

NORFOLK BIODIVERSITY ACTION PLAN

COASTAL SAND DUNES

Dune systems are developed around the British coast usually where there are extensive intertidal sandflats, as there is interchange of material between the two. Dune systems on the western side of Britain are generally more extensively developed because of the prevailing westerly winds than those on the east coast. They can vary from highly calcareous where there are extensive shell deposits, to acidic where shell material is rare or absent. Dunes support a variety of habitats, from pioneer foredunes, marram-dominated yellow dunes to dune grassland sometimes with wet slacks. In places, they become covered in scrub or woodland.

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1. CURRENT STATUS

National Status

- Coastal sand dunes develop where there is an adequate supply of sand (sediment within the size range 0.2 to 2.0 mm) in the intertidal zone and where onshore winds are prevalent. The critical factor is the presence of a sufficiently large beach plain whose surface dries out between high tides. The dry sand is then blown landwards and deposited above the high water mark, where it is trapped by specialised dune-building grasses which grow up through successive layers of deposited sand.
- Sand dunes form in relatively exposed locations, and in a number of physiographic situations. The most common are: bay dunes, where a limited sand supply is trapped between two headlands; spit dunes, which form as sandy promontories at the mouths of estuaries; and hindshore dunes, which occur in the most exposed locations where large quantities of sand are driven some distance inland, over a low-lying hinterland. This last type forms the largest dune systems in the UK. Less common types are: ness dunes, which build out from the coast; dunes on offshore islands, which are often superimposed on a base of other material such as shingle; climbing dunes, where sand is blown up on to high ground adjacent to the beach; and tombolos, where a neck of sand is deposited between two islands or between a promontory and an island.
- Sand dune vegetation forms a number of zones, which are related to the time elapsed since the sand was deposited, the degree of stability which it has attained, and local hydrological conditions. Embryonic and mobile dunes occur mainly on the seaward side of a dune system where sand deposition is occurring and occasionally further inland in blow-outs. They support very few plant species, the most characteristic being marram grass *Ammophila arenaria*. Semi-fixed dunes occur where the rate of sand accretion has slowed but the surface is still predominantly bare sand; marram is still common, but there is an increasing number of other species. Fixed dune grassland forms largely closed swards where accretion is no longer significant, the surface is stabilised and some soil development has taken place. Calcareous fixed dunes support a particularly wide range of plant species. On dunes which have become acidified by leaching, acid dune grassland or dune heaths develop. Dune heaths are usually dominated by heather *Calluna vulgaris*. Acidic dunes which are heavily grazed by rabbits may support lichen communities. Dune slack vegetation occurs in wet depressions between dune ridges; it is often characterised by creeping willow *Salix repens* ssp *argentea* and a number of

mosses. Fixed dunes and dune heath are particularly threatened habitats and are regarded as priorities under the EC Habitats Directive.

- The fixed dune communities mentioned above are, or have been, maintained by grazing, whether by domestic stock or by rabbits. In their absence, the succession proceeds to rough grass and scrub. Dune scrub can include several species but only one of them, sea buckthorn *Hippophaë rhamnoides*, is largely confined to dunes; it is native to eastern England and south-east Scotland and has been widely introduced elsewhere, where its very invasive nature can cause problems. Wetter parts of dune systems may become colonised by willows *Salix* spp, birches *Betula* spp or alder *Alnus glutinosa*.
- Sand dune communities vary geographically: lyme grass *Leymus arenarius* is increasingly common in northern Britain, growing alongside marram grass in mobile dunes; wild thyme *Thymus polytrichus* is characteristic of south-west England; and common juniper *Juniperus communis* occurs on dunes only in two locations, both in Scotland.
- Dune grassland and dune slacks, especially on the more calcareous systems, support a wide variety of colourful flowering plants, including a number of species of orchid. Sand dune systems are also very rich in invertebrates, including butterflies, moths and burrowing bees and wasps.
- The Sand Dune Survey of Great Britain (1993-1995) gives the total area of sand dunes as 11,897 ha in England and 8,101 ha in Wales. The ongoing Sand Dune Vegetation Survey of Scotland indicates that there may be as much as 48,000 ha of dune and machair in Scotland, of which 33,000 ha is dune. There are approximately 3,000 ha of dunes in Northern Ireland.

Norfolk Status

- Estimates of the total area of sand dunes in Norfolk vary considerably. As shown in Table 1, Radley (1994) has given the total area as 1,091 ha; however, this figure does not include the dunes at Stiffkey, nor it does it include the stretches of dunes from Cromer to Paston and Sea Palling to Horsey. When these areas are added to Radley's figure, the total area of sand dunes in Norfolk is estimated to be approximately 1,200 ha.
- In north Norfolk, the dunes are a component of the barrier beach system which stretches from Holme to Kelling. They support a large area of woodland which has been long established at Holkham. Some foredunes occur at the foot of the soft cliffs between Cromer and Paston. A further stretch starts south of Sea Palling and extends in a single artificially managed ridge to Horsey where it broadens into the Horsey- Winterton ness system. Dunes then occur intermittently on the coast to Caister where a smaller ness system is developed which then extends south to Great Yarmouth.
- A large proportion of the sand dune resource in Norfolk is notified as SSSI and as SAC under the Habitats Directive. There are a number of other areas which are designated as County Wildlife Sites, mostly between Sea Palling and Horsey. However, between Hemsby and Caister, the remnant dune system is not protected by conservation designations. Hunstanton golf course also has no conservation status at present.
- Ownership: Most of the dune systems in Norfolk are owned by voluntary conservation bodies such as Norfolk Wildlife Trust or National Trust. Others are leased by Natural England from landowners (Holkham and Winterton). Some of the dunes are subject to common rights, notably Holme, Brancaster and Scolt.

Table 1: Distribution and status of dune systems in Norfolk.

Site	Status	Interest	Area (ha)	Features
Hunstanton and Holme Dunes	The Hunstanton dunes have no designation. The Holme dunes form part of the North Norfolk Coast SAC and SSSI.	Biological and geomorphological	134 (i)(ii)	Hunstanton has foredunes, yellow dunes and dune grassland. Holme has foredunes, yellow dunes, dune grassland and slacks, petalwort.
Thornham to Brancaster (inc Titchwell & Brancaster golf course)	Part of North Norfolk Coast SAC and SSSI	Biological and geomorphological	108 (i)(ii)	Foredunes, yellow dunes and dune grassland.
Scolt Head Island	Part of North Norfolk Coast SAC and SSSI	Biological and geomorphological	86 (i) 80 (ii)	Foredunes, yellow dunes and dune grassland.
Holkham	Part of North Norfolk Coast SAC and SSSI	Biological and geomorphological	248 (i) 266 (ii)	Foredunes, yellow dunes, dune grassland, plantation and slacks.
East Hills	Part of North Norfolk Coast SAC and SSSI	Biological and geomorphological	(included within Holkham total)	Foredunes, yellow dunes and dune slacks.
Blakeney Point	Part of North Norfolk Coast SAC and SSSI	Biological and geomorphological	69 (i)	
Sea Palling to Horsey	CWS	Biological	93 (iii)	Foredunes, yellow dunes.
Horsey to Hemsby, including Winterton	SSSI , SAC, and SPA	Biological and geomorphological	309 (i) 302 (ii)	Foredunes, yellow dunes, dune grassland, slacks and dune heath, little terns.
Caister to Great Yarmouth	SSSI , SPA,	Biological	137 (i)(ii)	Foredunes, acid dune grassland, little terns.

Sources for area: (i) Radley, 1994; (ii) Pye & French, 1992; (iii) County Wildlife Site citation.

Links with other BAP Habitats and Species in Norfolk

Habitats

- Dune systems form part of a suite of habitats in north Norfolk which function as one system. Therefore, coastal saltmarsh, vegetated shingle, intertidal sands and sheltered muddy gravels have links. There are also links with maritime cliff and slope, because of small dune systems developed at the foot of the cliffs.

Species

- The following national BAP priority species have significant populations on Norfolk's sand dunes:

<i>Bufo calamita</i>	Natterjack toad
<i>Cicindelia maritima</i>	Dune tiger beetle
<i>Petalophyllum ralfsii</i>	Petalwort

- Sand dunes are important for the following locally-important species, some of which may be deserving of their own local action plans:

<i>Aceras anthropomorpha</i>	Man orchid
<i>Dactylorhiza incarnata</i> var <i>coccinea</i>	Early marsh orchid
<i>Eryngium maritimum</i>	Sea holly
<i>Gnaphalium luteoalbum</i>	Jersey cudweed
<i>Usnea articulata</i>	Lichen
<i>Malachius barnevillei</i>	Malachite beetle

- Sand dunes also used by many bird species, including: sandwich tern; little tern; ringed plover; shelduck; snow bunting; shorelark; and stonechat. (*NB*: This list is incomplete.)

2. CURRENT FACTORS CAUSING LOSS OR DECLINE IN NORFOLK

- **Erosion and progradation:** Natural patterns of erosion and accretion operate on the Norfolk coast. In recent years, erosion has been most prevalent at Holme, Titchwell, Brancaster, Scolt and between Winterton and Hemsby. However, there have also been areas of accretion as in the vicinity of Gore Point, western end of Scolt Head island, eastern end of Brancaster, Holkham Bay, the western end of Blakeney Point and north of Winterton.
- **Falling Water Tables:** There is some evidence that the water table of dune slacks at Winterton in particular are now lower than historically recorded. The cause for this is not clear but may relate to lower levels on the adjacent grazing levels or possibly terrestrialisation of the now fossilised slacks. Elsewhere, dune slacks are an uncommon feature of the north Norfolk coast dunes, mostly occurring at Holme and Holkham but appear less affected.
- **Grazing:** Historically, most of the dune systems were probably grazed; however, this is now rare. Generally, rabbit numbers are sufficient but in some areas (eg Holme & Blakeney) lack of grazing has led to the development of vegetation dominated by coarse grasses. Sheep grazing has been introduced at Holme to redress this.
- **Recreation:** Some of the dune systems in Norfolk are under high recreational pressure (notably Holme, parts of Holkham, Winterton and Caister), where they are used extensively by holiday-makers, mostly on foot. In a few areas (eg Winterton), horse riding and motorcycles are additional pressures. 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 a few dune sites. There are three links golf courses in Norfolk at Hunstanton, Brancaster and Caister. 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.

- **Sea Defence and Stabilisation:** The length of dunes between Cart Gap (south of Happisburgh) and Winterton Ness is fronted by a massive concrete sea defence built in the period 1960s to 1980s and these continue south to Gt Yarmouth; this has effectively fixed the dune system in place and reduced the connection with the foreshore. This is combined with a combination of beach feeding off-shore reefs and rock groynes to prevent this stretch of coast functioning naturally. Elsewhere, as at Holme and Brancaster, sand fencing has been installed to reduce erosion and trap sand. Engineered defence systems usually reduce the biodiversity inherent in the natural dynamism of dune systems, and may cause sediment starvation down-drift.
- **Beach Management:** Beach feeding takes place down drift of the reefs at Sea Palling (see above).
- **Forestry:** There are 19th century plantings of Corsican pine, Scots pine and Holm oak on the dunes at Holkham and on a small scale at East Hills, Wells. These cover 80 hectares of dune. However in a Norfolk context, it is considered that these plantings have resulted in a habitat of at least local importance.
- **Military Use:** During the Second World War, the majority of dune systems were used for the construction of defensive installations, for military training or both. The resultant widespread erosion had a severe effect on dune vegetation which has since been reversed by protective measures and natural recovery. These impacts are noticeable at Holme and to a lesser extent at Winterton,
- **Invasion of Non-native Species:** There are a number of invasive non-native species established on the dune systems. These include: *Hippophaea* (sea buckthorn, status uncertain, possibly native to Norfolk), *Rosa rugosa*, *Rhododendron ponticum* and *Pinus nigra* (Corsican pine). These are controlled to varying degrees.
- **Other Human Influences:** 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, though in Norfolk there is no evidence that this has an impact.

3. CURRENT ACTION IN NORFOLK

- A biodiversity document has been produced for the Shoreline Management Plan area between Kelling and Lowestoft.
- A second generation Shoreline Management Plan has been produced for the coast between Kelling and Lowestoft, but has yet to be adopted. It is intended to replace the first generation plan, published 1996.
- Management plans are in place for all areas which are NNR and other areas managed by NGOs.
- Removal of sea defences at Brancaster is allowing these dunes to function naturally.

- Control of pine invasion at Holkham, scrub invasion at Holme and rhododendron at Winterton is ongoing.
- Monitoring of the water table in the Winterton dune system started in 2005.
- The North Norfolk Coast and Winterton CHaMPs were published in 2003.

4. ACTION PLAN OBJECTIVES AND TARGETS

National

- There should be no further net loss of the existing UK sand dune resource, its distribution and range of habitat types of about 56,500 ha (71,600 ha with Scottish Machair) from further losses to anthropogenic factors, whether caused directly or indirectly (e.g. by flood risk management schemes affecting coastal processes). This is a 'no net loss' target to take account of the dynamic nature of sand dunes.
- Achieve favourable or recovering condition by appropriate management of XX ha (figure to be determined) of coastal sand dune systems currently in unfavourable condition by 2010. This should achieve the retention or enhancement of populations of BAP priority species associated with sand dunes.
- Control natural succession to scrub, woodland, bracken and other invasive non-native plants. A target value of 200 ha by 2010.
- Re-establish Atlantic dune woodland habitat to two sites by 2015 (applicable to Wales only).
- Restore sand dune habitat lost or severely degraded as a result of afforestation, agriculture and infrastructure. A target figure of 1,000 ha (minimum) to be reinstated to dune habitat by 2010 (to be reviewed as a result of the inventory development).

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- Maintain the existing area of dunes (estimated at approximately 1,200 ha), subject to natural change.
- Restore dune slacks at Winterton, Holkham and Holme, to ensure that there is a succession of dune slacks at different stages of re-colonisation to provide a habitat for natterjack toads, Jersey cudweed and other dune slack species.
- Restore natural functioning to dune systems where at present constrained by sea defences (eg Winterton to Sea Palling) and facilitate dune roll-back. (This is a long-term aspiration).
- Enhance connectivity between dune systems by enhancing remnant dune systems and creating ecotones between dunes and inland habitats

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NATIONAL ACTION		NORFOLK ACTION	ACTION BY:	PARTNERS:
5.1	Policy and Legislation			
5.1.1	Develop and promote planning policies and procedures which will aim to prevent further losses of sand dune habitat to development and exploitation and minimise them where they are unavoidable.	Develop and promote planning policies and procedures which will aim to prevent further losses of sand dune habitat to development and exploitation and minimise them where they are unavoidable. Ensure SMP adequately protects coastal sand dunes.	KLWNBC, NNDC, GYBC, BA, EA	NE
5.1.2	Develop and promote agri-environment schemes which will encourage restoration and sustainable management of dune habitats.	Identify within targeting statement coastal sand dune sites which would benefit from agri-environment schemes.	NE	
5.1.3	Develop and promote incentives to encourage the management and restoration of landward transitional dune habitats and where appropriate to allow landward movement of dunes, especially where there are seaward losses due to sea level rise.	Develop and promote incentives to encourage the management and restoration of landward transitional dune habitats and where appropriate to allow landward movement of dunes, especially where there are seaward losses due to sea level rise.	NE, FWAG, NNDC, GYBC, KLWNBC	
5.1.4	Develop and promote coastal zone management policies which allow the maximum possible free movement of coastal sediment and pay full regard to the conservation of sand dunes. Include in Shoreline Management Plans where they have a role to play in flood defence.	Ensure SMP takes account of free-functioning coastal processes and requirements of coastal sand dunes.	EA, NE, NNDC, GYBC, KLWNBC	

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NATIONAL ACTION		NORFOLK ACTION	ACTION BY:	PARTNERS:
5.2	Site Safeguard and Management			
5.2.1	Notify by 2004 any remaining areas of sand dune habitat which meet national criteria as SSSI and ASSI and ensure appropriate management of designated sites.	Consider additional areas for notification either as SSSIs or County Wildlife Sites by 2008.	NE, NWT, NCC	
5.2.2	Use positive management agreements where appropriate to encourage sustainable grazing of sand dune SSSIs and other dunes where possible.	Use positive management agreements where appropriate to encourage sustainable grazing of sand dunes.	NE	
5.2.3	Encourage golf course management policies and practices which are sympathetic to the flora and fauna of sand dunes.	Promote best practice at local golf courses and include this topic in a one-day sand dune workshop, to be held by 2010.	Coastal BAP Group, NE, NWT, WESG	
5.2.4	Promote and encourage the restoration of open dune vegetation on afforested dune systems.	Contain current extent of afforested dune at Holkham to retain protected areas of open dune.	NE	
5.2.5	Promote and encourage the restoration of dune vegetation on dune systems used for arable farming or agriculturally improved grassland.	Promote and encourage the creation of semi-natural habitats behind dune systems to buffer from adjacent land use and allow roll-back.	NE, Coastal BAP Group, NWT, GYBC	
5.2.6	Monitor and regulate water abstraction and land drainage schemes which might affect water tables in sand dune systems, and promote remedial action where necessary.	Water abstractions identified in the appropriate assessment where no adverse impact cannot be shown either alone or in combination will be reviewed in stage 4 of the EA's Habitat Directive Review of Consents programme by 2008.	EA, NE	

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NATIONAL ACTION		NORFOLK ACTION	ACTION BY:	PARTNERS:
		Where dune slacks are identified as deteriorating because of low water tables, install monitoring equipment by 2008.	EA, NE	
5.2.7	Discourage unnecessary stabilisation of all dunes, and where appropriate promote managed destabilisation measures on over-stabilised dunes and dune slacks.	Ensure nature reserve management plans take account of the need to have a succession of developing dune slacks by programming the creation or enhancement of slacks where it is appropriate.	EA, NE	NWT, NT, RSPB
5.2.8	Support beach management strategies which encourage the protection of the seaward fronts of dune systems from unsustainable pressure by pedestrian or vehicular traffic, and discourage the use of mechanical beach cleaning close to dune fronts.	<p>Address in management plans when appropriate. (beach cleaning only locally at Hunstanton).</p> <p>Identify areas where wardening may be appropriate to reduce pressures. Work with local communities to consider ways of reducing damaging effects.</p> <p>Organise a one-day workshop on sand dune management by 2010.</p> <p>Ensure that new built development does not adversely affect coastal sand dunes.</p> <p>Ensure that impacts of aerial emissions from new developments on sand dunes are adequately addressed through the planning system.</p> <p>Monitor the extent of sea buckthorn and alien species and decide on appropriate management.</p>	<p>NNDC, KLWNBC, GYBC, NE</p> <p>NNDC, KLWNBC, GYBC, NE</p> <p>Coastal BAP Group</p> <p>LPAs, EA</p> <p>EA, LPAs, NE</p> <p>NWT, NT, RSPB, NE</p>	<p>Landowners, NCP</p> <p>Landowners, NCP</p> <p>Landowners</p>

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NATIONAL ACTION		NORFOLK ACTION	ACTION BY:	PARTNERS:
5.3	Advisory			
5.3.1	Where appropriate, promote and develop demonstration sites for the restoration of dune vegetation on dune systems which have been converted to forestry or agriculture.	No Norfolk action proposed.		
5.3.2	Encourage the appropriate management of sand dunes by preparing and disseminating updated guidance material.	Disseminate guidance material when available.	Coastal BAP Group	
5.3.3	Ensure all relevant agri-environment project officers and members of regional agri-environment conservation groups are advised of the location of existing examples of this habitat, its importance and management requirements for its conservation.	Ensure participation of key agri-environment officers in the proposed sand dune management workshop.	Coastal BAP Group	
5.3.4	Make use of the potential provided by existing estuary management partnerships in taking forward the actions of this plan.	Produce Wash BAP and Norfolk Coast Management Plan.	WESG, NCP	
5.4	International			
5.4.1	Promote the exchange of information on sand dune ecology and management among European maritime states through organisations such as the European Union for Coastal Conservation and Eurosite.	Encourage information exchange on management and other issues with other North Sea countries, especially The Netherlands, Germany and Denmark.	NWT, NT, RSPB, NE	
5.4.2	Ensure lessons from EU LIFE projects are widely disseminated and incorporated into good practice.	In any EU LIFE bids, take account of coastal sand dune management.	Coastal Topic Group	

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NATIONAL ACTION		NORFOLK ACTION	ACTION BY:	PARTNERS:
5.5	Monitoring and Research			
5.5.1	Compile by 2002 an inventory of the desirability, feasibility and priority of sites for sand dune restoration from forestry and agriculture, and for the development of Atlantic woodland.	No Norfolk action proposed.		
5.5.2	Identify suitable locations and methods for dune activation.	No Norfolk action proposed.		
5.5.3	Co-ordinate information on changes in the extent and quality of the sand dune resource in the UK in order to enable effective monitoring of the objectives of this plan.	Ensure sites are subject to common standards monitoring every five years	NE	
5.5.4	Continue research into the use of remote sensing for monitoring soft coast habitats.	Ensure that any research being carried out on the coast takes account of coastal sand dunes.	EA	
5.5.5	Promote research into the causes of falling water tables in sand dune systems.	Identify areas where this may be an issue.	EA, NE	
5.5.6	Promote research on the effects on sand dunes of indirect influences such as nitrogen deposition, climate change and sea level rise.	Promote Norfolk sites for using this research when appropriate.	NE	
		Undertake genetic analysis of sea buckthorn to determine whether it is a native or alien species in Norfolk.	NE	

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NATIONAL ACTION		NORFOLK ACTION	ACTION BY:	PARTNERS:
5.6	Communications and Publicity			
5.6.1	Raise public awareness of the essential mobility of soft coasts and the value of maintaining unrestricted coastal processes.	Refer to SMP. Raise public awareness through statutory organisations.	NT, NWT	
5.6.2	Promote awareness of the implications of the policies outlined in this plan among decision-makers.	Promote awareness of the implications of the policies outlined in this plan among decision-makers	Coastal BAP Group	

Abbreviations

BA	Broads Authority
EA	Environment Agency
FWAG	Farming and Wildlife Advisory Group
GYBC	Great Yarmouth Borough Council
KLWNBC	King's Lynn and West Norfolk Borough Council
LPA	Local Planning Authority
NCC	Norfolk County Council
NCP	Norfolk Coast Partnership
NE	Natural England
NNDC	North Norfolk District Council
NT	National Trust
NWT	Norfolk Wildlife Trust
RSPB	Royal Society for the Protection of Birds
WESG	Wash Estuary Strategy Group

NORFOLK DISTRIBUTION

Please refer to Table 1.

MANAGEMENT GUIDANCE

(This guidance is a general summary; for more detailed information or advice, please consult the references or contacts below.)

Dune systems in Norfolk are increasingly under pressure from visitor numbers and are therefore vulnerable to trampling; many of the associated species (eg little tern and ringed plover) are also vulnerable to disturbance. Visitor management may be undertaken with signs and fencing but beach wardening remains one of the best ways of ensuring minimum impacts. Planning applications for sea defences require particular scrutiny and should only be permitted in exceptional circumstances.

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