



LORNE GILL/SNH

BARRY LINKS

DEFINITION

Sand dunes can develop where an adequate supply of dry, wind-blown sand (often from a low-lying coastal plain where sand can accumulate and dry out at low tide) is blown by onshore wind and trapped by an obstacle in its path (tidal litter, shingle or vegetation). Of these, vegetation is often the most important since specialist dune-building grasses such as marram grass trap sand and encourage further deposition through which they can then grow. These stabilising grasses make the growing dunes more hospitable for other plants and animals to colonise. Moving inland, the amount of blown sand reduces and the dunes are more stable and provide easier conditions for more grasses and herbs to form a grassland or heathland. Sand that is moved from the upper, drier area of the beach may be replenished by wave action on the lower shore. Sand dunes are an important natural form of sea defence, preventing storm waves from flooding areas of low-lying land.

KEY SITES

There are four main dune areas within Tayside. Within two of these areas there are several designated sites:

- The northern part of **Charleton and Kinnaber Links to Montrose** is included within the St Cyrus & Kinnaber Links SSSI
- The **Arbroath to Broughty Ferry** area contains Elliot Links SSSI, Easthaven SSSI, Barry Links SSSI and Monifieth Bay SSSI. Barry Links is also notified as a cSAC and is part of the Inner Tay SPA. Broughty Ferry Local Nature Reserve (LNR) is also in this section of coast.

CURRENT STATUS AND EXTENT OF HABITAT

The ongoing sand dune survey of Scotland indicates that there may be as much as 33,000 hectares of dune in Scotland (almost three times that of England). Tayside is thought to hold 2,196 ha. of this dune resource. Of this land 1,728 ha. is vegetated and only 9 ha. bare; 92 ha. is under arable or fallow land and 368 ha. has been developed.

In Tayside, the largest habitat on windblown sand is fixed acidic dune grassland which covers 27%. Acidic soils are also shown by small amounts of dry dune heath (2%) and wet dune heath (1%). Fixed calcareous dune is locally extensive, often occurring seaward of acidic conditions. Bare sand and mobile dune is uncommon (under 2%), with more semi-

Tayside Biodiversity Partnership

fixed (or yellow) dune covering 7%. Dune wetland is locally extensive, covering about 6%. Scrub is locally common (4%) and woodland locally important (5%). Improved grassland is the second largest category, dominating the dune interior in parts of Lunan Bay and Arbroath to Broughty Ferry. Arable land is locally extensive at 4%.

There are four main dune areas in Tayside:

- **Charleton and Kinnaber Links to Montrose.** This large 479 ha. bay dune and spit complex extends 6km from River North Esk to Montrose Basin where nature conservation interest is high. It consists of foredune, spit, sand-covered shingle, conifer plantations, acidic dune grassland, patches of heath, amenity grassland and offshore stone barriers to halt retreat.
- **Lunan Bay** is a moderately sized bay dune and dune spit site located to the north and south of the Lunan Water. It has a coastal frontage of 3.5 km which is excellent for walking. Ungrazed semi-fixed dune vegetation dominates the foredune zone. Much of the interior is improved grassland. Overall, nature conservation interest is moderate.
- **East of Arbroath.** This small bay dune system of 13 ha. is located behind 1.5km beach frontage below a raised beach cliffline. The interior is developed as mown amenity grassland. A seawall is extensive beside a promenade and road restricting any new dune development. Nature conservation interest is very low.
- **Arbroath to Broughty Ferry.** This open coast and ness (foreland) system is one of the largest sites on the east coast at 1,641.4 ha., extending for almost 23km. For much of this distance it forms a narrow belt of open dune coast up to 400m wide. Fixed dune habitat is locally extensive at Elliot Links. Further fixed and semi-fixed dune habitat occurs at East Haven. At its widest the site is almost 4km where a very large foreland system has developed at the mouth of the River Tay. This area, **Barry Links**, is owned by the MoD and is used for training. It has two dune types – fixed dunes and dune heath - which are regarded as a priority under the EU Habitats Directive. Most nature conservation interest is concentrated at Barry Links.

KEY SPECIES

P = UK Priority species C = UK species of conservation concern

Birds	Shelduck	<i>Tadorna tadorna</i>	C
	Ringed plover	<i>Charadrius hiaticula</i>	C
	Little tern	<i>Sterna albifrons</i>	C
	Arctic tern	<i>Sterna paradisaea</i>	C
	Common tern	<i>Sterna hirundo</i>	C
Amphibians/Reptiles	Adder	<i>Vipera berus</i>	C
	Smooth newt	<i>Triturus vulgaris</i>	C
Invertebrates	Small blue butterfly	<i>Cupido minimus</i>	C
	Northern brown argus	<i>Aricia artaxerxes</i>	P
Higher Plants	Greater yellow rattle	<i>Rhinanthus angustifolia</i>	C
	Coralroot orchid	<i>Corallorhiza trifida</i>	
	Meadow saxifrage	<i>Saxifraga granulata</i>	
	Rush-leaved fescue	<i>Festuca arenaria</i>	
	Baltic rush	<i>Juncus balticus</i>	
Sea pea	<i>Lathyrus japonicus</i>		
Lower Plants	a lichen	<i>Cladonia uncialis ssp uncialis</i>	C
	a lichen	<i>Cladonia mitis</i>	C
	Sea bryum	<i>Bryum warneum</i>	P
	Matted bryum	<i>Bryum calophyllum</i>	P

NATURE CONSERVATION IMPORTANCE

Dune systems generally comprise several distinct features:

- **FOREDUNES.** These are the youngest actively building dunes – often the most attractive for recreation, but also the most susceptible to erosion. A few well-adapted plants grow here such as Marram *Ammophila arenaria* and Lyme-grass *Leymus arenarius*. Many invertebrate species utilise the warm varied habitat provided by these dunes, especially spiders, butterflies, hoverflies and moths.
- **YELLOW (SEMI-FIXED) DUNES.** Species such as Sand sedge *Carex arenaria*, Hawkweed *Hieracium spp.*, Creeping thistle *Cirsium arvense*, Rush-leaved fescue *Festuca arenaria*, Sea holly *Eryngium maritimum* and Sea bindweed *Calystegia soldanella* begin to colonise the dry sand between grass clumps, thereby progressively stabilising the dunes.
- **FIXED DUNES.** Dune grassland occurs as a more stable dune develops. Sand trapping plants give way to sand “fixing” plants such as mosses and lichens (often *Cladonia* lichens) which raise the humus content of the soil, creating a carpet through which sand is unable to escape. Sand sedge forms a loose turf, accompanied by species like Wild thyme *Thymus praecox*, Sand fescue *Festuca rubra* L. subsp *arenaria*, and Birdsfoot trefoil *Lotus corniculatus*. Click beetles may occur.
- **LANDWARD DUNE EDGE.** Where dunes are fairly stable ranker grasses and scrub species might seed in, shading out some of the more interesting low-growing vegetation. Some invaders, such as Sea buckthorn *Hippophae rhamnoides* leave an enriched soil which changes the nature of the vegetation. Where grazing predominates, grassland may persist – otherwise scrub or woodland is typical. Where the soil is acid, heather dominated heath may develop. Willow or birch dominates scrub on wetter dune slack areas.
- **DUNE SLACKS.** These are low-lying wetland areas between dune ridges. Dragonflies and damselflies, as well as molluscs are found. Succession is largely determined by whether the soil remains waterlogged and becomes increasingly acidic where rushes and bog moss can dominate. If the soil dries out seasonally shrubs like Creeping willow *Salix repens* may occur which provide a useful source of nectar and a foodplant for invertebrates.

Mammals

Small mammals include several species of voles (Bank and Common), mice and Rabbits *Oryctolagus cuniculus* whose grazing is important in maintaining the varied vegetation structure and consequently the diverse range of habitats for plants and other animals. Small mammals and shore-nesting birds attract predators such as Foxes *Vulpes vulpes*, Weasels *Mustela nevalis* and Stoats *Mustela erminea*. Roe deer *Capreolus capreolus* have also been seen, as have Brown hares *Lepus europaeus*. Sheep graze the dune grassland at Barry Links.

Birds

Shore-nesting birds include Terns and Shelduck *Tadorna tadorna*. In the summer Skylarks *Alauda arvensis*, Meadow pipits *Anthus pratensis*, Linnets *Carduelis cannabina* and Stonechats *Saxicola torquata* are abundant. Birds of prey (including Short-eared owl *Asio flammeus* and Merlin *Falco columbarius*) hunt the dunes and slacks, whilst passage birds - including Fieldfares *Turdus pilaris* and Redwings *Turdus iliacus* - winter among Sea buckthorn where they feed on the berries. On fixed dunes and dune heaths and grasslands, species such as Skylark and Meadow pipit are typical. Barry Links and Monifieth Bay SSSI both support nationally and internationally important populations of wildfowl and waders and this is recognised by their designation as part of the Inner Tay and Eden Estuary Special Protection Areas (SPA) under the European Birds Directive.

Amphibians and Reptiles

Common toad *Bufo bufo*, Adder *Vipera berus* and Common lizard *Lacerta vivipara* often favour the warm, dry and open sandy habitats provided by the dunes.

Invertebrates

The variety of coastal dune habitats supports a variety of invertebrates, including grasshoppers, earwigs, many beetles, butterflies and moths. Sand-burrowing hunting wasps and bees may be abundant on open dunes, with bumblebees inhabiting older dunes. Crane fly grubs destroy marram grass shoots. Wolf and jumping spiders occur. Dragonflies, mayflies and caddis flies live in the wetter slacks. Pond skaters, water boatmen and whirligig beetles remain in or on the water. The Common banded snail *Cepaea nemoralis* and Garden snail *Helix aspera* are also frequently found. Small pearl-bordered fritillaries *Boloria selene* are often seen.

Small blue butterfly

The Small blue, the smallest of Britain's butterflies (with a wingspan of just 16 - 25 mm), has been in decline in the UK since the 1950s. The males have distinctive smoky-black wings with a silvery blue dusting of scales which they keep half-open to the sun during the breeding season. Breeding occurs where plant cover is sparse and the soil crumbly and fine, making the more sheltered sand dunes along the Angus coast where its sole foodplant the Kidney vetch grows, a favoured habitat.

Colonies are typically small and up to 30 adults will gather to roost at night on tall vegetation. Females lay eggs on the Kidney vetch flowers where the resulting grey-pink caterpillars later burrow into the buds and eat the developing anthers and seeds. By the end of July they begin hibernation within a crevice under soil or moss. The following spring they seek a pupation site and the butterflies emerge from mid-May; only a few survive into the summer.



PAUL KIRKLAND

Higher plants

The rarest plant known from the sand dunes of the Angus coast is Greater yellow rattle *Rhinanthus angustifolius* found at Easthaven; it grows nowhere else in Scotland. The Sea pea *Lathyrus japonicus* has also occurred in a few locations, but in recent years only small numbers have been found at the mouth of the Barry Burn.

Greater yellow rattle

Easthaven is the only location in Scotland for the Greater yellow rattle. It is an annual plant best seen in July and August. It is hemi-parasitic and gains its food partly from other plants. Bees and possibly butterflies pollinate the flowers throughout the summer.

At Easthaven it grows mainly within tall open vegetation on the dune grassland. SNH is currently undertaking research to improve knowledge of this species and to ensure its future management is safeguarded.



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NATIONAL BIODIVERSITY CONTEXT

There is a UK Broad Habitat Statement for sand dune habitat, which has the following main objective:

Maintain the extent and enhance the habitat quality of sand dune systems, and ensure the natural processes that create them are not unduly prevented by human influence.

Measures to be considered further include:

- Protecting sand dune habitats of conservation importance from inappropriate uses.
- Implementing strategies for managing the coastal zone at a local, as well as regional and national level.
- Reviewing the powers and duties of coastal authorities for safeguarding this habitat.
- Reducing the impact of sea level rise (and the resulting increase in wave attack and dune erosion), including replacing unavoidable losses.
- Reducing the damage resulting from the introduction of non-native species.
- Encouraging appropriate levels of grazing on sand dune systems.

ECOLOGY AND MANAGEMENT

- Much survey work has already been carried out on the designated sites.
- A full survey of the habitat is required in order to set up effective, area-wide monitoring and assessment in the future.
- Site Condition Monitoring of Sites of Special Scientific Interest is carried out according to a 6 year programme.

CURRENT FACTORS CAUSING LOSS OR DECLINE

Erosion

Unless artificially constrained seaward dune edges can be highly mobile. Few dune systems are in overall equilibrium and generally the coast of Tayside demonstrates net erosion. Limited natural erosion helps regenerate dune systems, but the survival of the biological interest and the actual structure may be at risk if it increases excessively.

Recreation

The coast and its sand dune systems offers easy access by local residents and visitors and provides opportunities to watch wildlife, pursue outdoor sports such as golf, or simply walk, contemplate and seek inspiration. However, such a major land use causes damage to vegetation, exposes the underlying sand to the wind and rain and results in the loss of vegetation and sand. Rehabilitation of such areas can be carried out, but it often takes years for the natural diversity to become re-established.

Grazing

Whilst continued grazing is necessary to maintain the grassland and to prevent scrub development, overgrazing can have damaging effects. Undergrazing is more widespread, allowing vegetation to be invaded by coarse grasses and scrub.

Development

Pressure, especially on the older dune systems, continues with further developments proposed leading to the destruction of this habitat. Many dune links are now golf courses where fertilisers, herbicides and irrigation are used for 'improving' the vegetation. Car and caravan parks widen access and increase trampling, fires and disturbance.

Sea defences

Many dune systems are affected by coastal defence works that arrest the formation of new dune systems and affect the dynamism of dune systems.

Non-native species

Whilst the invasive Sea buckthorn scrub stabilises the dunes at Barry Links, it also alters the dunes' nutrient status.

Afforestation

Over the years afforestation, often with non-native pines, has restricted dune development causing changes in dune vegetation and lowering water levels. Felling and permanent removal of trees means that native vegetation can be restored in a relatively short time.

Natural changes

Sea level rise and increased storms forecast as global climates change may cause foreshore steepening, thus allowing increased wave attack at the base of the dunes

MAIN THREATS TO KEY SPECIES

Sea pea	- Lack of ground disturbance on the dunes on which it grows. Its remaining population at Carnoustie, Barry Burn, is "squeezed" between the golf course and the dune edge.
	UK Importance of Tayside population: high
Greater yellow rattle	- Lack of habitat management and potential erosion of the dunes on which it grows.
	UK Importance of Tayside population: high – globally threatened: this is the only population in Scotland

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Little tern	- Disturbance and erosion of nesting sites. - Habitat loss due to development.	
	UK Importance of Tayside population:	moderate
Skylark	- Loss of grassland habitat. - Disturbance. - Reduction in abundance of insect food.	
	UK importance of Tayside population:	unknown - this is a UK Flagship Species and in decline nationally.
Small blue butterfly	- Loss of its foodplant, the Kidney vetch.	
	UK importance of Tayside population:	unknown - this species is in decline nationally

OPPORTUNITIES AND CURRENT ACTION

- Management plans for all designated sites to be kept current.
- Broughty Ferry LNR Management Plan is on a five year cycle.
- Site Condition Monitoring programme being carried out by SNH.
- SNH also monitors all SSSI notified interests on a 6-yearly basis. This could be supplemented in between by other work (potentially by others).
- Conservation Group involving MoD at Barry Links (large proportion of Tayside’s sand dune resource).
- Tay Estuary Forum and overall plan for Integrated Coastal Zone Management.

Case Study

Tern Project, Barry Buddon

During the 1950s Barry Buddon was home to five different species of tern consisting in total several thousand breeding pairs. Today no terns breed on the site. The decline in the breeding population may have been the result of habitat disturbance and the subsequent reduction in suitable nest sites. Such a decline in tern numbers probably began before the Ministry of Defence increased activity on the site over a decade ago. However, the area’s increased usage has led to a public access restriction to Saturday evenings and Sunday afternoons, perhaps making it once more suitable for terns.



COMMON TERNS

ERIC VAN POPPEL

Members of the Tayside Biodiversity Partnership are working together to encourage the terns back to this important site. Clay bird ‘decoys’ have been made, mostly using Carse of Gowrie clay, and some have been fired in the Dundee College pottery kilns. The local community, including local schoolchildren, have helped paint the models in readiness for siting near the lighthouse. Shelters and ‘tern calling-tapes’ may also be used to further attract the terns to breed on the site. It is hoped local volunteers will keep the site suitable for terns and long term planning, together with site monitoring, will assess the various management approaches used.

OBJECTIVES AND TARGETS

Objectives		Targets
1	Protect the existing sand dune resource in Tayside from further losses to anthropogenic factors, allowing for natural processes and replacing deterioration with positive conservation.	No net loss in area or reduction of quality of habitat beyond 2005.
2	Where conditions allow manage the coast in sympathy with natural processes, allowing soft-sediment coasts to function as natural coastal defences.	Allow the natural functioning of the coast where possible.
3	Where conditions allow attempt to restore areas of sand dune lost to forestry, agriculture or other human uses.	Restore degraded sand dunes, where realistic, by 2010.
4	Continue determining in detail the area, extent and condition of sand dune habitats in Tayside.	Complete survey of all sand dune habitat by 2003.
5	Maintain and protect the quality and integrity of designated sites. Ensure that the current set of management plans is completed and that monitoring of sites goes ahead. Seek to apply principles of management plans to all sand dune habitats in the region.	Keep up-to-date management plans for all designated areas.
	Set up a five-year programme to raise awareness of coastal biodiversity, its importance, the fragility of the coast and the need for its conservation in Tayside. Include sand dunes in this programme.	Set up a public awareness programme by 2002. Run public awareness programme until 2007.

Stakeholders

- Landowners, managers and advisors, developers, tourists and local users (including golfers).

ACTION FOR BIODIVERSITY

		Action - Sand Dunes	Deliverers		To take place by							Meets Objective No.	
			Lead Partners	Partners	02	03	04	05	06	07	11	16	
LBAP Ref.	A	Policy and legislation											
CE3	1	Contribute to the development of Angus Council's Shoreline Management Plan and land use planning policies to safeguard sand dune habitats.	AC	TBP	#	#							1
CE3	2	Where Tay Estuary Forum responsibility includes sand dunes of Barry Buddon, ensure that ICZM (TEF) policies and proposals complement those of the Shoreline Management Plan.	TEF	AC MoD	#	#	#	#	#	#	#	#	1
CE3	3	Complete SAC, SPA processes and subsequent designations.	SNH	SE EU	#								1
CE3	4	Encourage use of policies to safeguard existing sand dune habitats when Structure and Local Plans are reviewed.	PKC DCC AC	SNH FC NGOs	#	#	#	#	#	#	#	#	1

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CE3	5	Develop/promote agri-environment schemes which will encourage restoration and sustainable management of dune habitats.	FWAG SAC	SNH	#	1,2,3
B Site management						
CE3	1	As part of the review of the Barry Buddon Management Plan (by Defence Estates and SNH) encourage additional conservation and enhancement measures that support the natural heritage importance of the site, taking account of MoD operations and requirements.	MoD SNH		# # # # # # # # #	1,2,3
CE3	2	At Broughty Ferry Dunes undertake habitat improvement: dune stabilisation work, restoration of plant ecosystems, fencing to protect from disturbance, and habitat improvements for relevant species.	BFEP		# # #	1,2,3
CE3	3	Encourage golf course management policies and practices which are sympathetic to the flora and fauna of sand dune systems (see also the Golf Courses HAP)	SNH	TBP	# # # # # # # # #	1,2,3
C Species management						
CE3	1	Tern Project to encourage Little and Common terns back to Tayside coast at Barry Links.	SNH	TBP SWT MoD	# # #	1,5
CE3	2	Tern wardening, as done before, if the terns nest at Elliot Links.	SNH		#	1,5
CE3	3	Study on potential of re-colonisation of dunes by Sea Pea at Elliot Links.	SNH		#	1,5
CE3	4	Grazing Animals Project at Barry Links to ensure best possible management.	MoD	SNH	#	1,5
CE3	5	Work on Easthaven (Greater Yellow Rattle) to research best future management.	SNH		#	1,5
CE3	6	Cutting, burning and scarifying ground at Easthaven to make a more favourable habitat for, and at least maintain the current population of, Greater Yellow Rattle.	SNH	Dundee Naturalists	# # #	1,5
D Advisory						
CE3	1	Sharing Good Practice workshop, 6.4.02, Battleby. Sand dune Stabilisation – W. Monifieth dunes being used as an example.	SNH		#	1,6
CE3	2	Promote and develop demonstration sites for the restoration of dune vegetation on dune systems.	BFEP SNH	MoD	# #	1,6
CE3	3	Encourage best practise management of sand dunes by preparing and disseminating updated guidance material.	SNH		#	1,3,6
E Research and monitoring						
CE3	1	Complete study of sand dune sites, using findings to prioritise work and possibly to feed into any local wildlife sites.	SNH	SWT, PKC DCC, AC TBP	#	All
CE3	2	Site Condition Monitoring of Elliot Links, Easthaven, Barry Buddon, St Cyrus/Kinnaber Links – on 6 year cycle	SNH		# # # # # # # # #	4
CE3	3	At Broughty Ferry dunes carry out habitat surveys to monitor dune movement; survey plant species; explore dune fauna; relate dune, foreshore and marine habitats; review water quality measures; monitor leisure use of dunes; geodiversity; and to generate maximum participation from the community.	BFEP	DCC	# # #	4
CE3	4	Sand Dune Action Plan review process – ensure this plan is being delivered annually and in detail after 5 years.	TBP		# # # # # # # # #	All

	F	Promotion and awareness-raising				
CE3	1	Involve local community in Tern Project.	DCC	MoD SNH	#	6
CE3	2	At Broughty Ferry Dunes, provide seating produced (using driftwood) by local workshops with information about habitat and cultural information; produce leaflet/postcards from survey information; local storytelling linking people and biodiversity.	BFEP	TBP	# # #	6
CE3	3	Raise public awareness of the importance of sand dune habitats through guided walks, talks, publications, press releases and environmental education opportunities.	BFEP	SWT AC FE SNH REEF TBP	# # # # # # # # #	6

Sand Dunes

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.

