

European Community Directive  
on the Conservation of Natural Habitats  
and of Wild Fauna and Flora  
(92/43/EEC)

**Second Report by the United Kingdom under  
Article 17**

**on the implementation of the Directive  
from January 2001 to December 2006**

**Conservation status assessment for :**

**H2170: Dunes with *Salix repens* ssp. *argentea*  
(*Salicion arenariae*)**

Please note that this is a section of the report. For the complete report visit <http://www.jncc.gov.uk/article17>

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# H2170 Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)

*Audit trail compiled and edited by JNCC and the UK statutory nature conservation agencies Coastal Lead Coordination Network.*

This paper and accompanying appendices contain background information and data used to complete the standard EC reporting form (Annex D), following the methodology outlined in the commission document “Assessment, monitoring and reporting under Article 17 of the Habitats Directive, Explanatory Notes and Guidelines, Final Draft 5; October 2006”. The superscript numbers below cross-reference to the headings in the corresponding Annex D reporting form. This supporting information should be read in conjunction with the UK approach for habitats (see ‘Assessing Conservation Status: UK Approach’).

## 1. National-Biogeographic Level Information

### 1.1 General description & correspondence with NVC and other habitat types

Table 1.1.1 provides a summary description of H2170 and its relations with UK classifications.

Creeping willow is found on dunes throughout the UK. It grows predominantly in and around dune slacks, though on some sites it may spread up the drier ridges. Where dominant, it forms prominent, low scrubby growth. This habitat type comprises dunes or parts of dunes where *Salix repens* ssp. *argentea* is usually dominant and is associated with Yorkshire-fog *Holcus lanatus* and at times with the bryophytes *Campylium stellatum* and *Calliargon cuspidatum*. In the UK the predominant NVC type include:

SD16 *Salix repens* – *Holcus lanatus* dune slack community,

This type of vegetation marks the mature phase in the life cycle of calcareous dune slacks. When found with other wetland and dry dune vegetation it indicates that successional processes are still active and that the structure and function of the dune system are well-conserved. On most of the highest-quality sites this habitat type occurs alongside a number of others, particularly H2190 Humid dune slacks, calcareous and acidic fixed dune vegetation and, locally, dune heath.

Creeping willow is often found in dune slack vegetation, and the boundaries between H2170 Dunes with *Salix repens* ssp. *argentea* and H2190 Humid dune slacks are often diffuse and difficult to define on the ground. The examples that have been selected to represent the former habitat type in the UK sites series are those where creeping willow is usually dominant and forming prominent, low, scrubby growth (sometimes referred to as ‘hedgehog dunes’), and occurs along with Yorkshire-fog and at times the bryophytes *Campylium stellatum* and *Calliargon cuspidatum*. This type of vegetation tends to occur in and around mature slacks where there has been little or no sand movement for some time and where grazing is light. Creeping willow tends to grow most vigorously at the drier end of the spectrum of slack vegetation types and it is also mainly associated with calcareous dune sites. Most occurrences of *S. repens* ssp. *argentea* on dunes in Scotland have been allocated to H2190 Humid dune slacks. Only one site in Scotland, Invernaver, can be confidently allocated to Dunes with *Salix repens* ssp. *argentea*, because of the abundance of *Salix*. Elsewhere in the UK, this habitat type is of only local occurrence on most sites, Sefton Coast being exceptional in supporting a substantial area, with *S. repens* ssp. *argentea* extending out of the slacks onto the adjoining dry dunes.

Dunes with *Salix repens* ssp. *argentea* are widespread on the coasts of northern and western Europe. In the UK, H2170 Dunes with *Salix repens* ssp. *argentea* are widespread but rare, being estimated to cover much less than 1,000 ha. This habitat is best developed in Wales and on the west coast of England.

**Table 1.1.1** Summary description of habitat H2170 and its relations with UK vegetation/habitat classifications.

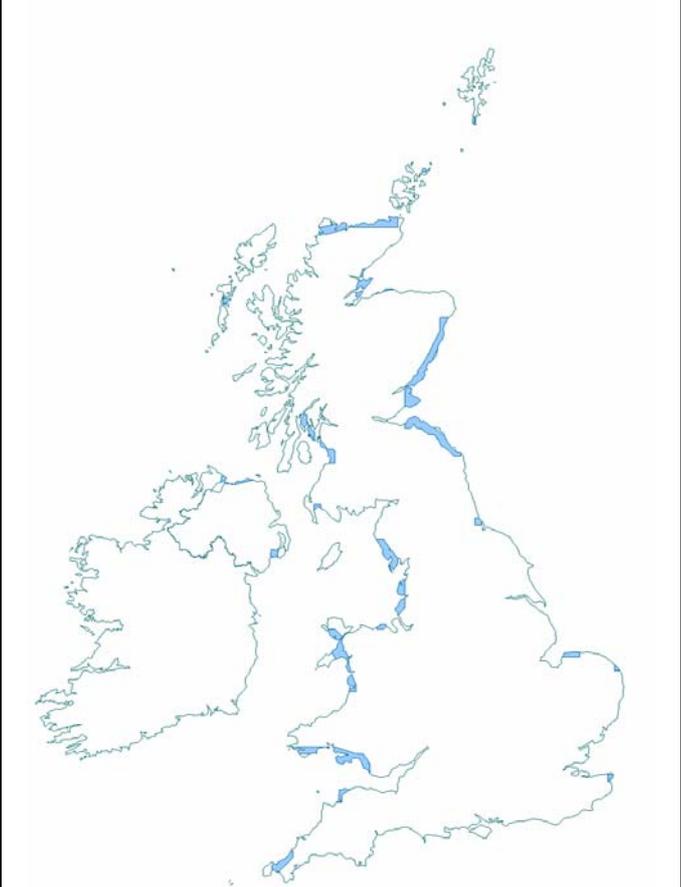
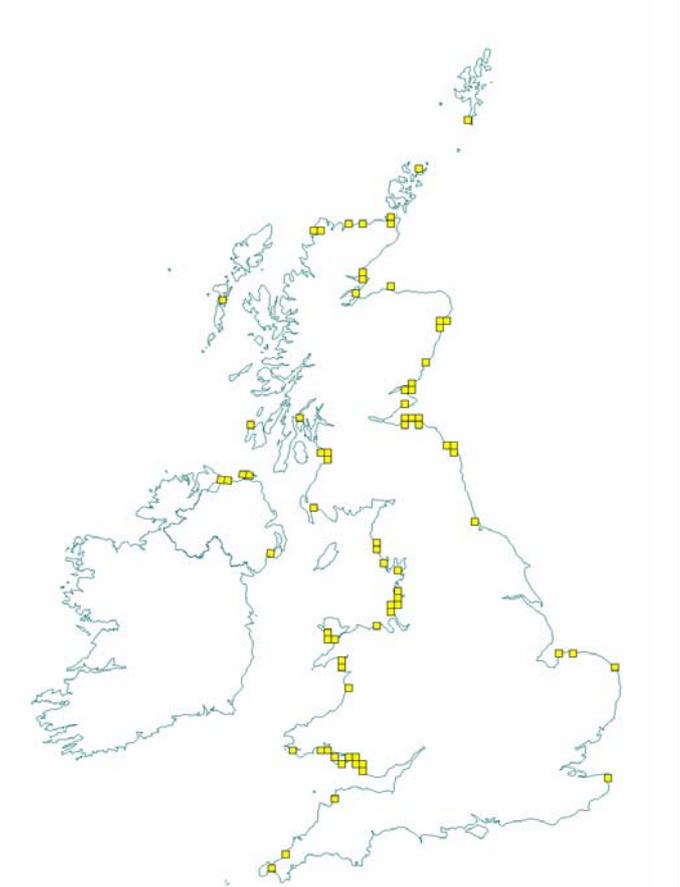
Classification	Correspondence with Annex I type	Comments
NVC	<ul style="list-style-type: none"> <li>SD16 <i>Salix repens</i> – <i>Holcus lanatus</i> dune slack community.</li> </ul>	<i>Salix repens</i> can be frequent and sometimes abundant in SD14 and SD15 communities. However, the associated ground flora indicates that these communities are on average wetter than the SD16 <i>Salix repens</i> - <i>Holcus lanatus</i> dune-slack community, which is characterised by constant and usually abundant <i>S. repens</i> . All SD14 and SD15 vegetation is included in Annex 1 habitat H2190 Humid dune slacks, whilst all SD16 vegetation is included in H2170 Dunes with <i>Salix repens</i> .
BAP priority habitat type	Coastal sand dune	Covers a much wider zone than H2170. Coastal sand dunes in the UK comprise the complete sand dune complex, including in addition embryo dunes, grey dunes, dune heath and dune slack communities.
EU Interpretation Manual	<p>1) <i>Salix repens</i> communities (<i>Salicion arenariae</i>), colonising wet dune slacks. Following the lowering of the ground water table or accumulation of drift sand, these communities may develop into mesophilous communities as the <i>Pyrolo-Salicetum</i> (with <i>Pyrola rotundifolia</i>, <i>Viola canina</i>, <i>Monotropa hypopitys</i>) or, into xerophilous <i>Salix</i> communities (with <i>Carlina vulgaris</i>, <i>Thalictrum minus</i>) or into <i>Salix repens</i> communities with <i>Mesobromion</i> elements.</p> <p>2) Plant species: <i>Salix repens</i> ssp. <i>argentea</i> (i.e. <i>Salix arenaria</i>).</p> <p>3) Corresponding categories United Kingdom classification : "SD16 <i>Salix repens</i>-<i>Holcus lanatus</i> dune slack". German classification : "1006b Kriechweiden-Teppiche der Dünen".</p> <p>4) This habitat forms mosaics with other dune slack vegetation containing <i>Salix arenaria</i> but which is rich in bryophytes and referable to the <i>Caricion davalliana</i> (16.33), as well as mosaics with dune grasslands and with thickets with <i>Rosa pimpinellifolia</i>. This habitat is often invaded by <i>Hippophae rhamnoides</i> and <i>Ligustrum vulgare</i>.</p>	
CSM reporting categories	Supralittoral sediment (Dunes, shingle and machair).	Covers a much wider zone than H2170. Includes all zones of sand dune: embryo, white dune, grey dune, dune heath and dune slack.

## 2. Range <sup>2.3</sup>

### 2.1 Current range

**Range surface area <sup>2.3.1.</sup>:** 787 km<sup>2</sup>  
**Date calculated <sup>2.3.2.</sup>:** May 2007  
**Quality of data <sup>2.3.3.</sup>:** Moderate

The surface area estimate was calculated within alpha hull software, using extent of occurrence as a proxy measure for range (see Map 2.1.1). The value of alpha was set at 25 km; the alpha hull software used to calculate the surface area of the range could only be clipped to a 10km strip width along the coast. The geomorphological and physical factors influencing the distribution of the habitats are likely to occur only within a far smaller distance of the coastline (at most 1km) and hence the area value has been reduced by a factor of 10 to give a more realistic value for the surface area of the range for these habitats.

Map 2.1.1 Habitat range map <sup>1.1</sup> for H2170	Map 2.1.2 Habitat distribution map <sup>1.2</sup> for H2170
	
<p>Range envelope shown in blue/grey shade in above map is a minimum convex polygon constructed using JNCC Alpha Shapes tool (see Technical Note I for details of methodology)</p>	<p>Each yellow square represents a 10x10km square of the National Grid and shows the known and/or predicted occurrence of this habitat                      10-km square count: 74</p>

See Section 7.1 for map data sources

Maps 2.1.1 and 2.1.2 show the range and distribution of H2170 in the UK. The map shows records for NVC community SD16 together with other sites where this habitat type is known to occur, including Special Areas of Conservation supporting this Annex I type. Although the map shows ‘Dunes with *Salix repens*’ to be widespread in the UK, it is much more frequently encountered on English and Welsh sand dunes than in Scotland. In addition, much of the resource is concentrated on a small number of sites – Braunton Burrows and the Sefton Coast in England, Newborough Warren in Wales, and Barry Links in southern Scotland. Elsewhere, generally, there is only a small area within each dune system.

The SD16 community that represents the H2170 habitat is the most abundant and widely recorded dune slack community in England and Wales. Furthermore, it occurs in a number of places on the Norfolk coast where other dune slack communities are rare (Radley 1994). However, all the east coast English sites contain only small areas of the H2170 habitat. *Salix repens* has three subspecies in the UK. The great majority of the *S. repens* occurring in dune slacks is the subspecies *argentea*. Elsewhere, on moors and heaths subspecies *repens* is typical, and in East Anglian fens subspecies *repens* is characteristic. It is worth noting that Stace (1997) only gives these different types the lower ‘variety’ status.

## 2.2 Trend in range since c.1994

<b>Trend in range</b> <sup>2.3.4</sup> :	<b>Stable</b>
<b>Trend magnitude</b> <sup>2.3.5</sup> :	<b>Not applicable</b>
<b>Trend period</b> <sup>2.3.6</sup> :	<b>1994-2006</b>
<b>Reasons for reported trend</b> <sup>2.3.7</sup> :	<b>Not applicable</b>

Although dune systems are naturally dynamic structures, their general locations have remained mostly stable over the long term. Nevertheless, internal dynamics caused by natural or anthropogenic factors can greatly influence the proportionate representation of constituent habitats, including especially all types of dune wetland. However, although there have been substantial losses of wetlands within dune systems (see section 3), there is no discernible decline in range for H2170 Dunes with *Salix repens* at either a UK or regional level. Even on the south and east coasts of England, where Dunes with *Salix repens* are few and far between, there have not been complete losses at any sites over the last 50 years leading to gaps in the range or in regional representation. The broad range of H2170 has remained stable since 1994.

## 2.3 Favourable reference range

**Favourable reference range**<sup>2.5.1</sup>: **787 km<sup>2</sup>**

Section 3.2.1.3 of ‘Assessing Conservation Status: UK Approach’ sets out how favourable reference range estimates for habitats have been determined in the UK. Based on this approach, the current surface area, 787 km<sup>2</sup>, has been set as the favourable reference area. Reasons for this are discussed below.

The range of H2170 Dunes with *Salix repens* is largely determined by physical and geomorphological processes. Coastal areas that support sand dunes are widely distributed around the UK coast where conditions are suitable – i.e. the presence of sufficient mobile sand to develop into a dune complex. Not all sites that develop dunes will contain wetlands within. An additional requirement is a water table that has the potential to reach the ground surface. Even then, H2170 Dunes with *Salix repens* may not develop if soil chemistry and hydrological regimes are not suitable. Gaps in the Actual Range map largely reflect where suitable natural conditions do not exist.

Despite the scarcity of suitable conditions for H2170 Dunes with *Salix repens* to develop, the 1994 range is considered to be sufficiently extensive and with adequate representation of the ecological variation. There is however a concern that the scarcity along the English coast may cause the habitat to be vulnerable to catastrophic events.

## 2.4 Conclusions on range

**Conclusion**<sup>2.6.i</sup>: **Favourable**

The current range of H2170 Dunes with *Salix repens* appears to be similar to that from the past although, due to substantial losses of the habitat over time, remaining areas are often smaller than in the past. These losses of area emphasise the need to maintain the current range which is considered to be the favourable reference range. The 1994, and, as the habitat range has been stable since, current range are considered to be viable and with sufficient representation of ecological variation.

### 3. Area <sup>2.4</sup>

#### 3.1 Current area

<b>Total UK extent <sup>2.4.1</sup>:</b>	<b>6.42km<sup>2</sup></b>
<b>Date of estimation <sup>2.4.2</sup>:</b>	<b>May 2007</b>
<b>Method <sup>2.4.3</sup>:</b>	<b>3 = ground based survey</b>
<b>Quality of data <sup>2.4.4</sup>:</b>	<b>Moderate</b>

Table 3.1.1 provides information on the area of H2170 in the UK. Comprehensive extent data are available from the Sand Dune Survey of Great Britain (1987-1990) and the subsequent Sand Dune Vegetation Survey of Scotland. The Sand Dune Database and other survey reports provide information on the NVC type SD16.

Much of the resource is concentrated on a small number of sites – Braunton Burrows (66ha) and the Sefton Coast (99ha) in England, Newborough Warren (97ha) in Wales, and Barry Links (99ha) in southern Scotland. Elsewhere, generally, there is only a very small area within each dune system. As such, it is highly vulnerable.

The SD16 community that represents the H2170 habitat is the most abundant and widely recorded dune slack community in England and Wales.

**Table 3.1.1** Area of H2170 in the UK.

	<b>Area (ha)</b>	<b>Method <sup>2.4.3</sup></b>	<b>Quality of data <sup>2.4.4</sup></b>
<b>England</b>	230	2	Moderate
<b>Scotland</b>	170	2	Moderate
<b>Wales</b>	230	2	Moderate
<b>Northern Ireland</b>	12	2	Moderate
<b>Total UK extent <sup>2.4.1</sup></b>	642	3	Moderate

Method used to estimate the habitat surface area: 1 = only or mostly based on expert opinion; 2 = based on remote sensing data; 3 = ground based survey. Only the most relevant class is given if more than one applies.

Quality of habitat surface area data: 'Good' e.g. based on extensive surveys; 'Moderate' e.g. based on partial data with some extrapolation; 'Poor' e.g. based on very incomplete data or on expert judgement

#### 3.2 Trend in area since c.1994

<b>Trend in area <sup>2.4.5</sup>:</b>	<b>Decreasing</b>
<b>Trend magnitude <sup>2.4.6</sup>:</b>	<b>Unknown</b>
<b>Trend period <sup>2.4.7</sup>:</b>	<b>1994-2006</b>
<b>Reasons for reported trend <sup>2.4.8</sup>:</b>	<b>3 – Direct human influence</b>
	<b>4 – Indirect anthropogenic or zoogenic influence</b>
	<b>5 – Natural processes</b>

Losses have occurred from the lowering of the water table even where dunes survive. Trends in climate change have resulted in some losses. For example, at Braunton Burrows a decline of 5% in effective rainfall since 1966 has resulted in a decline of about 0.5m in the groundwater level (Robins 2007). In addition, conifer plantations, surface drainage (on or adjacent to the dunes), and groundwater abstraction have all resulted in a lowering of the water table and less surface flooding at many sites – although the scale of these impacts in comparison to trends (or cycles) in climate is still controversial. Furthermore, in part due to these impacts, most dunes have become substantially more stable over the last 50 years.

Although these trends may, on some sites, have temporarily increased the area of the H2170 Dunes with *Salix repens* habitat at the expense of H2190 Humid dune slacks habitat, where these adverse impacts on

the water table continue, this latter habitat has given way to mesotrophic grassland or scrub woodland. As a consequence trend in area has been a decline which is still occurring.

### 3.3 Favourable reference area

**Favourable reference area<sup>2.5.2</sup>: 6.5 km<sup>2</sup>**

Section 3.2.2.3 of 'Assessing Conservation Status: UK Approach' sets out how favourable reference area estimates have been determined in the UK. Based on this approach, the favourable reference area has been identified as greater than the current extent, but not by a factor of more than 10%. Reasons for this are discussed below.

The area of H2170 Dunes with *Salix repens* is largely determined by physical and geomorphological processes. Coastal sites that support sand dunes are widely distributed around the UK coast where conditions are suitable – i.e. the presence of sufficient mobile sand to develop into a dune complex. Not all sites that develop dunes will contain H2170 Dunes with *Salix repens*. An additional requirement is a water table that has the potential to reach the ground surface. Gaps in the current range largely reflect where suitable natural conditions do not exist.

Hydrology is critical to the functioning of all these communities. Specific information for British dune slacks tends still to be anecdotal, but a provisional summary has been published in Davy et al. (2006) and is reproduced here.

**Table 3.3.1** Water requirements for H2170 NVC types

Annex 1 habitat code	NVC	NVC Name	Approximate winter water table depth (cm)*	Approximate summer water table depth (cm)
H2190	SD13	<i>Sagina nodosa</i> - <i>Bryum pseudotriquetrum</i> community	+2	-60 to -160
	SD14	<i>Salix repens</i> - <i>Campylium stellatum</i> community	+10 to +50	-10 to -60
	SD15	<i>Salix repens</i> - <i>Calliergon cuspidatum</i> community	+5	-40
	SD17	<i>Potentilla anserina</i> - <i>Carex nigra</i> community	+50	Unknown
H2170	SD16	<i>Salix repens</i> - <i>Holcus lanatus</i> community	0	-50 to -200

\* Positive values indicate water tables above the soil surface i.e. flooding.

Within dunes where there is potential for H2170 Dunes with *Salix repens*, currently a range of human activities have reduced the potential area that these slacks could cover. These include drainage, abstraction, forestry plantations, erosion control measures, removal or reduction of grazing. These activities have a further adverse affect on H2170 Dunes with *Salix repens* by inceasing dune stabilisation, soil formation and therefore succession away from slack vegetation, resulting in critically small remaining areas in some dune systems.

The habitat only covers 642 ha, which is rather scarce, especially as it is found all around the British coast. This scarcity is not a natural phenomenon but the consequence of a decline due to past reclamation and development. For example, about 40% of the original Sefton coast dune area has been lost to development, mostly since the mid-1800s (Smith, 1999). It is reasonable to assume that there were H2190 Humid dune slacks in these lost areas.

Much of the resource is concentrated on a small number of sites – Braunton Burrows (66ha) and the Sefton Coast (99ha) in England, Newborough Warren (97ha) in Wales, and Barry Links (99ha) in

southern Scotland. Elsewhere, generally, there is only a very small area within each dune system. As such, it is highly vulnerable.

The scarcity of suitable conditions for H2170 Dunes with *Salix repens* to develop and the critically small areas of H2170 Dunes with *Salix repens* currently in some dune systems are also of grave concern. Not only is the habitat made of isolated patches within its range, but these can be so small as to induce doubt regarding their viability. This could lead to total losses in area in some sites. This vulnerability is compounded by the fact that restoration requires modifying the water table and allowing remobilisation of the whole dune system on which these communities depend. The range is considered to be unviable although it is not possible to determine if it is more than 10% below the favourable reference range.

### 3.4 Conclusions on area covered by habitat

#### Conclusion<sup>2.6.ii</sup>: Unfavourable – Inadequate and deteriorating

H2170 Dunes with *Salix repens* is a rare and vulnerable community, much of which is concentrated on sites with only very small areas on most other dune systems. There have also been substantial losses in the past, and currently losses are still occurring. The area is considered to be unviable although assessing if it is more than 10% below the favourable reference area has not been possible.

## 4. Specific Structures and Functions <sup>(including typical species)</sup>

### 4.1 Main pressures <sup>2.4.10</sup>

Both human activities and changes in climate can rapidly affect humid dune slacks. And, in practice, this community is under great pressure from falling water tables, combined with increasing stabilisation of dunes, under-grazing and lack of remedial action (scrub/tree clearance).

The factors affecting coastal sand dunes are covered in the *Habitat Action Plan for Coastal sand dunes* (UKBAP website). The main pressures affecting humid dune slacks are listed below. The related EC codes are shown in brackets.

- Falling water tables (**853 Management of water levels, 920 Drying out**)

Dune slacks support characteristic communities dependent on a seasonally high water table, including the formation of temporary or even permanent ponds. There may be considerable variation in the behaviour of the water table from year to year, resulting in a stressed ecosystem where only specialised species can survive. However in some dune systems with important slacks, a long term fall in the water table has led to loss of the specialist slack flora and invasion by coarse vegetation and scrub. While unusually dry summers may have contributed to this problem, the long-term causes are believed to be local extraction of water and/or drainage of adjacent land used for agriculture or housing. The H2170 Dunes with *Salix repens* habitat is critically dependent on continuity of appropriate dune hydrology – maintaining both an adequate groundwater level and annual fluctuations. A new typology of dune slacks has been proposed (Davy *et al.*, 2006) based on hydrological functioning: more work still needs to be done to relate these dune slack hydrological types to the occurrence of H2170 Dunes with *Salix repens* (SD16) as it does for other dune slack ‘SD’ communities. However, in their review of dune slack habitats, Davy *et al.* concluded that all ‘SD’ dune slack vegetation is highly sensitive to changes in hydrological regime. Nevertheless, it is possible that H2170 Dunes with *Salix repens* habitat has suffered less than other dune slack communities due to them characteristically occurring as a late successional community of areas that are only transiently flooded. Similarly, H2170 Dunes with *Salix repens* are likely to be at least partially buffered from human-induced changes to the water table in the high rainfall areas of the north and west of the UK.

Although flooding is not a controlling factor of this community, hydrology is still critical to the functioning of this community. More work needs to be done to clarify the hydrological regime(s) that

result in this community, but some work suggests that the water table is typically 50-200cm below the ground surface in summer, and that flooding is only transient in winter (Ranwell 1972 and Jones 1993). Lowering of water tables in dunes is widely reported from around England and Wales, and to a lesser extent in Scotland. This has resulted in adverse impacts on H2170. Causes of falling water tables include drainage, water abstraction, and forestry plantations. These activities have a further adverse affect on H2170 Dunes with *Salix repens* by increasing dune stabilisation, soil formation and therefore succession away from slack vegetation, resulting in critically small remaining areas in some dune systems.

- **Grazing (140 Grazing)**

In the absence of human interference, most stable dunes, with the exception of those experiencing severe exposure, would develop into scrub and woodland. The preponderance of grassland and heath vegetation on British dunes is due to a long history of grazing by livestock. Continued grazing is normally necessary to maintain the typical fixed dune communities, but over-grazing, particularly when combined with the provision of imported feedstuffs, can have damaging effects. A more widespread problem is under-grazing, leading to invasion by coarse grasses and scrub, though rabbits are locally effective in maintaining a short turf. Parts of some stabilised dune systems have been entirely converted to agricultural use, resulting in almost total loss of the conservation interest. Undergrazing and lack of remedial action (scrub/tree clearance) reinforce the adverse impacts of falling water tables and increasing dune stabilisation but, in practice, they are subsidiary pressures.

As flooding does not represent a significant disturbance, successional development is probably inhibited by livestock and rabbit grazing. Recorded reductions in grazing (livestock and rabbits) therefore probably have had a larger proportional affect on this habitat than on its related H2190 Humid dune slacks. By itself and in combination with reductions in water table, this has led to successional changes, including an increase in broad-leaved grasses like *Dactylis glomerata* and *Arrhenatherum elatius* (indicative of a move to drier MG grassland) and frequently shrubs and trees such as bushy *Salix* species, hawthorn and birch.

- **Forestry (162 Artificial planting)**

Afforestation of dunes is not as prevalent in Britain as it is in parts of continental Europe, but in a few locations it has had a major effect on large areas of dune landscape. Some sites hold large conifer plantations which have the effect of suppressing the dune vegetation communities and lowering the water table. However, both routine fellings and permanent removal of conifers have shown that vegetation close to the original can be restored in a relatively short time.

- **Recreation (622 walking, horse riding and non-motorised vehicles, 623 motorised vehicles)**

Recreation is a major land use on sand dunes. Many dune systems are used extensively by holiday-makers, mostly on foot but also for parking cars and in some cases for driving four-wheel-drive vehicles or motorcycles. Moderate pressure by pedestrians may cause little damage, and may even help to counteract the effects of abandonment of grazing. However, excessive pedestrian use, as on routes between car parks and beaches, and vehicular use in particular, have caused unacceptable erosion on many dune sites. Many dune systems also support one or more golf courses. Here much of the original vegetation may be retained in the rough, but the communities of the fairways, and particularly the greens and tees, are often severely modified by mowing, fertilising and re-seeding. Fragmentation of dune systems by golf courses makes grazing management much more difficult.

- **Sea defences and stabilisation (871 sea defence or coast protection works)**

Many dune systems are affected by sea defence works or artificial stabilisation measures such as sand fencing and marram planting. These practices are particularly prevalent on the more developed coastlines where drifting sand may be perceived as a threat to urban or holiday developments. While carefully applied dune management measures can help to counteract severe erosion which may threaten the existence of a dune, engineered defence systems usually reduce the biodiversity inherent in the natural

dynamism of dune systems, and may cause sediment starvation down-drift. UK dunes as a whole suffer from over-stabilisation and poor representation of the mobile phases.

- Beach management (**302 removal of beach material, 622 walking, horse riding and non-motorised vehicles, 623 motorised vehicles**)

The seaward accretion of dune systems takes place through the accumulation of wind-blown sand caught by plants or debris along the driftline; the initial accumulations are colonised by pioneer plant species and form embryo dunes. On some heavily used beaches this process is inhibited by pressure of pedestrian or vehicular traffic, or by beach cleaning using mechanical methods, where the organic nuclei for sand deposition may be removed. These factors may remove the minor obstacles which would catch the sand initially, or destroy the embryo dunes at an early stage in their formation. In either case a dune system in a location where the physical conditions exist for accretion may actually be static or eroding.

- Erosion and progradation (**900 erosion**)

Unless artificially constrained, the seaward edges of sand dunes can be a highly mobile feature, though there is a natural trend to greater stability further inland. Very few dune systems are in overall equilibrium, and a majority of those in the UK demonstrate net erosion rather than net progradation; insufficient sand supply is frequently the underlying cause. There is no particular geographical distribution of either trend, both normally being present along any one stretch of coastline, and often within individual sites. Changes may be cyclical, both seasonally and over longer periods of time. Landward movement of mobile dunes often entails loss of fixed dune and dune heath habitat, as the latter are usually stable, or retreat may be impeded by development; in a few cases dune systems may move inland where not artificially constrained. The net loss of dune habitat in England to erosion has been estimated as not more than 2% of the resource over the next 20 years.

- Other human influences (**302 removal of beach material, 400 Urbanised areas, human habitation, 410 Industrial or commercial areas, 422 disposal of industrial waste, 421 disposal of household waste**)

Sand dunes have also been affected in the past by housing developments, industrial development, waste tips on or adjacent to them, fly tipping and sand extraction. Indirect effects on dunes include atmospheric nutrient deposition, and coastal squeeze due to rising sea levels and increased storminess. The potential for dredging and marine aggregate extraction, through the disruption of coastal processes, to have cumulative and long-term effects on sand dunes is an area for further investigation.

- Air pollution (**702 air pollution**)

Nutrient deposition also needs to be considered. It is suspected that nutrient deposition on many sand dunes is already above their critical threshold for impacts on vegetation (Jones *et al* 2002, 2004, 2005). There is no certainty that there will be a decline in the foreseeable future. The consequence of this for H2190 Humid dune slacks is the tendency to a speeded up succession away from dune slack vegetation.

## 4.2 Current condition

### 4.2.1 Common Standards Monitoring condition assessments

Condition assessments based on Common Standards Monitoring (see <http://www.jncc.gov.uk/page-2199>) provide a means to assess the structure and functioning of H2170 in the UK. The following attributes were examined for all CSM assessments relevant to the habitat:

Structure and function are critical parts of the condition assessment using CSM methods for designated sites. The H2170 Dunes with *Salix repens* (SD16) CSM attributes include:

Vegetation structure: condition of *Salix repens*

Vegetation structure: bare ground

Vegetation composition: typical species

Vegetation composition: negative indicator species

Vegetation composition: cover of broad-leaved grasses

Vegetation composition: scrub and trees

The sites selected as SACs are for the most part the largest examples of this habitat type, representing the range of variation of the habitat, with good structure and function, and which support a well-developed succession to other dune slack communities. Most have transitions to other high-quality habitat. Reflecting the impact of the adverse pressures on H2170 Dunes with *Salix repens* described above, 99% of SAC condition assessments for H2170 are currently classed as Unfavourable.

### SAC condition assessments

Table 4.2.1 and Map 4.2.1 summarise the Common Standards Monitoring condition assessments for UK SACs supporting habitat H2170. These data were collated in January 2007. The maps give an impression of the overall spread of where Unfavourable and Favourable sites exist (summary statistics for the map are given in Section 7.2). The combined assessments show that of the SACs assessed:

- 99% of the area and 85% of the number of assessments was Unfavourable;
- at least 71% of the total UK habitat area was in Unfavourable condition.

### SSSI/ASSI condition assessments

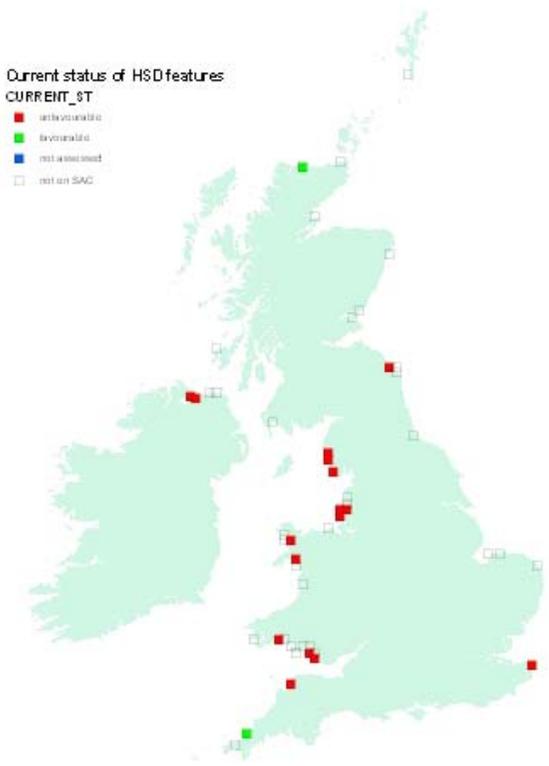
SSSI/ASSIs Common Standards Monitoring condition assessments are not relevant as most or all the resource is on SACs.

**Table 4.2.1** Common Standards Monitoring condition assessment results for UK SACs supporting H2170. See notes below table for details. Information on the coverage of these results is given in Section 7.2.

Condition	Condition sub-categories	Area (ha)	Number of site features
Unfavourable	Declining	244	4
	No change	39	2
	Unclassified	11	1
	Recovering	161	4
	Total	455	11
	<i>% of all assessments</i>	<b>99%</b>	<b>85%</b>
	<i>% of total UK resource</i>	<b>71%</b>	<b>unknown</b>
Favourable	Maintained	02	1
	Recovered		
	Unclassified	01	1
	Total	03	2
	<i>% of all assessments</i>	<b>1%</b>	<b>15%</b>
	<i>% of total UK resource</i>	<b>0%</b>	<b>unknown</b>

#### Notes

1. Data on features that have been partly-destroyed have been excluded from this table because they are not relevant to the consideration of present condition.
2. The data included are from CSM assessments carried out between April 1998 and December 2006. NB: these include additional and some up-date data from those used in the six year report produced by JNCC. (Williams, J.M., ed. 2006. *Common Standards Monitoring for Designated Sites: First Six Year Report*. Peterborough, JNCC)
3. Only assessments made for qualifying interest features on SAC have been included in this analysis.
4. Area figures for CSM assessments have been calculated using the data presented on the standard Natura 2000 data forms submitted to the EU.

Current Condition of H2170 based on Common Standard Monitoring condition assessments (See Sections 4.2 and 7.2 for further information)		
<b>Map 4.2.1</b> SAC assessments	<b>Map 4.2.2</b> Assessments strongly indicative of the condition on SSSI/ASSIs	<b>Map 4.2.3</b> Assessments weakly indicative of the condition on SSSI/ASSIs
	<p style="text-align: center;">Not applicable</p>	<p style="text-align: center;">Not applicable</p>
<p><b>Key</b>  <u>Red = Unfavourable</u>, i.e. the square contains at least one SAC where this habitat feature is present and has been judged to be Unfavourable  <u>Green = Favourable</u>, i.e. the square contains at least one SAC where this habitat feature is present and has been assessed as Favourable but there are no Unfavourable SAC features  <u>Blue = SAC not assessed</u>, i.e. the square contains at least one SAC supporting this habitat feature but no assessment has been reported  <u>Transparent = SAC feature not present</u>, i.e. the square does not</p>	<p><b>Key*</b>  <u>Green</u> – 80 – 100% of assessed features on 10km square are Favourable  <u>Yellow</u> - 50 – 80% of assessed features on 10km square are Favourable  <u>Orange</u> - 20 – 50% of assessed features on 10km square are Favourable  <u>Red</u> - 0 – 20% of assessed features on 10km square are Favourable            *This is the same key as was used for JNCC CSM Report 2006</p>	

contain any SAC features of this habitat type	
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### 4.3 Typical species

**Typical species<sup>2.5.3</sup>:** None used  
**Typical species assessment<sup>2.5.4</sup>:** Not applicable

No species are particularly faithful to the habitat or to the main related sand dune community type (SD16) within the NVC, so available trend data at the UK-level is not particularly meaningful and has not been utilised here.

**Table 4.3.1** Trends and faithfulness of selected typical species for H2170

Typical species	Faithfulness to habitat H2170 (based on analysis of NVC synoptic tables)	Trend over last 25 years from BSBI atlas – based on change in 10 km square occupancy across UK (see <a href="http://www.jncc.gov.uk/page-3254">http://www.jncc.gov.uk/page-3254</a> )
<i>Epipactis helleborine</i>	Low	Significant increase, but <25% in 25 years
<i>Erigeron acer</i>	Very low	Significant increase, but <25% in 25 years
<i>Salix repens</i>	Very low	Significant increase, but <25% in 25 years
<i>Rubus caesius</i>	Very low	Significant increase, but <25% in 25 years
<i>Epipactis palustris</i>	Very low	Significant decline, but <25% in 25 years

This community is recognised by the frequency of *Salix repens* combined with a relatively low diversity of herbs and grasses characteristic of, at most, damp ground. *Salix repens* is generally dominant in a low bushy canopy. H2170 Dunes with *Salix repens* is characteristic of older dry slacks, at the dry end of succession in dune slack vegetation (Rodwell 2000), and is less dependent on base-rich soils or water than earlier succession dune slack communities.

### 4.4 Conclusions on specific structures and functions (including typical species)

**Conclusion<sup>2.6.iii</sup>:** Unfavourable – Bad and deteriorating

The EC Guidance states that where “more than 25% of the area of the habitat is Unfavourable as regards its specific structures and functions”, the conclusion should be Unfavourable – Bad. In the UK this was generally taken to mean that more than 25% of the habitat area in Unfavourable condition.

H2170 Dunes with *Salix repens* is a rare and vulnerable habitat, much of which is concentrated on a small number of sites with only very small areas on most other dune systems. There have also been substantial losses in the past, and currently losses are still occurring due to falling water tables, dune stabilisation, under-grazing and scrub encroachment. SAC condition assessments for H2190 show that, in terms of area, 99% are classed as Unfavourable, which represents 71% of the total UK resource. About 53% of the area assessed, and thus 38% of the overall resource, is classed as declining.

## 5. Future Prospects

### 5.1 Main factors affecting the habitat

#### 5.1.1 Conservation measures

- Protection within designated sites

Around 71% of the resource of H2170 lies within SACs with management measures specifically aimed at maintaining and enhancing the features for which they are designated, and to address some of the pressures listed within section 4.1 and the future threats listed in section 5.1.2. A significant proportion of the resource of this habitat also lies within the SSSI/ ASSI series where similar management measures are in place.

- UK BAP

The habitat is covered by the *Coastal sand dunes* action plan under the UK Biodiversity Action Plan (see <http://www.ukbap.org.uk>), as well as under country and local biodiversity action plans and strategies, with targets to maintain, improve, restore and expand the resource.

Where loss of the H2170 Dunes with *Salix repens* community has been caused by drying out of the slack and/or progression to wet woodland, the area can be increased directly by reversing the fall in water tables (if anthropogenic) and/or the removal of trees and scrub combined with follow-up grazing management. It is also possible to “chase the water table down” by excavation or scraping to an appropriate depth within areas that have dried out. This work is expensive and is likely to remain dependent on agri-environment funding for the foreseeable future. However, if the current trend of falling water tables is maintained (and not reversed by changes in climate), appropriate scrub clearance and grazing restoration and maintenance management will not be sufficient to reverse the trend of declining extent and quality of the ‘Humid due slacks’ community.

Where loss of dune wetlands has been part of a wider loss of whole areas of dune systems, their re-creation is intricately bound up with the re-creation of the wider dune system. Scope for this is probably greatest in situations where agricultural improvements have been made on the landward side of a number of dune systems. In addition, where plantations have been planted in the past directly on dune slacks (a significant impact on a number of key dune systems), often following drainage, removal of the trees combined with rehabilitation of the integrity of the hydrology would make a substantial contribution to increasing the area of this scarce and vulnerable H2170 Dunes with *Salix repens* community.

In the longer term, remobilisation of dune systems would allow a readjustment of ground levels to lower water tables and hence the establishment of new dune slack successions – if the current trend of falling water tables is maintained. However, few dune systems are now unconstrained by infrastructure and other land uses (eg. golf courses and woodlands), either within the dune system or along the landward fringe. There would be strong objections to the need for relocation if dunes were to be remobilised, as has already been found where plantation felling has been proposed (e.g. Sefton coast and Newborough Warren).

There are therefore enormous challenges to maintaining the very small resource of ecologically functioning H2170 Dunes with *Salix repens* through the current period of continuing dune stability. Davy *et al.* (2006) have reviewed current understanding of dune slack hydrology, and establishing a “new conceptual model for dune slack hydrology, based on a water balance approach”. The author advocates relying on experience from other European countries (the Netherlands, Denmark, Germany...) for a better understanding of British dune slacks.

### 5.1.2 Main future threats<sup>2.4.11</sup>

The most obvious major future threats to H2170 are listed below, several of which are referred to in Section 4.1. The related EC codes are shown in brackets.

- Climate change (900 erosion, 920 Drying out)

Based on the literature review (Technical Note IV) climate change is considered a major threat to the future condition of this habitat especially in the long term. Climate change and its impacts on dune hydrology are probably critical to the future of H2170 Dunes with *Salix repens*. Climate is predicted to get drier, with rainfall more concentrated in the winter with longer droughts in the summer. These trends are potentially severe but difficult to predict given our current lack of sufficient knowledge of the hydrological functioning of even the key dune systems for H2170 Dunes with *Salix repens* – as well as the range of predictions for future climate. Modelling work on the Ainsdale Dunes National Nature Reserve part of the Sefton coast suggests that there will be a significant decline in water tables under all

future climate predictions (Clarke & Sanitwong-Na-Ayutthaya 2006) – increasing the already severe pressures on dune slacks. [The more extreme predictions, though, would lead to sufficient summer drought to kill dune vegetation allowing dunes to remobilise.] However, work at Newborough Warren is more equivocal (Hollingham 2006). Some of this difference seems to be explained in part by different predictions of the future pattern of local rainfall and its impact on water tables. It is becoming clear that reduced rainfall in recent years is having a significant effect on dune water tables and hence having an adverse impact on H2170 Dunes with *Salix repens*. For example, at Braunton Burrows a decline of 5% in effective rainfall since 1966 has resulted in a decline of at least 0.5m in the groundwater level (Robins 2007).

However, there is a high degree of uncertainty in defining future climate threats on habitats and species due to uncertainty in: future greenhouse gas emissions; the consequential changes in climatic features (for instance temperature, precipitation CO<sub>2</sub> concentrations); the responses of habitats and species to these changes (for instance location, phenology, community structure) and the role of other socio-economic drivers of environmental change. The scale of change in habitats and species as a result of climate change will vary across ecosystems. Small changes in the climate are more likely to have a substantial impact on habitats and species which exist within a narrow range of environmental conditions. The future impacts of climate change on UK biodiversity will be exacerbated when coupled with other drivers of environmental change

- **Falling water tables (853 Management of water levels, 920 Drying out)**

It therefore becomes critical to address other reasons for falling water tables. More work is required to better understand the hydrological regimes of all sand dune systems in the UK, but any artificial drainage within and adjacent to dune systems is highly likely to be having a negative effect on dune hydrology and hence on dune slacks. The evidence is less clear-cut for the impact of plantations on dune water tables. Even if scientific agreement can be reached over the degree of water table impact exerted by plantations, there will still continue to be significant public opposition to plantation clearance. In addition, abstractions into dune groundwater will intensify this draw-down, even if only in localised areas. Future drier summers are likely to increase the demand for irrigation of golf courses and other human developments and, depending on how they source this water, there may be increased demand for abstraction.

- **Dune stabilisation (990 Other natural processes, 950 Biocenotic evolution)**

Over the longer term, the functioning of dune slacks (including H2170 Dunes with *Salix repens*) is probably dependent on periodic remobilisation of significant portions of dune systems. Evidence of buried soil horizons at Newborough Warren suggests a major remobilisation there about every 200 years. At many other dune systems, we are currently observing a process of maturing and stabilisation following major remobilisation during the 1940s as a consequence of military training.

- **Air pollution (702 air pollution)**

Nutrient deposition also needs to be considered. It is suspected that nutrient deposition on many sand dunes is already above their critical threshold for impacts on vegetation (Jones et al 2002, 2004, 2005). There is no certainty that there will be a decline in the foreseeable future. The consequence of this for H2170 Dunes with *Salix repens* is the tendency to a speeded up succession away from dune slack vegetation.

- **Undergrazing and scrub encroachment (140 Grazing)**

Lack of appropriate grazing regimes and the subsequent development of scrubs contribute to the stabilisation of the dune system, which is not Favourable to H2170.

- **Habitat fragmentation (990 Other natural processes)**

The fragmented nature of the remaining resource and the frequently small size of habitat patches mean that localised extinctions become more likely on some sites.

## 5.2 Future condition (as regards range, area covered and specific structures and functions)

### 5.2.1 Common Standards Monitoring condition assessments

The Common Standards Monitoring condition assessments reported in Sections 4.2.1-2 provide a basis to predict the potential future condition of H2170 in the UK. This involved treating all assessments currently identified as either Favourable or Unfavourable recovering as future-Favourable: remaining categories were treated as future-Unfavourable – see Table 5.2.1.1. There are a number of caveats to this approach, which are set out beneath this table.

#### SAC condition assessments

Table 5.2.1 and Map 5.2.1 summarise the predicted potential future condition of H2170 on UK SACs. This is based on the approach described above. The maps give an impression of the overall spread of where future-Unfavourable and future-Favourable sites are predicted to occur (summary statistics for the map are given in Section 7.2). The combined assessments show that of the SACs assessed:

- 36% of the area and 46% of the number of assessments fall within the future-Favourable category;
- at least 26% of the total UK habitat area falls within the future-Favourable category.

**Table 5.2.1** Predicted future condition of UK SACs supporting H2170 based on current Common Standards Monitoring condition assessments. See notes below table for details. Information on the coverage of these results is given in Section 7.2.

Future condition	Present condition	Area (ha)	Number of site features
<b>Future-Unfavourable</b>	Unfavourable declining	244	4
	Unfavourable no change	39	2
	Unfavourable unclassified	11	1
	Total	<b>294</b>	<b>7</b>
	<i>% of assessments</i>	<b>64%</b>	<b>54%</b>
	<i>% of total UK extent</i>	<b>46%</b>	<b>Unknown</b>
<b>Future-Favourable</b>	Favourable maintained	02	1
	Favourable recovered		
	Unfavourable recovering	161	4
	Favourable unclassified	01	1
	Total	164	6
	<i>% of assessments</i>	<b>36%</b>	<b>46%</b>
	<i>% of total extent</i>	<b>26%</b>	<b>Unknown</b>

Note that the scenario presented above is based on the same information as used to construct the Table in section 4.1. It is based on the following premises:

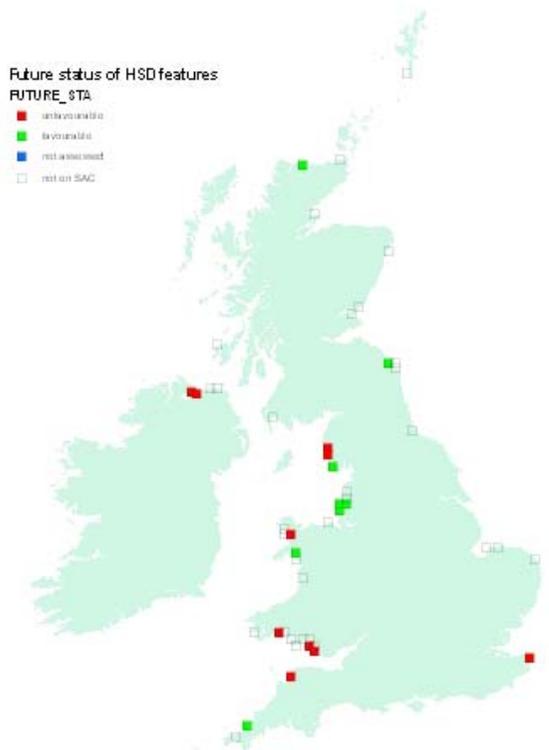
- the Unfavourable-recovering condition assessments will at some point in the future become Favourable.
- all Unfavourable-unclassified sites will remain unfavourable, which is probably overly pessimistic;
- sympathetic management will be sustained on sites already classified as Favourable and these will not be seriously damaged by any unforeseen events.

**IMPORTANT NOTE:** we do not have information on the timescale of the predicted recovery, which may be influenced by many past, natural and human related factors. A sustained, sympathetic management regime is more likely to result in 'Favourable' condition being attained.

#### SSSI/ASSI condition assessments

SSSI/ASSIs Common Standards Monitoring condition assessments are not relevant as most or all the resource is on SACs.

**Predicted Future Condition of H2170 based on Common Standard Monitoring condition assessments** (See Sections 5.2 and 7.2 for further information on these maps)

Map 5.2.1 SAC assessments	Map 5.2.2 Assessments strongly indicative of the condition on SSSI/ASSIs	Map 5.2.3 Assessments weakly indicative of the condition on SSSI/ASSIs
	<p>Not applicable</p>	<p>Not applicable</p>

**Key**  
Red = future-Unfavourable, i.e. the square contains one or more SACs where this habitat feature is present and has been predicted to be future-Unfavourable  
Green = future-Favourable, i.e. the square contains at least one SAC where this habitat feature is present and has been predicted to be future-Favourable  
Blue = SAC not assessed, i.e. the square contains at least one SAC supporting this habitat feature but no assessment has been reported  
Transparent = SAC feature not present, i.e. the square does not contain any SAC features of this habitat type

**Key\***  
Green – 80 – 100% of assessed features on 10km square are Favourable  
Yellow - 50 – 80% of assessed features on 10km square are Favourable  
Orange - 20 – 50% of assessed features on 10km square are Favourable  
Red - 0 – 20% of assessed features on 10km square are Favourable  
 \*This is the same key as was used for JNCC CSM Report 2006

### 5.3 Conclusions on future prospects (as regards range, area covered and specific structures and functions)

**Conclusion<sup>2.6.iv</sup>:** **Unfavourable – Bad and deteriorating**

The EC Guidance states that where “habitat prospects are bad, with severe impacts from threats expected and long-term viability not assured”, the judgement should be Unfavourable – Bad. In the UK, this was generally taken to mean that habitat range and/or area are in decline, and/or less than 75% of the habitat area is likely to be in Favourable condition in 12-15 years.

The key adverse pressures that have reduced H2170 Dunes with *Salix repens* to their current fragmented and vulnerable state – falling water tables and increasing dune stability – are likely to continue to threaten this habitat into the future. Scrub clearance and more effective grazing may ameliorate, but not reverse, these trends. This is reflected in assessment of future predicted condition of SACs supporting H2170 habitat, where 64% of the resource is predicted to remain in Unfavourable condition, which represents 46% of the total UK resource. About 53% of the area assessed, and thus 38% of the overall resource, is expected to continue to decline. The UK BAP, working towards enhancing future viability, has targets to bring the dune systems into Favourable or recovering condition by 2010 while maintaining the current extent. Despite progress already made and some additional recovery once further conservation measures are put into place, the expectation is that more than 25% of the habitat will be in Unfavourable condition in the next 10-15 years.

## 6. Overall Conclusions and Judgements on Conservation Status

**Conclusion<sup>2.6</sup>:** **Unfavourable – Bad and deteriorating**

On the basis of the Structure and Function and Future Prospects assessments, the overall conclusion for this habitat feature is Unfavourable – Bad.

**Table 6.1** Summary of overall conclusions and judgements

Parameter	Judgement	Grounds for Judgement	Confidence in judgement*
<b>Range</b>	Favourable	Range is stable and not less than the favourable reference range.	1
<b>Area covered by habitat type within range</b>	Unfavourable – Inadequate and deteriorating	Current extent is below the favourable reference area, but not by more than 10%.	1
<b>Specific structures and functions</b> <small>(including typical species) 2</small>	Unfavourable – Bad and deteriorating	More than 25% of the habitat area is considered to be Unfavourable as regards its specific structures and functions. Significantly more of the resource in Unfavourable condition is declining than improving.	1
<b>Future prospects</b> <small>(as regards range, area covered and specific structures and functions)</small>	Unfavourable – Bad and deteriorating	Habitat prospects over next 12-15 years considered to be bad, with severe impact from threats expected and long term viability not assured. Further measures are required to address threats to future extent and structure and function for the overall UK resource.	1
<b>Overall assessment of conservation status</b>	Unfavourable – Bad and deteriorating	On the basis of the Structure and Function and Future Prospects assessments, the overall conclusion for this habitat feature is Unfavourable – Bad.	1

Key to confidence in judgement: 1 = High; 2 = Medium; 3 = Low

## 7. Annexed Material (including information sources used 2.2)

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## 7.2 Further information on Common Standards Monitoring data as presented in Sections 4.2 and 5.2

**Table 7.2.1** Summary of the coverage of the data shown in Tables 4.2.1 and 5.2.1

Data	Value
Number of SACs supporting feature (a)	14
Number of SACs with CSM assessments (b)	13
% of SACs assessed (b/a)	93
Extent of feature in the UK – hectares (c)	642
Extent of feature on SACs – hectares (d)	458
Extent of features assessed – hectares (e)	458
% of total UK hectarage on SACs (d/c)	71
% of SAC total hectarage that has been assessed (e/d)	100
% of total UK hectarage that has been assessed (e/c)	71

Notes

1. Extent of features on SACs (d) includes only those features that have been submitted on the official Natura 2000 data form as qualifying features. This figure is based on the habitat extent figures presented on standard Natura 2000 data forms.
2. The data included are from CSM assessments carried out between April 1998 and December 2006. NB: these include additional and some up-date data form those used in the six year report produced by JNCC (Williams, J.M., ed. 2006. *Common Standards Monitoring for Designated Sites: First Six Year Report*. Peterborough, JNCC)

**Table 7.2.2** Summary of grid square map data shown in Maps 4.2.1-3 and 5.2.1-3

Status	Number of squares	Proportion of all squares
Current – Unfavourable (red)	16	33%
Current – Favourable (green)	2	4%
On SAC but not assessed (blue)	0	0%
Not on SAC (transparent)	31	63%
Total Number of 10km squares (any colour)	49	100%
Future – Unfavourable (red)	10	20%
Future – Favourable (green)	8	16%