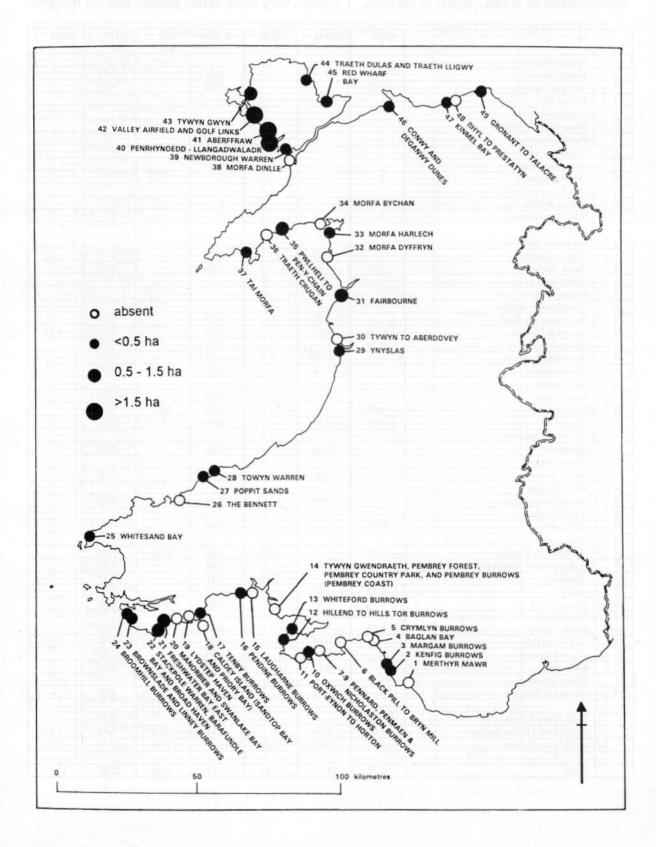


Figure 8.5 Location of sites with SD10 Carex arenaria dune.

Table 8.8 SD10 Care.	x arenaria dune and SD11	Carex arenaria-Cornicularia aculeata dune
communities in Wales.	Areas in hectares. $T = tracent$	ce, very small extent present and not mapped.

	Site	SD10	SD10a	SD10b	All SD10	SD10 trans.	SD10 total	SD11
1	Merthyr Mawr							
2	Kenfig Dunes	0.56	1		0.56		0.56	
3	Margam Burrows	0.02			0.02		0.02	
4	Baglan Bay			1 1 1 1 1				
5	Crymlyn Burrows			1.00				
6	Black Pill to Bryn Mill			1000	100000	11111		
7	Pennard Burrows	Call of the second second	1	1 2 2 2 A C				
8	Penmaen Burrows	100					1.000	
9	Nicholaston Burrows			1				-
10	Oxwich Burrows	Т			Т		T	-
11	Port-Eynon to Horton			1	-		-	
12	Hillend to Hills Tor	Т	-	-	T		T	-
13	Whiteford Burrows	T	-		T		T	
14	Pembrey Coast		-	1000	1		1	
15	Laughame Burrows			1000	-			-
16	Pendine Burrows		0.03	-	0.03		0.03	-
17	Tenby Burrows	0.01	0.03	1	0.03		0.03	-
18	Caldey Island	0.01	-		0.01		0.01	1
18	Lydstep Haven			-	-			1
20	Manorbier/Swanlake		-	1				1
20	Freshwater Bay East	717	1.76	-	1.76		1.76	
22	Stackpole Warren	0.75	0.97		1.70		1.78	1.2
23	Brownslade/Linney	0.73	0.97		0.29	-	0.29	1.2
23	Broomhill Burrows	0.29	0.39		0.29		0.29	-
	and the state of t							-
25	Whitesand Bay		0.06		0.06		0.06	-
26	The Bennett		0.00		0.00		0.00	
27	Poppit Sands		0.22		0.22	0.00	0.22	-
28	Towyn Warren	0.02			0.02	0.02	0.04	
29	Ynyslas	0.01	0.10		0.11		0.11	-
30	Tywyn to Aberdovey			-				-
31	Fairbourne		0.66		0.66		0.66	
32	Morfa Dyffryn	and the second	-	-				
33	Morfa Harlech		0.20	- man con	0.20		0.20	
34	Morfa Bychan	Line and the		and a start	and the second			
35	Pwllheli/Pen-y-Chain	and a mouth	0.69		0.69	100.00	0.69	
36	Traeth Crugan						1	
37	Tai Morfa	0.04			0.04		0.04	
38	Morfa Dinlle	A Contraction				123 0240		9.9
39	Newborough Warren	0.19		0.06	0.25	0.30	0.55	
40	Penhrhynoedd - Llangadwaladr		3.62		3.62		3.62	
41	Aberffraw			7.35	7.35		7.35	
42	Valley	0.55	1.55		2.10		2.10	
43	Tywyn Gwyn	0.05	0.78		0.83	0.14	0.97	
44A	Traeth Dulas				1 1 12	A Mark		
44B	Traeth Lligwy	0.23			0.23		0.23	
45	Red Wharf Bay		0.05		0.05		0.05	
46	Conwy/Deganwy	AND ALL	0.46		0.46	1.2.2	0.46	
47	Kinmel Bay		0.12	1.58	0.12	1000	0.12	
48	Rhyl to Prestatyn	1.75.2						
49	Gronant to Talacre	111 1 200 2 2	0.02		0.02	1.1.1.1	0.02	
	and the later of the later of the				1 2 2 1	1.19.10		
1	South Wales Region	0.58		1	0.58		0.58	
200	Dyfed & Mid-Wales Region	1.08	3.53		4.61	0.02	4.63	1.2
h.at P	North Wales Region	1.06	8.15	7.41	16.62	0.44	17.06	9.9
					-	1.1		
-	Totals	2.72	11.68	7.41	21.81	0.46	22.3	27

.

Table 8.9 Maritime cliff vegetation	(MC5, MC8, MC9, MC10, MC12) on Welsh sand dunes	
Areas in hectares.		

Sit		MC5	MC5b	MC5d	MC6
	erthyr Mawr				and the second
	enfig Dunes		and the second second	2 martine - the	12-02-12-22-7
	argam Burrows	a second s	and the second second		1 (2001 p. 1502)
	aglan Bay				And a state of the second
	rymlyn Burrows				A CONSTRUCTION
	ack Pill to Bryn Mill				Contraction and the
	ennard Burrows				- And States
	enmaen Burrows				Preparate Constraints
	icholaston Burrows				and the second second
	xwich Burrows				A DECKING THE REAL
	ort-Eynon to Horton		And the second second		and the second second
	illend to Hills Tor				ing align to reports
	hiteford Burrows				na sel se algun
Per	embrey Coast		and the second states		and the second second
La	aughame Burrows				en and a state of the state of
Pe	endine Burrows				A toracle and only
Te	enby Burrows		1. K. L. L. L.		The second second
	aldey Island				a ball chief.
	ydstep Haven				prest of fact.
	anorbier/Swanlake		0.43		
	reshwater Bay East				
Sta	ackpole Warren			0.70	In Provincia State
	rownslade/Linney			231.2	A Local Mental
	roomhill Burrows				and the state of the state of the
	/hitesand Bay	0.34			100000000000000000000000000000000000000
	he Bennett				5.04.00.02
	oppit Sands				
	owyn Warren				In the Part of the
	nyslas				
	ywyn to Aberdovey				1.12.1.1.1.1
	airbourne				
	lorfa Dyffryn				1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
	lorfa Harlech				Sector 1 and 40
-	lorfa Bychan				
_	wllheli/Pen-y-Chain				
	raeth Crugan				
	ai Morfa				
	lorfa Dinlle				
					1000
	ewborough Warren			-	
	enhrhynoedd - Llangadwaladr				
	berffraw				0.72
	alley				0.72
	ywyn Gwyn	1000			
	raeth Dulas				
	raeth Lligwy				-
R	ed Wharf Bay				
	Conwy/Deganwy	and the second second			
	inmel Bay				
R	hyl to Prestatyn				
G	ironant to Talacre				
-		The second se			
	outh Wales Region				
	byfed & Mid-Wales Region	0.34	0.43	0.70	
N	lorth Wales Region	and the second second	11. 11.		0.72
		and a start of the			0.72
N	lational Totals	0.34	0.43	0.70	

Table 8.9 (continued)	Maritime cliff vegetation	(MC5, MC8,	MC9, MC10,	MC12) on W	Velsh sand
dunes. Areas in hectar	es.				

1.5	Site	MC8	MC8a	MC8e	MC8f
1	Merthyr Mawr				add to the first of
2	Kenfig Dunes	4.52			in the second second
3	Margam Burrows			100 100 100 100 100	and the second second
4	Baglan Bay				a Cinduit de la
5	Crymlyn Burrows				Section 1
6	Black Pill to Bryn Mill			11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CONTRACTOR OF
7	Pennard Burrows				no deservice s
8	Penmaen Burrows			- 1 - 1 - 1 kst	and include the second second
9	Nicholaston Burrows			and a second	For mice all in the
10	Oxwich Burrows				test forward 1 - Oi
11	Port-Eynon to Horton				
12	Hillend to Hills Tor			the second s	
13	Whiteford Burrows			Contraction of the second	A Contraction of the
14	Pembrey Coast				n Constitut 1
15	Laughame Burrows			in the second	eff and a faith and a state of the
16	Pendine Burrows		S		and the second states of
17	Tenby Burrows	5.33			a particular to the
18	Caldey Island	0.19			in Colerin 1 - St
19	Lydstep Haven				and cooled 1 - 21
20	Manorbier/Swanlake			and the second sec	and the second second
21	Freshwater Bay East				1 0000008-1
22	Stackpole Warren	/ /		1.	and the second second
23	Brownslade/Linney				test Quarterile Inc. in
24	Broomhill Burrows			1.	0.13
25	Whitesand Bay		0.17		A DESCRIPTION OF
26	The Bennett				in the second second
27	Poppit Sands			the second s	the contrast of the second
28	Towyn Warren				in the second second
29	Ynyslas				the second second
30	Tywyn to Aberdovey			191.00	the strategy of the state
31	Fairbourne				a charter i - 12
32	Morfa Dyffryn	1			dia dia Maria dia mandri
33	Morfa Harlech				and the second second
34	Morfa Bychan				oursellentres (de 1999 - 198
35	Pwllheli/Pen-y-Chain			and the second se	and States and the second
36	Traeth Crugan			0.12	and a family line of
37	Tai Morfa			0.24	
38	Morfa Dinlle				State State State State
39	Newborough Warren	1111 1.2			
40	Penhrhynoedd - Llangadwaladr	1.18		And the state of the	and the second second
41	Aberffraw	1.10			
42	Valley	1.2	1.11		
43	Tywyn Gwyn		0.10		
44A	Traeth Dulas		0.10		
44B	Traeth Lligwy			a second second	and Barrent - Lorenza
45	Red Wharf Bay				1 N N 2 - 71
46	Conwy/Deganwy				
47	Kinmel Bay				the second second
48	Rhyl to Prestatyn			The second second	
49	Gronant to Talacre				
17	Stonant to Tataore				
	South Wales Region	4.52		the second second second	the second s
-	Dyfed & Mid-Wales Region	5.52	0.17	and the second s	0.13
-	North Wales Region	1.18	1.21	0.36	
		1.10	1.0.1	0100	
	National Totals	11.22	1.38	0.36	0.13

in the	Site	MC9	MC9b	MC10	MC12a	Total MC
1	Merthyr Mawr			0.42		0.42
2	Kenfig Dunes	ALC NOVED THE	Charles Street Store	1.42	Distance Second	5.94
3	Margam Burrows	Ref C. Ch (Level				
4	Baglan Bay	Part Inc.		28 26 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	The second second	~ 지 귀 문 이 분 가 있
5	Crymlyn Burrows		* 102 TO 1014	- 800 NO. 67 S	Sector SV	0.000.01
6	Black Pill to Bryn Mill	AND TO STAR				
7	Pennard Burrows		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	02.010.0000		a contraint
8	Penmaen Burrows	Carl State State	1/11/1	1 7 3 3 7 7	11111011/1	
9	Nicholaston Burrows	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1			11 11 12	
10	Oxwich Burrows	1			-	-
11	Port-Eynon to Horton			C TOTAL O PULL	1 5 1 6 1 5 1 6	
12	Hillend to Hills Tor	1110000				
13	Whiteford Burrows			-		
14	Pembrey Coast		17.5	1 201 Situatori	-	1 2 1 2 1 2 2 2 1
15	Laughame Burrows	10 10 10 10 10		-	1.1.1.1	-
16	Pendine Burrows					-
17	Tenby Burrows			-		5.22
18	Caldey Island			-	C C D P P P P P	5.33
18	Lydstep Haven				1000 200 0000	0.19
20	Manorbier/Swanlake	CALCO CONTRACT	1.00			1.70
20	Freshwater Bay East		1.29	COLUMN STREET	CONTRACTORY OF	1.72
21	Stackpole Warren	tite officers	10 10 10 10	AND AND ADD DO	0.26	0.00
22	Brownslade/Linney	and a state of the		-	0.26	0.96
23	Brownslade/Linney Broomhill Burrows	and south 11		-		0.12
24 25	Whitesand Bay	the state of the	0.46	-	0.16	0.13
			0.46	Ne ly as a la	0.16	1.13
26 27	The Bennett			the second second	A the second	-
	Poppit Sands		-		-	-
28	Towyn Warren		2000	100000000	Sevenal de	
29	Ynyslas				1	-
30	Tywyn to Aberdovey			-	-	
31	Fairbourne				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
32	Morfa Dyffryn				-	
33	Morfa Harlech					0.05
34	Morfa Bychan	0.38	0.47		1010	0.85
35	Pwllheli/Pen-y-Chain			al concerne	marken marks	
36	Traeth Crugan	10.00				0.12
37	Tai Morfa		-			0.24
38	Morfa Dinlle					1 Mailton
39	Newborough Warren	1.33				1.33
40	Penhrhynoedd - Llangadwaladr				and the second second	1.18
41	Aberffraw					Contractory
42	Valley		LINSINGLA DO	Contraction of the second		1.83
43	Tywyn Gwyn					0.10
44A	Traeth Dulas	1101	1 man 2017	A SECTION OF	2010 113	1000126
44B	Traeth Lligwy	111111	Sec. And	in the second	a strange	and the second second
45	Red Wharf Bay					
46	Conwy/Deganwy		A 44.5			
47	Kinmel Bay		A NULL	and the second second		the second of
48	Rhyl to Prestatyn					
49	Gronant to Talacre					
155	South Wales Region			1.84		6.36
	Dyfed & Mid-Wales Region	122	1.75		0.42	9.46
	North Wales Region	1.71	0.47	Callent Pro-		5.65
				1		
-	National Totals	1.71	2.22	1.84	0.42	21.47

Table 8.9 (continued) Maritime cliff vegetation (MC5, MC8, MC9, MC10, MC12) on Welsh sand dunes. Areas in hectares.

9. Dry heath and wet heath

9.1 NVC communities

This section covers dune heath and other dry heath vegetation described in the heathland chapter (H) of the NVC. It also includes wet heath and allied communities which are covered in the mires chapter (M) of the NVC. Virtually all occurrences of heath on Welsh dunes are restricted to sands which are low in calcium carbonate, allowing leaching to produce acidic soils. Such sands are generally restricted to stable areas at the rear or edge of dune systems, often climbing dunes, where there has been sufficient time for leaching to occur.

9.2 H11 Calluna vulgaris-Carex arenaria dune heath

This type of heathland is exclusively associated with the dune environment and is most clearly separated from more general heath communities by the presence of sand sedge *Carex arenaria*. There are three sub-communities, with the following order to be adopted in the published chapter (Rodwell 1991b):

- H11a Erica cinerea sub-community;
- H11b Empetrum nigrum nigrum subcommunity;
- H11c Hypnum cupressiforme subcommunity.

The H11 community is rare and total extent is only 40.9 ha (Table 9.1). More than half of the Welsh H11 dune heath area is undifferentiated in terms of sub-communities, including the largest dune heath area in Wales at Crymlyn Burrows (23.1 ha). The H11b sub-community is absent and is probably confined to Scotland. Sites with the remaining two sub-communities all have small extents and are restricted to northern Wales. There is a large area of heath transitional to calcifugous grassland (H11/U5) at Valley. The largest extents of H11 dune heath are in South Wales but the type is more frequent in North Wales, perhaps due to sands which are less calcareous or to acidic soil types (Figure 9.1).

9.3 Other dry heath types (H1, H7, H8, H10, H11)

Six sites contain a very small area of additional NVC heath types but the total extent is very small (2.7 ha, Table 9.2). The largest area at Valley is mapped as transitional to H11 dune heath (1.5 ha, H8/H11). Additional dry heath is therefore very rare in Wales.

9.4 Wet heath (M15 Scirpus cespitosus-Erica tetralix)

Wet heath on dunes, as elsewhere, is characterised by the occurrence of cross-leaved heath *Erica tetralix*. A solitary case of M15 *Scirpus cespitosus-Erica tetralix* wet heath is recorded for Wales as a small damp depression at Kenfig which is mapped as transitional to H11 dune heath (Table 9.1). No clear wet heath is therefore found in Wales.

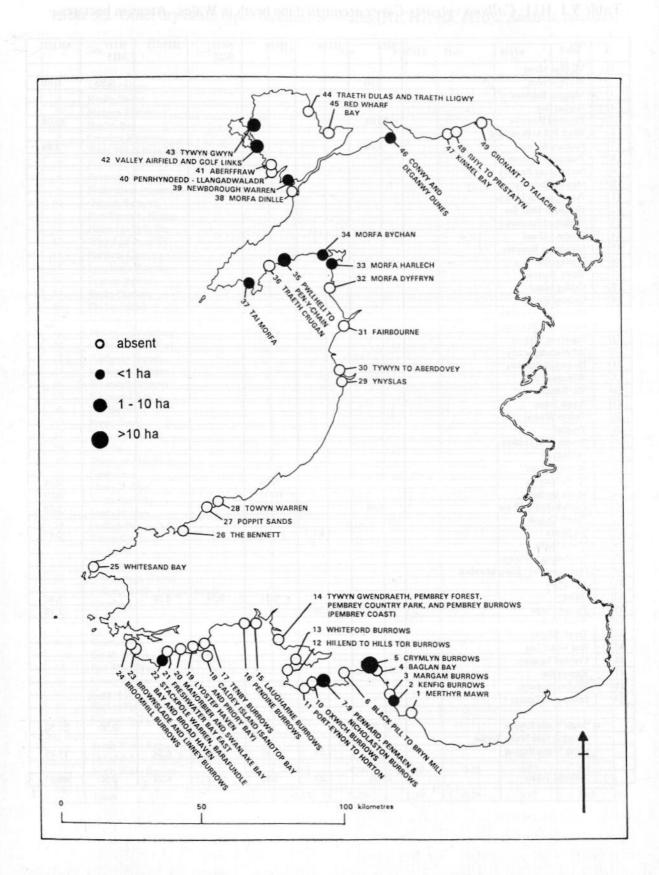


Figure 9.1 Distribution of H11 *Calluna vulgaris-Carex arenaria* dune heath and other dry heath types (H1, H7, H8, H10) on Welsh dunes.

Table 9.1	H11	Calluna vulgaris-Carex arenaria dune heath in Wales. Areas in hectares.

	Site	H11	Hlla	H11c	H11/ W23	H11/U5	H11/ M15	All H1
1	Merthyr Mawr				1125		1113	1.15 5
2	Kenfig Dunes	0.10					0.50	0.6
3	Margam Burrows	and the section of	Ler Li		COLUMN TWO	10000	0.00	0.0
4	Baglan Bay	and the second se	1			1.0.000		
5	Crymlyn Burrows	23.08	1					23.0
6	Black Pill to Bryn Mill	20100	1 1 2 1 1			10000000	100.00	20.0
7	Pennard Burrows	3.84	1					3.8
8	Penmaen Burrows	0.01		-			-	5.0
9	Nicholaston Burrows	2.4			-			
10	Oxwich Burrows	1 1 1 1 1				0.11.000		-
11	Port-Eynon to Horton			-				-
12	Hillend to Hills Tor				-		100 0000	-
13	Whiteford Burrows			-		-		1
14	Pembrey Coast	1000	-	-	-			
15	Laughame Burrows		-		-			
16	Pendine Burrows		-	-	-		1000	-
17	Tenby Burrows			-		-		
17	Caldey Island		-	-	-	-	100	-
			-	-	-			
19 20	Lydstep Haven Manorbier/Swanlake			-		-		-
			-	-				-
21	Freshwater Bay East			-				
22	Stackpole Warren		-	-			ale o	
23	Brownslade/Linney			-				-
24	Broomhill Burrows	IL DOUGT DE	10.11	- Channell	1.00	1.0.12	1	Sec. 1
25	Whitesand Bay	1.0000000000000000000000000000000000000	1					
26	The Bennett	Sector Street and					15	
27	Poppit Sands					19. Pit.		
28	Towyn Warren	10191						
29	Ynyslas	care a Natio				and a	the set	
30	Tywyn to Aberdovey							
31	Fairbourne							
32	Morfa Dyffryn	and a contract of						
33	Morfa Harlech		-	0.04				0.0
34	Morfa Bychan			0.07	a constant			0.0
35	Pwllheli/Pen-y-Chain	0.49	1.1.1.1	2.23				2.7
36	Traeth Crugan			anhat me	0.0.00	-		
37	Tai Morfa		0.67	CONTRACTOR OF	1. 181 as	12825		0.6
38	Morfa Dinlle						-	
39	Newborough Warren						100 Mar.	
40	Penhrhynoedd - Llangadwaladr					and the factor	1200	
41	Aberffraw	2111					1.	
42	Valley	0.07	No. 1946	1.51	0.54	6.28		8.4
43	Tywyn Gwyn	0.93	0.56	1 1 1			N. 81	1.4
44A	Traeth Dulas							
44B	Traeth Lligwy	3	A COMPANY OF A	1 18. 1		1500	10 Y 10	
45	Red Wharf Bay				100	00		
46	Conwy/Deganwy				1 TY	11102		
47	Kinmel Bay	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	10 mil	14	1 1 1 1	10.23	1.1	
48	Rhyl to Prestatyn	(28.3 (Seal)	1	1000	18.8 8	188.3	1000	
49	Gronant to Talacre		A	18	1000	1451		-
	South Wales Region	27.02		1	1		0.50	27.5
	Dyfed & Mid-Wales Region	1. 1. 19.9	11 3	1000	1.2.2.5	1		
1.11	North Wales Region	1.49	1.23	3.85	0.54	6.28		13.4
			1.00	1.05	0.00	1 1 2 2 2	0.00	10.0
	National Totals	28.51	1.23	3.85	0.54	6.28	0.50	40.9

	Site	HI	H7e	H8/H11	H10	H10a	Total all other heath
1	Merthyr Mawr	and history.					1
2	Kenfig Dunes			-2.5	C. Strend	a contraction	
3	Margam Burrows	and the first states		MOV-SE	1111111	1.1.1.1.1	
4	Baglan Bay	CARL CONTRACTOR		a long be set of			
5	Crymlyn Burrows						
6	Black Pill to Bryn Mill			10/11/11/11	MON-ME.	ALL GIVE	18.11231
7	Pennard Burrows	A ST CASE OF ST	KA UZ	TAK STO			
8	Penmaen Burrows	1.5 ST 175		1.1.1.1			
9	Nicholaston Burrows		1 B	The star	12111111111	1000 100000	1
10	Oxwich Burrows	0.00 8 0.00002	TONES	101210117	10000 00000	Contraction in the second	
11	Port-Eynon to Horton	Thursday and the	Contraction of the	a service in the		C. C. C.	
12	Hillend to Hills Tor		1 22/22/1	100 100 0000	THE STREET	10 10 10	
13	Whiteford Burrows	COMPANY AND	1 31253		100000000		
14	Pembrey Coast	Jul annexCi	A Shield		1		
15	Laughame Burrows			1	100		1
16	Pendine Burrows			101010	111111	1000	11000
17	Tenby Burrows	1.2. 1011124	1.000				
18	Caldey Island						
19	Lydstep Haven		1			-	-
20	Manorbier/Swanlake	100000000000000000000000000000000000000		11.19101		17/1 11	
21	Freshwater Bay East				-	-	-
22	Stackpole Warren		0.14	1	1	-	0.14
23	Brownslade/Linney		0.14	-	-	-	0.14
24	Broomhill Burrows		-		-		
25	Whitesand Bay		-	-	-	-	-
	The Bennett	1. 10 10 10 10 10 10 10 10 10 10 10 10 10				-	-
26 27			22.0		1	100000	-
	Poppit Sands	COLUMN TRANSPORT	121.0	-		-	-
28	Towyn Warren	The second second					
29	Ynyslas				-	-	-
30	Tywyn to Aberdovey			-			-
31	Fairbourne						
32	Morfa Dyffryn						
33	Morfa Harlech		(3.15			Read and the	
34	Morfa Bychan	0.63					0.63
35	Pwllheli/Pen-y-Chain		0.06		-		0.06
36	Traeth Crugan	Contra Constantin	110125				-
37	Tai Morfa	interior poli		- duna		-	
38	Morfa Dinlle						
39	Newborough Warren		Don L	16 23	A DOME	0.07	0.07
40	Penhrhynoedd - Llangadwaladr			1. 12.12	1.116.55	-	1
41	Aberffraw	and the second			1		_
42	Valley			1.49	10000000		1.49
43	Tywyn Gwyn	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	La Maria		1		
44A	Traeth Dulas	olding wines	1 Clab	11.	(maine)	COLUMN 1	and and
44B	Traeth Lligwy				10.000	1	
45	Red Wharf Bay		A State				
46	Conwy/Deganwy	heinen avit of		and she to	0.26	a second	0.26
47	Kinmel Bay						
48	Rhyl to Prestatyn		1.		and the second		
49	Gronant to Talacre	Section 2	- Secole	A loss for an	1.1.1		
	Sand Web David				-	-	-
	South Wales Region		0.14		-		0.14
	Dyfed & Mid-Wales Region	0.02	0.14	1.40	0.26	0.07	
-	North Wales Region	0.63	0.06	1.49	0.26	0.07	2.51
	Totals	0.63	0.20	1.49	0.26	0.07	2.65

Table 9.2 Other dry heath types on dunes in Wales (H1, H7, H8, H10). Areas in hectares.

10. Dune wetlands

10.1 NVC communities and rare species

Dune wetlands comprise dune slack communities (SD13, SD14, SD15, SD16, SD17), plus a wide range of mire (NVC M chapter), swamp and tall-herb fen (NVC S chapter), wet mesotrophic grassland types (NVC MG chapter) and aquatic vegetation. In addition some forms of wet woodland occur (NVC W chapter) if grazing is relaxed and trees tolerant of wet conditions can invade. This diversity of types reflects the range of moisture and successional conditions in which dune wetland is established, including the swampy edges of open water in some dune systems.

Slack communities in Wales are habitats for several rare and nationally scarce vascular and pteridophyte species: *Epipactis dunensis*, *Equisetum variegatum*, *Gentianella uliginosa* and *Liparis loeselii*. Rare mosses and liverworts also occur, e.g. *Petalophyllum ralfsii*.

10.2 Dune slack communities (SD13–SD17)

The five NVC dune slack communities represent vegetation developed in relation to soil pH, water regime and successional stage. SD13 and SD14 represent early succession types. SD17 is recognised as more acidic in character than other mature types. SD15 and SD16 types cover more basic slacks, with SD15 representing vegetation with a swamp/tall-herb fen character and SD16 drier conditions. Subcommunities of all types are probably related to different water regime characteristics.

Total slack area (the sum of all SD13–SD17 types, including transitions) is 614.6 ha (Table 10.1), with a very uneven distribution between sites. Large extents are present at Kenfig (130.7 ha) and Newborough Warren (128.7 ha) and six other sites (Whiteford, Pembrey Coast, Laugharne Burrows, Morfa Dyffryn, Morfa Harlech, Aberffraw) have extents >30 ha (Figure 10.1). Areas in other sites are usually much smaller and 23 sites have no slack habitat at all. The large extents in a few sites result from parabolic dune activity in large hindshore and spit dunes, plus slacks formed between ridges in large prograding systems or imbricated spits. The small sand area and a lack of deep depressions close to a water table are the principal reasons for the low extent or absence of slacks in many bay and climbing dunes.

SD13 Salix repens-Bryum pseudotriquetrum dune slack

This is a very rare community (15.1 ha, three sites) and is largely confined to the Kenfig Dunes, plus a small area at Newborough Warren and very small patches at Whiteford Burrows (Table 10.1). Most is mapped only at community level but small areas of the SD13b *Holcus lanatus-Festuca rubra* sub-community are recorded at Kenfig and Newborough Warren.

SD14 Salix repens-Campylium stellatum dune slack

This is the commonest young succession dune slack type and all four sub-communities are recorded for Wales. Total extent is 137.5 ha, most of this area being in South Wales (Table 10.2). Only ten sites have the community and hence it is uncommon. A large proportion of the community either is not differentiated into sub-communitites (25.1 ha) or is recorded as intermediate between SD14 and SD15 (36.6 ha). The SD14a Carex serotina-Drepanocladus sendtneri sub-community is very rare (0.7 ha, only at Newborough Warren). The SD14b Rubus caesius-Galium palustre sub-community is the most extensive (52.1 ha) but is only mapped for Kenfig and Margam Burrows in South Wales. The SD14c Bryum pseudotriquetrum-Aneura pinguis subcommunity is recorded from only three sites and most of the total area (5.0 ha) is found at Newborough Warren. The SD14d Festuca rubra sub-community is recorded from two sites but is of moderate extent (18.0 ha), almost all of this at Kenfig. Overall, the most important location by far is Kenfig with 80.8 ha. There is no clear explanation for the abundance of young slacks in this site.

SD15 Salix repens-Calliergon cuspidatum dune slack

Seventeen sites have this community. Total extent including transitions is 133.4 ha, with the largest areas in South Wales and Dyfed/Mid-Wales (Table 10.3). The sites with the largest areas are Kenfig (34.0 ha) and Laugharne Burrows (30.0 ha). More than half of the mapped area is not differentiated into subcommunities. The SD15a *Carex nigra*, SD15b *Equisetum variegatum* and SD15c *Carex flacca-Pulicaria dysenterica* sub-communities are all moderately extensive (16.9–20.0 ha) but the SD15d *Holcus lanatus-Angelica sylvestris* sub-community is recorded from only two sites and has a small total area (1.4 ha).

SD16 Salix repens-Holcus lanatus dune slack

Seventeen sites have this community but the total extent (including transitions) of 225.2 ha (Table 10.4) is largely found at only four locations: Newborough Warren (97.4 ha), Pembrey Coast (35.6 ha), Aberffraw (29.1 ha) and Morfa Dyffryn (25.3 ha). It is the most extensive slack community type in Wales. More than half of total mapped area is not differentiated into sub-communities. The four sub-communities (SD16a Ononis repens, SD16b Rubus caesius, SD16c Prunella vulgaris-Equisetum variegatum, SD16d Agrostis stolonifera) range in total area between 6.8 and 38.2 ha, with almost all found in North Wales. Transitions are very rare and the total area involved is very small.

SD17 Potentilla anserina-Carex nigra dune slack

Twenty sites have this community but the total extent of 103.4 ha is largely found in North Wales, with one site (Morfa Harlech, 45.2 ha) predominant (Table 10.5). A large proportion of the Morfa Harlech area is a transition to saltmarsh (SD17/SM18, 14.7 ha), the only large slack/saltmarsh transition in Wales. Other transitions are rare and of low extent. A large proportion of SD17 extent is not differentiated into sub-communities (17.8 ha). All subcommunities are present (SD17a Festuca rubra-Ranunculus repens, SD17b Carex flacca, SD17c Caltha palustris, SD17d Hydrocotyle *vulgaris-Ranunculus flammula*), with total areas ranging from 7.4 ha for SD17a to 33.0 for SD17d. Transitions between sub-communities are mapped in a small number of sites.

10.3 Mire communities on sand dunes in Wales

A diverse set of seven NVC mire communities (excluding M15 wet heath: see Chapter 9) is found on surveyed dunes (Table 10.6), though total extent is small (29.4 ha) and only fifteen sites have any occurrence (Morfa Bychan, Newborough Warren and Aberffraw are the only sites with >5 ha of mire). Most mire communities and sub-communities occur in small quantities but two types, M27 Filipendula ulmaria-Angelica sylvestris mire (8.7 ha) and M28 Iris pseudacorus-Filipendula ulmaria mire (14.4 ha), are present in a few large stands. The NVC syntaxonomy of other mires listed in Table 10.6 is given in Table 4.1. Mire habitat is very rare in South Wales and Dyfed/Mid-Wales. It is concentrated in North Wales and might reflect a combination of acidic wetland, higher rainfall and lower evapotranspiration compared with other parts of coastal Wales.

10.4 Swamps and tall-herb fens on sand dunes in Wales

As with mires, a diverse set of swamp and fen types (fifteen NVC communities) is present on Welsh dunes covering a total area of 70.8 ha (Table 10.7). Most communities, subcommunities and transitions occur in only a few sites and as small extents. The exceptions are S4 Phragmites australis swamp (36.5 ha, including one large transition area at Pembrey to S21 Scirpus maritimus swamp) and S7 Carex acutiformis swamp (12.6 ha, all at Brownslade/Linney Burrows). Thirty sites have some form of swamp (Figure 10.2) but large extents (>10 ha) are restricted to Pembrey Coast, Laugharne Burrows and Brownslade/Linney Burrows. The most diverse set of swamp communities and sub-communities is found at Gronant to Talacre (nine types), followed by Laugharne Burrows with seven

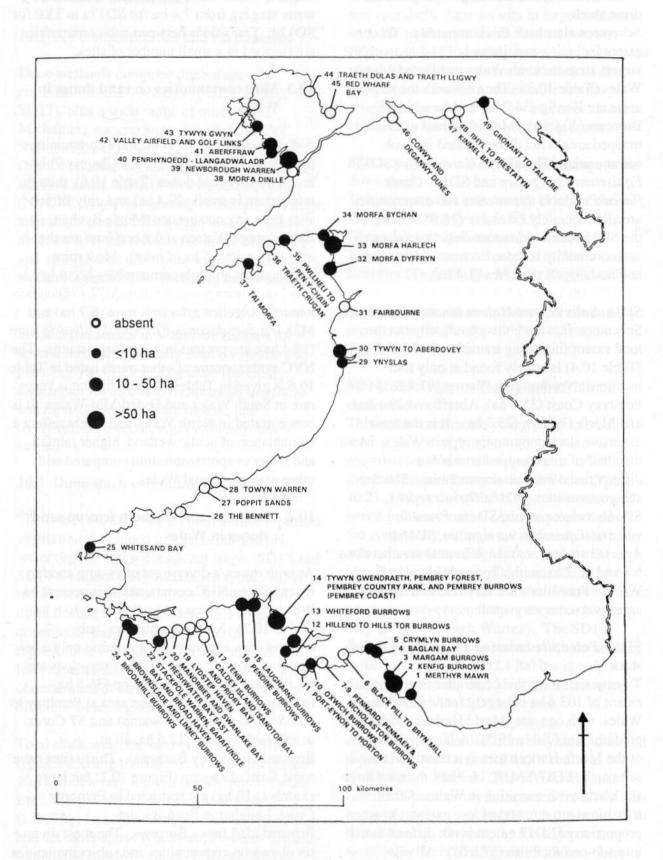


Figure 10.1 Location of sites with dune slack vegetation (SD13-SD17) in Wales.

 Table 10.1
 Total slack (SD13–SD17) areas and SD13
 Salix repens-Bryum pseudotriquetrum dune slack in Wales. Areas in hectares.

	Site	Total slack area	SD13	SD13b	All SD13
1	Merthyr Mawr	7.08	10.65 30.03		Contraction of the
2	Kenfig Dunes	130.69	13.22	0.42	13.64
3	Margam Burrows	4.74	1.0.00		Second a
4	Baglan Bay	0.30			100 C
5	Crymlyn Burrows	2.00			invindat p
6	Black Pill to Bryn Mill				2012 5 910 61 57
7	Pennard Burrows	1 B 1 B 1 B 1 B			The among 58 b
8	Penmaen Burrows				CHARACTER IN
9	Nicholaston Burrows				Colonical di Cu
10	Oxwich Burrows	8.85			in the second of
11	Port-Eynon to Horton				in a service to be a
12	Hillend to Hills Tor	6.34			Contraction of the
13	Whiteford Burrows	32.57			Т
14	Pembrey Coast	65.18			in the second
15	Laughame Burrows	32.17			Contract Contra
16	Pendine Burrows	12.68			
17	Tenby Burrows				in the second
18	Caldey Island				
19	Lydstep Haven				harry Services
20	Manorbier/Swanlake				A STATE AND
21	Freshwater Bay East				mit solt in
22	Stackpole Warren	0.02			
23	Brownslade/Linney	0.72			
24	Broomhill Burrows	1.63			The second second
25	Whitesand Bay	0.07			
26	The Bennett				
27	Poppit Sands				
28	Towyn Warren				
29	Ynyslas	3.63			
30	Tywyn to Aberdovey	14.59			
31	Fairbourne	11.07			
32	Morfa Dyffryn	37.78	1 1 22 0 1		
33	Morfa Harlech	65.03			
34	Morfa Bychan	5.11			
35	Pwllheli/Pen-y-Chain	0.32			
36	Traeth Crugan	0.52			- 12/
37	Tai Morfa	1.35			
38	Morfa Dinlle	1.55			
39	Newborough Warren	128.68	1	1.49	1.49
40	Penhrhynoedd - Llangadwaladr	2.09		1.47	1.47
40	Aberffraw	44.12			
41	Valley	5.43			
42	Tywyn Gwyn	5.45			
43 44A	Traeth Dulas				-
44B	Tracth Lligwy	the second second second			
45	Red Wharf Bay				
46	Conwy/Deganwy		1		
47	Kinmel Bay				
48	Rhyl to Prestatyn				
49	Gronant to Talacre	1.43			
49	oronant to ratacre	1.43			
	South Wales Region	192.57	13.22	0.42	13.64
		192.57	13.22	0.42	13.04
-	Dyfed & Mid-Wales Region North Wales Region	305.93		1.49	1.49
	North wates Region	303.93		1,49	1.49
	National Totals	614.60	13.22	1.91	15.13

	Site	SD14	SD14a	SD14b	SD14c	SD14d	SD14/ SD15	All SD14
1	Merthyr Mawr	0.06			0.77		10.25	0.83
2	Kenfig Dunes	14.75		48.55		17.55		80.85
3	Margam Burrows		-	3.54			- Dermost	3.54
4	Baglan Bay	6.9 M 10.1					100	State 1
5	Crymlyn Burrows	14		0.0			anterio de la	a second second
6	Black Pill to Bryn Mill	See 1				1000	I MARKING	1.660.011
7	Pennard Burrows					1.0	A CONTRACTOR OF	
8	Penmaen Burrows						Service 1	Decision 1
9	Nicholaston Burrows							
10	Oxwich Burrows						5.13	5.13
11	Port-Eynon to Horton	1.1.1.2					a could get a co	Sec. 1
12	Hillend to Hills Tor	1.14					2.88	2.88
13	Whiteford Burrows			1000			15.00	15.00
14	Pembrey Coast	A second second		10000			13.62	13.62
15	Laughame Burrows	200					A contraction	
16	Pendine Burrows			84.53			a normali	Please I
17	Tenby Burrows						est involution	1
18	Caldey Island	1						
19	Lydstep Haven						1.000	
20	Manorbier/Swanlake						-	
21	Freshwater Bay East							
22	Stackpole Warren			101			Acres 17 - 5	1.1.2
23	Brownslade/Linney			1	-		-	-
24	Broomhill Burrows						Constant In	
25	Whitesand Bay				0.07	-	-	0.07
26	The Bennett				0.07	1.7	1	0.07
27	Poppit Sands		-				-	
28	Towyn Warren				-		-	
29	Ynyslas		-	1000				
30	Tywyn to Aberdovey		-	100.00	-		100000	-
31	Fairbourne		1					-
32	Morfa Dyffryn	0.55		2011			-	0.55
33	Morfa Harlech	0.55		-			-	0.55
34	Morfa Bychan		-	-	-		-	
35	Pwllheli/Pen-y-Chain						-	-
36	Traeth Crugan			-				-
37	Tai Morfa			-			-	
38	Morfa Dinlle						-	
39	Newborough Warren	9.74	0.68		4.12	0.47	-	15.01
40	Penhrhynoedd - Llangadwaladr	9.74	0.08		4.12	0.47	-	15.01
	Aberffraw		-	-		-		-
41			-				-	1111
42 43	Valley							-
	Tywyn Gwyn						-	
44A	Traeth Dulas		1				10.000	
44B	Traeth Lligwy		-			-	-	-
45	Red Wharf Bay		-		-	-	-	
46	Conwy/Deganwy		-			-		-
47	Kinmel Bay		-	-	-	-	1	-
48	Rhyl to Prestatyn		-		-		-	
49	Gronant to Talacre		-		-	-		
						-	-	
	South Wales Region	14.81		52.09	0.77	17.55	23.01	108.23
	Dyfed & Mid-Wales Region				0.07	1000	13.62	13.69
	North Wales Region	10.29	0.68		4.12	0.47	1233.214	15.56
	National Totals	25.10	0.68	52.09	4.96	18.02	36.63	137.48

 Table 10.2
 SD14
 Salix repens-Campylium stellatum
 dune slack community in Wales.
 Areas in hectares.

	Site	SD15	SD15a	SD15b	SD15c	SD15d
1	Merthyr Mawr					
2	Kenfig Dunes	20.56	6.81	6.60	0.07	
3	Margam Burrows	0.91	0.29		1	
4	Baglan Bay	/	0.30			
5	Crymlyn Burrows					
6	Black Pill to Bryn Mill				The second second	1000000
7	Pennard Burrows					
8	Penmaen Burrows				-	11000
9	Nicholaston Burrows		-			
10	Oxwich Burrows				2.56	-
11	Port-Eynon to Horton				2.50	
12	Hillend to Hills Tor				3.20	
13	Whiteford Burrows				11.54	
14	Pembrey Coast	15.06			11.54	
15	Laughame Burrows	30.00			-	
16	Pendine Burrows	0.08	7.35	0.13		0.21
17	Tenby Burrows	0.08	1.55	0.13	-	0.21
17	Caldey Island					
18						
20	Lydstep Haven					
	Manorbier/Swanlake Freshwater Bay East					
21	Freshwater Bay East			0.02		
22	Stackpole Warren			0.02		
23	Brownslade/Linney		-		0.16	-
24	Broomhill Burrows				0.46	
25	Whitesand Bay					
26	The Bennett					
27	Poppit Sands					
28	Towyn Warren		-			
29	Ynyslas				0.02	
30	Tywyn to Aberdovey			-		
31	Fairbourne		-			
32	Morfa Dyffryn	1.55				
33	Morfa Harlech	2.01			0.70	
34	Morfa Bychan					
35	Pwllheli/Pen-y-Chain					
36	Traeth Crugan					
37	Tai Morfa					
38	Morfa Dinlle					
39	Newborough Warren	2.87	2.17	8.75		
40	Penhrhynoedd - Llangadwaladr					
41	Aberffraw			4.46		10 10 10 202
42	Valley					
43	Tywyn Gwyn					
44A	Traeth Dulas					
44B	Traeth Lligwy					125 . 525
45	Red Wharf Bay					
46	Conwy/Deganwy					
47	Kinmel Bay					
48	Rhyl to Prestatyn					
49	Gronant to Talacre	0.22				1.16
					1	
-	South Wales Region	21.47	7.40	6.60	17.37	
	Dyfed & Mid-Wales Region	45.14	7.35	0.15	0.48	0.21
	North Wales Region	6.65	2.17	13.21	0.70	1.16
	thorn that stop in	0.05	4.11	1.5.61	0.10	1.10
		the second se				

Table 10.3 SD15 Salix repens-Calliergon cuspidatum dune slack community in Wales. Areas inhectares.

Table 10.3 (continued) SD15 Salix repens-Calliergon cuspidatum dune slack community inWales. Areas in hectares.

	Site	SD15/SD16	SD15/M28	SD15/other wetland	SD15/W1	All SD15
1	Merthyr Mawr					
2	Kenfig Dunes					34.04
3	Margam Burrows					1.20
4	Baglan Bay					0.30
5	Crymlyn Burrows					
6	Black Pill to Bryn Mill					
7	Pennard Burrows					
8	Penmaen Burrows					
9	Nicholaston Burrows					
10	Oxwich Burrows	and the second states of				2.56
11	Port-Eynon to Horton					
12	Hillend to Hills Tor	in the second second				3.20
13	Whiteford Burrows		Contract Section	and providents to		11.54
14	Pembrey Coast					15.06
15	Laughame Burrows			and Sharp in the		30.00
16	Pendine Burrows	0.41	2.44		0.03	10.65
17	Tenby Burrows	a sala di secara ng jaway	and the second second	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	and the second s	10000000
18	Caldey Island	and the second				
19	Lydstep Haven					
20	Manorbier/Swanlake					
21	Freshwater Bay East					
22	Stackpole Warren		1.	-	Contraction of the	0.02
23	Brownslade/Linney		1214-514-51		Contraction (Contraction)	
24	Broomhill Burrows					0.46
25	Whitesand Bay				and the second	
26	The Bennett					
27	Poppit Sands					
28	Towyn Warren		1	1		-
29	Ynyslas	- man and a second second	and the part of the	0.44		0.46
30	Tywyn to Aberdovey			0.11		0.10
31	Fairbourne		-			
32	Morfa Dyffryn		1.			1.55
33	Morfa Harlech	The second second second	Carl Street Barriers		and the second second second	2.71
34	Morfa Bychan					2.71
35	Pwllheli/Pen-y-Chain		1.	and the second	and the second second	
36	Tracth Crugan				Contraction of the	-
37	Tai Morfa		1.	-	Contraction de	the second second second
38	Morfa Dinlle				-	-
39	Newborough Warren					13.79
40	Penhrhynoedd - Llangadwaladr					15.79
40	Aberffraw				-	4.46
41 42	Valley			-		4.40
42						-
43 44A	Tywyn Gwyn Traeth Dulas	the second second	-			-
44A 44B	Traeth Lligwy			-		Press and Pr
44B 45	Red Wharf Bay				-	-
45	Conwy/Deganwy					-
					-	-
47 48	Kinmel Bay Rhyl to Prestatyn					-
					-	1.20
49	Gronant to Talacre				1.	1.38
-	Carat Walas Davi		Contraction of			63.04
	South Wales Region	0.41	244	0.11	0.02	52.84
-	Dyfed & Mid-Wales Region	0.41	2.44	0.44	0.03	56.65
	North Wales Region					23.89
					1	

Table 10.4 SD16 Salix repens-Holcus lanatus dune slack community in Wales. Areas in hectares.

	Site	SD16	SD16a	SD16b	SD16c	SD16c/d	SD16d
1	Merthyr Mawr	1.78	1	0.83	1.27		
2	Kenfig Dunes	1.12	0.10	100 00 00 00		1.	
3	Margam Burrows						144.4
4	Baglan Bay						
5	Crymlyn Burrows	0.85		1			
6	Black Pill to Bryn Mill	A second second					
7	Pennard Burrows						
8	Penmaen Burrows						
9	Nicholaston Burrows						
10	Oxwich Burrows	1.03					
11	Port-Eynon to Horton						
12	Hillend to Hills Tor	0.26					
13	Whiteford Burrows	5.77				1	
14	Pembrey Coast	35.58				-	110100
15	Laughame Burrows	2.17					1012121
16	Pendine Burrows		0.07		0.53		0.70
17	Tenby Burrows				1.		
18	Caldey Island						1000
19	Lydstep Haven						0.000
20	Manorbier/Swanlake						1000
21	Freshwater Bay East		1				
22	Stackpole Warren						
23	Brownslade/Linney			1.	1.	1.1.1	
24	Broomhill Burrows				0.61	0.10	0.10
25	Whitesand Bay						
26	The Bennett						
27	Poppit Sands						
28	Towyn Warren				-		
29	Ynyslas		0.02				
30	Tywyn to Aberdovey			1			10.7710.97
31	Fairbourne						
32	Morfa Dyffryn	25.26					
33	Morfa Harlech	17.00					0.15
34	Morfa Bychan						
35	Pwllheli/Pen-y-Chain						
36	Traeth Crugan			-			
37	Tai Morfa						
38	Morfa Dinlle		1.				
39	Newborough Warren	39.10	10.95	5.92	15.42		25.44
40	Penhrhynoedd - Llangadwaladr	07110			1		1
41	Aberffraw	6.31	2.48	19.00		9.33	11.02
42	Valley	1.50			0.99		0.81
43	Tywyn Gwyn				1		0.01
44A	Traeth Dulas			1			
44B	Traeth Lligwy					1	1000
45	Red Wharf Bay					1	i natos
46	Conwy/Deganwy						
47	Kinmel Bay						1000
48	Rhyl to Prestatyn						in the second
49	Gronant to Talacre	0.02				0.03	
-	South Wales Region	10.81	0.10	0.83	1.27	-	-
	Dyfed & Mid-Wales Region	37.75	0.10	0.03	1.14	0.10	0.80
_	North Wales Region	89.19	13.43	5.92	1.14	9.36	37.42
	North wates Region	89.19	13.43	3.92	10.41	9.30	51.42
	National Totals	137.75	13.62	6.75	18.82	9.46	38.22

Table 10.4 (continued)SD16 Salix repens-Holcus lanatus dune slack community in Wales. Areasin hectares.

-	Site	SD16/M27	SD16/MG1	SD16/SD18	All SD16
1	Merthyr Mawr				3.88
2	Kenfig Dunes				1.22
3	Margam Burrows				
4	Baglan Bay				
5	Crymlyn Burrows				0.85
6	Black Pill to Bryn Mill				10000000000
7	Pennard Burrows				
8	Penmaen Burrows				and a state of the
9	Nicholaston Burrows				
10	Oxwich Burrows				1.03
11	Port-Eynon to Horton				States of States
12	Hillend to Hills Tor		The second second second	100 C C C C C C C C C C C C C C C C C C	0.26
13	Whiteford Burrows				5.77
14	Pembrey Coast				35.58
15	Laughame Burrows				2.17
16	Pendine Burrows				1.3
17	Tenby Burrows				1.0
18	Caldey Island				-
19	Lydstep Haven			1	
20	Manorbier/Swanlake	7			
20	Freshwater Bay East				
22	Stackpole Warren				
23	Brownslade/Linney				a second point of
24	Broomhill Burrows				0.81
25	Whitesand Bay				0.01
26	The Bennett				
27	Poppit Sands		-		-
28	Towyn Warren				-
29	Ynyslas		-		0.02
30	Tywyn to Aberdovey				0.02
	Fairbourne				-
31 32			the second second		25.26
	Morfa Dyffryn Morfa Harlech				17.15
33					17.15
34	Morfa Bychan				
35	Pwllheli/Pen-y-Chain				-
36	Traeth Crugan				1.00000
37	Tai Morfa				
38	Morfa Dinlle		0.00	6.10	0.0.11
39	Newborough Warren	0.13	0.33	0.12	97.41
40	Penhrhynoedd - Llangadwaladr		1. 1. 1. 1. 1.		-
41	Aberffraw			-	29.14
42	Valley				3.30
43	Tywyn Gwyn				A STREET
44A	Traeth Dulas				tell head?
44B	Traeth Lligwy				- Company
45	Red Wharf Bay				
46	Conwy/Deganwy			-	Contract of
47	Kinmel Bay			-	
48	Rhyl to Prestatyn				-
49	Gronant to Talacre	Contraction of the			0.05
				antino antino	S about the set
	South Wales Region			de la presenta	13.01
	Dyfed & Mid-Wales Region				39.88
	North Wales Region	0.13	0.33	0.12	172.31
-	National Totals	0.13	0.33	0.12	225.20

 Table 10.5 SD17 Potentilla anserina-Carex nigra dune slack community in Wales. Areas in hectares.

	Site	SD17	SD17a	SD17b	SD17b/d	SD17c	SD17c/d	SD17d
1	Merthyr Mawr	2.37	122111	13211-01	1.000	1121	ALC: NO	
2	Kenfig Dunes	200						0.47
3	Margam Burrows							
4	Baglan Bay							
5	Crymlyn Burrows	1.15					100	
6	Black Pill to Bryn Mill							1000
7	Pennard Burrows							
8	Penmaen Burrows							
9	Nicholaston Burrows					-		
10	Oxwich Burrows	0.13						
11	Port-Eynon to Horton							-
12	Hillend to Hills Tor							
13	Whiteford Burrows	0.26			1			
14	Pembrey Coast	0.92						
15	Laughame Burrows							1.1.1.1.1.1
16	Pendine Burrows			0.59				0.07
17	Tenby Burrows							
18	Caldey Island							1. 1
19	Lydstep Haven							
20	Manorbier/Swanlake		1.1.1					
21	Freshwater Bay East							
22	Stackpole Warren		1					
23	Brownslade/Linney	0.72						
24	Broomhill Burrows	0.12	-					0.23
25	Whitesand Bay		1					0120
26	The Bennett			-				
27	Poppit Sands		-	-				
28	Towyn Warren			-				
29	Ynyslas	0.35	-	1.00		0.16	0.06	1.58
30	Tywyn to Aberdovey	0.55	3.88	3.18		5.65	0.00	1.88
31	Fairbourne		5.00	5.10	-	5.05		1.00
32	Morfa Dyffryn	6.88	-	0.04		0.40		2.93
33	Morfa Harlech	0.39	-	7.27		3.75		17.93
34	Morfa Bychan	0.39	1.67	2.93		5.73		0.20
		0.31	1.07	2.93				0.20
35	Pwllheli/Pen-y-Chain	0.32	-					
36	Traeth Crugan	0.04						0.51
37	Tai Morfa	0.84	-	-			154	0.51
38	Morfa Dinlle	0.02	0.40			0.04		0.11
39	Newborough Warren	0.02	0.48			0.04		0.44
40	Penhrhynoedd - Llangadwaladr	2.09		-	2.0		0.07	1 100
41	Aberffraw	1.05	1.01	0.15	2.67		0.27	6.32
42	Valley		1.34	0.15	-			0.46
43	Tywyn Gwyn							-
44A	Traeth Dulas							
44B	Traeth Lligwy			-				-
45	Red Wharf Bay		-					-
46	Conwy/Deganwy		-	-	-			
47	Kinmel Bay		-	-	-		-	-
48	Rhyl to Prestatyn		-		-	-	-	-
49	Gronant to Talacre							-
								-
	South Wales Region	3.91						0.47
	Dyfed & Mid-Wales Region	1.99		1.59		0.16	0.06	1.88
	North Wales Region	11.90	7.37	13.57	2.67	9.84	0.27	30.6
						1		

Table 10.5 (continued) SD17 Potentilla anserin-Carex nigra dune slack community in Wales.Areas in hectares.

	Site	SD17/U4	SD17/W1	SD17/S10	SD17/S20
1	Merthyr Mawr				
2	Kenfig Dunes			Summer and the second	1 9 4 C C S
3	Margam Burrows				a the second second
4	Baglan Bay	All managements		In the second second	nin von p
5	Crymlyn Burrows				and a support of the support
6	Black Pill to Bryn Mill				
7	Pennard Burrows				
8	Penmaen Burrows				
9	Nicholaston Burrows	- In the second se		and the second second	
10	Oxwich Burrows				
11	Port-Eynon to Horton				
12	Hillend to Hills Tor				
13	Whiteford Burrows			4	
14	Pembrey Coast				
15	Laughame Burrows				
16	Pendine Burrows				A CONTRACTOR OF THE OWNER
17	Tenby Burrows				Contraction of the
18	Caldey Island	A Designed and the second second			Callent 1980
19	Lydstep Haven	1.1			and the second second
20	Manorbier/Swanlake	1			
21	Freshwater Bay East				
22	Stackpole Warren				and the second second
23	Brownslade/Linney				S THE PERMIT
24	Broomhill Burrows				a source cases
25	Whitesand Bay				1 204 200 000
26	The Bennett				the second second
27	Poppit Sands				
28	Towyn Warren				
29	Ynyslas	A A A A A A A A A A A A A A A A A A A			
30	Tywyn to Aberdovey	111			
31	Fairbourne		-		the second
32	Morfa Dyffryn	The second second	-	0.06	
33	Morfa Harlech		0.84	0.00	0.33
34			0.04		0.55
	Morfa Bychan				
35	Pwllheli/Pen-y-Chain				
36	Traeth Crugan				-
37	Tai Morfa	and the second second			
38	Morfa Dinlle				
39	Newborough Warren				
40	Penhrhynoedd - Llangadwaladr	0.01		-	
41	Aberffraw	0.21			
42	Valley				
43	Tywyn Gwyn	difference in the second			
44A	Traeth Dulas				and the second second
44B	Traeth Lligwy				
45	Red Wharf Bay			4	
46	Conwy/Deganwy	8.3			
47	Kinmel Bay	1.5			
48	Rhyl to Prestatyn	de la companya de la		distance and a	
49	Gronant to Talacre				and the second second
	South Wales Region			A long the second	
	Dyfed & Mid-Wales Region				
	North WalesRegion	0.21	0.84	0.06	0.33
	National Totals	0.21	0.84	0.06	0.33

Table 10.5 (continued) SD17 Potentilla anserina-Carex nigra dune slack community in Wales.Areas in hectares.

	Site	SD17/ MG1	SD17/ MG11	SD17/ M14	SD17/ M27	SD17/ SM18	SD17/ other wetland	All SD17
1	Merthyr Mawr	V. S. Markell		Introtos		Man man	discourse of	2.37
2	Kenfig Dunes		0.47					0.94
3	Margam Burrows	NA DAMAG		101000000		a log to a log	al shares	The Inc.
4	Baglan Bay	and to a fe			2 metric		deals min	120000
5	Crymlyn Burrows	in the second						1.15
6	Black Pill To Bryn Mill				-			
7	Pennard Burrows	The Interform		THE DO S	analessa.	al ordan	The second	111
8	Penmaen Burrows					1		
9	Nicholaston Burrows						The second	
10	Oxwich Burrows							0.13
11	Port-Eynon To Horton				and the second			SULL.
12	Hillend To Hills Tor							
13	Whiteford Burrows	112 2230		018	2 210 100	- 2000 0010	100 001	0.26
14	Pembrey Coast	and in the second			the base of	and a state		0.92
15	Laughame Burrows							
16	Pendine Burrows	0.07			VIELE ROD	1.000	2161276	0.73
17	Tenby Burrows							L. males
18	Caldey Island		1.					
19	Lydstep Haven			100000		-	1.10.1.000	1.12
20	Manorbier/Swanlake					1.000	0-3411-8	10111
21	Freshwater Bay East							
22	Stackpole Warren						-	
23	Brownslade/Linney	DOM N DODO			THE OTHER		Distant P	0.72
24	Broomhill Burrows			1.1.2 5 1.1	1		0.13	0.36
25	Whitesand Bay		-		-		0.10	0.00
26	The Bennett	1351 251 1 2 33	-	011100	1 1 1 1 1 1 1	11.215.07	2111111	
27	Poppit Sands		-					-
28	Towyn Warren	1.104 1.141 1.141 1.144						-
29	Ynyslas	Detroiterer?		100-100	1 1 1 1 2 1 P	Peter Press	277 124	3.15
30	Tywyn To Aberdovey				-		Laurs Y.	14.59
31	Fairbourne		-		-	-		14.37
32	Morfa Dyffryn			-	0.11	-		10.42
33	Morfa Harlech	THE PERSON ST	-	-	0.11	14.66	1.	45.17
34	Morfa Bychan		-			14.00	-	5.11
35	Pwllheli/Pen-y-Chain			-	-	-	-	0.32
36		1000 1000 20 3			1		-	0.54
37	Traeth Crugan Tai Morfa			-		-		1.35
38	Morfa Dinlle	a the rall reason			-	-		1.55
38 39	Newborough Warren			-	1 1 2 1 1 1	-		0.98
39 40				-	-			2.09
40	Penhrhynoedd - Llangadwaladr Aberffraw		-		1011101	-	-	10.52
41 42	Valley			0.09	0.09	-	-	2.13
			-	0.09	0.09	-		2.13
43	Tywyn Gwyn Traeth Dulas			-	-	-	-	-
44A 44B	Traeth Lligwy	n observision?	-	14-00	6-10-6091	a second of	and some	1991 12
440	Red Wharf Bay			in the second		CONT ON A	1.0.0	-
45	Conwy/Deganwy			-	-	-		-
40	Kinmel Bay			-	-	-	-	-
47	Dhul To Destatur			7000		-	-	the second
	Rhyl To Prestatyn				-		-	
49	Gronant To Talacre	steleter for st	-			1000	-	1000
	C ANUL D		0.17			-	-	1.00
1101	South Wales Region	0.07	0.47		-	-		4.85
	Dyfed & Mid-Wales Region	0.07	-	0.00	0.00	11.00	0.13	5.88
-	North Wales Region	100 B (100	-	0.09	0.20	14.66	-	92.68
		0.07	0.47	0.09	0.20	14.66	0.13	103.41

types. The largest regional extents are found in Dyfed and Mid-Wales where there are sizeable swampy margins to open water or upper saltmarsh in several sites (notably Pembrey Coast, Laugharne Burrows and Brownslade/ Linney on the southern coast). The regional pattern in swamp and tall-herb fens is therefore different from that for mire habitats.

10.5 Wet mesotrophic grasslands on sand dunes in Wales

Five NVC mesotrophic grassland communities are mapped on Welsh dunes but these are recorded for only twelve sites and total extent is only 17.3 ha (Table 10.8). Such habitat is therefore rare. Only the MG10 *Holcus lanatus-Juncus effusus* rush pasture has a large area (12.0 ha). Some wet mesotrophic grassland might represent former attempts to drain and improve wet dune grassland, allowing smooth rush *Juncus effusus* to invade an area. If this is the case such impacts are not very extensive.

10.6 Other wetland and open water on sand dunes in Wales

Target notes for 27 sites suggest, on the basis of species content, non-NVC types of wetland which total 63.5 ha (Table 10.9). This represents 7.6% of all dune wetland (slacks and all other wetland habitats, total area 835 ha), suggesting that it is possible to allocate more than 92% of these diverse habitats into NVC categories at community and sub-community level. Few sites have large areas of non-NVC vegetation (Laugharne Burrows and Morfa Harlech are the only locations with >10 ha of such vegetation) and in general anomalous wetland is not common.

Open water bodies on dunes are rare in Wales. They are mapped in only twelve sites and only two locations have a large extent: Kenfig (with the very important Kenfig Pool, 29.4 ha) and Laugharne Burrows (7.8 ha). Total extent is 39.6 ha. Aquatic NVC vegetation types were not mapped as part of the national dune survey and comment on their importance is not possible.

10.7 Wet woodland and scrub on sand dunes in Wales

Woodland and scrub are found in wet dune habitats of Wales in a total of 26 sites. They are therefore moderately common and total extent is also of reasonable quantity (118.4 ha, Table 10.10). Four NVC woodland communities are involved: W1 Salix cinerea - Galium palustre woodland, W2 Salix cinerea-Betula pubescens-Phragmites australis, W4 Betula pubescens-Molinia caerulea woodland and W6 Alnus glutinosa-Urtica dioica woodland. All communities are not differentiated into subcommunities, usually due to a combination of a small number of quadrats and poor visual fit with sub-communities which were probably originally defined without samples from wooded dune wetland. Most occurrences represent wet ground which has lacked grazing (or has had insufficient grazing) for several years, allowing Salix cinerea, Betula pubescens and Alnus glutinosa to invade and in time establish closed woodland.

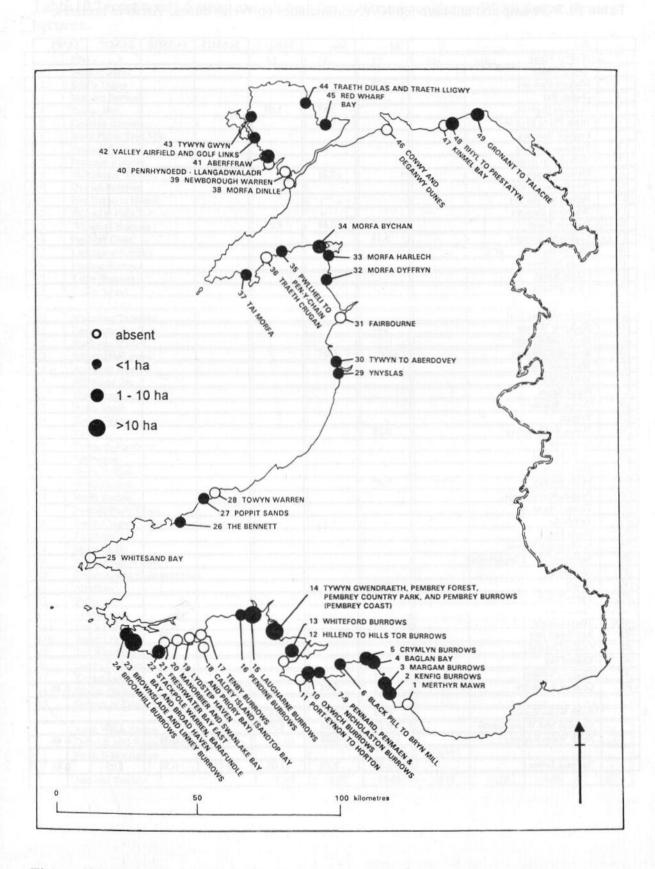
The largest extents of woodland are found on the southern coast of Wales, especially on the Pembrey Coast (38.9 ha), Laugharne Burrows (18.4 ha) and Oxwich Burrows (13.5 ha). These three sites are not grazed by stock (apart from recent goat grazing experiments at Oxwich) and in the case of Pembrey woodland has developed in former slacks surrounded by afforested land. The commonest and most extensive community is the W1 Salix cinerea-Galium palustre type and some of this is young and scrubby in character. The W6 Alnus glutinosa-Urtica dioica community is more restricted to the south-east coast but is characteristic of the transition zone between saltmarsh and sand dune at Oxwich and Whiteford Burrows. Scrubby W6 stands are present here and mature stands are found at Margam, Crymlyn, Oxwich, Whiteford, Pembrey and Laugharne Burrows. The W2 and W4 types are rare and total extent is not large.

Table 10.6 Mire communities (M5, M10, M11, M23, M25, M27, M28) on Welsh dunes. Areas in hectares.

-	Site	M5	M10c	M11	M23	M25	M25b
1	Merthyr Mawr						
2	Kenfig Dunes		1. 2 M. 1945	120.00	a series and a series		aughter a
3	Margam Burrows						1000
4	Baglan Bay						e costi co s
5	Crymlyn Burrows						
6	Black Pill To Bryn Mill						1
7	Pennard Burrows	and the second			1		1000
8	Penmaen Burrows		-		-	1	-
9	Nicholaston Burrows				1		-
10	Oxwich Burrows	and the second second			-	in the second	
11	Port-Eynon To Horton		Jun Come		-		-
12	Hillend To Hills Tor					-	10000
13	Whiteford Burrows					1	
14	Pembrey Coast						
15	Laughame Burrows			1	1000		
16	Pendine Burrows	- Carlo		a contract of the	1000		
17	Tenby Burrows					-	-
18	Caldey Island						-
19	Lydstep Haven		1				-
20	Manorbier/Swanlake						10.7
21	Freshwater Bay East					100	- Contra
22	Stackpole Warren			-		100	-
23	Brownslade/Linney		-	1		1	-
24	Broomhill Burrows				_	11	-
25	Whitesand Bay			25.8	-		
26	The Bennett			-	_	-	-
27	Poppit Sands					-	10000
28	Towyn Warren		-				- Carlos 12
29	Ynyslas	1.0					-
30	Tywyn To Aberdovey				_	_	-
31	Fairbourne				_		-
32	Morfa Dyffryn			_			-
33	Morfa Harlech	0.06		100	1.26		-
34	Morfa Bychan	State of the state				0.05	
35	Pwllheli/Pen-y-Chain	A AND DOCEDRICE		1	0.47		1.07
36	Traeth Crugan	Call Program				-	-
37	Tai Morfa			-			1.5
38	Morfa Dinlle						1010
39	Newborough Warren				0.45	1.17	1000
40	Penhrhynoedd - Llangadwaladr	8		-			1
41	Aberffraw				-		10000
42	Valley	-		0.22		0.17	0.71
43	Tywyn Gwyn	-	0.01			0.29	0.71
44A	Traeth Dulas			1	1		1100.000
44B	Traeth Lligwy						Called A
45	Red Wharf Bay		-	-			-
46	Conwy/Deganwy	4	-	-		-	-
47	Kinmel Bay			-		-	-
48	Rhyl To Prestatyn			-		-	-
49	Gronant To Talacre			-	-	-	
1.1						-	
	South Wales Region			-	-		
1.1	Dyfed & Mid-Wales Region					1.00	1.00
1.15	North Wales Region	0.06	0.01	0.22	2.18	1.68	1.78
	National Totals	0.06	0.01	0.22	2.18	1.68	1.78

	Site	M27	M27b	M27/ W24	M28	M28a	M28b	All mire types
1	Merthyr Mawr	0.54					Dali Mad	0.54
2	Kenfig Dunes						a shared of	1000
3	Margam Burrows						A State of the second second	
4	Baglan Bay						A STORES	
5	Crymlyn Burrows					1.1.1.1.1.2.4	10091 (C. 114)	0.000
6	Black Pill To Bryn Mill				The set of the		1.2.2.4.1.1.1	Sell's P.
7	Pennard Burrows						1. Constant	22.001
8	Penmaen Burrows							
9	Nicholaston Burrows					o and and a	Contraction of	
10	Oxwich Burrows						(0.6) (881)	1000
11	Port-Eynon To Horton							
12	Hillend To Hills Tor	state conclusion					100000	
13	Whiteford Burrows							Sec. 1
14	Pembrey Coast						100000000	
15	Laughame Burrows	0.07	1.5		The second		a transfer but	0.07
16	Pendine Burrows						Second St	in the
17	Tenby Burrows	and the second second			3.47		1.12867	3.47
18	Caldey Island	1					1000	
19	Lydstep Haven	Tall and the second				and the second second	and a strength	and the
20	Manorbier/Swanlake						1 - 1 - 1	Store 1
21	Freshwater Bay East					100058.0	Selections in	12.62
22	Stackpole Warren						The second second	a constant.
23	Brownslade/Linney						1000000	
24	Broomhill Burrows	0.23			-	A CONTRACT OF	1000	0.23
25	Whitesand Bay	0.23				The second second	Contraction of the second	0.20
26	The Bennett						1	1.00
27	Poppit Sands	and the second second		-	-	and the second	10000	
28	Towyn Warren			0.32	0.11	0.22		0.65
29	Ynyslas			0.52	0.11	0.22	10000	0.0.
30	Tywyn To Aberdovey		-		0.04	1.26	-	1.30
31	Fairbourne				0.04	1.20	10000	1.50
and the second se	Morfa Dyffryn	0.38		-	0.11			0.49
32 33	Mona Dynryn Morfa Harlech	0.58		-	0.11	-		1.32
33				-	5.86	Contraction of the	-	5.91
	Morfa Bychan		-		5.00	-	-	1.54
35	Pwllheli/Pen-y-Chain			and the second second	-	-		1.5
36	Traeth Crugan	100				-	-	
37	Tai Morfa					-	-	
38	Morfa Dinlle	3.2	0.57		0.04	-	-	5.43
39	Newborough Warren	3.2	0.57	-	0.04	-	-	J.4.
40	Penhrhynoedd - Llangadwaladr	3.31	0.38	-	2.26	10000	0.38	6.3
41	Aberffraw	5.51	0.38		2.20	-	0.38	0.3
42	Valley	0.02	10.05/-					1.03
43	Tywyn Gwyn	0.02	-	-	-		-	1.0.
44A	Traeth Dulas	- The states				A ALLER AND A		
44B	Traeth Lligwy		-		-	1		
45	Red Wharf Bay	The second second	-				1	
46	Conwy/Deganwy		-		-	-		
47	Kinmel Bay	10-10-10-10-10-10-10-10-10-10-10-10-10-1		-	10 10 Parts	-		
48	Rhyl To Prestatyn		-	-	0.00	-		0.0
49	Gronant To Talacre				0.68		-	0.6
			-		-	And and a		
	South Wales Region	0.54	-				-	0.5
12.1	Dyfed & Mid-Wales Region	0.30		0.32	3.58	0.22		4.4
	North Wales Region	6.91	0.95		8.99	1.26	0.38	24.4
	CALL STREET AND AND ADDREED AND AD		COLUMN STATES			1	I I I I I I I I	

Table 10.6 (continued) Mire communities (M5, M10, M11, M23, M25, M27, M28) on Welsh dunes. Areas in hectares.



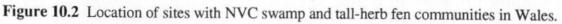


Table 10.7 Swamp and tall-herb fen NVC communities on Welsh dunes. Areas in hectares.

_	Site	S4	S4a	S4/S21	S4/SM15	S4/SM18	S4/M27	S4/W1
1	Merthyr Mawr							
2	Kenfig Dunes							
3	Margam Burrows	0.78			1.000			
4	Baglan Bay	The second s						
5	Crymlyn Burrows		3.85	1.03	1.			
6	Black Pill to Bryn Mill		0.10					
7	Pennard Burrows							
8	Penmaen Burrows							
9	Nicholaston Burrows			1.03	1 1 1 1 1			
10	Oxwich Burrows	1.1	3.21				1.11	
11	Port-Eynon to Horton		-	1				
12	Hillend to Hills Tor							
13	Whiteford Burrows					-		-
14	Pembrey Coast		0.64	8.97				
15	Laughame Burrows	9.19	0.01	0.91	1			-
16	Pendine Burrows	7.17						
17	Tenby Burrows							
18	Caldey Island		-					
19	Lydstep Haven				1			
20	Manorbier/Swanlake							-
21	Freshwater Bay East	/- 1	1	1				-
22	Stackpole Warren	1.03	-	-	1	-		
23	Brownslade/Linney	1.05					-	-
24	Broomhill Burrows		0.01				1.05	
25	Whitesand Bay		0.01		-		1.05	
26	The Bennett		-					-
27			-					-
	Poppit Sands						-	-
28	Towyn Warren							
29	Ynyslas	0.00						-
30	Tywyn to Aberdovey	0.28	1 1			-		-
31	Fairbourne							
32	Morfa Dyffryn			-				
33	Morfa Harlech							
34	Morfa Bychan	0.80						1.1.1.
35	Pwllheli/Pen-y-Chain			1 agenous and				
36	Traeth Crugan			and a state of	and the second			
37	Tai Morfa				and the second			
38	Morfa Dinlle							
39	Newborough Warren					-		
40	Penhrhynoedd - Llangadwaladr							-
41	Aberffraw							
42	Valley	0.62		A second back of the				
43	Tywyn Gwyn	A PARTY OF						
44A	Traeth Dulas			1 1	100		1.1.1	1 1000
44B	Traeth Lligwy	0.06	a second	1	1		1.0	1
45	Red Wharf Bay				1	0.30		
46	Conwy/Deganwy	10 PA 10 P.			1. 18			
47	Kinmel Bay							
48	Rhyl to Prestatyn	1.29		No. and No.		1.1.1		
49	Gronant to Talacre	1.33	0.98		0.01	1.1		0.46
13.6		19.77.60						
	South Wales Region	0.78	7.16	2.06				
	Dyfed & Mid-Wales Region	10.22	0.65	8.97			1.05	1
	North Wales Region	4.38	0.98	WIT I	0.01	0.30	1.00	0.46
-		1.00	0.50	-	0.04	0.00		0.40
	National Totals	15.38	8.79	11.03	0.01	0.30	1.05	0.46

 Table 10.7 (continued)
 Swamp and tall-herb fen NVC communities on Welsh dunes.
 Areas in hectares.

	Site	S5	S6	S7	S8a	S10	S12	S12b
1	Merthyr Mawr						1.4.4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	
2	Kenfig Dunes		1				1 mers 43 1.0	21111
3	Margam Burrows		10.00				to a la terreta	
4	Baglan Bay						year's start	1000
5	Crymlyn Burrows				1.121		a second and the	0.11 2
6	Black Pill to Bryn Mill			1.1.1.1.1.1		1000	other the se	
7	Pennard Burrows						and the second second	
8	Penmaen Burrows							
9	Nicholaston Burrows					1 day	and an earlier	911113
10	Oxwich Burrows					1.	and states	0.11
11	Port-Eynon to Horton					1	Constant - La	
12	Hillend to Hills Tor		1.1				out of the Second	
13	Whiteford Burrows			1			and hours	1.03
14	Pembrey Coast						and the second	0.64
15	Laughame Burrows	0.10	0.03	110		2.78	1.1.1.1.1.1	
16	Pendine Burrows	0.440						
17	Tenby Burrows			10110				
18	Caldey Island							
19	Lydstep Haven							
20	Manorbier/Swanlake					1		
21	Freshwater Bay East							
22	Stackpole Warren							
23	Brownslade/Linney			12.56				1111
24	Broomhill Burrows			10100				
25	Whitesand Bay					-	1.00	
26	The Bennett						0.06	-
27	Poppit Sands						0.00	
28	Towyn Warren					-	-	-
29	Ynyslas					-	-	1
30	Tywyn to Aberdovey					-	1	-
31	Fairbourne						-	
32	Morfa Dyffryn						-	-
33	Morfa Harlech				0.35		-	
34	Morfa Bychan	the second second		10000000000	0.55			
35	Pwllheli/Pen-y-Chain							-
36	Traeth Crugan					-	-	-
37	Tai Morfa							-
							-	
38	Morfa Dinlle	Berger (error) -						-
39	Newborough Warren					1.17	-	-
40	Penhrhynoedd - Llangadwaladr				-	-	-	-
41	Aberffraw						-	-
42	Valley	In Manual	1	-			-	
43	Tywyn Gwyn	1 100					1000 10.00	-
44A	Traeth Dulas			1			1000	1.00
44B	Traeth Lligwy			-			11111	-
45	Red Wharf Bay					-	10.00	-
46	Conwy/Deganwy				-	-		-
47	Kinmel Bay			-				4
48	Rhyl to Prestatyn			-		-	-	-
49	Gronant to Talacre	6			-	1	-	
1.19	a Depart II Defection			DOL N	-	-	-	
	South Wales Region				-			1.03
	Dyfed & Mid-Wales Region	0.10	0.03	12.56		2.78	0.06	0.64
	North Wales Region	1. 0.0 0.00	141	1.3.01.5.1	0.35			
				1 1 1 1				

	Site	S14	S18a	S19	S19a	S19c	S19/W1
1	Merthyr Mawr	111				- Contraction	
2	Kenfig Dunes		part of the	-	- Landard Landard		100.00
3	Margam Burrows					0.00	A DIAN
4	Baglan Bay			1.5.1.1.1			10-1-1-1
5	Crymlyn Burrows	all she at				A DESCRIPTION OF THE PARTY OF T	N. P. Day
6	Black Pill to Bryn Mill	1911				1.1194010-10	1000
7	Pennard Burrows				a think the same		1.1.1.22/2
8	Penmaen Burrows			-		1.0000	Contraction of the
9	Nicholaston Burrows					1000	1000
10	Oxwich Burrows						
11	Port-Eynon to Horton					11000	100.000
12	Hillend to Hills Tor					10000	1 1 1 1 1
13	Whiteford Burrows					1000	
14	Pembrey Coast		-		-	-	
15	Laughame Burrows	0.31		1.1.1.1		1000	
16	Pendine Burrows	0.51			0.03	1 1 1 1 1	
17	Tenby Burrows				0.05		-
18	Caldey Island			-	-	-	
19	Lydstep Haven				-	1	
20	Manorbier/Swanlake		-			1000	-
20	Freshwater Bay East				-		-
22	Stackpole Warren			-		-	-
23	Brownslade/Linney			-	-	-	-
			-	-	0.02	0.22	-
24	Broomhill Burrows				0.03	0.23	-
25	Whitesand Bay		-		-	1	-
26	The Bennett				-	1	-
27	Poppit Sands		-	-		-	
28	Towyn Warren		-	-	1	Presidenter St	
29	Ynyslas	all the second			-	-	
30	Tywyn to Aberdovey		- Contractor	a second second			5 10 00 C
31	Fairbourne	the second		1	- Contractor	1	1000
32	Morfa Dyffryn	Add a second states		-	- Carlos - Carlos	-	10000
33	Morfa Harlech		and the second second	0.01	1	and some for	0.44
34	Morfa Bychan			0.31	- Andrewson	and and and	
35	Pwllheli/Pen-y-Chain				0.11		
36	Traeth Crugan			-			
37	Tai Morfa					0.07	
38	Morfa Dinlle				and the second		A CONTRACT
39	Newborough Warren	1.				1000000	
40	Penhrhynoedd - Llangadwaladr				dist.	in the part of	i contra
41	Aberffraw						
42	Valley	11		0.07			1.11
43	Tywyn Gwyn	1.1.1.1.1.1		0.03			1000
44A	Traeth Dulas						a faith less
44B	Traeth Lligwy	1.1.	1	in the second second	1		and I down
45	Red Wharf Bay					1 1	Stand of the
46	Conwy/Deganwy	1.6 0.0 1.1				A CALLON	
47	Kinmel Bay						and lards
48	Rhyl to Prestatyn					1.	
49	Gronant to Talacre		0.61			1.0.0	ad these
	Sand Web David					-	-
	South Wales Region	0.01	-	-	0.00	0.00	-
	Dyfed & Mid-Wales Region	0.31			0.06	0.23	
	North Wales Region		0.61	0.42	0.11	0.07	0.44
-	National Totals	0.31	0.61	0.42	0.17	0.30	0.44
	radonal rotats	0.51	0.01	0.76	0.17	0.00	0.4

Table 10.7 (continued) Swamp and tall-herb fen NVC communities on Welsh dunes. Areas in hectares.

	Site	S20	S20a	S20b	S21	S21a	S21c	S21/ SM6
1	Merthyr Mawr							01.10
2	Kenfig Dunes						1.1.1	
3	Margam Burrows							
4	Baglan Bay			1000	4.04			
5	Crymlyn Burrows							
6	Black Pill to Bryn Mill						incourse)	
7	Pennard Burrows						10.000	
8	Penmaen Burrows		1					1.1.1
9	Nicholaston Burrows							
10	Oxwich Burrows		12-05-0	-			and the second second	1.00
11	Port-Eynon to Horton				-		100000	
12	Hillend to Hills tor		-				1000000000	
13	Whiteford Burrows					-		
14	Pembrey Coast	Contraction of the						
15	Laughame Burrows	2.91				-		
16	Pendine Burrows		-	0.04			1.	
17	Tenby Burrows			0.01				
18	Caldey Island							
19	Lydstep Haven							-
20	Manorbier/Swanlake			-	-	-		
21	Freshwater Bay East			-	-	-		
22	Stackpole Warren				-		1.1.1.1	
23	Brownslade/Linney		-	-				-
24	Broomhill Burrows				0.23		-	-
25	Whitesand Bay				0.23		-	-
26	The Bennett						-	-
27	Poppit Sands		-	-		-		-
28	towyn Warren		-				-	-
29	Ynyslas			-		+	0.04	-
30						+	0.04	-
31	Tywyn to Aberdovey Fairbourne							-
32						+		
33	Morfa Dyffryn Morfa Harlech				-			
34			-					
35	Morfa Bychan		-	-	-			-
	Pwllheli/Pen-y-Chain		-	-			-	-
36	Traeth Crugan		+	-			-	-
37	Tai Morfa		-	-				-
38	Morfa Dinlle		-	-				-
39	Newborough Warren		-	-	-		-	-
40	Penhrhynoedd - Llangadwaladr	0.01	-	-	-	-	-	0.15
41	Aberffraw	0.64	-	-		-	-	0.15
42	Valley		-					
43	Tywyn Gwyn		-			-	-	+
44A	Traeth Dulas					1		
44B	Traeth Lligwy		-	-		0.12	-	-
45	Red Wharf Bay		-	-	-	0.12	-	-
46	Conwy/Deganwy			-	-		-	-
47	Kinmel Bay			-	-	-	-	-
48	Rhyl to Prestatyn			6.17		-	0.00	
49	Gronant to Talacre		0.08	0.67	-	3.42	0.08	-
1.1.2				-		-	-	-
	South Wales Region		-	-	4.04	-	-	-
	Dyfed & Mid-Wales Region	2.91	-	0.04	0.23	-	0.04	-
	North Wales Region	0.64	0.08	0.67	-	3.54	0.08	0.15
							1.000	

Table 10.7 (continued) Swamp and tall-herb fen NVC communities on Welsh dunes. Areas in hectares.

	Site	\$25	S26	S26d	S28	S28c	All swamp types
1	Merthyr Mawr						types
2	Kenfig Dunes					-	P
3	Margam Burrows	0.29	-	-			1.07
4	Baglan Bay	0.63		-		10000	4.04
5	Crymlyn Burrows		-			Contraction of the	4.88
6	Black Pill to Bryn Mill		-				0.10
7	Pennard Burrows		-	-		1	0.10
8	Penmaen Burrows			-	-	Annelli	
9	Nicholaston Burrows						1.03
10	Oxwich Burrows						3.21
11	Port-Eynon to Horton					100 1000	
12	Hillend to Hills Tor					Summing of	
13	Whiteford Burrows					-	1.03
14	Pembrey Coast				1.0.0	100000	10.25
15	Laughame Burrows		1		0.06	1.000	15.38
16	Pendine Burrows				0100	1.00	0.07
17	Tenby Burrows			1			1
18	Caldey Island					2110	Constant I
19	Lydstep Haven					- Section 2	
20	Manorbier/Swanlake					I toll well	
21	Freshwater Bay East					annu.	
22	Stackpole Warren				1000	man i	1.03
23	Brownslade/Linney						12.56
24	Broomhill Burrows						1.55
25	Whitesand Bay						
26	The Bennett						0.06
27	Poppit Sands		1			0.01	0.01
28	Towyn Warren						
29	Ynyslas					N. Williams	0.04
30	Tywyn to Aberdovey				-		0.28
31	Fairbourne					100	
32	Morfa Dyffryn			0.24		1.00	0.24
33	Morfa Harlech	the second s					0.80
34	Morfa Bychan						1.11
35	Pwllheli/Pen-y-Chain					-	0.11
36	Traeth Crugan		-				
37	Tai Morfa						0.07
38	Morfa Dinlle					10000	
39	Newborough Warren				1 Bala		
40	Penhrhynoedd - Llangadwaladr		-	11.15			1.11.11
41	Aberffraw		0.95		1		1.74
42	Valley				0.01	-	0.70
43	Tywyn Gwyn				0.01		0.03
44A	Traeth Dulas					1	0.00
44B	Traeth Lligwy		1			1.	0.06
45	Red Wharf Bay					1	0.42
46	Conwy/Deganwy						
47	Kinmel Bay						
48	Rhyl to Prestatyn	10.0				and and a local of the	1.29
49	Gronant to Talacre						7.64
					1.1.2.7	- MAGERIA	Seller S
	South Wales Region	0.29			0.1.1		15.36
_	Dyfed & Mid-Wales Region		1305-1		0.06	0.01	40.95
	North Wales Region		0.95	0.24	0.01	10	14.49
144.0	National Totals	0.29	0.95	0.24	0.07	0.01	70.80

Table 10.7 (continued) Swamp and tall-herb fen NVC communities on Welsh dunes. Areas in hectares. P = present, extent not mapped.

	Site	MG2	MG9b	MG10	MG10a	MG10b	MG10b/c	MG10c
1	Merthyr Mawr	DO NOTORAL	101314					
2	Kenfig Dunes	0.14				1	1.111	
3	Margam Burrows	1 1 1 10 - 10					1 Carlotter	
4	Baglan Bay							13.07
5	Crymlyn Burrows							1
6	Black Pill to Bryn Mill						1 1 1 1	
7	Pennard Burrows							
8	Penmaen Burrows			-				
9	Nicholaston Burrows		-					
10	Oxwich Burrows			-				
11	Port-Eynon to Horton							
12	Hillend to Hills Tor			-				
13	Whiteford Burrows			-	-			
14	Pembrey Coast		-			-		
15	Laughame Burrows							-
16	Pendine Burrows			-	1.86	1.86	5.35	0.21
17	Tenby Burrows			-	1.00	1.00	3.33	0.21
18	Caldey Island							
19	Lydstep Haven		-					
20	Manorbier/Swanlake		-	-			12.000	
			-					-
21	Freshwater Bay East							
22	Stackpole Warren						1000	-
23	Brownslade/Linney						and the first the	-
24	Broomhill Burrows					0.12	10000000000	
25	Whitesand Bay		-	-	-			-
26	The Bennett						and the second second	
27	Poppit Sands		-				1.0.0	
28	Towyn Warren			0.11			A STREET	
29	Ynyslas						and the second	10112
30	Tywyn to Aberdovey			0.46			dens H	
31	Fairbourne							
32	Morfa Dyffryn			0.45				
33	Morfa Harlech							
34	Morfa Bychan		0.23				and the second	and the second
35	Pwllheli/Pen-y-Chain						and the second	melle F
36	Traeth Crugan						had been	
37	Tai Morfa							10121
38	Morfa Dinlle						30,000	2.00
39	Newborough Warren							
40	Penhrhynoedd - Llangadwaladr						Collect.	
41	Aberffraw				0.12		1	
42	Valley							1000
43	Tywyn Gwyn	1 1 1 1 1 1 1						
44A	Traeth Dulas			-				
44B	Traeth Lligwy						1.1.1.1	1.124
45	Red Wharf Bay							
46	Conwy/Deganwy							
47	Kinmel Bay		-					1
48	Rhyl to Prestatyn			1	-			1
40	Gronant to Talacre		-	1.16	0.02	0.11		1
49	Oronant to Tatacre		-	1.10	0.02	0.11		
	C-d Wd - D-	0.14	-	-	-		-	
	South Wales Region	0.14	-	0.11	1.94	1.09	6.95	0.21
-	Dyfed & Mid-Wales Region		0.00	0.11	1.86	1.98	5.35	0.21
	North Wales Region		0.23	2.07	0.14	0.11		-
	National Totals	0.14	0.23	2.18	2.00	2.09	5.35	0.21

Table 10.8 Wet mesotrophic grassland communities on Welsh dunes. Areas in hectares.

	Site	MG10/ MG11	MG10/ MG12	MG10/ W23	MG11	MG11a	MG11/ S4 •	MG11/ W1
1	Merthyr Mawr				1.01		Income.	1917
2	Kenfig Dunes							1000
3	Margam Burrows						in the second	and the second
4	Baglan Bay						and the state	
5	Crymlyn Burrows						e cound	
6	Black Pill to Bryn Mill						and shall	
7	Pennard Burrows					in the second sector	instrikkers h	
8	Penmaen Burrows				and the second s			
9	Nicholaston Burrows					and the second	instant of	10000
10	Oxwich Burrows							
11	Port-Eynon to Horton						in ann a fa	3,01507-
12	Hillend to Hills Tor						and the second second	Contractor
13	Whiteford Burrows					1.	0000	-
14	Pembrey Coast	1.1						- all mails
15	Laughame Burrows							1.000
16	Pendine Burrows						- (11-1)	- Children
17	Tenby Burrows							ALC: NO
18	Caldey Island							1.1
19	Lydstep Haven						1. 1. 2. 2. 1.	
20	Manorbier/Swanlake						-come IC	
21	Freshwater Bay East							
22	Stackpole Warren							Constantial line
23	Brownslade/Linney							
24	Broomhill Burrows	0.01	0.90		1.26	0.12		0.14
25	Whitesand Bay							
26	The Bennett	1 1 1 2 2 2 2						
27	Poppit Sands							
28	Towyn Warren	11						
29	Ynyslas		1		0.51			
30	Tywyn to Aberdovey			1	UID A			
31	Fairbourne							1
32	Morfa Dyffryn							
33	Morfa Harlech					0.05		
34	Morfa Bychan			1		0.05		
35	Pwllheli/Pen-y-Chain							
36	Traeth Crugan							
37	Tai Morfa							
38	Morfa Dinlle		-	-	-			
39	Newborough Warren					-		
40	Penhrhynoedd - Llangadwaladr							
40	Aberffraw			0.02				
42	Valley		1	0.02	0.62	0.03		
42	Tywyn Gwyn				0.02	0.05		1.1.1
45 44A	Traeth Dulas				-	-		100
44A 44B	Traeth Lligwy							1300
440	Red Wharf Bay							-
45	Conwy/Deganwy					-	1000	
40	Kinmel Bay			-		-		
47	Rhyl to Prestatyn					-		
40	Gronant to Talacre			-		-	0.01	
43							0.01	
-	South Wales Region				1.01			
1	Dyfed & Mid-Wales Region	0.01	0.90		1.01	0.12		0.14
-	North Wales Region	0.01	0.90	0.02	0.62	0.08	0.01	0.14
-	Listal Hars Region	-		0.00	0.02	0.00	0.01	
-	National Totals	0.01	0.90	0.02	3.40	0.20	0.01	0.14
					-			

 Table 10.8 (continued)
 Wet mesotrophic grassland communities on Welsh dunes. Areas in hectares.

	Site	MG11/ Other wetland	MG12a	MG12b	All wet mesotrophic grassland
1	Merthyr Mawr				1.01
2	Kenfig Dunes				0.14
3	Margam Burrows				
4	Baglan Bay				
5	Crymlyn Burrows				1.
6	Black Pill to Bryn Mill				a second independent
7	Pennard Burrows				
8	Penmaen Burrows				a second second second
9	Nicholaston Burrows				and the second
10	Oxwich Burrows				
11	Port-Eynon to Horton				
12	Hillend to Hills Tor				
13	Whiteford Burrows				
14	Pembrey Coast				and the second second
15	Laughame Burrows				
16	Pendine Burrows				9.28
17	Tenby Burrows				
18	Caldey Island				I we shall be to
19	Lydstep Haven				4421 343
20	Manorbier/Swanlake				
21	Freshwater Bay East				and an and the
22	Stackpole Warren				
23	Brownslade/Linney				and and a
24	Broomhill Burrows	0.34	0.06		2.95
25	Whitesand Bay				
26	The Bennett				Contraction and the
27	Poppit Sands				
28	Towyn Warren				0.11
29	Ynyslas				0.51
30	Tywyn to Aberdovey				0.46
31	Fairbourne				
32	Morfa Dyffryn			1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.45
33	Morfa Harlech			0.12	0.17
34	Morfa Bychan				0.23
35	Pwllheli/Pen-y-Chain				
36	Traeth Crugan				
37	Tai Morfa				
38	Morfa Dinlle				
39	Newborough Warren				
40	Penhrhynoedd - Llangadwaladr				
41	Aberffraw			The second second	0.14
42	Valley				0.65
43	Tywyn Gwyn				
44A	Traeth Dulas				1.000
44B	Traeth Lligwy				
45	Red Wharf Bay				1001212
46	Conwy/Deganwy			-	and to call.
47	Kinmel Bay				13000
48	Rhyl to Prestatyn				
49	Gronant to Talacre				1.30
	South Wales Region	0.34	0.06		1.15
	Dyfed & Mid-Wales Region				12.85
	North Wales Region		al an and	0.12	3.40
					and when the day
	National Totals	0.34	0.06	0.12	17.40

 Table 10.8 (continued)
 Wet mesotrophic grassland communities on Welsh dunes. Areas in hectares.

Site Other (non-NVC) Total of swamp, mire, Open water wetland wet mesotrophic grassland, other wetland and open water Merthyr Mawr 1.55 2.24 29.36 2 Kenfig Dunes 31.60 Margam Burrows 3 1.22 0.15 4 Baglan Bay 4.04 Crymlyn Burrows 4.88 5 6 Black Pill to Bryn Mill 0.10 7 Pennard Burrows 8 Penmaen Burrows 9 Nicholaston Burrows 1.03 Oxwich Burrows 3.21 10 11 Port-Eynon to Horton 12 Hillend to Hills Tor Whiteford Burrows 1.03 13 10.25 14 Pembrey Coast 7.84 15 11.15 Laughame Burrows 34.44 16 Pendine Burrows 0.94 10.29 17 Tenby Burrows 2.61 6.08 Caldey Island 18 19 Lydstep Haven 20 0.50 0.50 Manorbier/Swanlake 21 Freshwater Bay East 0.01 0.01 6.98 22 Stackpole Warren 8.01 23 Brownslade/Linney 0.09 12.65 24 **Broomhill Burrows** 1.40 1.11 7.24 25 Whitesand Bay 0.19 0.19 26 The Bennett 0.08 0.14 27 Poppit Sands 0.01 0.02 Towyn Warren 0.11 0.87 28 0.34 29 Ynyslas 0.99 1.88 30 Tywyn to Aberdovey 0.78 2.82 31 Fairbourne 7.31 0.35 8.84 Morfa Dyffryn 32 33 Morfa Harlech 11.61 0.17 14.07 3.39 10.64 34 Morfa Bychan 35 Pwllheli/Pen-y-Chain 2.45 4.10 36 Traeth Crugan 0.66 0.73 37 Tai Morfa 38 Morfa Dinlle 0.24 0.24 Newborough Warren 39 0.22 0.05 5.70 40 Penhrhynoedd - Llangadwaladr 0.14 0.14 Aberffraw 2.08 10.29 41 42 Valley 3.66 5.40 Tywyn Gwyn 43 0.06 1.12 44A Traeth Dulas 0.07 0.07 0.06 44B Tracth Lligwy 0.14 0.26 Red Wharf Bay 45 0.42 46 Conwy/Deganwy 47 Kinmel Bay 1.29 Rhyl to Prestatyn 48 3.52 0.04 49 Gronant to Talacre 13.18 South Wales Region 29.51 2.24 48.66 Dyfed & Mid-Wales Region 24.96 9.39 92.57 North Wales Region 36.33 0.67 79.31 63.53 39.57 220.54 National Totals

Table 10.9 Other (non-NVC) wetland vegetation, open water and non-slack wetland habitat totals for dunes in Wales. Areas in hectares.

Table 10.10 Wet woodland and scrub on sand dunes in Wales. Areas in hectares.

1383	Site	W1	W2	W4	W6	Total wet woodland
1	Merthyr Mawr	0.54	1000	7.45	0.95	8.94
2	Kenfig Dunes	0.28	1	and of the second	No. of Contract of Contract	0.28
3	Margam Burrows		2.77		2.28	5.05
4	Baglan Bay	相信,自己的问题,自己			10 10 10 10 10 10 10 10 10 10 10 10 10 1	
5	Crymlyn Burrows	2.43	C. Standard	I. C. FILLER	3.20	5.63
6	Black Pill to Bryn Mill		y11.1.218	adent north	lario no be	Contra hards
7	Pennard Burrows	1 A THE LEVEL OF A THE PARTY				
8	Penmaen Burrows	Alocholic entry	11111111111111111111111111111111111111	HANNELS'S		
9	Nicholaston Burrows	0.38	hineli		043 O.L.	0.38
10	Oxwich Burrows	7.05	and the second sec		6.40	13.45
11	Port-Eynon to Horton	er nortuni	1.1.1.2.4.43			
12	Hillend to Hills Tor	0.83	Suchter 1	11. 10.10.00	1111220-0	0.83
13	Whiteford Burrows	2.56		A Sharan	1.28	3.84
14	Pembrey Coast	20.83	11111 211	Castration	18.05	38.88
15	Laughame Burrows	13.40	CONTRACT OF CONTRACT		5.03	18.43
16	Pendine Burrows	1.77	in here	new horizon	and at inco	1.77
17	Tenby Burrows	1.46		and an and and	e asses	1.46
18	Caldey Island		11.3-9	infinite the	d an an an	
19	Lydstep Haven			Strand Strand		
20	Manorbier/Swanlake	0.50				0.50
21	Freshwater Bay East	ab star denies	The second	1.22.27.22.20		
22	Stackpole Warren	LA CLASSIC	Diama Charles	A STATISTICS	0.64	0.64
23	Brownslade/Linney	and the second			and the O	Particular a
24	Broomhill Burrows	MULT UT	NAME OF	10020-0001001	120.002.20	Contraction 1.1
25	Whitesand Bay	0.06	CURRENT.	NUMBER OF	THE CALSE INCOME	0.06
26	The Bennett			and send the	Concernit of	in the second second
27	Poppit Sands	10.000	110000	Concerning and		1. 1. 6.8557
28	Towyn Warren	and the second	1 2 2 3 1 3	A CONTRACT NO	100 B 100 B 10	A REPORT OF
29	Ynyslas	0.24			and a set of	0.24
30	Tywyn to Aberdovey	3.01				3.01
31	Fairbourne	5101	Contraction of	10000	A STREET STREET	
32	Morfa Dyffryn	2.93	Received to	I STAND		2.93
33	Morfa Harlech	6.60				6.60
34	Morfa Bychan	2.69	1 1 1 1 1 1	200 10000000	1000	2.69
35	Pwllheli/Pen-y-Chain	0.10	131800	WEEK CLUDED	DR. Verline	0.10
36	Traeth Crugan	0.10		1		0.10
37	Tai Morfa	193 10000 740	100000118			1111
38	Morfa Dinlle		1.4.1.4	1		
39	Newborough Warren	1.22		1		1.22
40	Penhrhynoedd - Llangadwaladr	1.0.00	27 W 11 20	1	1.1.1.1.1.1.1.1.1	
40	Aberffraw		1	1.1.1.2	10000000000	100000
41 42	Valley			1		1
42	Tywyn Gwyn		1.000		-	
43 44A	Traeth Dulas	0.01				0.01
44A 44B	Traeth Lligwy	0.70		a bankaran	- Line marine	0.70
44.0	Red Wharf Bay	0.70			1	0.10
		0.22	11000	Contraction of the second		0.22
46	Conwy/Deganwy	0.22	1000	1.7 2 1 1941	0 30 66 5	0.22
47	Kinmel Bay Bhul to Brostature		-		-	-
48	Rhyl to Prestatyn	0.34	0.24	-		0.58
49	Gronant to Talacre	0.34	0.24	-	-	0.38
131.5	la iwi p	14.07	0.77	7.45	14.11	38.40
	South Wales Region	14.07	2.77	7.45	23.72	61.98
	Dyfed & Mid-Wales Region	38.26	0.24	-	23.12	the second se
1.10	North Wales Region	17.82	0.24			18.06
	The second second at the second se	A CONTRACTOR OF A CONTRACTOR O			IL SIL ALC LED	A STREET AS LEVER ST

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11. Scrub, bracken and woodland

11.1 NVC communities

This chapter presents results for scrub, bracken and woodland mapped on dry dune habitats (scrub and woodland found in dune wetland are discussed in Chapter 10). No NVC woodland type is restricted to dunes in Britain and only one NVC scrub type is recognised for this habitat: SD18 Hippophae rhamnoides dune scrub. Other types of scrub are also present on dunes and are described in the woodland and scrub (W) NVC volume (W21, W22, W23, W24). These are described here, together with non-NVC scrub types recorded in target notes or mapped as a distinct type (notably privet Ligustrum vulgare). Bracken is also quite frequent and most cases are more closely related to the W25 underscrub type than to the more acidic U20 vegetation, though examples of the latter are recorded in a few cases in Wales. Woodland other than afforested dune is rare in Wales but two NVC types are mapped on dune sand: W8 and W10. Non-NVC woodland (including afforested areas and sycamore Acer pseudoplatanus) is also considered in this chapter.

11.2 SD18 Hippophae rhamnoides dune scrub

Sea buckthorn Hippophae rhamnoides dune scrub is mapped in fifteen sites and has a total mapped extent of 178.3 ha (Figure 11.1, Table 11.1). It is not native in Wales and has been introduced to several dune systems to control dune erosion, spreading to other sites by seeds which are probably dispersed in bird droppings. Most of the national area is found in only two sites (105.1 ha, Pembrey Coast; 39.9 ha, Merthyr Mawr). The extent in the latter site is an underestimate, taken from a vegetation map restricted to SSSI boundaries and using 1988 aerial photography. More recent survey (Dargie 1992) covering all blown sand at Merthyr Mawr and using 1992 air photographs estimated sea buckthorn area at 53.8 ha, part of an exponential rate of increase which can be traced

since 1.5 ha was mappable on 1957 air photographs. An area of 27.6 ha in vegetation maps is not mapped to sub-community level in eight sites. A further 59.3 ha of the SD18a *Festuca rubra* sub-community is also recorded in seven sites and the more mature SD18b *Urtica dioica-Arrhenatherum elatius* subcommunity has an area of 91.5 ha in six sites. Most of the national extent is found on the southern coast, with little west of Stackpole Warren. Stands formerly present at Whiteford Burrows NNR have been removed as part of a deliberate eradication policy for this species.

11.3 Other scrub on sand dunes in Wales

In the absence of grazing rank grassland and scrub can develop on sand dunes. Sites with a large area (>5 ha) of rank grassland (SD9, MG1: Chapter 8) also tend to have a high shrub cover, involving a range of NVC and non-NVC vegetation types. These scrub types are discussed in this section and, along with the extent of rank grassland, are an indirect, inverse measure of the stock grazing pressure on a site. They probably relate less strongly to rabbit grazing pressure since rabbits tend to use scrub and rank grass for shelter whilst grazing largely on short sward grasslands: they do little to retard the advance of scrub once it starts to invade an area.

W21 Crataegus monogyna-Hedera helix scrub

This NVC scrub type is uncommon on dunes in Wales and is found in eleven sites with a total area of 25.6 ha (Table 11.2). It is present in all recorded sites as a scatter of small stands. The largest extent is at Newborough Warren (9.1 ha) but no sub-community is recorded. The W21a Hedera helix-Urtica dioica subcommunity is found in low quantities in six sites, with the W21b Mercurialis perennis subcommunity only in one site. A transition from W23 Ulex europaeus-Rubus fruticosus agg. scrub is recorded from Poppit Sands.

W22 Prunus spinosa - Rubus fruticosus agg. scrub

This NVC scrub type is common on dunes in Wales and is found in 29 sites, with a moderate total extent of 44.2 ha (Table 11.3). Only two sites (Newborough Warren, Freshwater Bay East) have areas >5 ha. Most stands are not differentiated into sub-communities but between five sites small extents of the W22a *Hedera helix-Silene dioica*, W22b *Viola riviniana*-*Veronica chamaedrys* and W22c *Dactylis glomerata* sub-communities are recorded.

W23 Ulex europaeus-Rubus fruticosus agg. scrub

This NVC scrub type is also common on dunes in Wales and is found in 26 sites, with the largest area of other scrub types (96.6 ha, Table 11.4). Seven sites have extents >5 ha (Towyn Warren the largest with 18.2 ha, plus Conwy/Deganwy, Valley, Whitesand Bay, Pennard, Aberffraw and Morfa Harlech). The largest areas are found in North Wales and might reflect less calcareous sands in this region which also has the largest extents of acidic grasslands. Most mapped areas are not differentiated into sub-communities but between five sites there is a very small mapped total with the W23a Anthoxanthum odoratum, W23b Rumex acetosella and W23c Teucrium scorodonia sub-communities.

W24 Rubus fruticosus agg.-Holcus lanatus underscrub

This NVC scrub type is also common on dunes in Wales and is present in 27 sites, with a total extent of 74.8 ha (Table 11.5). Six sites have total areas >5 ha: Penmaen, Hillend to Hills Tor, Stackpole Warren, Newborough Warren, Gronant to Talacre. As with other types of scrub, most mapped areas are not differentiated into sub-communities. Five sites have the W24a *Cirsium arvense-Cirsium vulgare* and W24b *Arrhenatherum elatius-Heracleum sphondylium* sub-communities.

Other non-NVC scrub

A heterogeneous set of other scrub types is recorded frequently on dunes in Wales. The majority are described only by brief target notes and cover privet Ligustrum vulgare (11.5 ha, Table 11.5) and several other scrub types (Other scrub in Table 11.5, 29.6 ha): elder Sambucus nigra stands, thick clones of dewberry Rubus caesius and blackberry R. fruticosus agg., thick prostrate clumps of old man's beard Clematis vitalba and mixed stands of R. fruticosus, gorse Ulex europaeus and hawthorn Crataegus monogyna which could not be allocated to a precise NVC community or clear transition. Few sites have large extents but Ligustrum vulgare is extensive at Merthyr Mawr (11.6 ha) and undescribed scrub covers 6.0 ha at Laugharne Burrows.

11.4 Bracken on dunes in Wales

Bracken Pteridium aquilinum is common on dunes in Wales and was mapped in 24 sites, with a total extent of 92.2 ha (Table 11.5). It is extensive (>5 ha) at only six sites: Kenfig Dunes (17.1 ha), Merthyr Mawr (14.1 ha), Pwllheli/Pen-y-Chain (13.0 ha), Stackpole Warren (12.5 ha), The Bennett (5.9 ha), Whitesand Bay (5.4 ha). Bracken is the dominant species in two NVC communities: W25 Pteridium aquilinum-Rubus fruticosus agg. underscrub and the U20 Pteridium aquilinum-Galium saxatile community. The latter is rare in Wales and is mapped only at Pwllheli/Pen-y-Chain and Tywyn Gwyn. The remainder of sites have vegetation which fits the W25 type better, though quadrat information is not plentiful and exact status is uncertain. Transitions are rare and involve small areas. The only exception is an SD8/W25 transition at Kenfig Dunes (5.3 ha, Table 8.1) where bracken is probably best displaying its invasive habit. Elsewhere trends in its extent are largely unknown. A programme of control by mowing has been operating for several years at Oxwich Bay NNR.

11.5 Woodland on sand dunes in Wales

NVC woodland vegetation is very rare on dunes in Wales and is mapped for only three sites (Merthyr Mawr, Oxwich Burrows, Pembrey Coast), with a low total extent of 11.9 ha (Table 11.6). At Merthyr Mawr an absence of stock

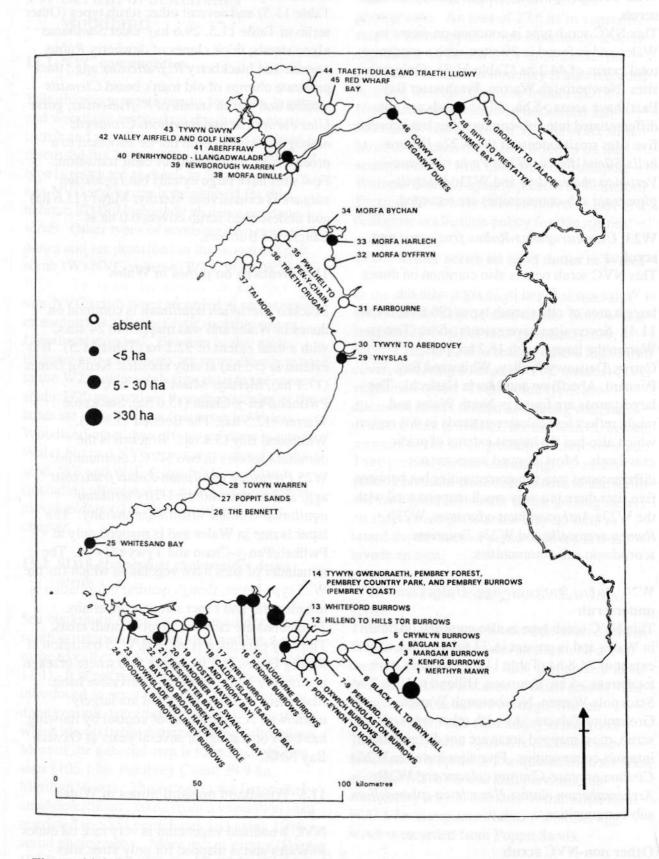


Figure 11.1 Distribution of SD18 Hippophae rhamnoides dune scrub in Wales.

	Site	SD18 undifferentiated	SD18a	SD18b	Total SD18
1	Merthyr Mawr		8.60	31.30	39.90
2	Kenfig Dunes	0.63			0.63
3	Margam Burrows				
4	Baglan Bay		A State of the second second	1.	4 State Based
5	Crymlyn Burrows		1221 - 12		
6	Black Pill to Bryn Mill	Р			
7	Pennard Burrows				and the second second
8	Penmaen Burrows				
9	Nicholaston Burrows				
10	Oxwich Burrows				
11	Port-Eynon to Horton				
12	Hillend to Hills Tor			1.28	1.28
13	Whiteford Burrows				THE CONTRACTOR OF
14	Pembrey Coast		47.41	57.69	105.10
15	Laughame Burrows	10.30	a seller a seller		10.30
16	Pendine Burrows	4.95			4.95
17	Tenby Burrows	9,90			9.90
18	Caldey Island	and the second			
19	Lydstep Haven				
20	Manorbier/Swanlake				
21	Freshwater Bay East				
22	Stackpole Warren	0.82	0.02	1.08	1.92
23	Brownslade/Linney			0.07	0.07
24	Broomhill Burrows				
25	Whitesand Bay			0.03	0.03
26	The Bennett				- Cardina C
27	Poppit Sands				
28	Towyn Warren				The second stars
29	Ynyslas	0.03			0.03
30	Tywyn to Aberdovey				
31	Fairbourne				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
32	Morfa Dyffryn				
33	Morfa Harlech				
34	Morfa Bychan		0.32		0.32
35	Pwllheli/Pen-y-Chain		010 8		0.02
36	Traeth Crugan				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
37	Tai Morfa				
38	Morfa Dinlle			1000	-
39	Newborough Warren	0.82	2.28		3.10
40	Penhrhynoedd - Llangadwaladr				
41	Aberffraw				
42	Valley				
43	Tywyn Gwyn		1		18 1.15 1. 55
44A	Traeth Dulas				
44B	Traeth Lligwy				- Arrest Terr
45	Red Wharf Bay				
46	Conwy/Deganwy	0.16	0.56		0.72
47	Kinmel Bay		C CONTRACTOR		- 1-9- 9-9-8
48	Rhyl to Prestatyn		0.07		0.07
49	Gronant to Talacre		Viv/		0.01
47			TOLD IN THE		
-	South Wales Region	0.63	8.60	32.58	41.81
-	Dyfed & Mid-Wales Region	26.00	47.43	58.87	132.30
-	North Wales Region	0.98	3.23	00.07	4.21
	North wates Region	0.90	3.63		7.21
	National Totals	27.61	59.26	91.45	178.32

Table 11.1 SD18 Hippophae rhamnoides dune scrub in Wales. Areas in hectares.P = present as amenity planting, very low total area.

Table 11.2 W21 Crataegus monogyna-Hedera helix scrub on dunes in Wales. Areas in hectares.

	Site	W21 undiff.	W21a	W21b	W21/W23	Total W21
1	Merthyr Mawr	-				
2	Kenfig Dunes					
3	Margam Burrows				and the second	a Manta
4	Baglan Bay				i i i i i i i i i i i i i i i i i i i	T Small
5	Crymlyn Burrows		0.13		and the second s	0.13
6	Black Pill to Bryn Mill					Caller R. L. V.
7	Pennard Burrows	1.41			(internation	1.41
8	Penmaen Burrows		1.92		The second	1.92
9	Nicholaston Burrows		1.55		New port	1.55
10	Oxwich Burrows		1.02			1.02
11	Port-Eynon to Horton				and the second second	a stand in
12	Hillend to Hills Tor				and the second se	1.1.1.1
13	Whiteford Burrows				mohell of m	1.1.1.1
14	Pembrey Coast					and the state of the
15	Laughame Burrows				C. Second A	S
16	Pendine Burrows	and the second second	1.06			1.06
17	Tenby Burrows	0.61	and the second		and the second	0.61
18	Caldey Island				- Annalis	a second second
19	Lydstep Haven		000			
20	Manorbier/Swanlake					
21	Freshwater Bay East					Control of a
22	Stackpole Warren		0.79	2.18		2.97
23	Brownslade/Linney				the second second second	
24	Broomhill Burrows					1
25	Whitesand Bay		1000		1	
26	The Bennett					
27	Poppit Sands	2			5.26	5.26
28	Towyn Warren					
29	Ynyslas					
30	Tywyn to Aberdovey					
31	Fairbourne					
32	Morfa Dyffryn					
33	Morfa Harlech					
34	Morfa Bychan	the second se				
35	Pwllheli/Pen-y-Chain	Cherry Constanting		100000000000000000000000000000000000000		
36	Traeth Crugan					
37	Tai Morfa					
38	Morfa Dinlle	the second second			- Contract of the second	
39	Newborough Warren	9.10				9.10
40	Penhrhynoedd - Llangadwaladr	2.10				9.10
40	Aberffraw		-	-	-	
41 42	Valley	term the second				
43	Tywyn Gwyn					
44A	Traeth Dulas	the second second				-
44A 44B	Traeth Lligwy	and the second	and the second			
440	Red Wharf Bay	100000000000000000000000000000000000000			-	
45	Conwy/Deganwy			-		
40	Kinmel Bay					-
48	Rhyl to Prestatyn				1	-
40	Gronant to Talacre	0.57	-	-	-	0.57
47		0.57	-			0.57
	South Walso Basiss	1.41	1.62	-	-	6.03
	South Wales Region	1.41	4.62	2.18	5.26	9.90
-	Dyfed & Mid-Wales Region	0.61	1.85	2.18	5.26	
-	North Wales Region	9.67	-			9.67
	National Totals	11.69	6.47	2.18	5.26	25.60

14.2	Site	W22 undiff.	W22a	W22b	W22c	W22/ W23	W22/ W24	Total W22
1	Merthyr Mawr	2942		18.000	1 1 1 1 1 1 1 1 1	1125	1121	1.22
2	Kenfig Dunes			1000	1		10000	
3	Margam Burrows				1		10000	
4	Baglan Bay						10066.000	0.1
5	Crymlyn Burrows	1.03	1	1.1.1.1			Contraction of the	1.03
6	Black Pill to Bryn Mill					1	102212307	1
7	Pennard Burrows	0.51	1	1.12	1		a construction of	0.51
8	Penmaen Burrows						Columna .	
9	Nicholaston Burrows						add a data i	
10	Oxwich Burrows		1					
11	Port-Eynon to Horton	0.64	1 1 1 2 1			1.		0.64
12	Hillend to Hills Tor	0.26				1.	100000000	0.26
13	Whiteford Burrows	1.92	1		1		1001000	1.92
14	Pembrey Coast	3.52		116.1	1		Later Later	3.52
15	Laughame Burrows					1		
16	Pendine Burrows	1.64					100110112	1.64
17	Tenby Burrows	0.80						0.80
18	Caldey Island	0.00	0.09			0.24	-	0.33
19	Lydstep Haven		0.07			U tar 1	1.2.2.1	0.00
20	Manorbier/Swanlake		2.58		1	0.35		2.93
21	Freshwater Bay East	6.73	2.50			0.00		6.7
22	Stackpole Warren	0.05	1	1 1 1 1			1.	0.0
23	Brownslade/Linney	0.05		1		4.12		4.12
24	Broomhill Burrows	0.05		1 337	0.01	4.12		0.0
25	Whitesand Bay	0.44			0.01	-	1001120000	0.4
26	The Bennett	0.07			-		190000	0.0
27	Poppit Sands	0.07				-	10000	0.0
28	Towyn Warren						-	-
29	Ynyslas	0.33					0.13	0.4
30	Tywyn to Aberdovey	0.33			-	-	0.15	0.3
31	Fairbourne	0.51		-		-		0.5
32	Morfa Dyffryn	0.80			-		-	0.8
33	Morfa Harlech	3.57	-	0.13	-			3.7
34		2.36	0.19	0.15	-		-	2.5
	Morfa Bychan	2.30	0.19	-	-	0.12	-	0.1
35	Pwllheli/Pen-y-Chain	0.23			+	0.12	-	0.1
36	Traeth Crugan	0.23		-				0.2
37	Tai Morfa		-	1.0.0		-		-
38	Morfa Dinlle	2.40			-	-		7.4
39	Newborough Warren	7.42				-	-	0.0
40	Penhrhynoedd - Llangadwaladr	0.07	-			-	-	0.0
41	Aberffraw	0.05						0.0
42	Valley	0.05	-			-	-	0.0
43	Tywyn Gwyn		-	-	-	-	-	0.0
44A	Traeth Dulas	0.21						0.2
44B	Traeth Lligwy	0.02	and the second	Constanting		-	-	0.0
45	Red Wharf Bay	0.02		-				
46	Conwy/Deganwy	3.19	-	-				3.1
47	Kinmel Bay				-	-		-
48	Rhyl to Prestatyn				-		-	1
49	Gronant to Talacre					-		-
-	South Walas Paging	4.36				-		4.3
	South Wales Region		2.67	1000	0.01	4.71	0.13	21.1
13-6	Dyfed & Mid-Wales Region	13.63	0.19	0.13	0.01	0.12	0.13	18.6
	North Wales Region	10.23	0.19	0.15		0.12		10.0
-	National Totals	36.22	2.86	0.13	0.01	4.83	0.13	44.1
	interiorial rotato	0.44						

Table 11.3 W22 Prunus spinosa-Rubus fruticosus agg. scrub on dunes in Wales. Areas inhectares.

	Site	W23 undiff.	W23a	W23b	W23b/c	W23c	W23/ W24	Total W23
1	Merthyr Mawr	1.25					Tradit orato	1.25
2	Kenfig Dunes	0.73			and shared because		and the second	0.73
3	Margam Burrows				1		Contraction of the	
4	Baglan Bay						-	
5	Crymlyn Burrows	1.15					Contraction in the	1.15
6	Black Pill to Bryn Mill					10000	8219969	
7	Pennard Burrows	7.57			1		COLUMN THE	7.57
8	Penmaen Burrows	1.28					ALC: CONTROL	1.28
9	Nicholaston Burrows					1000		
10	Oxwich Burrows	1.1						1
11	Port-Eynon to Horton						a log log of the	
12	Hillend to Hills Tor					30	1 million for a	161-0
13	Whiteford Burrows				1		Part De Car	
14	Pembrey Coast	1.60		The sector sector			THE CARL	1.60
15	Laughame Burrows			1		1.1	Contraction of the	
16	Pendine Burrows			1.1.1			North Sector	11111
17	Tenby Burrows	2.72					100000000	2.72
18	Caldey Island							
19	Lydstep Haven						100 mill 2005	
20	Manorbier/Swanlake					300	1	
21	Freshwater Bay East			1.11				
22	Stackpole Warren	4.13		The Second		-	a collector	4.13
23	Brownslade/Linney			1		1	de l'abalance	
24	Broomhill Burrows	0.06		1 Nord	0.57	1 2 20	S real claims	0.63
25	Whitesand Bay	7.76		1		1.1.1.1	0.19	7.95
26	The Bennett	0.80				1		0.80
27	Poppit Sands				-	0.66	1000	0.66
28	Towyn Warren	18.22				0.00	1.1.1	18.22
29	Ynyslas	10.00	1				1	
30	Tywyn to Aberdovey	1.95				0.00	a second and the	1.95
31	Fairbourne	1.75					10000	1.75
32	Morfa Dyffryn	0.73		0.0			Constitution of	0.73
33	Morfa Harlech	5.06	0.98	0.21			The second second	6.25
34	Morfa Bychan	4.64	0.70	0.21		-	Daniel Andrews	4.64
35	Pwllheli/Pen-y-Chain	4.49	0.03	-				4.52
36	Traeth Crugan	1.83	0.00					1.83
37	Tai Morfa	0.83				-	- Contractor	0.83
38	Morfa Dinlle	0.05	-	-		-	and share to be	0.0.
39	Newborough Warren	0.35				10.00	1 Section	0.35
40	Penhrhynoedd - Llangadwaladr	0.00						1 0.0.
41	Aberffraw	5.86						5.80
42	Valley	8.47	1.21	1 Done 1				9.6
43	Tywyn Gwyn	0.17	1.4.1			-		1.00
44A	Traeth Dulas	0.17				-		0.1
44B	Trach Lligwy	0.17	1	1	Second second		The second second	0.1
45	Red Wharf Bay			1000		1 C 1	1.195.000	
46	Conwy/Deganwy	8.47						8.4
47	Kinmel Bay	0.17						0.1
48	Rhyl to Prestatyn	2.58						2.5
49	Gronant to Talacre	2.00			-			
17	Stonan to ratero			-	-	1		-
-	South Wales Region	11.98				-	The second	11.9
-	Dyfed & Mid-Wales Region	35.29			0.57	0.66	0.19	36.7
	North Wales Region	45.43	2.22	0.21	0.57	0.00	0.17	47.8
	TOTAL TRACTORION	45.45	B.B.B.	Viart		-	1	11.00
	National Totals	92.70	2.22	0.21	0.57	0.66	0.19	96.5

 Table 11.4 W23 Ulex europaeus-Rubus fruticosus agg. scrub on dunes in Wales. Areas in hectares.

Table 11.5 W24 Rubus fruticosus agg.-Holcus lanatus underscrub, W25 Pteridium aquilinum-
Rubus fruticosus agg. underscrub, U20 Pteridium aquilinum-Galium saxatile community and other
scrub types on dunes in Wales. Areas in hectares. T = trace, very small extent.

	Site	W24 undiff.	W24a	W24b	Total W24	Coastal privet scrub	Other scrub	Bracken W25 or U20*
1	Merthyr Mawr	0.42		1.1.1	0.42	11.63	a long	14.12
2	Kenfig Dunes							17.07
3	Margam Burrows		-	10.20	10.02260	The to y		2.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1
4	Baglan Bay			- Assessment for	125.424	with the rate	Contra 10 a	L. L. L.
5	Crymlyn Burrows	0.13			0.13			
6	Black Pill to Bryn Mill	1.92		1000	1.92	1 1 1 1 1 1 1 1	Contractory of	
7	Pennard Burrows	2.57		12 2 30	2.57	100000	Tree Sector	
8	Penmaen Burrows	5.13			5.13	Т		1.92
9	Nicholaston Burrows	0.52		0100	0.52		-	
10	Oxwich Burrows	3.85			3.85	1000	1 1 1 1 1 1 1	3.85
11	Port-Eynon to Horton				0100	Т		1.02
12	Hillend to Hills Tor	9.10			9.10			1.0.0
13	Whiteford Burrows			1025	7.10	Т	11.1.5	1000
14	Pembrey Coast	2.56			2.56	T	1.000	
15	Laughame Burrows	2.50		-	4.00	1	6.02	-
16	Pendine Burrows			-		0.11	4.82	-
17	Tenby Burrows	2.17	-	1 Danse	2.17	0.11	1.16	4.63
18	Caldey Island	4.17		1 1 1 1 1 1 1 1 1	6.11	0.12	0.14	4.03
19	Lydstep Haven			-	1	0.12	2.76	-
20	Manorbier/Swanlake		-	100000	-		2.10	0.17
21	Freshwater Bay East			CALL COLL CO			0.79	0.17
22	Stackpole Warren	9.94			9.94	0.33	2.51	12.47
23	Brownslade/Linney	9.94	-	-	9.94	0.55	2.31	12.4/
24	Broomhill Burrows	0.07	4.09	0.20	5.24	-	-	2.17
		0.07	4.98	0.29	5.34	-		2.17
25	Whitesand Bay	2.27			2.27		0.05	5.40
26	The Bennett				-		0.25	5.90
27	Poppit Sands			0.41	0.41		2.10	1.72
28	Towyn Warren	0.02		0.41	0.41		2.10	1.73
29	Ynyslas	0.02			0.02		0.10	
30	Tywyn to Aberdovey	0.41	0.01	-	0.41	1.2.2.4.1.3	0.61	
31	Fairbourne		0.01		0.01	-		
32	Morfa Dyffryn	0.17		-	0.17	-	1.16	3.33
33	Morfa Harlech	2.53	and the second of		2.53		0.73	
34	Morfa Bychan	0.35		-	0.35	-11272	1.58	2.00
35	Pwllheli/Pen-y-Chain	0.05	-		0.05		0.30	13.02
36	Traeth Crugan			A CONTRACTOR		a salahan sa	0.12	0.18
37	Tai Morfa		-	10000	10000	1.	0.07	a mark
38	Morfa Dinlle	-			-		0.03	0.02
39	Newborough Warren	9.27		A PROVIDE	9.27		2.48	-
40	Penhrhynoedd - Llangadwaladr			-	-		-	1.29
41	Aberffraw	0.01		0.34	0.35		-	- Contra
42	Valley	0.07		-	0.07		-	0.05
43	Tywyn Gwyn	1				0.0815	121.021	0.01
44A	Traeth Dulas	Part and					0.05	1.17
44B	Traeth Lligwy		-		-		-	0.48
45	Red Wharf Bay	0.08			0.08			0.07
46	Conwy/Deganwy	1.04			1.04	0.13	0.43	0.11
47	Kinmel Bay						0.01	
48	Rhyl to Prestatyn	1.05			1.05	0.16	0.16	
49	Gronant to Talacre	0.94		12.09	13.03		1.26	
				. June				
	South Wales Region	23.64			23.64	11.63		37.98
	Dyfed & Mid-Wales Region	17.03	4.98	0.70	22.71	0.56	20.65	32.47
	North Wales Region	15.97	0.01	12.43	28.41	0.29	8.99	21.73
	Contraction of the second s			1				

grazing for several decades, plus the effects of myxomatosis in reducing rabbit grazing, has allowed young groves of W8 Fraxinus excelsior-Acer campestre-Mercurialis perennis and W10 Quercus robur-Pteridium aquilinum-Rubus fruticosus agg. woodland to develop (7.7 ha), associated with a large number of individual trees, mainly on shallower areas of sand overlying limestone at the rear of the main dune system. Stands at Oxwich and Pembrey Coast are smaller and mapped as the W10c Hedera helix sub-community: in both areas the woodland probably developed from seed sources on nearby adjacent hills, aided by an absence of stock grazing (and perhaps relaxed rabbit grazing following myxomatosis).

Non-NVC woodland was recorded in several sites (Table 11.6). Sycamore Acer pseudoplatanus woodland (total area 29.8 ha) is present in nine sites (Pennard, Nicholaston, Port-Eynon to Horton, Whiteford, Pembrey, Tenby, Stackpole, Conwy/Deganwy, Gronant to Talacre) but is extensive (>5 ha) only at Stackpole Warren (23.2 ha). Other broadleaved plantation is rare (Tenby Burrows). Coniferous plantation is mapped at five sites (Margam, Whiteford, Pembrey Coast, Morfa Harlech, Newborough Warren, Valley) and is also present on sand beyond SSSI boundaries at Merthyr Mawr (precise extent unknown). Total area is very large (1737.6 ha) but only two sites have sizeable extents: Pembrey Coast (967.0 ha) and Newborough Warren (737.8 ha). Mixed plantation is very rare and is mapped only at Stackpole Warren (9.4 ha).

Table 11.6 W8 Fraxinus excelsior-Acer campestre-Mercurialis perennis woodland, W10Quercus robur-Pteridium aquilinum-Rubus fruticosus agg. woodland and plantation woodland on
dunes in Wales. Areas in hectares. P = present, extent not known.

	Site	W8	W10	W10c	Plantation woodland
1	Merthyr Mawr	5.28	2.43	In a manager of the	P
2	Kenfig Dunes	NO 16 Same			
3	Margam Burrows	The March and a set			6.26
4	Baglan Burrows		A CLASSING TO A		a contraction of the
5	Crymlyn Burrows	portable subchera	in the needed was	dention to be	COLOR DO NO
6	Black Pill to Bryn Mill	1 States and			and a second of the
7	Pennard Burrows				1.16
8	Penmaen Burrows	Production and Production		Partie Charles	1 1 1 1 1 1 1 1
9	Nicholaston Burrows	orthe CO stand	Contraction of the second	the best conterns	1.03
10	Oxwich Burrows			3.21	
11	Port-Eynon to Horton	ages a source street	1.	A CONTRACTOR OF	0.77
12	Hillend to Hills Tor	for canter of hou		E Boy May	and a data bala
13	Whiteford Burrows				25.83
14	Pembrey Coast	ALC: NOTE THAT HERE IN		1.02	968.71
15	Laughame Burrows	000000000000000000000000000000000000000	in to solution	mi heurois sen	Contrates of
16	Pendine Burrows			in the second second	1
17	Tenby Burrows				0.60
18	Caldey Island	IS A Det Mallis	1 (A) V	ALL DATE REAL Y	on al bolho
19	Lydstep Haven	1 Di mana hand d		allal long	the share of the state
20	Manorbier/Swanlake				
21	Freshwater Bay East	a a chasta an	on control	DE LOTE DECE	no p gritneto
22	Stackpole Warren	Tree or short have	and the second second	Contract Contract I	32.52
23	Brownslade/Linney				
24	Broomhill Burrows	CLAUSER REPORTS	1 TALES	The state of the s	11 10 10 10 10 ACT 10
25	Whitesand Bay	to be been married	1 Participation	- Andrews	1
26	The Bennett				
27	Poppit Sands	11) 2 Cipitrico Ind		0.000000000	1.1.11111120203
28	Towyn Warren	1 Falls Tell Strenderment	1 1002001000	the state of the state	100000000000000000000000000000000000000
29	Ynyslas				
30	Tywyn to Aberdovey	COLUMN AND ADDRESS OF			the second second second
31	Fairborne	100 011 71 0012	0.25402	THE REPORT NO	14 1941 1 1941 5
32	Morfa Dyffryn				
33	Morfa Harlech	- <u>9 - 9 - 19 - 19 - 19 - 19 - 19 - 19 -</u>		1999 (Col. (0110) - 1000	1.36
34	Morfa Bychan	C 21 10 10 2 5 10 10	1.10	1.01.01001.0220	1.50
35	Pwllheli/Pen-y-Chain				
36	Traeth Crugan	1.			
37	Tai Morfa	COLUMN AT TALL	Success 1	1000121010	10 201 201 200
38	Morfa Dinlle	the states and		The set in the set	The second starts
39					732.91
<u>39</u> 40	Newborough Warren Penhrhynoedd - Llangadwaladr	to gitter	(52) (32)		134.71
	Aberffraw			1000000	
41		AND DESCRIPTION OF THE PARTY			0.13
42	Valley	2010 01 213 24 28 1			0.15
43	Tywyn Gwyn	to the second second			0.61
44A	Traeth Dulas				0.01
44B	Traeth Lligwy	Contra Contra Station of			
45	Red Wharf Bay	the destatores		70 1001 100	0.21
46	Aberconwy				0.21
47	Kinmel Bay	TOTAL PARTY	1	the court of the loss	
48	Rhyl to Prestatyn			100 1107 0 100 Kg	0.27
49	Gronant to Talacre				0.27
	a pred company to subs 500 s				25.05
	South Wales Region	5.28	2.43	3.21	35.05
	Dyfed & Mid-Wales Region			1.02	1001.83
177	North Wales Region	A WISH DIG	A DOLLAR	a 22000.014	735.49
	and the second sec	and the second second second	A CONTRACTOR OF A	and a second sec	and the second second

12. Other miscellaneous vegetation and land cover types

12.1 Other miscellaneous vegetation types

Target note information and report descriptions list a residuum of other vegetation types which do not fit NVC types. Species lists allow these to be grouped (Table 12.1) into three categories: tall ruderal (dominated by rosebay willowherb Chamaenerion angustifolium), disturbed ground (ephemeral and hemicryptophyte ruderals frequent) and remaining vegetation (all dry ground in terms of species content). The tall ruderal type is very rare and is recorded in very low quantity (0.1 ha) only at Morfa Harlech and Valley. Vegetation indicating disturbed ground on dunes is frequent (mapped in 33 sites) and has a moderate total extent (89.2 ha), though only two sites have areas >5 ha: Laugharne Burrows (49.5 ha) and Broomhill Burrows (8.1 ha). Military training is responsible for the disturbed ground at Laugharne Burrows (the site report contains no detail) but at Broomhill Burrows a mixture of poaching by stock and recreational path development are the two main factors involved. In general the extent of mapped disturbed ground is low in Welsh dunes. Species lists for other dry ground suggest no clear ecological factors - total extent is low (33.6 ha) and no site has a large area (>5 ha).

12.2 Other land cover types

A wide range of other types of land cover is mapped (Table 12.2), including bare sand, bare ground, sea defence structures, concrete and buildings, dumps, arable land, sand and gravel extraction sites, car parks, caravan parks, residential buildings and map polygons with no data (recorded as no information or blank). The extent of bare sand is important as an indicator of dune mobility and availability of a scarce habitat which is important for a range of invertebrates. Mapped area totals 135.1 ha, with large extents (>5 ha) at Merthyr Mawr, Hillend to Hills Tor, Brownslade/Linney Burrows, Morfa Dyffryn, Morfa Harlech, Newborough Warren, Aberffraw and Gronant to Talacre. Reports suggest that little of this area is the result of recreational erosion and sites with large extents of bare sand probably contain much of the current very mobile dune resource of Wales. Bare ground (total extent 72.4 ha) is dominated by an old road and a tip (complete area not mapped) for steel production waste at Margam Burrows (32.4 ha) and motorway (M4) and railway sidings at Kenfig Dunes (13.9 ha). Extents elsewhere are much lower and maps/target notes often lack detail on the cause of bare ground. Sea defences are not large in area (total extent 7.4 ha) but their ecological impact is likely to cover a much larger zone beyond actual installations. The largest set is probably found at Tywyn to Aberdovey (3.1 ha) but other areas with defences (e.g. Black Pill to Bryn Mill, Kinmel Bay) lack precise data on maps and the full extent is not known. Concrete and buildings (often part of old military coastal defences) are not common (total extent 19.6 ha) and only the remains of old munitions stores and new country park facilities at Pembrey Coast are large (11.9 ha). Dumps of agricultural waste and fly tipping are occasionally found but their total extent (8.9 ha) is low and only one site (Brownslade/Linney) is large (4.0 ha). Arable land is uncommon on dune sand (mapped extent is 23.0 ha, mostly at Broomhill Burrows, possibly not of all of this on sand) but not all occurrences on sand will have been mapped due to lack of access. The precise extent is therefore unknown. Sand and gravel extraction is rare (recorded from five sites, extent 4.2 ha), though this still occurs from a large area (3.9 ha) within the dunes at Merthyr Mawr.

All car parks on the edge of dunes have not probably been mapped (e.g. a large park at Oxwich Bay) or are recorded as bare ground. Certain cases are recorded at eleven sites but total area is low (4.06 ha). Caravan sites on dunes are rare (five sites) but two sites have a large area (54.5 ha at Morfa Bychan, 20.1 ha at Lydstep Haven) and other sites have large sites on adjacent land (e.g. Merthyr Mawr). Residential housing on dune sand is very rare (mapped only at Port-Eynon to Horton) but access difficulties might have prevented all cases being mapped on the edge of all dune systems. Unlabelled map polygons (generally on the edge of dune systems and perhaps representing arable land beyond the limit of blown sand) are common but extent is low in most sites. Military land without access at Laugharne Burrows is an exception (33.3 ha).

	Site	Tall Ruderal (Chamaenerion angustifolium)	Vegetation with indicators of disturbed ground	Other vegetation indicating dry ground	Total of miscellaneous vegetation type:
1	Merthyr Mawr		CONSERVICE.		
2	Kenfig Dunes	No. 1 House Contraction	0.89		0.89
3	Margam Burrows		CONTRACTOR DE	i sento totti	SIU Unover
4	Baglan Bay		A CONTRACTOR OF THE OWNER		
5	Crymlyn Burrows	Ser Webster	0.15		0.15
6	Black Pill to Bryn Mill		1.00.00.0000000	1.220,000,0000	NA SECTION
7	Pennard Burrows				
8	Penmaen Burrows				2.4.1.1.1.1.1.1.1
9	Nicholaston Burrows				11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10	Oxwich Burrows				
11	Port-Eynon to Horton	THA STORE A	A REPORT OF THE		STRONE ALC:
12	Hillend to Hills Tor	10.00			
13	Whiteford Burrows			1.28	1.28
14	Pembrey Coast		1.28		1.28
15	Laughame Burrows		49.50		49.50
16	Pendine Burrows		0.45	0.62	1.07
17	Tenby Burrows	10.0	0.53	3.59	4.12
18	Caldey Island		0.03	0.05	0.08
19	Lydstep Haven		0.92		0.92
20	Manorbier/Swanlake				
21	Freshwater Bay East		0.02	0.02	0.04
22	Stackpole Warren		0.30	3.01	3.31
23	Brownslade/Linney		1.65	1.75	3.40
24	Broomhill Burrows	1	8.10	0.32	8.42
25	Whitesand Bay	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	0.81	0.27	1.08
26	The Bennett		0.07	0.27	0.07
27	Poppit Sands		0.14	Contraction of the	0.07
28	Towyn Warren		4.18	0.83	5.01
29	Ynyslas		0.48	0.85	1.33
30	Tywyn to Aberdovey		1.11	0.98	2.09
31	Fairbourne	24 M 15 19	0.09	0.98	0.09
32	Morfa Dyffryn		3.14	2.68	5.82
33	Morfa Harlech	0.03	1.30	0.96	2.29
34		0.05	2.54	3.27	5.81
35	Morfa Bychan		4.42	3.21	4.42
35	Pwllheli/Pen-y-Chain		0.09	0.85	0.94
30	Traeth Crugan Tai Morfa		0.60	0.05	0.94
38	Morfa Dinlle		0.80	3.23	3.51
38	Newborough Warren		0.28	0.70	0.70
40	Penhrhynoedd - Llangadwaladr			3.39	3.39
40	Aberffraw		1.13	0.36	1.49
41 42	Valley	0.08	2.08	2.3	4.46
42	Tywyn Gwyn	0.08	0.08	2.3	0.08
	Traeth Dulas		0.08	0.18	0.08
44A 44B	Tracth Lligwy		0.54	0.18	0.18
44B 45	Red Wharf Bay		0.34		0.34
			1.09	0.84	1.93
46	Conwy/Deganwy				
47	Kinmel Bay	10.00 Million 10.00	1.08	0.19	1.27
48	Rhyl to Prestatyn		0.17	0.30	0.30
49	Gronant to Talacre Totals	0.11	0.16 89.23	0.74 33.56	0.90

Table 12.1 Other miscellaneous vegetation types on dunes in Wales. Areas in hectares.

Table 12.2 Other land cover types on dunes in Wales. Areas in h	hectares.
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	Site	Bare sand	Bare ground	Sea defence	Concrete and buildings	Dump	Arable	Sand or gravel extract- ion
1	Merthyr Mawr	13.76						3.92
2	Kenfig Dunes		13.93		0.81		2.35	
3	Margam Burrows		32.42	1.12	, 2.72			
4	Baglan Bay				0.79			
5	Crymlyn Burrows	0.64	3.64					
6	Black Pill to Bryn Mill		Contraction of the					
7	Pennard Burrows	3.04						
8	Penmaen Burrows	0.22					1.000	
9	Nicholaston Burrows	0.08						
10	Oxwich Burrows	0.24		1				
11	Port-Eynon to Horton	0.16						
12	Hillend to Hills Tor	5.96	0.44	10.00				
13	Whiteford Burrows	1.40			El en el		STORES STORES	
14	Pembrey Coast	1.76	2.52		11.92			
15	Laughame Burrows							
16	Pendine Burrows	1.62	0.85	0.05	0.27	0.58		
17	Tenby Burrows	1.79	0.63			0.13		
18	Caldey Island	0.06	1.5					
19	Lydstep Haven		1.05	0.42		1.1.1.1		
20	Manorbier/Swanlake	0.75	0.26	16.2	0.03	and the second		
21	Freshwater Bay East							
22	Stackpole Warren	1.62	0.41		0.02			
23	Brownslade/Linney	18.51				3.98		
24	Broomhill Burrows	4.31	0.18		0.03	0.64	20.67	
25	Whitesand Bay	0.17	0.04				A Contraction	0.0
26	The Bennett	0.03		0.12				
27	Poppit Sands	0.03		1.11.1.1				
28	Towyn Warren	0.06	0.44	0.02		0.01		
29	Ynyslas	2.55	1.81				-	
30	Tywyn to Aberdovey	1.74	0.42	3.11	0.14	0.14		0.1
31	Fairboume	0.74	1.21				-	-
32	Morfa Dyffryn	35.91	0.81			0.45		-
33	Morfa Harlech	5.85	2.65	0.07				-
34	Morfa Bychan	1.07		_	0.3		and the	0.0
35	Pwllheli/Pen-y-Chain	1.52	1.57		0.27	0.06		-
36	Traeth Crugan		0.27	1.71			-	-
37	Tai Morfa	1.44				0.27	-	
38	Morfa Dinlle	0.88	2.58	0.77	0.08	0.35	-	-
39	Newborough Warren	6.96	0.21	1	0.01		-	-
40	Penhrhynoedd - Llangadwaladr	0.21			-		-	-
41	Aberffraw	5.85				0.15		0.0
42	Valley	4.87	0.80		0.26	1.03	-	-
43	Tywyn Gwyn	0.05		-		0.05	-	-
44A	Traeth Dulas						1000	
44B	Traeth Lligwy	0.14	0.10	-			-	-
45	Red Wharf Bay	0.15	0.48			0.00	1	-
46	Conwy/Deganwy	0.47	0.48	-	1.07	0.09		-
47	Kinmel Bay	1.05	0.85	-	1.96	0.00	-	-
48	Rhyl to Prestatyn	1.02	0.50		-	0.62	-	-
49	Gronant to Talacre	6.60	2.52	7.00	10.01	0.30	22.02	1 1
	Totals	135.13	72.42	7.39	19.61	8.85	23.02	4.1

	Site	Car park	Caravan park	Resid- ential	No inform- ation	Blank	Total of other cover types
1	Merthyr Mawr			1000		1.16	18.84
2	Kenfig Dunes		PERSONAL PROPERTY			4.15	21.24
3	Margam Burrows	11 162			23.60	0.15	60.01
4	Baglan Bay					9.15	9.94
5	Crymlyn Burrows		1.1.1	10.57			4.28
6	Black Pill to Bryn Mill					The Present of	1120
7	Pennard Burrows		1			24.00	3.04
8	Penmaen Burrows			D. House		in the second	0.22
9	Nicholaston Burrows		1	0.0		a second la	0.08
10	Oxwich Burrows			00 11		1.100	0.24
11	Port-Eynon to Horton		2.28	2.20		to Marche	4.64
12	Hillend to Hills Tor	0.96	4.72			1	12.08
13	Whiteford Burrows	0120	1.1.2			errobine (1.40
14	Pembrey Coast		3.80			1.1.1	20.00
15	Laughame Burrows		1		33.27	1.1.1.1.1.1.1	33.27
16	Pendine Burrows				2.25	0.89	6.51
17	Tenby Burrows	1.35	1.0.0		15.93	1.84	21.67
18	Caldey Island	1.55			0.08	1.04	0.14
19	Lydstep Haven	1 1 1 1 1 1 1 1 1	20.12		0.08	15	20.54
20	Manorbier/Swanlake	0.47	20.12	10.000		-	1.51
21	Freshwater Bay East	0.47				-	1.51
22	Stackpole Warren		-		1.30	0.05	3.40
23	Brownslade/Linney				1.50	0.05	22.49
24	Broomhill Burrows				0.27	1.00	27.10
			-			1.00	
25	Whitesand Bay	0.41	-	-	0.16	0.24	0.40
26	The Bennett	0.41				0.34	0.90
27	Poppit Sands	0.05	-			0.17	0.08
28	Towyn Warren				0.40	0.17	0.70
29	Ynyslas				0.68	1.00	5.04
30	Tywyn to Aberdovey			-	0.51	1.88	8.07
31	Fairbourne	0.00			0.07	0.74	1.95
32	Morfa Dyffryn	0.09			2.97	0.76	40.99
33	Morfa Harlech		51.10		2.55	2.95	14.07
34	Morfa Bychan		54.49	-	9.88	1.27	67.05
35	Pwllheli/Pen-y-Chain		1000	-	1.80	0.30	5.52
36	Traeth Crugan					1	1.98
37	Tai Morfa				0.00		1.71
38	Morfa Dinlle				0.39	2.01	5.05
39	Newborough Warren		-		1.04	2.94	11.16
40	Penhrhynoedd - Llangadwaladr			1	1.00	2.10	2.31
41	Aberffraw				1.39	1.08	8.50
42	Valley				4.23	1.76	12.95
43	Tywyn Gwyn			-	0.17	0.07	0.34
44A	Traeth Dulas	- Andrewski	- and a fam	1.	0.08	0.23	0.31
44B	Traeth Lligwy		-		0.03	0.00	0.17
45	Red Wharf Bay			-		0.03	0.51
46	Conwy/Deganwy	0.10	-			0.93	2.07
47	Kinmel Bay	0.30		-	0.41	0.08	4.65
48	Rhyl to Prestatyn				1.15	0.25	3.04
49	Gronant to Talacre	0.33			6.87	1.50	18.12
	Totals	4.06	85.41	2.20	111.01	37.03	510.28

Table 12.2 (continued) Other land cover types on dunes in Wales. Areas in hectares.

13. The nature conservation value of Welsh dunes

13.1 Assessing nature conservation value

A survey of this type which is aimed at defining the national resource must consider the overall nature conservation value of the resource, the range of quality and the controls of quality. Assessing nature conservation value is inevitably subjective (Usher 1986) but Ratcliffe (1977, 1986) has proposed a series of criteria against which judgements can be made in a structured way. These criteria include: naturalness, diversity, fragility, rarity, typicalness and position in an ecological/geographical unit, recorded history and educational value, potential value and intrinsic appeal. They are widely accepted and underpin the selection of sites for statutory conservation protection (Nature Conservancy Council 1989). These criteria are therefore discussed here, though in a wider and modified form compared with that employed for statutory site selection. A formal comparison of sites in terms of value is not attempted here since there is no agreement on approach (Usher 1986).

13.2 Naturalness

No dune system in Wales is entirely natural but natural processes have played a major and obvious part in the formation of all dune systems. Geomorphological processes leading to formation can still be determined and in many cases are still operating in an almost unconstrained fashion. The most natural dune sectors are mobile dune communities (SD5, SD6), where geomorphological processes usually operate without human modification. Further inland geomorphology is still important as a factor in the stabilisation of vegetation cover, and in producing the more complex topography associated with secondary destabilisation and restabilisation. The vegetation of most, if not all, Welsh dunes has been influenced by a long history of stock grazing, though documentation is often lacking. This form of human intervention has operated over sufficient time to produce, in interaction

with geomorphological factors, the complex and apparently sustainable mosaic of semi-fixed dunes, dune grassland and sometimes dune heath which are all highly valued semi-natural habitats.

Several factors combine to reduce the naturalness of some Welsh dunes and these are reviewed in Chapter 14 and below, but the general level of naturalness is high by the standards of other lowland habitats in Wales. It is not possible to suggest a site which is the most natural since all have a history of management. Some large dune systems (e.g. Kenfig Dunes, Laugharne Burrows, Morfa Dyffryn, Morfa Harlech, Newborough Warren, Aberffraw) contain extensive tracts of dune with a high degree of naturalness, though at least one is much modified (Pembrey Coast, by afforestation). Smaller dune systems tend to be more modified by recreational pressure, lack of grazing, or development (e.g. Margam Burrows, Black Pill to Bryn Mill, Lydstep Haven, The Bennett, Traeth Dulas, Traeth Lligwy, Kinmel Bay). Size is therefore an important factor in retaining naturalness over much of a dune area.

13.3 Diversity

The overall diversity of Welsh dunes is reflected in the large total of National Vegetation Classification (NVC) dune (SD) communities and sub-communities recorded, plus many other NVC communities and sub-communities (Table 4.1). Such diversity reflects four major types of gradient which operate upon Welsh dunes: successional/stabilisation trends, moisture gradients, transitions to other coastal habitats (including saltmarsh), and transitions to other non-maritime habitats in inland sectors. Site size is also an important factor influencing the diversity of habitats in a particular site, with larger sites usually having a wider range of the underlying gradients affecting diversity. The pattern of diversity for vegetation types also reflects contrasting dune geomorphology and land use differences between sites.

The role of site area is illustrated in Figures 13.1 and 13.2 for six sites representing large (Kenfig 602 ha, Newborough Warren 529 ha), intermediate (Morfa Harlech 341 ha, Brownslade/Linney 253 ha) and small size (Morfa Dinlle 67 ha, Fairbourne 15 ha). In Figure 13.1 the large sites, plus Morfa Harlech, have a large number of NVC sand dune communities, including sizeable areas of mobile and semi-fixed dune, plus large extents of slack. In smaller sites the range of NVC dune communities is much reduced, there is little mobile or semi-fixed dune, and slacks are absent. This pattern of diversity contrast associated with site size is even stronger if NVC sub-communities are considered. The role of area is equally strong for other (non-dune) NVC communities (Figure 13.2).

13.4 Fragility

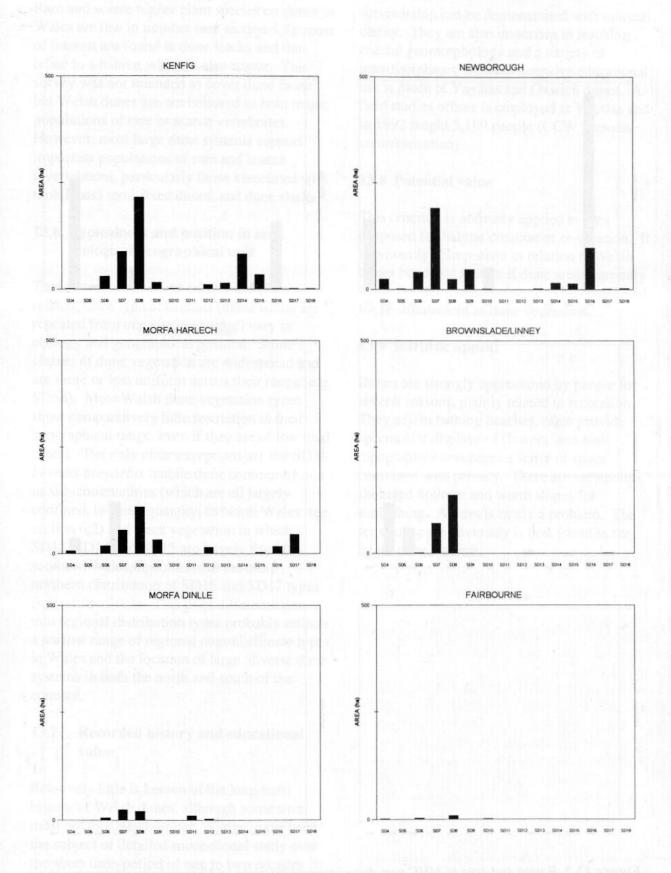
Dune environments are something of a paradox in relation to this criterion. They are clearly robust in that they are capable of rapid recovery following disturbance (e.g. dune stabilisation measures using Ammophila arenaria). Aerial photographs of dunes in South Wales show considerable dune mobility in the 1950s and 1960s, probably resulting from disturbance initiated by military training in the 1940s. Later photographs demonstrate that much stabilisation has occurred naturally in the last two decades. Dune systems are also fragile and are vulnerable to heavy visitor pressure (e.g. Penmaen Burrows, The Bennett), turf modification (Conwy/Deganwy) and some habitat conversion and loss (e.g. dune heath at Crymlyn Burrows) upon golf courses, and to loss of diversity following loss of grazing and scrub expansion (e.g. much of Towyn Warren). Some loss of diversity might also be the result of overzealous protection and several dune systems are either re-introducing grazing in a controlled manner (e.g. Newborough Warren, Oxwich Burrows) or are using a mowing regime to maintain a shorter grass sward (Kenfig Dunes).

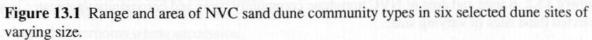
Large sectors of the more stable landward areas of dunes have been used for development and, in addition to habitat loss, new buildings, fences, walls and roads destroy the most fragile aspect of dunes, the subjective and unquantifiable quality of wilderness. This has been a major pattern in dunes around Swansea Bay and elsewhere.

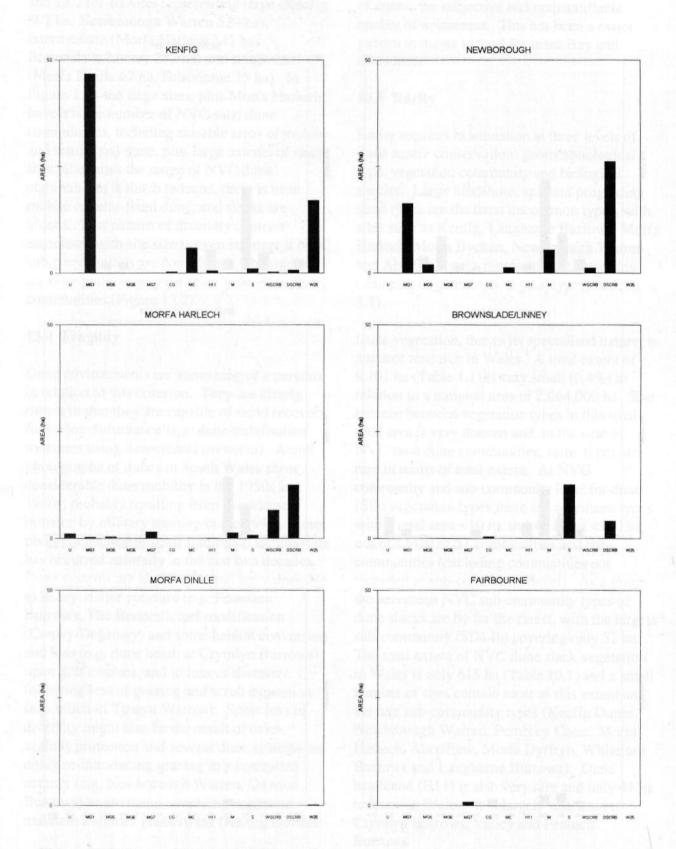
13.5 Rarity

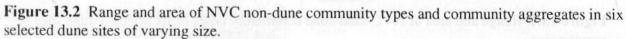
Rarity requires examination at three levels of dune nature conservation: geomorphological type, vegetation community and biological species. Large hindshore, spit and prograding dune types are the most uncommon types, with sites such as Kenfig, Laugharne Burrows, Morfa Harlech, Morfa Bychan, Newborough Warren and Aberffraw each representing outstanding examples of geomorphological type (see section 3.1).

Dune vegetation, due to its specialised nature, is a scarce resource in Wales. A total extent of c. 8,101 ha (Table 1.1) is very small (0.4%) in relation to a national area of 2,064,000 ha. The balance between vegetation types in this small total area is very uneven and, in the case of NVC sand dune communities, some types are rare in terms of total extent. At NVC community and sub-community level for dune (SD) vegetation types there are seventeen types with a total area <10 ha and 43 types <100 ha, out of a total of 51 communities and subcommunities (excluding communities not recorded to sub-community level). As a group, the seventeen NVC sub-community types of dune slacks are by far the rarest, with the largest sub-community (SD14b) covering only 52 ha. The total extent of NVC dune slack vegetation in Wales is only 615 ha (Table 10.1) and a small number of sites contain most of this extent and the rare sub-community types (Kenfig Dunes, Newborough Warren, Pembrey Coast, Morfa Harlech, Aberffraw, Morfa Dyffryn, Whiteford Burrows and Laugharne Burrows). Dune heathland (H11) is also very rare and only 41 ha is found in Wales. It is largely restricted to Crymlyn Burrows, Valley and Pennard Burrows.









Rare and scarce higher plant species on dunes in Wales are few in number (see section 4.3); most of interest are found in dune slacks and thus relate to a habitat which is also scarce. This survey was not intended to cover dune fauna but Welsh dunes are not believed to hold major populations of rare or scarce vertebrates. However, most large dune systems support important populations of rare and scarce invertebrates, particularly those associated with mobile and semi-fixed dunes, and dune slacks.

13.6 Typicalness and position in an ecological/geographical unit

These two conservation criteria are often related, since typical habitats (those which are repeated from one site to another) vary in ecology and geographical position. Some classes of dune vegetation are widespread and are more or less uniform across their range (e.g. SD6d). Most Welsh dune vegetation types show comparatively little restriction in their geographical range, even if they are of low total extent. The only clear exceptions are the SD5 Leymus arenarius mobile dune community and its sub-communities (which are all largely confined, in small quantity, to North Wales: see section 6.2) and slack vegetation in which SD13, SD14 and SD15 are largely found in southern Wales, in contrast to the more northern distribution of SD16 and SD17 types (see section 10.2). This poor differentiation into regional distribution types probably reflects a narrow range of regional coastal climate types in Wales and the location of large, diverse dune systems in both the north and south of the country.

13.7 Recorded history and educational value

Relatively little is known of the long-term history of Welsh dunes, although some sites, most notably Newborough Warren, have been the subject of detailed successional study over the short time-period of one to two decades (Ranwell 1960a, 1960b). Dunes make excellent ecological classrooms where succession, zonation, competition, dispersal and survivorship can be demonstrated with unusual clarity. They are also important in teaching coastal geomorphology and a variety of interdisciplinary studies. Intensive educational use is made of Ynyslas and Oxwich dunes. A field studies officer is employed at Ynyslas and in 1992 taught 5,189 people (CCW personal communication).

13.8 Potential value

This criterion is normally applied to sites proposed for habitat creation or re-creation. It is presently unimportant in relation to Welsh dunes but could feature if dune areas currently under conifer plantation were to be considered for re-instatement as dune vegetation.

13.9 Intrinsic appeal

Dunes are strongly appreciated by people for several reasons, mainly related to recreation. They adjoin bathing beaches, often provide spectacular displays of flowers, and their topography encourages a sense of space combined with privacy. There are viewpoints, sheltered hollows and warm slopes for sunbathing. Access is rarely a problem. The sense of space obviously is best found in the larger dune systems.

14. The impact of human activities

14.1 Interpretation and limitations of the data

Information on the impact of human activities on dunes was collected in site survey (see Chapter 2). The most serious limitation of such data is that they are heavily dependent on information collected during a single visit to each site, generally during the summer months. Although other sources of information were sought to supplement the field recording it is inevitable that some forms of activity, especially seasonal ones, will have been under-recorded.

Another limitation that should be borne in mind when considering these data is that for most activities the information was collected in a qualitative rather than a quantitative fashion. For example, a dune where there is small-scale sand removal for agriculture would have been recorded as having mineral extraction in the same way as one with a large commercial quarry. There is also some imprecision in those cases where the surveyor was asked to estimate subjectively the level of an activity. This was the case for grazing, erosion and vehicle damage.

Other information on human impacts was derived from the areas of modified dune vegetation or other land cover (e.g. improved grassland, car or caravan park, coniferous plantation) recorded on vegetation maps. All non-dune vegetation types of cover were not consistently mapped for the full wind-blown sand area of every site, largely due to private ownership and thus difficulty in obtaining access permission. Such cover types are therefore under-recorded but information is still useful in identifying sites with much alteration.

Despite limitations the information collected on human activities does have the advantage of having been collected from sites in Wales within the period 1987-91. It is moreover based largely on direct observation. As such it provides a useful summary of the current state of human activity on dunes.

14.2 Agriculture

The dunes of Wales have probably been shaped and moulded by agriculture for most of their existence. The characteristic semi-natural vegetation of most stable dunes is grasslands or heathlands which have developed as a result of grazing of the indigenous vegetation by sheep, rabbits and cattle. In the absence of such grazing some areas of stable dune would probably have developed into scrub - a common feature on many Welsh dunes. Dune woodlands are rare in Wales (apart from a few very large forestry plantations) but are common elsewhere abroad, notably in The Netherlands where the tradition of pastoral management of dunes is much less widespread.

During this survey grazing by domestic stock was recorded from eighteen out of 49 sites (Table 14.1), a figure suggesting that undergrazing is the current norm for the resource at a national scale. Most large sites are still grazed, usually by sheep or cattle but also occasionally by ponies and goats. Grazing intensity is uncertain for most sites and it probably varies considerably with season and from area to area within a single dune system. Some sites with recorded stock might have little or no grazing over large sectors of dune. Excessive grazing is very rare and heavy grazing was recorded only at Tywyn Gwyn where it had also induced dune erosion. Stock feeding was recorded only at Kenfig Dunes, though the practice is probably more widespread and applied in winter. No problems of excessive winter feeding were noted in Wales. One site (Newborough Warren) is the location for a long-term grazing monitoring experiment by the Institute of Terrestrial Ecology, using Soay sheep as grazers in a 9.7 ha area divided into two replicated groups of sixteen paddocks (with varied grazing intensity and seasonality as treatments) and two ungrazed paddocks as controls (Ashall, Duckworth & Smart 1992). Small sites are rarely grazed (Penmaen and Pennard on the Gower Peninsula are notable

exceptions). A small number of larger sites (Merthyr Mawr, Laugharne and Pendine Burrows) are also ungrazed by stock, though the latter two sites do have deer populations as alternative grazers. The lack of grazing management at Merthyr Mawr might be affecting the conservation value of the site, allowing rank grassland and scrub to develop over large areas. The absence of grazing from the majority of sites is largely due to displacement by other land uses. Recreation and leisure development are the main reasons in most sites, with military use for Laugharne and Pendine Burrows.

Agricultural improvement (re-seeding, ploughing, fertiliser application, etc.) was recorded in fourteen sites (Table 14.1), most of them in southern Wales. The actual extent of dune land impacted by agriculture in this way is uncertain. Areas of agricultural land on blown sand, with no natural or semi-natural vegetation and located on the edge of vegetated dune, were not surveyed as part of this project and this lost dune vegetation habitat has therefore not been recorded in full. The historical loss of dune vegetation to intensive agriculture is likely to have been very significant but cannot be estimated from these data.

Rabbits were formerly raised in large numbers in warren systems on dunes and have since spread to become widely established as wild animals (Sheail 1971). Rabbits were recorded in 41 out of 49 sites in this survey (Table 14.1) and are probably present in most sites with no information. They are probably absent only from the Black Pill to Bryn Mill site in Swansea where heavy recreational pressure throughout the year might prevent colonies becoming established. Rabbits are thus distributed around all parts of the Welsh coast and represent the most widespread grazing animal on dunes. Grazing intensity by rabbits is generally only light or moderate and only eight sites were recorded with heavy levels in Pembrokeshire, at Ynyslas, and in North Wales (notably at Aberffraw). Prior to the outbreak of myxomatosis in the 1950s rabbit grazing might have been much heavier in character but

numbers have probably not fully recovered and there might be an important correlation with the reduction in stock grazing on dunes. Rabbits in The Netherlands are regarded as 'structure followers', extending grazing into short sward grasslands only where this is created by domestic stock ('structure leaders') - they do not by themselves create short swards from rank vegetation (Wallage Drees 1988). Tall, rank swards have probably increased considerably in Wales as stock grazing has fallen over the past three to four decades, at a time when rabbit numbers were depressed following myxomatosis. Rabbit grazing might therefore have been insufficient to maintain large areas of short grass sward, allowing rank grasses and some scrub to invade.

14.3 Recreation

The extent to which sand dunes are used for recreation is not easily quantified. A number of indirect indicators of the level of recreational activity were used in this study: presence of car parks, caravan parks, camp sites and other leisure complexes (with an indication of large size involving dune habitat loss and change); presence of golf courses and the degree of modification of dune turf on fairways; degree of path erosion and presence of dune stabilisation works (fencing, marram planting, boardwalk, brushwood barriers, sea buckthorn planting). Results are summarised in Table 14.2.

Several authors have documented the effects of visitors, which can include a proliferation of path networks and widespread erosion (Liddle & Greig-Smith 1975a, 1975b; Boorman & Fuller 1977; Richards & Stead 1978; Southern et al. 1985; Southern 1987; Williams & Randerson 1989). An attempt was therefore made during the present survey to categorise subjectively the degree of erosion damage as a measure of recreational use. Moderate or heavy erosion of path systems in dunes was found in twelve sites, most of them in South Wales. Most have associated dune stabilisation works (fenced areas with marram planting, often with netting and brushwood laid to aid sand accumulation; boardwalk to minimise footpath

wear and tear). Only one site, Merthyr Mawr, had moderate erosion and no attempt to stabilise dunes. Other locations had attempts to reduce erosion using boardwalk but parts of the sites away from such measures were badly trampled and eroding, particularly the climbing dunes on steep slopes at Pennard and Penmaen on the Gower coast. Light path erosion was recorded in a further fifteen sites (mostly in West and North Wales) and hence dune erosion by paths can be considered widespread around the coast of Wales. A few dune sites had local dune stabilisation measures to control eroding blowouts created by natural processes but these were comparatively rare and small in scale in comparison with efforts to cope with recreational pressure.

Recreational trampling can be particularly heavy in the foredune zone at the top of a beach, interfering with the natural creation of embryo dunes, foredunes and the base of the main outer dune - several fencing schemes had been installed to restore dunes badly damaged in these zones. In two cases (Black Pill to Bryn Mill, Port-Eynon to Horton) the upper beach zone of heavily managed locations is scraped clean of seaweed and other tidal debris and litter. Such material is also important in forming embryo dunes and foredunes, acting as a barrier to sand movement and, once buried, a nutrient source for plants. Removal of material inhibits this process and restricts the natural development of outer dune features.

Car parks were recorded in 23 sites, with three of sufficient size (Oxwich, Port-Eynon to Horton, Pembrey Burrows) to entail significant loss of dune habitat at the site scale. Fifteen sites also had caravan parks, camp sites or large leisure complexes on sand or directly adjacent to a dune system. In five cases (Port-Eynon to Horton, Pembrey Coast, Lydstep Haven, Towyn Warren, Morfa Bychan) these were sufficiently large to have entailed significant loss or change of dune habitat. In the case of Pembrey Country Park a large leisure facility has been created from a former munitions manufacturing and storage facility constructed upon the dunes. Some areas of significant habitat loss on the edges of dune systems were not mapped in full due to access problems and hence the precise extent of such recreational impact is uncertain. In total, 27 sites had car parks and/or caravan parks, camp sites or major leisure developments present and these were distributed around all sectors of the Welsh coast.

One particular aspect of the leisure industry that warrants special attention is the use of dunes as golf courses. The game of golf is believed to have originated on the dune grasslands or 'links' of eastern Scotland (Nature Conservancy Council 1989) and the oldest Welsh course is reputedly that on dunes at Ynyslas. Golf courses were recorded on fifteen sites distributed around all sectors of the Welsh coast. Golf courses only rarely result in the total destruction of semi-natural vegetation but the modern game does seem to require the greens and tees to be converted to a completely artificial sward, whilst the fairways are normally at least part-modified in character. The least modified dune vegetation is usually found in the areas of rough. A total of fifteen golf courses was recorded in this survey, around all sectors of the Welsh coast. Part-modified and improved fairways were recorded at the majority of golf courses, with major alteration present at Morfa Bychan, Deganwy and Rhyl to Prestatyn.

Recreation is thus a very widespread and important activity which ranks as a major form of land use on dune systems. It probably affects many more sites than the traditional use of such areas for stock grazing. Relatively few sites have little recreational pressure and its absence is in general due to industrial development of the area (Margam Burrows, Baglan Bay) or military usage (Laugharne and Pendine Burrows). All other sites with low impact are small and relatively isolated (Penhrhynoedd-Llangadwaladr, Tywyn Gwyn, Traeth Dulas/Traeth Lligwy).

14.4 Urban and industrial development

Some Welsh dunes are remote from urban and industrial development and hence show little

impact from these land uses. The exceptions are dune systems located close to the major urban and industrial areas of Wales, particularly in the south between Swansea and Cardiff (Tables 14.3 and 14.4). A large length of dune has been lost to development for the steel industry between Baglan Bay and Kenfig Dunes (the extent and quality of loss is unknown) and major tipping continues at Margam Burrows. Petrochemical works and car plants are adjacent to Baglan Bay and Crymlyn Burrows, with pipework running through both sites and gas storage tanks located on the western parts of the Crymlyn system. The Pembrey area was formerly used for munitions production and storage but this area has been converted into a country park which still contains remnants of old buildings. A more modern industrial estate is also located on part of the Pembrey dune system. Sewage treatment works are located in two dune systems at Merthyr Mawr and Morfa Harlech.

Sand and underlying shingle have been traditionally extracted from dune systems but this practice is now restricted in Wales to six dune systems (Table 14.3). Sand or shingle removed from the beach zone can induce or increase erosion by wave action but this is now probably very rare in Wales.

Eight dune systems in North and South Wales are directly adjacent to residential developments (Table 14.4), with most of the former dune system between Black Pill and Bryn Mill in Swansea converted into housing, car parking and higher education facilities. Roads and railway lines are also routed through ten dune systems, notably the M4 in Kenfig Dunes. Transport corridors running parallel with the coast impose a major boundary within dune systems which interrupts changes in natural zonation patterns and can allow easier access for people and vehicles into sensitive parts of an area. Fly tipping (noted in eight sites) is a further problem, usually associated with tracks into dunes rather than major roads, though it was always very local in scale.

Urban and industrial areas are therefore common in areas adjacent to many Welsh dunes and in several cases occupy or have replaced dune systems. Their major direct impacts are land take leading to habitat loss, dumping of industrial waste and extraction of dune materials. There are also less quantifiable impacts of emissions and discharges which were not examined in this survey.

14.5 Sea defence

Erosion is frequently seen as a threat to dunes. Erosion is, however, also the counterpart of accretion in the dynamic processes which shape and maintain coastal dunes. The presence of sea defences can profoundly affect those dynamic processes. This in turn can have major implications for the vegetation.

A total of 21 dune systems were recorded with some form of sea defence measure in place (Table 14.5) and several other dune systems were adjacent to coastal sectors with groynes and sea walls, structures which change the nature of coastal erosion, sediment transport and sand inputs to the beach zone. In most cases defences were not extensive and consisted of gabions or rocks placed at the junction of dune and hard rock coast to protect residential property, industrial buildings or a sector of golf course from erosion. Such defences were inadequate for the dunes between Rhyl and Prestatyn in the winter storms of 1989/90, with some areas behind the sea wall damaged by standing salt water. In three cases (Black Pill to Bryn Mill in South Wales, Kinmel Bay and Rhyl to Prestatyn in North Wales) sea walls formed large lengths of defence, isolating dunes to landward from a sand supply and hence any realistic opportunity for further natural development to seaward. A new system of large rock boulder groynes was under construction at Rhyl to Prestatyn at the time of dune survey. In the case of dunes between Tywyn and Aberdovey coastal defences to the north might have greatly reduced sand supply, allowing erosion to predominate along all of the beach zone. These four cases probably make up the most serious impacts of sea defence upon

	Site	Stock grazing	Stock feeding	Serious erosion by stock	Agricultural improvement	Rabbit grazing
1	Merthyr Mawr		1		A STATION AND A STATION	L
2	Kenfig Dunes	Р	P			L/M
3	Margam Burrows	20.1	• • • • • • • • • • • • • • • • • • •	04 / 2000 22 1	an for margan	L/M
4	Baglan Bay	The In Dr. Mar.		2 Harden Charles	in each to white	?
5	Crymlyn Burrows	and and a line			Р	L/M
6	Black Pill to Bryn Mill	1.010.000.000.20		CALIFORNIA STATE	Constant the constant of	and that day
7	Pennard Burrows	P		The state	Р	L/M
8	Penmaen Burrows	Р			P	L/M
9	Nicholaston Burrows	111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		and a first of	P	L/M
10	Oxwich Burrows	P		The Contraction	A CONTRACTOR	L/M
11	Port-Eynon to Horton				Contraction of the	L
12	Hillend to Hills Tor			-	Р	L/M
13	Whiteford Burrows	Р		11 17 IICTUD V 0	The second second	L/M
14	Pembrey Coast		-	10 11 10 10 10 10	Р	L
15	Laughame Burrows					L/M
16	Pendine Burrows	onternari b	-	0 17 AD010 - A	Р	L/M
17	Tenby Burrows	The second second	1.22		P	?
18	Caldey Island	Р	-	-		L
19	Lydstep Haven					2
20	Manorbier/Swanlake	CO. CO. CO.	The Charles	CONTRACTOR STREET	ACT SOLUTION PRACT	L
21	Freshwater Bay East					H
22	Stackpole Warren	P			Р	H
23	Brownslade/Linney	O DEPTERUTE	77 5011	CHARLEN STAT	1 P	L/M
24	Broomhill Burrows	Р	and the second	C CT COMMON	P	L/M
25	Whitesand Bay				P	?
26	The Bennett	10 1 10 7 7 10				L
27	Poppit Sands	100000000000000000000000000000000000000			A CONTRACTOR OF THE OWNER	L
28	Towyn Warren				Р	2
29	Ynyslas	111 100 1000 P	111	Contraction of the	100 min 055	H
30	Tywyn to Aberdovey	1537 C Tot Market	0.0	T COMPLEXING	TTL STORE AND	M
31	Fairbourne		100			2
32	Morfa Dyffryn	P	-		1 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	L/M
33	Morfa Harlech	P	10 00 00	THE OWNER WATER OF THE	Contractor Statistics	M
34	Morfa Bychan					M
35	Pwllheli/Pen-y-Chain	P		17 NO 19 19 19 19	Р	L
36	Traeth Crugan	r		-	1	L
37	Tai Morfa	Р		1.		M
38	Morfa Dinlle	r	-			H
39		Р		to the state of	the state of the	M
40	Newborough Warren	P P				H
40	Penhrhynoedd - Llangadwaladr Aberffraw	P P			A COLORED AND AND	H
41 42	Valley	P P				M/H
10				D	The Property of the I	
43	Tywyn Gwyn	PH		P		H L
44A 44B	Traeth Dulas	w night black	3.4	Spinit and	Service of the Ba	L
	Traeth Lligwy					L
45	Red Wharf Bay		1	- <u>1926</u> 12296 12	the second states of the second	L/M
46 47	Conwy/Deganwy		54			L/M L
47	Kinmel Bay		-	The second second	the second se	
	Rhyl to Prestatyn	P	-			
49	Gronant to Talacre	P	-		a ser unionita line	L/M

Table 14.1 Agricultural impacts upon Welsh sand dunes (including rabbit grazing).P = present. L = light. M = moderate. H = heavy. ? = uncertain.

Table 14.2 Recreational impacts on Welsh sand dunes. P = present. * = large size, involving
habitat loss or change. Golf course fairways: U = unmodified turf; M = part-modified turf; I =
improved turf; ? = no information. Path erosion: L = light; M = moderate; H = heavy.

	Site	Car park	Caravan or camp site, other leisure complex	Golf course	Path and other dune erosion	Dune stabilisation works
1	Merthyr Mawr	P		moderne more	M	
2	Kenfig Dunes	Р		P?		-
3	Margam Burrows	the second s			and a second second	
4	Baglan Bay	and the second second				
5	Crymlyn Burrows	Р		М	L	
6	Black Pill to Bryn Mill			M		
7	Pennard Burrows	and construction		M	Н	Р
8	Penmaen Burrows				Н	P
9	Nicholaston Burrows		Second Second		Н	P
10	Oxwich Burrows	P*	Р		М	Р
11	Port-Eynon to Horton	P*	P*		М	Р
12	Hillend to Hills Tor	Р	Р		L	Р
13	Whiteford Burrows				L	Р
14	Pembrey Coast	P*	P*	M	L	Р
15	Laughame Burrows		and the second second			
16	Pendine Burrows		2	Sec. Sec.		
17	Tenby Burrows	Р	Р	M/I	?	?
18	Caldey Island				114	
19	Lydstep Haven		P*	Cost Contractor		11. 11. 11. 11. 11. 11. 11. 11. 11. 11.
20	Manorbier/Swanlake	Р			M	P
21	Freshwater Bay East	Р			M	P
22	Stackpole Warren	and a second second second			L	
23	Brownslade/Linney				?	?
24	Broomhill Burrows	Р				
25	Whitesand Bay	Р	Р	M/I		A REPORT OF SUC
26	The Bennett	Р		- de la composition de la comp	Н	Р
27	Poppit Sands	Р			M	Р
28	Towyn Warren	P	P*			P
29	Ynyslas	Р	Р	U/M	L	Р
30	Tywyn to Aberdovey		- No	M	Н	Р
31	Fairbourne	Р			L	P
32	Morfa Dyffryn	Р	Р		L	Р
33	Morfa Harlech		-	U/M	L	Р
34	Morfa Bychan	Р	P*	I	M	Р
35	Pwllheli/Pen-y-Chain	Р	Р		L	Р
36	Traeth Crugan			U/M		
37	Tai Morfa	Р			L	Р
38	Morfa Dinlle					
39	Newborough Warren	Р	-	-	L	Р
40	Penhrhynoedd - Llangadwaladr			-		-
41	Aberffraw		-		L	Р
42	Valley		1	U/M	-	-
43	Tywyn Gwyn				-	
44A	Traeth Dulas					
44B	Traeth Lligwy	-				
45	Red Wharf Bay	Р	-		-	-
46	Conwy/Deganwy	P	Р	M/I	-	-
47	Kinmel Bay		P			-
48	Rhyl to Prestatyn		P P	I	L	P P

Table 14.3 Dune sites with adjacent industry or used for dumping, mineral extraction or for sewagetreatment. P = present. F = formerly used for this purpose. * = large-scale impact.

	Site	Adjacent industrial development	Dumping	Mineral extraction	Sewage works
1	Merthyr Mawr	-	F	Р	Р
2	Kenfig Dunes	Р			
3	Margam Burrows	Р	P*	F	
4	Baglan Bay	Р			and a subscription
5	Crymlyn Burrows	Р			
6	Black Pill to Bryn Mill				
7	Pennard Burrows				
8	Penmaen Burrows				
9	Nicholaston Burrows				
10	Oxwich Burrows				
11	Port-Eynon to Horton				
12	Hillend to Hills Tor				and the second second
13	Whiteford Burrows				
14	Pembrey Coast	P and F		F	Sand Stranger
15	Laughame Burrows				and the local state
16	Pendine Burrows		1		La sa sul della
17	Tenby Burrows				
18	Caldey Island				ALC: NOT A
19	Lydstep Haven				and a second of the
20	Manorbier/Swanlake	ILLE SALES			and an art of the
21	Freshwater Bay East				1
22	Stackpole Warren				
23	Brownslade/Linney		La la la	Р	
24	Broomhill Burrows			F	
25	Whitesand Bay				
26	The Bennett				A CONTRACTOR OF
27	Poppit Sands				and the second second
28	Towyn Warren				and and the
29	Ynyslas				
30	Tywyn to Aberdovey				
31	Fairbourne				
32	Morfa Dyffryn				
33	Morfa Harlech	Р			Р
34	Morfa Bychan				
35	Pwllheli/Pen-y-Chain		1		A STREET OF THE STREET
36	Traeth Crugan				
37	Tai Morfa				and a second
38	Morfa Dinlle				and the state of the
39	Newborough Warren		P	Р	There is a second
40	Penhrhynoedd - Llangadwaladr		-	P and F	allowed and a
41	Aberffraw		Р	Р	
42	Valley				and and a start of the
43	Tywyn Gwyn			Р	and a state
44A	Traeth Dulas				Sec Black
44B	Traeth Lligwy				and and and and
45	Red Wharf Bay	and the second second			and a month
46	Conwy/Deganwy				
47	Kinmel Bay	Р			- management
48	Rhyl to Prestatyn				a succession in
49	Gronant to Talacre				

	Site	Adjacent residential and suburban land	Fly tipping	Transport corridor	
1	Merthyr Mawr	Р			
2	Kenfig Dunes	on a second and a second		Р	
3	Margam Burrows			P	
4	Baglan Bay		and the second second	P	
5	Crymlyn Burrows		Р	P	
6	Black Pill to Bryn Mill	Р	and with 75	Р	
7	Pennard Burrows	Р			
8	Penmaen Burrows				
9	Nicholaston Burrows	- Indiana State Indiana	. freeday would		
10	Oxwich Burrows			Р	
1	Port-Eynon to Horton	Р	186304119-2-10-7-D		
12	Hillend to Hills Tor	ever a construction of the	GOER when w	(the Instantio) rais	
13	Whiteford Burrows				
14	Pembrey Coast		Р		
15	Laughame Burrows	The second shares and	Р	a share Birak	
16	Pendine Burrows	Р	Р	and the second	
17	Tenby Burrows		1 NY 244 NA	Р	
18	Caldey Island			nicia niarte l ta	
19	Lydstep Haven	a broken a state of the			
20	Manorbier/Swanlake				
21	Freshwater Bay East			PARTY CONTRACTOR	
22	Stackpole Warren	entre management &	and the last	in a set of the base	
23	Brownslade/Linney				
24	Broomhill Burrows				
25	Whitesand Bay	tit see all se day is shown	an transformer was	to to American Strengton	
26	The Bennett				
27	Poppit Sands				
28	Towyn Warren	CREAT YOUR ADDRESS	talens paul mes	NOT THE WORK OF THE	
29	Ynyslas	er en la la chema	and a state of the state of the		
30	Tywyn to Aberdovey				
31	Fairbourne		23500(200.u	Р	
32	Morfa Dyffryn	trend a substantial states and	a delas selectos	all interventions	
33	Morfa Harlech		P		
34	Morfa Bychan		COLUMN STREET		
35	Pwllheli/Pen-y-Chain	Bert Vi dependentes des	Lucion	intercontence made	
36	Traeth Crugan		Р		
37	Tai Morfa		이 목가 목도 나이지 않는 것이 하는 것.	 Community 	
38	Morfa Dinlle	De the perificates and D	Р	the married at one	
39	Newborough Warren				
40	Penhrhynoedd - Llangadwaladr		CALENDAL LIVES AND	CARD BUILDER ST.	
41	Aberffraw		Lagrades pro	and the second land	
42	Valley	the state of the second se	Р	March Street Land	
43	Tywyn Gwyn		A CONSTRUCT OF ANY A		
44A	Traeth Dulas	Text parts tenner i tes	101501010551	TIDS TO TOLDERSE	
44B	Traeth Lligwy	And the state of the	And the same second	and the second beauty	
45	Red Wharf Bay				
46	Conwy/Deganwy	Р	10.01.H002931303		
47	Kinmel Bay	Р	the linkerstry	Р	
48	Rhyl to Prestatyn	Р		Р	
49	Gronant to Talacre	Р	and the second s		

Table 14.4 Dune systems influenced by residential and suburban land, fly tipping and presence of a transport corridor. P = present.

Welsh dunes. Very few examples of the newer 'soft engineering' type of defences were encountered during this survey.

14.6 Forestry

Large-scale, state-financed afforestation with conifers has been carried out on two large Welsh dune systems (Table 14.5). The largest plantations are on dunes of the Pembrey Coast, with 967 ha of conifers in Pembrey Forest, comprising first generation areas of Corsican pine Pinus nigra (planted in the early 1930s) and second generation plantings of Corsican pine and Sitka spruce Picea sitchensis. At Newborough Warren a further 728 ha of Corsican pine were planted in the late 1940s and the 1950s on the western sectors of dune. In both cases plantings have replaced large extents of dune grassland and slack habitat. The forest extent at Pembrey is so large that the remaining areas of dune interest are largely confined to spit dunes at either end of the system, the bulk of the vegetation in the very large hindshore sector being lost to tree cover (though the main dune and slack topography remains). Older stands have good structural diversity, with a developing shrub layer. The remaining fragments of dune interest within the forest have been mapped by the Forestry Commission and incorporated into a conservation plan. Planting at Newborough Forest did not extend into the wetter slacks and these still retain biological interest, with several nationally rare higher plant species more abundant or confined to the forest area. The planted area is therefore rated as a Site of Special Scientific Interest. Recreational facilities are also provided by the Forestry Commission at Newborough Warren.

Planting on a much smaller scale is present elsewhere, including broadleaved species (mainly sycamore *Acer pseudoplatanus*) and mixed woodland (e.g. at Merthyr Mawr and Stackpole Warren). Conifers on the main dune sector at Whiteford Burrows have been felled and dune vegetation is being allowed to reestablish, though a plantation at the southern end of the dune system has been retained as a distinct landscape feature. The total extent of coniferous plantation, broadleaved and mixed woodland plantings recorded during survey was 1,772 ha. This comprises 21.8% of surveyed dune area (8,146 ha, Table 1.1) and is thus the largest human impact upon Welsh dunes, measured in terms of highly altered vegetation cover. Forestry Commission plantations make up 96% of all planted tree cover and these are the major component of all such cover.

14.7 Military usage

The coastal zone has long been of military importance. This form of land use reached a peak during the Second World War when many British dune systems had some form of defence installation and larger sites were intensively used for battle training. Defence installations were recorded in five sites (Pembrey Coast, Laugharne Burrows, Brownslade/Linney, Morfa Dyffryn, Valley) and recent military ownership is also known for Merthyr Mawr, a further sector at Pembrey (now developed as Pembrey Country Park), Ynyslas and Morfa Dinlle. The scale of past and present impact is very varied, with some areas only being used as rifle ranges and others as major proof/experimental testing locations or for munitions manufacture and storage. Ground disturbance is extensive at Laugharne Burrows, less so at Tywyn Gwendraeth (the northern spit dune on the Pembrey Coast). The area involved is uncertain (it is not mapped accurately for Laugharne Burrows) but in the case of Tywyn Gwendraeth it has involved excavation to below water table and thus the creation of some wetland habitat of ecological interest. Military ownership also restricts access and recreational impacts are generally few in locations used for testing. This is not the case for the airfield site at Valley and dune areas beyond the military boundary fence have been, in part, developed. In general military use is not a major impact on dune vegetation in Wales.

14.8 Conservation

The management of land for nature conservation is a comparatively recent phenomenon. Nature conservation was recorded as a land use from a large number of locations. Twenty-four sites were recorded as SSSIs, ten as National Nature Reserves (Kenfig Pool and Dunes; Oxwich Bay, including Nicholaston and Oxwich Burrows; Whiteford Burrows, Stackpole Warren, Ynyslas, Morfa Dyffryn, Morfa Harlech, Newborough Warren), one as a Local Nature Reserve (Morfa Bychan, maintained by North Wales Wildlife Trust). Several fall within the boundaries of the Pembrokeshire Coast and Snowdonia National Parks, some are managed for conservation by the National Trust (e.g. Penmaen), a large number are within the Gower Area of Outstanding Natural Beauty (offering some protection for coastal landscape) and three sites fall within the Lleyn Peninsula Environmentally Sensitive Area. In total 35 sites had some form of conservation status. Those excluded tend to be small, highly altered dune systems of reduced ecological value. Much of the Welsh dune resource therefore has some form of protection in place, reflecting the high quality of much of the remaining habitat.

Designated site area was often smaller than survey area, and at least two sites (Margam and Tenby Burrows) are parts of areas designated primarily for other coastal habitat. Other sites (e.g. Oxwich Bay and Whiteford/Llandisfarne saltmarsh) comprise other important coastal habitats in addition to high-quality dunes. Conservation is rarely the sole use of land over the whole survey area, though conservation management has reduced the impact of some other activities. Apart from stabilisation of eroding dunes caused by recreational impact, active management for conservation was noted in several sites including scrub clearance (total eradication of sea buckthorn Hippophae rhamnoides from Whiteford Burrows, gorse Ulex europaeus clearance from parts of Towyn Warren), felling of coniferous plantations at Whiteford Burrows, and bracken mowing at Oxwich Burrows. The commonest management was by grazing (and, in the case of Kenfig Dunes, mowing) to maintain short-sward grasslands and removal of birch and alder scrub from slacks. All these programmes directly affect the course of natural succession and aim

to maintain open dune grassland and slack vegetation with high species diversity.

Table 14.5Sea defences, military use, forestry and conservation status of Welsh dunes.P = present.F = former use.* = very large impact.SSSI = Biological Site of Special ScientificInterest.NNR = National Nature Reserve.LNR = Local Nature Reserve.Park.ESA = Environmentally Sensitive Area.GAONB = Gower Area of Outstanding NaturalBeauty.

	Site	Sea defences	Military use	Forestry	Conservation status
1	Merthyr Mawr	Р	F	P	SSSI
2	Kenfig Dunes	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		and the second second second	SSSI, NNR
3	Margam Burrows	A CONTRACTOR OF		Р	SSSI
4	Baglan Bay	State States			And the second second second
5	Crymlyn Burrows	Р		Р	SSSI
6	Black Pill to Bryn Mill	P*	Lawson	COMPANY OF	Contraction of States and
7	Pennard Burrows		and the second second	Contraction of the	GAONB
8	Penmaen Burrows				GAONB
9	Nicholaston Burrows	PARTIN AND AND A		CALCED STORESTIC	SSSI, NNR, GAONB
10	Oxwich Burrows	Р		real statements in the	SSSI, NNR, GAONB
11	Port-Eynon to Horton				GAONB
12	Hillend to Hills Tor	Р	10000	22 10 10 10 10 10	GAONB
13	Whiteford Burrows	The second second	a shirt of	P	SSSI, NNR, GAONB
14	Pembrey Coast		P and F	p*	SSSI
15	Laughame Burrows	a set a set a set a set	Р	Contraction of the second s	SSSI
16	Pendine Burrows	Р	and a sector by	the base series	SSSI
17	Tenby Burrows				SSSI
18	Caldey Island				
19	Lydstep Haven	they all the first	No. Do Selfine	THE REPORTS	NP
20	Manorbier/Swanlake		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	and a state of the second	NP
21	Freshwater Bay East	Р			NP
22	Stackpole Warren		n n n n n n n n n n n n n n n n n n n	Р	SSSI, NNR, NP
23	Brownslade/Linney	and the second s	P	and a state of some	SSSI, NP
24	Broomhill Burrows				SSSI, NP
25	Whitesand Bay	P	1.	1 1 1 1 1 1 1 1 1 1	NP
26	The Bennett	P	2 1. 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 1 2 2 2 2 2 2 2 2	NP
27	Poppit Sands				NP
28	Towyn Warren	P	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		SSSI
29	Ynyslas	P	F	N STATISTICS	SSSI, NNR
30	Tywyn to Aberdovey	P			
31	Fairbourne	P			
32	Morfa Dyffryn	-	Р		SSSI, NNR, NP
33	Morfa Harlech		-	and Shareday	SSSI, NNR, NP
34	Morfa Bychan	Р			SSSI, LNR, ESA
35	Pwllheli/Pen-y-Chain	P		and a statistic county	ESA
36	Traeth Crugan	P	1 2 2 4 4		The deal Arministration
37	Tai Morfa				SSSI, ESA
38	Morfa Dinlle	a la tauna ancas	F		
39	Newborough Warren	Р	Color Corre	p*	SSSI, NNR
40	Penhrhynoedd - Llangadwaladr				SSSI
41	Aberffraw				SSSI
42	Valley	Р	Р	COLUMN TO SA	
43	Tywyn Gwyn				
44A	Tracth Dulas				
44B	Traeth Lligwy	n Fontsmy	bernine	the indian me	she po treb hours bear of the
45	Red Wharf Bay				and the strend line of the
46	Conwy/Deganwy	Р			
47	Kinmel Bay	p*		The second second second	000000000000000000000000000000000000000
48	Rhyl to Prestatyn	p*			A CONTRACTOR OF A CONTRACTOR
49	Gronant to Talacre	P			SSSI

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