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**Assessment of landform change  
within Forvie NNR and Foveran Links SSSI**

**FINAL REPORT**

*Prepared for :*

**Scottish Natural Heritage,  
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by


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## 1. BACKGROUND TO PROJECT

The Sands of Forvie and Foveran Links are located respectively north and south of the mouth of the river Ythan, at the northern limit of the 20km arc of soft coastline, known as Aberdeen Bay, which stretches from Footdee on Aberdeen beach to Rockend at the northern limit of Forvie beach. Both areas are of geomorphological significance since they contain good examples of coastal dune belts, blowouts, deflation plains, sand waves and, in the case of North Forvie, a complex system of parabolic dunes. The two areas have also experienced differing land management practices, with Foveran Links subject to certain human pressures from a working farm and recreational use, while Forvie has been relatively devoid of human interference since it was declared a National Nature Reserve in 1959.

The Sands of Forvie and Ythan Estuary NNR is 810ha in extent. The Sands of Forvie portion occupies 660ha, with about one-third of that area in South Forvie (south of the path from Waterside Bridge to Rockend). The Sands of Forvie form one of the largest dune areas in Scotland, and is believed to be the fifth largest area of blown sand in Britain. Lying immediately south of Forvie Sands is Foveran SSSI, which stretches for 3.5km southwards from the mouth of the river Ythan to just north of Leyton Farm, embracing the links areas of Foveran, Drums and Menie. Towards the southern limit, Sandend and Newtyle burns drain across the area into the beach, where they discharge into a longshore beach channel (clearly evident on the aerial photography). Foveran SSSI covers an area of about 240ha (i.e. it is larger than South Forvie), but it is long and narrow in shape. For much of its length the SSSI varies between 300 and 600m wide, but narrows in the vicinity of the two burns to less than 100m. The Sands of Forvie and Foveran Links were selected as a site for the Beaches of

 Lowland Scotland block of the Coastal Geomorphology of Scotland Geological Conservation Review (GCR). The Sands of Forvie GCR site lies within two larger Sites of Special

Scientific Interest : the Sands of Forvie and Ythan Estuary SSSI and Foveran Links SSSI, which together enclose the northern and southern shores of the mouth of the Ythan river.

In the late 1960s, a number of detailed surveys of Forvie were conducted on the ground and using 1967 stereoscopic aerial photography, by scientists at the universities of Aberdeen and

## 2b *Foveran*

The coastal dune ridge is fairly fragmented in the middle section, but is more pronounced at the southern end and towards the northern end, where the coastline bends inland at the Ythan mouth (Figure 7). Immediately inland from the coast, the landscape is characterised by a series of parallel and sub-parallel dune systems, trending mostly south-north but with a secondary system running obliquely to the main direction of the coastal edge.

At the north end of Foveran a distinctive broad zone of embryo dunes (1 to 2m high) has been forming on the emergent coastal edge. Further evidence of coastal emergence is given by the significant widening of the beach, which is evident from a comparison of the 1967 and 1994 aerial photography, with a seaward horizontal displacement of the HWM of almost 100m apparent at the northern end near the Ythan mouth. The dune crest lines and the intervening linear hollows provide a deeply dissected landscape, especially towards the Foveran end where the parallel ridges and hollows are even evident through the covering of wind-blown sand which is progressively engulfing the dune complexes from east to west. A series of mobile sand bars and troughs are also evident in the near-shore zone, less than 100m in plan from the HWM.

The ground-based photographs of Foveran SSSI (in Appendix E) present visual evidence of the major landform units over the entire area, and supplement the geomorphological mapping give in Figures 7,8 and 9.

## 3 DESCRIPTION OF CHANGES

### 3a Forvie

#### 3a.1 *Position of coastal edge*

It is not possible to map the position of MHWS unless the photography has been taken at the appropriate time. The photography used in this project has not been taken with this task in

cells reveals a significant revegetation of the previous large expanse of sand in the north-west corner of South Forvie . [Full data for each 250m grid cell, for all 5 dates from 1967-99 are given in Appendix B for S. Forvie].

### 3a.3 Spit and bar complex

It is difficult to detect these features as some of the sets of aerial photos were taken at or near to high tide. However, there appears to be a north trending spit developing from the Foveran side of the Ythan (detectable on photography from 1973, 1978 and 2000). This accords with the recent reports by Halcrow Crouch (1999) which identifies a net northerly drift of material along the entire frontage of Aberdeen Bay from the River Dee to the River Ythan. A series of sand bars is evident on the south side of the Ythan mouth, aligned to the channel outlet (1973, 1974, 1978, 1989 and 2000) and on the north side a large sand bar parallel to the south-north trending shore can be seen to be migrating progressively shoreward (1973, 1978) and becoming aligned in a more west-east direction, off John's Hole Point (1989 and 2000). This confirms the concept of a semi-closed sediment circulation cell postulated by Stove (1978) and Weatherhill (1980), in which sand erosion and wind action have moved sand from the west side of the South Forvie peninsula into the river, which then transports sand back to the mouth of the estuary, forming a sand spit and bars which are then moved back onto the foreshore by wave and tidal forces.

### 3a.4 Gross morphology of dune systems

Mapping from the aerial photography generally revealed that the main dune features in North Forvie are essentially in or about the same location as in 1967. Although parabolic dunes are often referred to as 'shifting dunes', in the case of North Forvie stabilisation by vegetation cover is fairly advanced. However, there has been some readjustment and realignment of dune crests (in some cases a retreat of 15m is detectable) and the area and shape of deflation plains and position of trailing arms have altered in detail, but the main system

'whale-back' ridge sandhill is invariably detectable, as is the rump of the vegetated dunes at John's Hole Point on the southernmost tip ( Figure 6 ).

### 3b Foveran

Before analysis of 'changes' can be attempted, it is necessary to map the situation for at least two dates. The baseline mapping of Foveran is derived from only one set of aerial photography (July, 1994) and so a 'Description of Changes' cannot be done in the same way as for Forvie.

Although not a part of the original remit, it was decided to look at the 1967 aerial photographic cover, in order to gain an impression of the overall pattern of bare sand cover in 1967 and 1994, and of movements between 1967 and 1994. Table 2 reveals that the overall area covered by bare sand appears to have changed very little, with an increase in the area occupied by bare sand of only 1.4%

Year	(ha)	% of total	1967 as base 100
1967	58.1300	24.5	100
1994	58.9200	24.8	101.4

*N.B.  
This is Foveran  
SSSI which  
includes Menie*

However, internal changes in the distribution pattern of bare sand areas within Foveran SSSI has been quite dramatic during the 27 year period. The bare sand data in Table 2 for the whole SSSI area conceal some large scale movements and redistribution of bare sand within the designated area (for example, in places the sand 'edge' appears to have migrated almost 200m inland during the 27 year period). A further striking feature has been the widening of the 'dry sand' beach at the northern end by about 100m, confirming the view of an emergent coastline and providing an increased supply of dry sand for uplifting and transporting on-shore by wind action. As for Forvie, detailed maps were prepared and

measurements made of the bare sand areas (this time for 1967 and 1994) in each 250m square grid cell. Details of the percentage sand cover in each 250m square grid cell for 1967 and 1994 are given in Appendix C, where it is evident that the two most extensive bare sand fields (at the northern and southern ends of the SSSI) exhibit a marked south to north transfer of sand, while generally retaining the sand within the SSSI designated area (thus, perhaps, explaining why the data of Table 2 suggests little change overall in the total area of bare sand).

*Reminded  
this is the  
Menie  
area*

Unlike the Forvie NNR, where public access and human activity are closely controlled, the Foveran SSSI is subject in places to heavy recreational use, and part of it is a working farm. There is also sand extraction in several areas, but comparison of the two dates of aerial photography suggests that most of the increased extraction has been taking place outwith the SSSI boundary (this can be investigated further once a field visit is possible). However, although the human-induced changes may require monitoring, the scale of these changes is relatively minor when compared with the natural changes detected in the time-lapse study of sand movements shown on the 1967 and 1994 aerial photography.

Following the lifting of 'Foot and Mouth' restrictions, a field visit was made on 10 August. This revealed that the main changes in the SSSI were increasing emergence of the coastline (especially towards the north end) and vegetation colonisation and stabilisation of blowouts and deflation plains. This is evident in the ground-based photos in Appendix E.

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No evidence was found of sand extraction, and some sand pits visible on the 1994 aerial photography have, in fact, now disappeared (Appendix E, Photo 25). The most extensive areas of blown sand occur towards the southern end of the SSSI (Drums and Menie Links) where there has been some landward (and northward) extension of blown sand, but also vegetation colonisation of deflation plains (visible in a range of the ground-based photos).

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# Sands of Forvie NNR

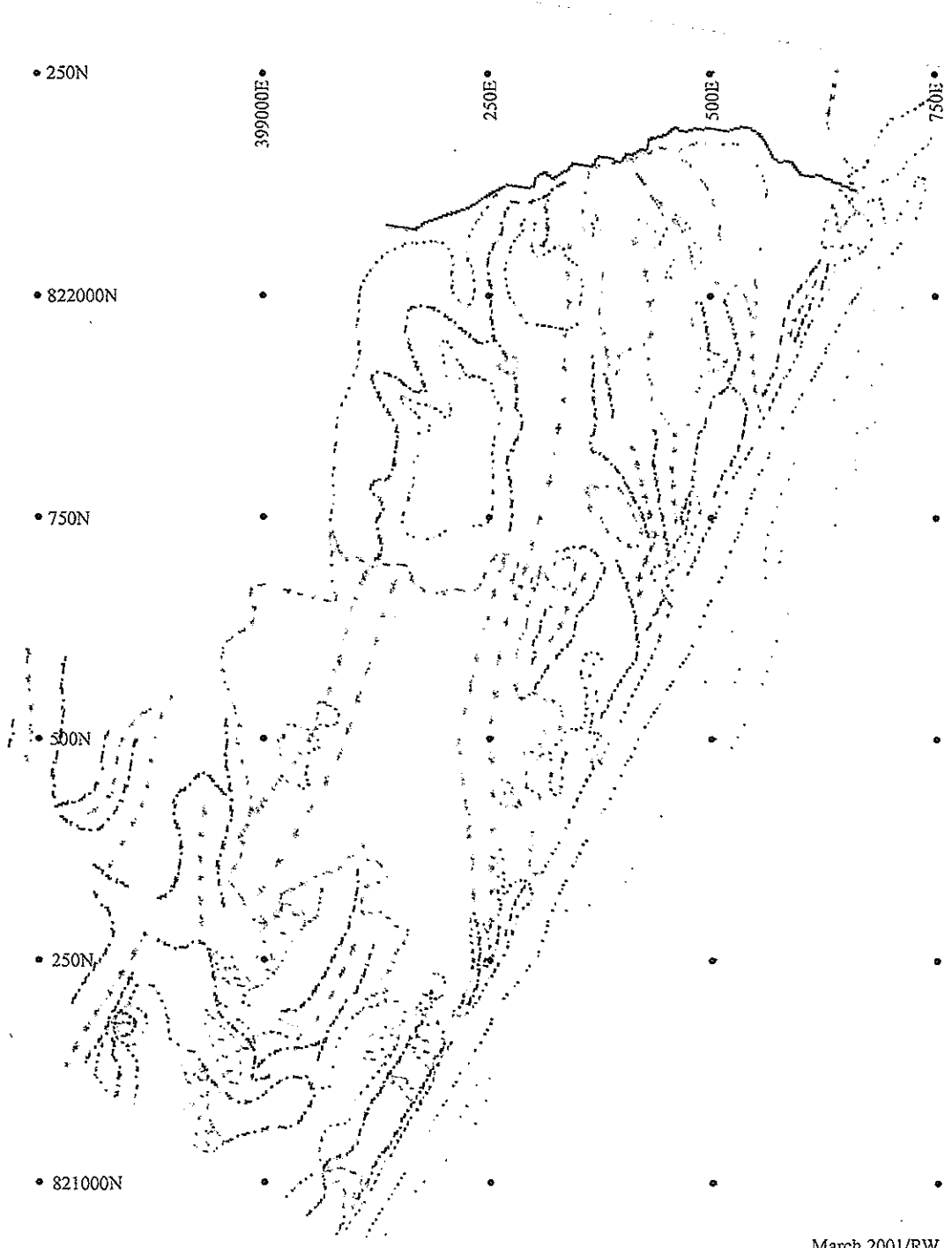
## Key to geomorphology maps: Figures 1-6

*(based on interpretation of aerial photography of 1979, 1989 and 1999)*

- — — Dune ridge crest, 1979
- Dune ridge crest, 1989
- ..... and ..... Dune ridge crest, 1999
- ⑫ Landform unit, 1999. Numbers follow key of 1967 classification, as follows:
  - 1a Stable, vegetated, smooth sand surface, frequently transitional to adjacent non-sand surfaces.
  - 1b Low, raised shoreline surface.
  - 2 Higher sand surface, broken by hills and hollows, some of which are active. Frequently adjoining major dune or sandhill complexes.
  - 3 Stable plateau or plain surface which is essentially a deflation landform. Often wet in winter. Sand cover thin, discontinuous or absent. Generally under heath vegetation. Surface is essentially formed on drift, till or rock.
  - 4 Major arc of dune or sandhills.
  - 5 Hillock zone with broken sand ridges superimposed on a pre-existing smooth surface.
  - 6a Stable, smooth, often flat deflation surface, usually associated with relatively recent retreat of sand ridge or dune complex.
  - 6b Active, smooth, often flat deflation surface, usually associated with relatively recent retreat of sand ridge or dune complex.
  - 7 Residual sand ridges, dune or higher surfaces. Often the penultimate stage in the removal of an older high sand surface.
  - 8 Generally smooth or gently undulating till, drift or rock ridges. May be thinly covered by sand features.
  - 9 Coastal dune complex.
  - 10a Stable but relatively recent V-shaped blowout.
  - 10b Active V-shaped blowout.
  - 11 Gravel spreads within the dune complex.
  - 12 All forms of bare sand, including blowouts, beach areas above high water mark and sand waves on the dune areas.
  - 13 Undulating drift or till or fluvio-glacial surface. This is a general description of the topography lying landwards of the main areas of sand cover.
  - 14 Higher sand surface which is mainly smooth. Often forms the backslope of dune and sandhill complexes. May have small hillocks superimposed on surface.
- Water feature

*Original geomorphology classification on 1967 map at 1:7500 scale. Figures 1-6 are at 1:7500 scale with grid points every 250m. Major changes in dune ridge crests can be seen by placing transparencies over 1967 map. For clarity, the numbered landform units (in red) are shown only for 1999.*

**Figure 9** Foveran SSSI : Geomorphology, 1994.



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