

# Wales Coastal Ecosystem Group Priority Action

## Sand Dune Priority Area

Sand dunes represent one of the most natural and species-rich habitats in Wales, supporting vast numbers of plants, fungi and invertebrates. The total floristic assemblage for Welsh sand dunes amounts to some 945 species, with vascular plants representing about 439 of these (Rhind 1999). Fungi unexpectedly form the next most important group with approximately 289 species, followed by bryophytes (171 species) and terricolous lichens (66 species). They are also extremely rich in invertebrates (Howe *et al.* 2010), with 454 species restricted or mostly confined to sand dunes in Wales including 156 beetles, 117 flies, 65 bees & wasps, 50 bugs and 25 spiders. Whilst the largest dune systems inevitably support the largest numbers of species, some of our smaller sites support rare vegetation communities, (Morfa Dinlle and Crymlyn Burrows) or key species. For example, Morfa Conwy supports the only Welsh population of the belted beauty moth *Lycia zonaria*.

It is therefore of considerable concern that sand dunes are now facing many threats to their conservation. For example, most of the Natura 2000 sand dunes features in Wales are now considered to be unfavourable and declining. The following outlines some of the major areas of concern.

### Major Concerns

- *Stabilization*

The dune resource of Wales has changed dramatically over the past 50 years, becoming much more stable with far fewer mobile dunes and embryonic dune slacks. At Newborough Warren, for example, nearly 75% of the total dune area in the 1950s consisted of mobile dunes and embryonic dune slacks with open vegetation. By 1991 only about 6% of the site could be classed as mobile and open, while embryonic dune slacks are now virtually non-existent. Of the total Welsh dune resource of about 8051 ha, only about 135ha can be described as bare or sparsely vegetated (Rhind *et al.* 2008).

Many of our rarest dune plants are confined to these habitats and there are now major concerns over the long-term survival of the now critically endangered fen orchid (*Liparis loeselii* var. *ovata*). This species has a requirement for early successional dune slacks and is confined to just a handful of dune slacks on Kenfig NNR having been lost from Whiteford Burrows and Laugharne & Pendine Burrows in recent years. 65% (295 of the 454) invertebrate species closely associated with dunes are dependent upon early-successional habitats such as strandlines, marram stands, bare and sparsely-vegetated sand and pioneer dune slacks. Factors considered to have influenced stabilization include the deposition of atmospheric nutrients, soil development and a decreasing sediment supply. Climate change is also likely to become a major influence. Internal factors such as levels of managed grazing can also be influential, but there are now concerns that the degree of stabilization has gone beyond normal management control for many sites and we may now be facing accelerated levels of ecological succession. A number of techniques to counter stabilization are now being trialled in Wales. These include topsoil stripping and deep ploughing (topsoil inversion). However, to successfully reverse this trend we need to consider reasonably large-scale destabilization on several targeted sites. This would go some way towards achieving favourable condition on these sites.

A provisional study (Houston & Dargie, 2010) has shown that at least eight dune systems in Wales have potential for re-mobilisation including Tywyn Aberffraw, Morfa Harlech, Broomhill Burrows, Brownslade & Linney Burrows, Laugharne-Pendine Burrows, Whiteford

Burrows, Kenfig Burrows and Merthyr Mawr Warren. At each site detailed proposals have been developed. Newborough Warren is also a strong candidate for re-mobilization.

- ***Maintaining or restoring sand supply***

At least 27 of the 49 dunes systems in Wales are now subject to net erosion (Dargie 1995). This is a major concern and possibly constitutes an intractable problem for certain sites. Beach nourishment is one solution but this is an extremely expensive operation. Its value has been clearly demonstrated at Talacre Warren in North Wales. Here in 2003, 150,000m<sup>3</sup> of dredged sand was pumped on to the foreshore, along a section of eroding dunes. The material was made available from navigation dredging operations in the Dee Estuary thereby significantly reducing the cost. New foredunes are now developing and sand is now being channelled into hind dune areas creating new mobile dunes. The process has re-invigorated the dunes as whole by causing a much-needed increase in the overall level of sand mobility.

Dune sites critically affected by disrupted sand supply include Kenfig Burrows, Pembrey Coast, Laugharne & Pendine Burrows, Broomhill Burrows, Aberdyfi Dunes and Gronant Dunes & Talacre Warren (see Appendix 1).

- ***Reducing the impact of nutrient enrichment***

The stabilization of dunes is thought to be at least in part attributable to the input of artificially high levels of nitrogen from atmospheric and ground water sources. The recommended critical load range for sand dunes is 10 – 20 kg N ha<sup>-1</sup> yr<sup>-1</sup> and several sites in Wales are now regarded as approaching threshold levels on the basis of atmospheric inputs alone. To reduce further inputs we are proposing the establishment of buffer zones around certain sites and looking into the possibility of designating certain water catchments as Nitrogen Sensitive Areas. CCW is also supporting strategic efforts to reduce background NOx and ammonia levels.

Sites critically affected by nutrient enrichment include Crymlyn Burrows, Pennard Burrows, Oxwich & Nicholaston Burrows, Pembrey Burrows, Laugharne & Pendine Burrows, Pen Yr Eryd, Newborough Warren and Tywyn Aberffraw.

- ***Optimising water supply***

The water tables of various dune systems have been significantly lowered as a result of local drainage schemes. There is now the possibility of resolving this issue at certain sites through the implementation Water Level Management Plans. These are prepared by the UK's Environment Agency (EA) and aim to reconcile and integrated the water level requirements for a range of activities, including agriculture, flood defence and conservation, but with priority given to maintaining or restoring hydrological regimes that are important to conservation features of national or international importance. CCW is now working in close partnership with EA to help restore more natural hydrological regimes to various dune sites.

Sites selected for critical water management include Talacre Warren, Newborough Warren, Tywyn Aberffraw, Kenfig Burrows, Brownslade & Linney Burrow, Broomhill Burrows, Morfa Harlech and Morfa Dyffryn.

- ***Removal of non-native trees (mainly conifers)***

Conifer plantation now occupies some 1700 ha (approximately 21%) of dune habitat in Wales and has a major impact on the conservation status of the resource. Apart from the loss of habitat they also have a major stabilizing influence suppressing natural geomorphological

processes and can adversely affect the hydrology of adjacent dunes. Sites that include conifer plantations are Newborough Warren, Pembrey, Whiteford Burrow and Morfa Harlech. All of these are designated SACs under the protection of the EC Habitats Directive, and it can be argued that these plantations are now in direct conflict with Directive requirements in terms of maintaining and enhancing favourable conservation status. In other words their continued presence at some locations could be causing adverse impacts that could be interpreted as contravening European Law. We are, therefore, advocating their removal or partial removal but this has proved to be a contentious issue. Some of these plantations are highly valued by both local people and visitors and constitute a perceived asset to the local tourist industry.

Key sites for the removal of conifers include Whiteford Burrows, Morfa Harlech and Newborough Warren (see Appendix 2).

- ***Implementing the re-creation or re-invigoration of dune slack***

Welsh dunes are extremely important for their dune slack components with over 57% of the entire British resource of the *Sagina nodosa* - *Bryum pseudotriquetrum* dune-slack community and a staggering 77% of the British *Salix repens* - *Campyllum stellatum* dune-slack community. This is despite the fact that the remaining area of this habitat in Wales is just 615 ha out of a UK total of about 2285 ha. Most of the rare plant species of dune systems occur within this habitat. 33 of the 454 dune invertebrate species are associated with the open conditions offered by pioneer dune slacks such as bare mud, short vegetation and dune pools. It is crucial therefore that the remaining dune slack habitat is maintained in favourable condition, and that opportunities are sought to re-create additional habitat.

Dune sites provisionally selected for dune slack re-creation or re-invigoration are Brownslade Burrows, Laugharne & Pendine Burrows, Kenfig Burrows, Ynyslas Dunes, Pembrey Coast, Gronant & Talacre Warren and Newborough Warren.

- ***Implementing scrub control***

Natural or semi-natural scrub typically includes blackthorn and privet. These represent an important phase in the natural succession and can be important for certain bird species. However, there is now major concern regarding the invasive spread of sea-buckthorn (*Hippophae rhamnoides*). This species is not native to Wales but has now become well established on a number of dune systems, and has become particularly problematic at Merthyr Mawr. Over 52 ha have now been cleared at substantial cost. Much of it was grubbing out using an excavator fitted with a weed rake, while herbicide foliar spraying was used on smaller specimens. Several other sites have now been identified as requiring intensive scrub control.

Sites prioritized for scrub clearance include Merthyr Mawr Warren, Whiteford Burrows, Pembrey Coast, Laugharne & Pendine Burrows, Freshwater East and Stackpole Warren (see Appendix 3).

- ***Establishing appropriate grazing levels***

The purpose of using domestic grazing stock is to either emulate a natural grazing regime or to maintain a long-term traditional regime. Choice of stock can influence a whole range of factors, both those affecting the conservation of the site, such as vegetation structure, plant composition, impact on rare species, and tree or scrub cover, but also on the practicalities of keeping stock, such as method of enclosure, staff or grazier involvement to manage the animals and so on. The main types of stock used on Welsh sand dunes are cattle, sheep and equines and each creates a characteristic range of dune habitat types. To maintain the overall

diversity of the sand dune resource in Wales, it is important therefore that we retain and possibly enhance the overall variety of grazing stock. Currently, 20 dune sites in Wales support grazing stock, but many of the current regimes are far from satisfactory.

It should be noted that grazing can present something of a dilemma for invertebrate conservation. Whilst there is an important sand dune element associated with dung, (localized) overgrazing can have a detrimental impact by removing inflorescences or vegetation structure. A dynamic dune system should be able to maintain the early-successional habitats required by most species, with grazing rarely able to provide the desired effect.

Dune sites selected for establishing or maintaining appropriate and regulated grazing include Merthyr Mawr Warren, Kenfig Burrows, Whiteford Burrows, Stackpole Warren, Broomhill Burrows and Newborough Warren (see Appendix 4).

### **Priority Sites for Action**

Sand dune sites are given priority rankings of A, B and C. The accompanying maps show Priority A sites which should be the major focus of action. Priority B and C sites will be included within wider biodiversity mapping work with management of B and C sites being undertaken when opportunities arise.

More detail mapped management action can be obtained from Mike Howe at [m.howe@ccw.gov.uk](mailto:m.howe@ccw.gov.uk)

### **Species Interest**

#### ***Key Section 42 Species***

Dactylorhiza purpurella subsp. Cambrensis	A marsh orchid
Monotropa hypopitys	Yellow bird's-nest
Asparagus prostrates	Wild asparagus
Gentianella anglica	Early gentian
Gentianella campestris	Field gentian
Gentianella uliginosa	Marsh gentian
Liparis loeselii	Fen orchid
Matthiola sinuate	Seastock
Platanthera bifolia	Lesser butterfly orchid
Chara baltica	Baltic stonewort
Collema fragile	A lichen
Fissidens curvatus	Portuguese pocket-moss
Tortula cuneifolia	Wedge-leaved Screw-moss
Bombus sylvarum	Shrill carder-bee
Cupido minimus	Small blue
Pyrgus malvae	Grizzled skipper
Osmia xanthomelana	A mason bee
Hemaris tityus	Narrow-bordered Bee Hawk-moth
Erynnis tages	Dingy skipper
Pyrrhocorax pyrrhocorax	Chough
Pluvialis apricaria	Golden Plover
Epidalea calamita	Natterjack toad
Lacerta agilis	Sand lizard
Triturus cristatus	Greater-crested newt
Arvicola terrestris	Water vole
Lutra lutra	Otter

***Key Invertebrate Species on Welsh sand dunes (\*Section 42)***

<b>Species</b>	<b>Order</b>	<b>Family</b>	<b>Status</b>
<i>Vertigo angustior*</i>	Mollusca	Vertiginidae	RDB1
<i>Geotomus punctulatus</i>	Hemiptera	Cydnidae	RDB1
<i>Odontoscelis fuliginosa</i>	Hemiptera	Scutelleridae	RDB3
<i>Rhopalus rufus</i>	Hemiptera	Rhopalidae	pRDB3
<i>Heterogaster artemisiae</i>	Hemiptera	Lygaeidae	Notable B
<i>Pionosomus varius</i>	Hemiptera	Lygaeidae	RDB3
<i>Nabis pseudoferus</i>	Hemiptera	Nabidae	Notable B
<i>Monosynamma sabulicola</i>	Hemiptera	Miridae	Notable B
<i>Systellonotus triguttatus</i>	Hemiptera	Miridae	Notable B
<i>Trigonotylus psammaecolor</i>	Hemiptera	Miridae	Notable B
<i>Ulopa trivia</i>	Hemiptera	Cicadellidae	Notable B
<i>Wesmaelius balticus</i>	Neuroptera	Hemerobiidae	Notable B
<i>Chrysopa abbreviata</i>	Neuroptera	Chrysopidae	Notable B
<i>Cicindela maritima</i>	Coleoptera	Carabidae	Notable B
<i>Nebria complanata</i>	Coleoptera	Carabidae	Notable A
<i>Dyschirius impunctipennis</i>	Coleoptera	Carabidae	Notable B
<i>Dyschirius nitidus</i>	Coleoptera	Carabidae	Notable A
<i>Bembidion pallidipenne</i>	Coleoptera	Carabidae	Notable B
<i>Calathus ambiguus</i>	Coleoptera	Carabidae	Notable B
<i>Agonum gracilipes</i>	Coleoptera	Carabidae	Notable A
<i>Amara fusca</i>	Coleoptera	Carabidae	pRDB1
<i>Amara infima</i>	Coleoptera	Carabidae	Notable A
<i>Amara lucida</i>	Coleoptera	Carabidae	Notable B
<i>Amara spreta</i>	Coleoptera	Carabidae	Notable B
<i>Harpalus sabulicola</i>	Coleoptera	Carabidae	pRDB3
<i>Harpalus melancholicus*</i>	Coleoptera	Carabidae	pRDB1
<i>Harpalus serripes</i>	Coleoptera	Carabidae	Notable B
<i>Harpalus servus</i>	Coleoptera	Carabidae	Notable B
<i>Harpalus tenebrosus</i>	Coleoptera	Carabidae	Notable A
<i>Anisodactylus nemorivagus</i>	Coleoptera	Carabidae	Notable A
<i>Acupalpus brunnipes</i>	Coleoptera	Carabidae	Notable A
<i>Panagaeus bipustulatus</i>	Coleoptera	Carabidae	Notable B
<i>Panagaeus cruxmajor*</i>	Coleoptera	Carabidae	pRDB1
<i>Demetrias monostigma</i>	Coleoptera	Carabidae	Notable B
<i>Halacritus punctum</i>	Coleoptera	Histeridae	pRDBK
<i>Saprinus cuspidatus</i>	Coleoptera	Histeridae	Notable B
<i>Hypocaccus metallicus</i>	Coleoptera	Histeridae	pRDB3
<i>Hypocaccus rugiceps</i>	Coleoptera	Histeridae	Notable A
<i>Baeckmanniolus</i>	Coleoptera	Histeridae	Notable B

dimidiatus

<i>Leiodes ciliaris</i>	Coleoptera	Leiodidae	Notable B
<i>Leiodes furva</i>	Coleoptera	Leiodidae	Notable B
<i>Agathidium marginatum</i>	Coleoptera	Leiodidae	Notable B
<i>Omalius rugulipenne</i>	Coleoptera	Staphylinidae	pRDBK
<i>Thinobius brevipennis</i>	Coleoptera	Staphylinidae	pRDBK
<i>Paederus caligatus</i>	Coleoptera	Staphylinidae	RDB3
<i>Philonthus lepidus</i>	Coleoptera	Staphylinidae	pRDBK
<i>Philonthus pullus</i>	Coleoptera	Staphylinidae	RDB I
<i>Gabrius exiguus</i>	Coleoptera	Staphylinidae	RDB I
<i>Arena tabida</i>	Coleoptera	Staphylinidae	pRDBK
<i>Oxypoda lurida</i>	Coleoptera	Staphylinidae	Notable B
<i>Aegialia rufa</i>	Coleoptera	Scarabaeidae	RDB1
<i>Aphodius coenosus</i>	Coleoptera	Scarabaeidae	Notable B
<i>Aphodius plagiatus</i>	Coleoptera	Scarabaeidae	Notable B
<i>Aphodius putridus</i>	Coleoptera	Scarabaeidae	Notable B
<i>Euheptaulacus sus</i>	Coleoptera	Scarabaeidae	pRDB1
<i>Euheptaulacus villosus</i>	Coleoptera	Scarabaeidae	Notable A
<i>Heptaulacus testudinarius</i>	Coleoptera	Scarabaeidae	pRDB1
<i>Psammodius asper</i>	Coleoptera	Scarabaeidae	Notable A
<i>Onthophagus nuchicornis</i>	Coleoptera	Scarabaeidae	Notable A
<i>Dryops nitidulus</i>	Coleoptera	Dryopidae	pRDB3
<i>Cardiophorus asellus</i>	Coleoptera	Elateridae	Notable B
<i>Dicronychus equisetioides</i>	Coleoptera	Elateridae	pRDB2
<i>Orthocerus clavicornis</i>	Coleoptera	Colydiidae	Notable B
<i>Cylindrinotus pallidus</i>	Coleoptera	Tenebrionidae	Notable B
<i>Anthicus bimaculatus</i>	Coleoptera	Anthicidae	Notable A
<i>Chrysolina sanguinolenta</i>	Coleoptera	Chrysomelidae	Notable A
<i>Longitarsus curtus</i>	Coleoptera	Chrysomelidae	Notable A
<i>Protapion dissimile</i>	Coleoptera	Apionidae	Notable B
<i>Cleonis pigra</i>	Coleoptera	Curculionidae	Notable B
<i>Hypera dauci</i>	Coleoptera	Curculionidae	Notable B
<i>Bagous lutulosus</i>	Coleoptera	Curculionidae	Notable A
<i>Orthochaetes insignis</i>	Coleoptera	Curculionidae	Notable B
<i>Datonychus arquatus</i>	Coleoptera	Curculionidae	RDB I
<i>Ceutorhynchus hirtulus</i>	Coleoptera	Curculionidae	Notable B
<i>Glocianus pilosellus</i>	Coleoptera	Curculionidae	RDB2
<i>Pachytychius quinquepunctatus</i>	Coleoptera	Curculionidae	RDB2
<i>Stigmella spinosissimae</i>	Lepidoptera	Nepticulidae	Notable A
<i>Monochroa elongella</i>	Lepidoptera	Gelechiidae	RDB I
<i>Chionodes distinctella</i>	Lepidoptera	Gelechiidae	Notable B
<i>Anacamptis temerella</i>	Lepidoptera	Gelechiidae	Notable A
<i>Acleris permutana</i>	Lepidoptera	Tortricidae	pRDB3

<i>Collicularia microgrammana</i>	Lepidoptera	Tortricidae	Notable B
<i>Pyrausta sanguinalis</i>	Lepidoptera	Pyralidae	pRDB1
<i>Lasiocampa trifolii trifolii</i>	Lepidoptera	Lasiocampidae	Notable A
<i>Lycia zonaria britannica*</i>	Lepidoptera	Geometridae	pRDB3
<i>Euxoa cursoria</i>	Lepidoptera	Noctuidae	Notable B
<i>Agrotis ripae</i>	Lepidoptera	Noctuidae	Notable B
<i>Sideridis albicolon</i>	Lepidoptera	Noctuidae	Notable B
<i>Mythimna litoralis</i>	Lepidoptera	Noctuidae	Notable B
<i>Luperina nickerlii gueneei</i>	Lepidoptera	Noctuidae	RDB2
<i>Nephrotoma quadristriata</i>	Diptera	Tipulidae	pRDB2
<i>Pamponerus germanicus</i>	Diptera	Asilidae	pRDB3
<i>Dialineura anilis</i>	Diptera	Therevidae	pRDB3
<i>Thereva fulva</i>	Diptera	Therevidae	pRDB3
<i>Phthiria pulicaria</i>	Diptera	Bombyliidae	Notable B
<i>Drapetis setigera</i>	Diptera	Empididae	pRDB3
<i>Platypalpus excisus</i>	Diptera	Hybotidae	Notable B
<i>Tachytrechus ripicola</i>	Diptera	Dolichopodidae	RDB I
<i>Syntormon filiger</i>	Diptera	Dolichopodidae	Notable B
<i>Neurigona biflexa</i>	Diptera	Dolichopodidae	RDB I
<i>Tomosvaryella minima</i>	Diptera	Pipunculidae	RDB3
<i>Eudorylas zermattensis</i>	Diptera	Pipunculidae	Notable B
<i>Trupanea amoena</i>	Diptera	Tephritidae	pRDB2
<i>Tetanops myopinus</i>	Diptera	Ulidiidae	Notable B
<i>Chyliza vittata</i>	Diptera	Psilidae	Notable B
<i>Trixoscelis marginella</i>	Diptera	Heleomyzidae	Notable B
<i>Salticella fasciata</i>	Diptera	Sciomyzidae	RDB2
<i>Pherbellia knutsoni</i>	Diptera	Sciomyzidae	pRDB3
<i>Pherbellia nana</i>	Diptera	Sciomyzidae	Notable B
<i>Dichetophora finlandica</i>	Diptera	Sciomyzidae	pRDB3
<i>Aphanotrigonum meijerei</i>	Diptera	Chloropidae	RDB2
<i>Eutropha fulvifrons</i>	Diptera	Chloropidae	Notable B
<i>Exorista grandis</i>	Diptera	Tachinidae	
<i>Eurithia intermedia</i>	Diptera	Tachinidae	Notable B
<i>Estheria cristata</i>	Diptera	Tachinidae	
<i>Miltogramma germari</i>	Diptera	Sarcophagidae	RDB3
<i>Pterella grisea</i>	Diptera	Sarcophagidae	Notable B
<i>Macronychia griseola</i>	Diptera	Sarcophagidae	RDB3
<i>Delia flavogrisea</i>	Diptera	Anthomyiidae	pRDBK
<i>Delia tarsifimbria</i>	Diptera	Anthomyiidae	pRDBK
<i>Fannia latipalpis</i>	Diptera	Fanniidae	pRDBK
<i>Helina parcepilosa</i>	Diptera	Muscidae	pRDB2
<i>Helina pubescens</i>	Diptera	Muscidae	RDB3
<i>Helina quadrinotata</i>	Diptera	Muscidae	RDB3
<i>Spilogona litorea</i>	Diptera	Muscidae	RDB3

<i>Spilogona scutulata</i>	Diptera	Muscidae	pRDB3
<i>Neolimnophora virgo</i>	Diptera	Muscidae	RDB3
<i>Lispocephala rubricornis</i>	Diptera	Muscidae	pRDB3
<i>Coenosia atra</i>	Diptera	Muscidae	Notable B
<i>Coenosia flavimana</i>	Diptera	Muscidae	pRDB3
<i>Coenosia minutalis</i>	Diptera	Muscidae	Notable B
<i>Hedychridium cupreum</i>	Hymenoptera	Chrysididae	Notable B
<i>Chrysis fulgida*</i>	Hymenoptera	Chrysididae	RDB1
<i>Oxybelus argentatus</i>	Hymenoptera	Sphecidae	Notable A
<i>Oxybelus mandibularis</i>	Hymenoptera	Sphecidae	Notable A
<i>Mimumesa littoralis</i>	Hymenoptera	Sphecidae	RDB3
<i>Psen bicolor</i>	Hymenoptera	Sphecidae	RDB2
<i>Mimesa bruxellensis</i>	Hymenoptera	Sphecidae	Notable A
<i>Podalonia affinis</i>	Hymenoptera	Sphecidae	RDB3
<i>Colletes marginatus</i>	Hymenoptera	Colletidae	Notable A
<i>Colletes cunicularius</i>	Hymenoptera	Colletidae	RDB3
<i>Dasypoda altercator</i>	Hymenoptera	Melittidae	Notable B
<i>Stelis ornatula</i>	Hymenoptera	Megachilidae	RDB3
<i>Megachile dorsalis</i>	Hymenoptera	Megachilidae	Notable B
<i>Coelioxys mandibularis</i>	Hymenoptera	Megachilidae	RDB3
<i>Armadillidium album</i>	Isopoda	Armadillidiidae	Notable B
<i>Dactylochelifer latreillei</i>	Pseudoscorpiones	Cheliferidae	Notable B
<i>Haplodrassus dalmatensis*</i>	Araneae	Gnaphosidae	Notable B
<i>Agroeca dentigera</i>	Araneae	Liocranidae	RDB1
<i>Philodromus fallax</i>	Araneae	Philodromidae	Notable B
<i>Sitticus saltator</i>	Araneae	Salticidae	Notable B
<i>Synageles venator</i>	Araneae	Salticidae	Notable A
<i>Steatoda albomaculatus</i>	Araneae	Theridiidae	Notable B
<i>Mecopisthes peusi</i>	Araneae	Linyphiidae	Notable B



## Appendices

### Appendix 1. Dune sites affected by disrupted sand supply

SSSI Site name	Soft dune works	Hard coastal defence	Erosion /accretion	Quarrying/ sand moved	Military use
Merthyr Mawr Warren		(Ltd outside)	Net minor erosion	Quarrying until 1973 2 pipes	- 1970
Kenfig Pool & Dunes	Dredging offshore cont. Beach nourishment (c2002)	Haul road-along dune front	Stable-lack of accretion or erosion. Build-up of shingle ridge at top of beach	Excavated beach -1970	WW2
Margam Moors	Marram grass planting 1960s since C13th			Excavated sand pits/pools	
Crymlyn Burrows		Boulders River works		Pipe, Pool excavation	
Black Pill, Swansea	Sand trap fencing	River works			
Whiteford Burrows				Limited sand trapping 1930s	
Pennard valley	Sand trap fencing Marram grass planting				
Oxwich Bay				Excavated slack	WW2
Cwm Ivy marsh					
Pembrey Coast	Limited Sand trapping	Rock groynes (experimental)	Eroding (accreting)		Tanks 1926 -
Laugharne & Pendine	Beach nourishment?	Boulders Gabions			Tanks access rest.
Lydstep Head		Gabions Rock armouring			Tanks access restricted
Freshwater East cliffs					Tanks access restricted
Stackpole	Lake dam 1940s			Excavated sand until 1970	WW2
Castlemartin cliffs				Quarrying	Tanks
Broomhill Burrows	Sand trap fencing Enclosure			Quarrying.	

	fencing Marram planting				
Pen yr Ergyd		Gabions	Eroding		
Dyfi – Ynyslas	Sand trap fencing Exclosure fencing Marram planting	Wooden groynes and seawall at the south end of the system	Net accretion	Excavated sand WW2	WW2 (road)
Dyfi –north	Sand trap fencing Brashing Dumped materials	Boulders Rock armouring Slipway acting as groyne	Eroding- stable	Sand moved, Turf cutting	WW2
Morfa Harlech	Sand trap fencing Exclosure fencing	ER Cob (N of site)	Mobile		WW2
Morfa Dyffryn	Sand trap fencing Exclosure fencing Dumping materials	Boulders Limited sand trapping	Mobile		Airfield adj
Broadwater		Rock armouring Boulders River works		Farm quarry	WW2
Morfa Dinlle	Beach nourishment	Groyne			WW2
Morfa Bychan	Limited Sand trapping	Gabions Slipway acting as groyne			
Tywyn Aberffraw	Past works dredging		Mobile	Past sm. Excavated sand	Prob.W W2
Penrhynoedd Llangad					
Newborough Warren	Sand trap fencing Brashing	ER.cob	Low mobile erosion/accre tion		WW2 bombing rifle range
Llyn Maelog					
Glantraeth					
Coed y Gell/Morfa Du					
Beddmanarch- Cym				Excavated sand	
Gronant dunes	Sand trap	Rock groynes	Eroding-west	Pipe	WW2

	fencing Marram planting Beach nourishment	Boulders Proposed bund ER	& east end Stable		
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### *Appendix 2. Dune systems supporting forestry plantations in Wales*

These may affect management of the dunes (Pm), have an impact on hydrology (Ph), or cause seeding problems (Ps). Emboldened type indicates increased significance. CR denotes sites provisionally selected for conifer removal.

SSSI site name	Plantations and their impacts on conservation
Merthyr Mawr Warren	Pm
Margam Moors	Pm
Whiteford Burrows	Pm, Ph, CR
Cwm Ivy marsh	Ps
Pembrey Coast	<b>Pm</b> , Ph, CR
Stackpole	Pm
Morfa Harlech	Pm, CR
Newborough Warren	<b>Pm, Ph</b> , Ps CR

### *Appendix 3. Sites prioritized for scrub clearance*

SSSI site name	Native scrub	Sea buckthorn
Merthyr Mawr Warren	Scrub control	Approximately 60ha in 1996
Kenfig Pool & Dunes	Scrub control	Under tight control, almost absent by 2005)
Margam Moors		
Crymlyn Burrows	Scrub increasing	Minor problem
Black Pill, Swansea		
Whiteford Burrows		Significant problem
Pennard valley		Minor problem
Oxwich Bay	Scrub	
Cwm Ivy marsh		
Pembrey Coast	Scrub problem	Major problem
Laugharne & Pendine	Scrub problem	Major problem
Lydstep Head	Scrub control	Significant problem
Freshwater East cliffs	Scrub control	Significant problem
Stackpole	Scrub control	Significant problem
Castlemartin cliffs		Minor problem
Broomhill Burrows		

Pen yr Ergyd	Gorse control	
Dyfi - Ynyslas	Willow control	
Dyfi –north	Scrub	
Morfa Harlech	Willow control	
Morfa Dyffryn		
Broadwater		
Morfa Dinlle		
Morfa Bychan	Scrub	Minor problem
Tywyn Aberffraw	Gorse control late 1980s -minor scrub problem now	
Penrhynoedd Llangadwalader		
Newborough Warren		Minor problem
Llyn Maelog		
Glantraeth		
Coed y Gell/Morfa Du		
Beddmanarch-Cym		
Gronant dunes	Major scrub control	Minor problem

*Appendix 4. Dune sites selected for establishing or maintaining appropriate grazing*

<b>SSSI site name</b>	<b>Previous Grazing Assessment</b>
Merthyr Mawr Warren	Rabbits medium/high density
Kenfig Pool & Dunes	Sheep (N-part), Rabbits medium density (localised) Cattle (1960s)
Margam Moors	nil (1970s)
Crymlyn Burrows	Rabbits medium density
Black Pill, Swansea	nil
Whiteford Burrows	(Sheep), (Horses), Rabbits medium density
Pennard valley	Horses, Rabbits medium density
Oxwich Bay	Horses, Goats, Rabbits medium density
Cwm Ivy marsh	Rabbits high density
Pembrey Coast	nil (1970)
Laugharne & Pendine	Cattle (25% site?). Mostly ungrazed since WW2
Lydstep Head	Rabbits medium density?
Freshwater East cliffs	Rabbits medium density?
Stackpole	Cattle, Sheep, Horses, Rabbits medium density (Medieval walled rabbit warren)
Castlemartin cliffs	Cattle, Sheep, Rabbits medium density
Broomhill Burrows	Cattle, Sheep, Rabbits medium density (Medieval walled rabbit warren)
Pen yr Ergyd	Horses, Rabbits medium density

Dyfi -Ynyslas	Winter pony grazing (small part of system), Rabbits medium density
Dyfi –north	Cattle, Sheep, Rabbits medium density
Morfa Harlech	Cattle, Sheep, Rabbits medium density
Morfa Dyffryn	Cattle (part), Rabbits medium to high density
Broadwater	Cattle, Sheep, Rabbits medium density
Morfa Dinlle	Cattle, Sheep, Rabbits high density
Morfa Bychan	Cattle, Rabbits medium density
Tywyn Aberffraw	Long continuous history Cattle & Sheep until 1990s. (Cattle), Rabbits high density (rabbits farmed in the past)
Penrhynoedd Llangadwalader	Sheep, Rabbits medium density
Newborough Warren	Cattle, Horses, Soay Sheep, Sheep, Rabbits medium density (rabbits farmed C13)
Llyn Maelog	Rabbits medium density
Glantraeth	Cattle
Coed y Gell/Morfa Du	nil
Beddmanarch-Cym	Cattle
Gronant dunes	Rabbits medium density (1980s)

## References

Dargie, T. C. D. 1995. Sand Dune Vegetation Survey of Great Britain - a national inventory. Part 3: Wales. Joint Nature Conservation Committee, Peterborough, UK.

Houston, J.A. & Dargie, T.C.D. 2010. *A study to assess stakeholder support for implementing a programme of dune re-mobilization on selected dune systems in Wales*. CCW Contract Science. **936**. Countryside Council for Wales.

Howe, M. A., Knight, G. T., & Clee, C. 2010. The importance of coastal sand dunes for terrestrial invertebrates in Wales and the UK, with particular reference to aculeate Hymenoptera (bees, wasps & ants). *Journal of Coastal Conservation* 14:91-102.

Rhind, P. M. & Jones, P. S. 1999. The floristics and conservation status of sand-dune communities in Wales. *Journal of Coastal Conservation* 5: 31-42.

Rhind, P. M., Jones, R., Jones, M. L. M. 2008. Confronting the impact of dune stabilization and soil development on the conservation status of sand dune systems in Wales. Proceedings of the International Conference on Management and Restoration of Coastal Dunes, Santander, Spain (ICCD 2007). Universidad de Cantabria, pp143–152.