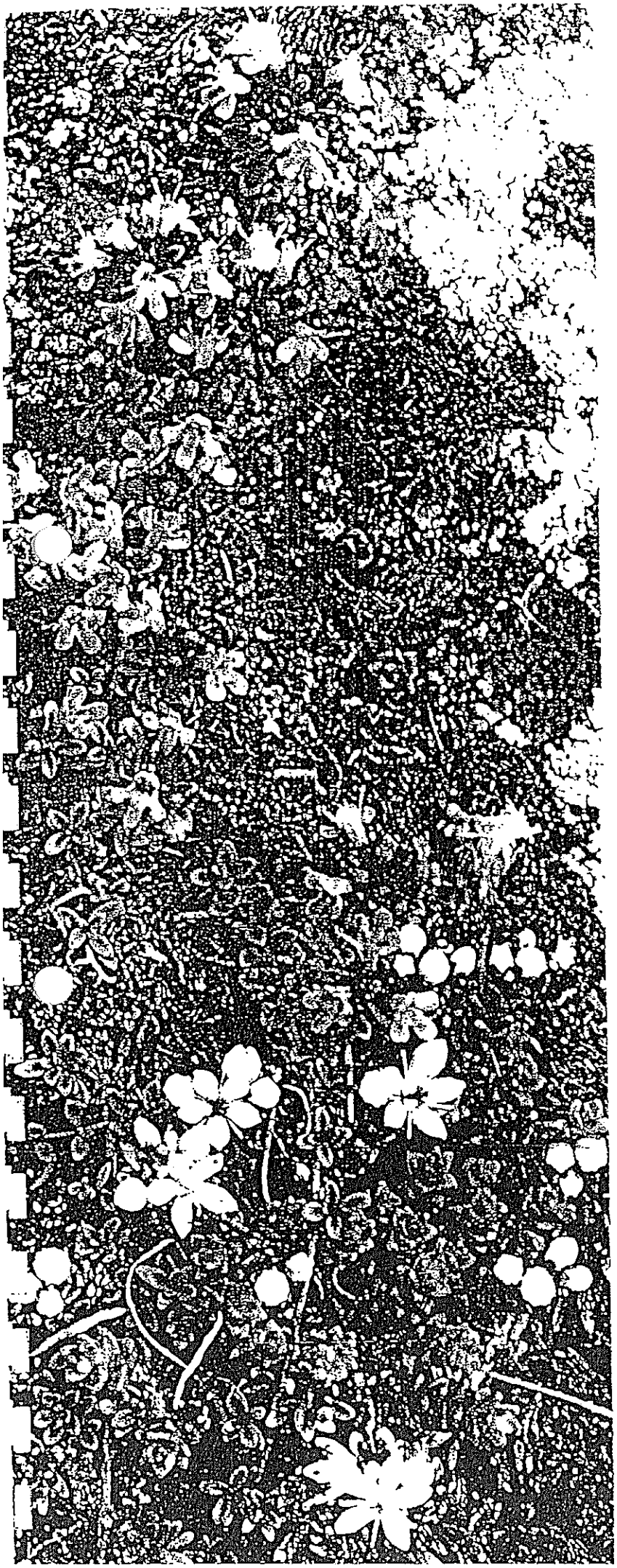

NOTHUMBRIA T32
LINDISFARNE

NVC Survey of Ross Links,
Lindisfarne SSSI:
Vegetation Change 1988 - 1998

T. Dargie
1998

A report to English Nature
(Northumbria Team)

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1. PROJECT OBJECTIVES AND END PRODUCTS

1.1 Background

Ross Links, including the tidal island of Old Law to the north, is part of the Lindisfarne SSSI/cSAC. It is a large sand dune system which is of particular note for its dune slacks (areas of low ground under the influence of the watertable, usually with some winter flooding on all except the highest levels), acidic dune grassland and dune heath. The dune heath is a significant habitat because it is the only substantial occurrence between Fife and Norfolk on the east coast of Britain, and is a priority habitat under the EC Habitats Directive. Several nationally scarce and nationally rare species (higher plants and bryophytes) have also been recorded for the site.

Ross Links (but not Old Law) has probably been used for stock grazing for many years, perhaps over several centuries. The land was requisitioned by the Ministry of Defence during the Second World War and was used for military training, including firearms practice using a target railway. The land was brought back into farming use after the war and stock grazing was resumed. From the mid-1960s extensive winter feeding has been used to allow all year pasture for cattle and sheep. The western part of blown sand at Ross Links (outside the SSSI) has been largely improved by modifying topography, re-seeding and fertiliser addition. Shelterbelts have also been planted in the west to increase stock production.

A survey in 1988 using the methods of the National Vegetation Classification (NVC) mapped the SSSI area and other blown sand to the west, reporting extensive localised degradation of vegetation within the SSSI (Woolven & Radley 1989). This degradation was considered due to increased nutrients produced directly from rotting feed and straw, and indirectly from stock dunging and urination. In addition, there was turf and soil damage from stock concentrated in feed areas, invasion of dune grasslands by species typical of improved pasture (*Lolium perenne, Cynosurus cristatus*), and extensive development of weed-dominated vegetation close to feeding areas. The scale of degradation was analysed using map overlay techniques to measure change in the period since 1955 using three vegetation maps (Dargie 1992). Almost 48% of the area surveyed in 1988 by Woolven and Radley was recorded as improved, although much of this ground was concentrated in the west of Ross Links outside the SSSI boundary.

A management agreement with the owner of Ross Links was agreed in 1995, aimed at restoring the nature conservation value of land within the SSSI. This has involved reducing stocking levels and the number of feeding stations in the north of the site (which holds the best remaining areas of slack and dune heath) and providing larger concrete feeding areas and new tracks in the south of Ross Links to minimise damage from stock trampling and vehicles transporting feed. This report covers aspects of vegetation monitoring. The primary aim is to assess the results of the management agreement in terms of vegetation change and the scale of improved nature conservation interest. Secondary aims include examining change in 21 quadrats recorded in 1988, plus a search for nationally rare and scarce higher plant species/hybrids recorded for the site.

1.2 Project objectives

There are three aims covered in this report:

1. A further NVC survey of Ross Links (including Old Law) within the SSSI boundary and an analysis of vegetation change since the 1988 survey (Woolven & Radley 1989);
2. Repeat survey of fixed quadrats established in 1988 at the time of the NVC survey (late May) and an analysis of qualitative and quantitative vegetation change;
3. Mapping and population estimates for the following nationally rare and scarce species/hybrids which have been recorded for the site: *Pyrola rotundifolia rotundifolia, Radiola linoides, Anagallis minima, Ranunculus baudotii, Equisetum variegatum, Corallorhiza trifida, Centaurium littorale,* and x *Calammophila baltica.*

1.3 End Products

The output specified for this contract is a report covering the three aims above, including an NVC map recording vegetation types on Ross Links in 1998.

2. 1998 NVC SURVEY AND ANALYSIS OF VEGETATION CHANGE

2.1 Methods

2.1.1 Timing

Ross Links was visited in late May 1998 to undertake most work. A further brief (half day) visit was completed in late July, to search for selected species which were not likely to be seen in the main phase of work in May. A total of seven days in the field was devoted to all project work.

2.1.2 Field preparation

The 1988 NVC map (Woolven & Radley 1989) was digitised using specialist raster-to-vector software. The map was scanned at 600 dpi and the raster image automatically vectorized. Annotation detail was deleted. The intersections of OS 1 km national grid lines were used as control points to calibrate vectors to OS national grid coordinates and then the grid lines were deleted. The vector data was then imported into the Tydac SPANS Explorer Geographical Information System (GIS) as a line layer. This was checked for duplicate lines, dangling segments and a self-intersection analysis performed to ensure all crossing lines had a node. The line layer was then transformed into an area (polygon) layer. This was checked for polygon integrity and several unclosed ring errors were noted. All were faults on the 1988 survey map, failing to close all boundaries for a polygon. For small cases an arbitrary additional boundary was added. For large cases the incomplete boundaries were deleted. A map composition was then created in the GIS, comprising polygon boundaries and 1 km OS national grid lines. This map was then printed at 1:5000 scale on A3 waterproof paper for use in the field (four map sheets were required to cover the survey area). Polygons outside the SSSI boundary were marked as being excluded from 1998 survey.

2.1.3 Field procedure

Each SSSI polygon on the 1988 map was located and carefully examined. If necessary, polygon boundaries were modified to reflect changes which have occurred since 1988. If no change in boundary position had occurred, the 1988 boundary line was marked carefully in pencil on an A3 transparent drafting film overlay placed over the 1988 boundary set. If changes had occurred, these were also recorded. In this manner a new NVC boundary map was constructed reflecting 1998 conditions but which, in addition, assessed 1988 boundaries. Locating boundaries used a combination of fixed points and lines in the field (compartment fences) and a hand-held GPS recorder providing OS national grid coordinates which were recorded to +/- 25 m accuracy (root mean square error, including military signal degradation by selective availability).

The 1998 NVC status of the vegetation in each new marked polygon was recorded by assessing current vegetation, based on the experience of the author on dunes at Ross Links (field survey in 1972) and elsewhere in Britain (>34000 ha of NVC dune survey in the period 1988 to 1998, extending from Shetland to the Isles of Scilly). No unfamiliar vegetation was encountered apart from ruderal vegetation which has yet to be made available in pre-publication NVC format. No additional quadrats were therefore recorded and the data set listed in Woolven & Radley (1989) can be considered adequate for summarising the site, apart from the NVC classification allocated to quadrats. The NVC system for sand dunes has been changed since the draft classification was issued in 1988 and the current list was applied, together with one potential new sub-community which is found locally in Scotland and at Ross Links (a form of semi-fixed dune on acidic sand).

The vegetation or other land cover (e.g. road) of each 1998 polygon was recorded in pencil on the transparent overlay. Mosaic vegetation (i.e. a polygon containing two or more NVC/other land cover types) was recorded using the following annotation system:

Type 1 (x) + Type 2 (y) + ... Type n (z)

where Type refers to the NVC or other land cover code, and the value in each brackets is an estimate (in tenths of polygon area) of the proportion of the mosaic occupied by the type. As an example, the mosaic notation SD12(7)+SD12/SD16(2)+SD16(1) refers to a polygon containing 70% SD12, 20% SD12/SD16 (an intermediate between SD12 and SD16), and 10% SD16. A list of the NVC types and other land cover types recorded in 1998 is given in Table 2.1. This notation system is used to cope with small-scale local variation in vegetation due to microtopography and patchy grazing impacts. It has only been used for areas where variation cannot be mapped with accuracy at a scale of 1:5000 on field sheets. However, such occurrences are common. Slack environments have differences in height above the watertable which can allow several vegetation types to occur in a small area. Areas close to rabbit warrens often show patchy vegetation development due to local differences in grazing pressure, plus scraping, burrowing, urination and dropping effects. Likewise, there is a local patchy zonation in stock grazing effects around feeding stations.

2.1.4 Digitising the 1998 map

The field sheets (annotated drafting film overlays) were treated in the same manner as the 1988 vegetation map. Each sheet was scanned and digitised by raster-to-vector software, removing annotations in editing and scaling results using the intersection of OS 1 km grid lines. The vector data sets from each scanned image were fused by importing into specialist software and linking lines on the edge of sheet joins. Results were imported into SPANS Explorer GIS as a line layer which was checked for duplicate lines and dangling segments. A self-intersection analysis was performed to ensure all crossing lines had a node. The line layer was then transformed into an area (polygon) layer.

2.1.5 Harmonising attributes for the 1988 and 1998 maps

The NVC and/or other land cover codes for polygons were added to the 1988 and 1998 data layers in SPANS Explorer GIS. For 1988 data this was not straightforward. The NVC classification for sand dune vegetation was changed in 1989 and data had to be harmonised with the present classification. Likewise, abbreviations used for other land cover types also had to be made equivalent between 1988 and 1998 results. A further complication with 1988 results is that several polygons are described using target notes or quadrat numbers and these had to be examined individually within Woolven & Radley (1989) to estimate their status in terms of a harmonised classification. Harmonisation details for 1988 polygons are given in Table 2.2.

To compare change over time in relation to management, it was also necessary to add the location of polygons in terms of management compartment. The interior of Ross Links is divided into 8 fenced paddocks (see Figure 2.1: N3-N6, S7-S10). These fence lines were marked on the 1988 and 1998 maps, retaining the lines in the GIS even if the same vegetation types were present either side of a fence. This approach was, however, difficult to apply in 1998 data for compartments S8 and S9 (as existed in 1988) because some 1988 fencelines had been removed and new tracks and fences constructed as part of management agreement implementation. No map was available giving the precise locations of new roads and fences and their positions were therefore added as approximations based on GPS recordings. In terms of analysis two other sectors of Ross Links are considered here as compartments: Old Law and the unfenced fringe of coastal-edge dunes on Ross Links. No stock grazing takes place in these two sectors and they provide a useful indicator of rabbit-only effects.

Table 2.1 NVC and other land cover codes used in 1998 survey and harmonising 1988 survey

Mapping codes	NVC and other land cover codes used for 1998 survey and harmonising 1988 vegetation map
BBG	Buildings and concrete feeding areas
BBS	Beach above MHWS
BS	Bare sand (within vegetated dunes - not beach)
BSH	Bare shingle
CP	Coniferous plantation
H11	H11 *Calluna vulgaris - Carex arenaria* heath
H11a	H11a *Erica cinerea* sub-community
H11c	H11c Species-poor sub-community
H11/SD12	H11/SD12 intermediate (probably reverting to SD12 grassland)
H11/U20	H11 invaded by U20 bracken
M23b	M23b *Juncus acutiflorus/J. effusus - Galium palustre* rush pasture, *J. effusus* sub-community
M23x	M23 with *Juncus* x *surrejanus* as the dominant *Juncus*
MG6	*Lolium perenne - Cynosurus cristatus* pasture
MG6/RUD	Ruderal-infested MG6
MG6/RUDPa	MG6 with abundant *Poa annua* and other ruderals
MG6/U20	MG6 invaded by U20 bracken
MG7	*Lolium perenne* ley
MG7/U20	MG7 invaded by U20 bracken
OV27e	OV27e *Chamerion angustifolium, Ammophila arenaria* sub-community
OW	Open water (small ponds, no clear aquatic vegetation types present)
ROAD	Road or other vehicle track (not all mapped)
RUD	Ruderal vegetation (usually *Arctium minus, Cirsium arvense, C. vulgare,* and/or *Senecio jacobaea*)
RUDPa	Ruderal vegetation dominated by *Poa annua*
RUDUd	Ruderal vegetation dominated by *Urtica dioica*
S10	S10 *Equisetum fluviatile* swamp
S14	S14 *Sparganium erectum* swamp
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community
SD10a	SD10a *Carex arenaria* dune, *Festuca rubra* sub-community
SD10b	SD10b *Carex arenaria* dune, *Festuca ovina* sub-community
SD12a	SD12a *Carex arenaria - Agrostis capillaris - Festuca ovina* fixed acidic dune grassland, *Anthoxanthum odoratum* sub-community
SD12b	SD12b *Holcus lanatus* sub-community
SD12z	SD12z Ammophila arenaria sub-community (acidic form of semi-fixed dune)
SD12/SD16	SD12 with high cover of *Salix repens*
SD12/U20	SD12 invaded by U20 bracken
SD12z/U20	SD12z invaded by U20 bracken
SD14a	SD14a *Salix repens - Campylium stellatum* dune slack, *Carex serotina - Drepanocladus* spp. sub-community
SD14c	SD14c *Bryum pseudotriquetrun - Aneura pinguis* sub-community
SD14d	SD14d *Festuca rubra* sub-community
SD15a	SD15a *Salix repens - Calliergon cuspidatum* dune slack, *Carex nigra* sub-community
SD16	SD16 *Salix repens - Holcus lanatus* dune slack
SD16/WH	SD16 with prominent amounts of *Erica tetralix*
SD16a	SD16a *Ononis repens* sub-community
SD16c	SD16c *Prunella vulgaris - Equisetum variegatum* sub-community
SD16d	SD16d *Agrostis stolonifera* sub-community
SD17d	SD17d *Potentilla anserina - Carex nigra* dune slack, *Hydrocotyle vulgaris - Ranunculus flammula* sub-community
SD2	*Cakile maritima - Honkenya peploides* strandline
SD4	SD4 *Elytrigia juncea* embryo dune
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elytrigia juncea* sub-community
SD6c	SD6c *Leymus arenarius* sub-community
SD6d	SD6d Typical sub-community
SD6e	SD6e *Festuca rubra* sub-community
SD6f	SD6f *Poa pratensis* sub-community
SD6g	SD6g *Carex arenaria* sub-community
SD7a	SD7a *Ammophila arenaria - Festuca rubra* semi-fixed dune, Typical sub-community
SD7b	SD7b *Hypnum cupressiforme* sub-community
SD7c	SD7c *Ononis repens* sub-community
SD7d	SD7d *Tortula ruralis* ssp. *ruraliformis* sub-community

Table 2.1 (continued) NVC and other land cover codes used in 1998 survey and harmonising 1988 survey

Mapping codes	NVC and other land cover codes used for 1998 survey and harmonising 1988 vegetation map
SD8b	SD8b *Festuca rubra - Galium verum* calcareous fixed dune, *Luzula campestris* sub-community
SD8b/SD16	SD8b with high cover of *Salix repens*
SD8b/U20	SD8b invaded by U20 bracken
SD8c	SD8c *Tortula ruralis* ssp. *ruraliformis* sub-community
SD9a	SD9a *Ammophila arenaria - Arrhenatherum elatius* dune grassland, *Festuca rubra* sub-community
SD9a/U20	SD9a invaded by U20 bracken
SM13	SM13 *Puccinellia maritima* saltmarsh
SM16	SM16 *Festuca rubra* saltmarsh
SM27	SM27 Ephemeral *Sagina maritima* saltmarsh
U20	U20 *Pteridium aquilinum - Galium saxatile* bracken
W21	High cover of *Crataegus monogyna* bushes in dune grassland (N.B. but not fully developed scrub)

Table 2.2 Harmonisation details used to convert 1988 codings to present NVC system and other land cover types

Codes on 1988 vegetation map	Harmonised codes using post-1989 NVC and other land cover detail (see Table 2.1 for details of types listed)	Comment
AG/SD15	SD12/SD16	AG could also be coded as U4 or U5 acidic grassland
AI	MG6	MG6 applied on basis of 1998 observations or 1988 target notes
AI	MG7	MG7 applied on basis of 1998 observations or 1988 target notes
BS	BS	
CP	CP	
H11	H11	
H11/Pt	H11/U20	No information available on extent of bracken invasion
H11+ScPt+SD11	H11/U20(5)÷SD12/U20(5)	Balance of mosaic components unknown - 50% each is arbitrary
M23	M23	
M23a	M23x	Most M23 *Juncus* is probably J. x *surrejanus*, the hybrid between *J. articulatus* and *J. acutiflorus* (latter is type species for M23a). M23x is used to denote unusual status of Ross Links M23 rush pasture.
M23a+MG6+SD10/SD11	M23x(1)+MG6(3)+SD8/SD12(6)	Balance of mosaic components unknown - values in brackets are arbitrary
M23b	M23b	
MG1/SD10	MG1/SD8	
MG1/SD11	MG1/SD12	
MG6	MG6	
MG6/SD10/SD11	MG6/SD8(5)÷MG6/SD12(5)	Balance of mosaic components unknown - 50% each is arbitrary
MG6+SD10	MG6/SD8	
MG7	MG7	
MIXED LABELS	SD8b(5)+SD12(3)+SD16(2)	Large unclosed polygon with different labels is different parts of the polygon area. All labels marked within the polygon used as a mosaic, arbitrary allocation of extents in brackets
NO LABEL	BBG	BBG applied on basis of 1998 observations
NO LABEL	BBS	BBS applied on basis of MHWS line on map
NO LABEL	BSH	BBG applied on basis of 1998 observations
NO LABEL	NO LABEL	Unlabelled polygon on 1988 map, likely 1988 status uncertain on basis of 1998 observations
NO LABEL	SD2	SD2 present in 1998, likely to have been here in 1988
Pt	U20	
Pt+SD10	SD8/U20	No information available on extent of bracken invasion
Pt+SD11	SD12/U20	No information available on extent of bracken invasion
Q17	SD17/WH	
Q22	SD16c	
Q23	SD15a	
ROAD	ROAD	
ScPt+SD11	SD12/U20	No information available on extent of bracken invasion
SD10	SD8	
SD10/MG6	MG6/SD8	
SD10/MG7	MG6/SD8	
SD10/SD11	SD8/SD12	
SD10+M23b	M23b(5)+SD8b(5)	Balance of mosaic components unknown - 50% each is arbitrary
SD10c	SD7b/SD8b	
SD10c	SD8b	
SD10c(SH)	BSH(4)+SD8b(6)	Balance of mosaic components unknown - values are arbitrary
SD10c(SH)	BSH(5)+SD8c(5)	Balance of mosaic components unknown - 50% each is arbitrary
SD10d	SD8b	
SD11	SD12	
SD11	SD12z	Quadrat data and 1998 status suggest SD12z in this SD11 type
SD11/H11	H11/SD12	
SD11/WH	SD12/WH	

Table 2.2 (continued) Harmonisation details used to convert 1988 codings to present NVC system and other land cover types

Codes on 1988 vegetation map	Harmonised codes using post-1989 NVC and other land cover detail (see Table 2.1 for details of types listed)	Comment
SD15	SD16	
SD15/SD16	SD16/SD17	
SD15/SD16+M23b	M23b(5)+SD16/SD17(5)	Balance of mosaic components unknown - 50% each is arbitrary
SD15/WH	SD16/WH	
SD15+M23b	M23b(5)+SD16(5)	Balance of mosaic components unknown - 50% each is arbitrary
SD15a	SD16c	
SD15b	SD15a	
SD15d	SD16	
SD16	SD17d	
SD16/WH	SD17/WH	
SD5	SD4	
SD6a	SD6d	
SD6b	SD6a	
SD6c	SD6g	
SD6e	SD6e	
SD6f	SD6f	
SD6f/10	SD7a	
SD7a	SD5b	
SD8	SD6b	
SD9	SD7c	
SD9/10	SD7/SD8	Assumed to be transitional between SD7 and SD8
SD9+SD10+SD15d	SD7c(3)+SD8(4)+SD16(3)	Balance of mosaic components unknown - values in brackets are arbitrary
SI SD10	MG6/SD3	
SM	SM16	
W	OW	

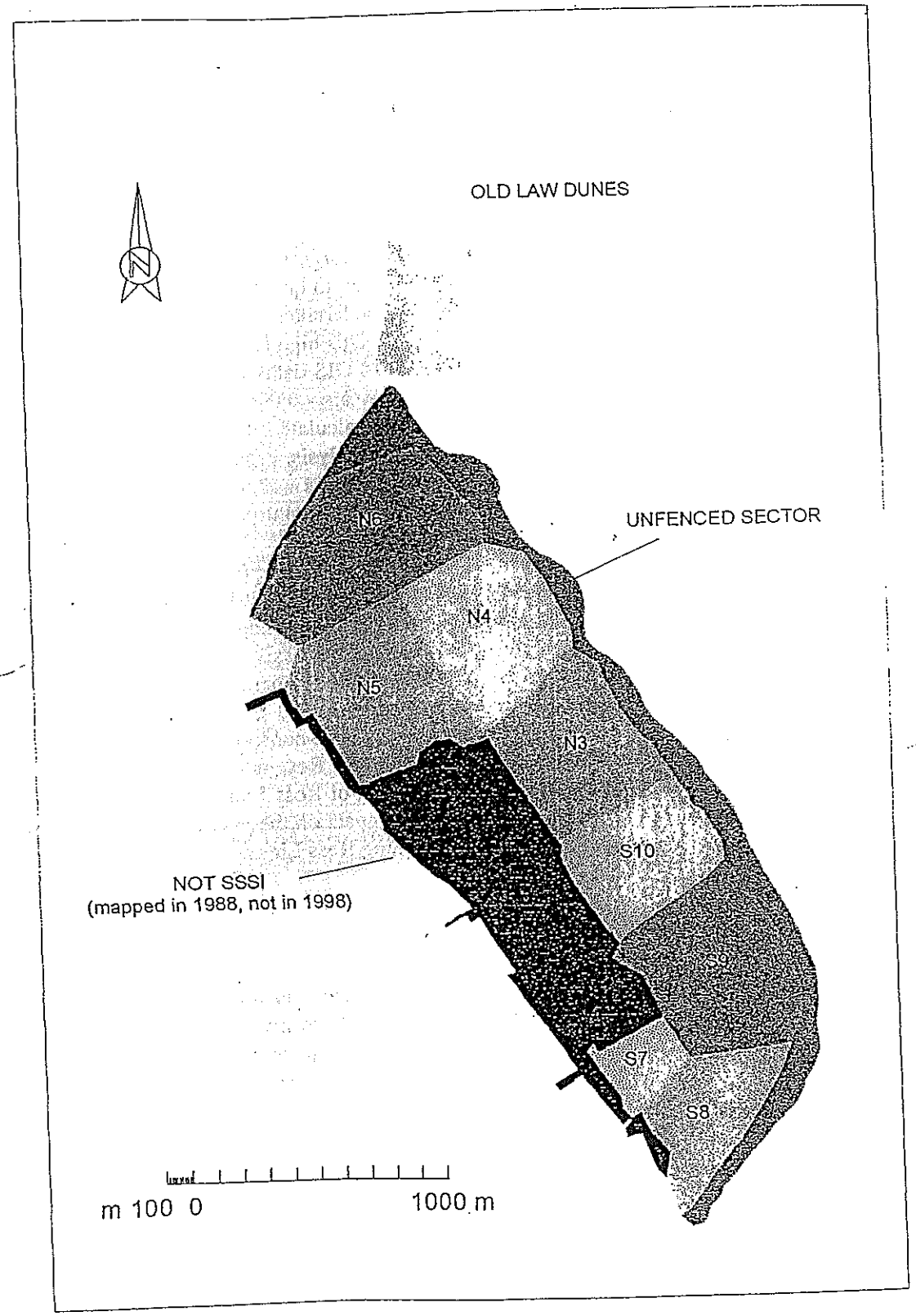


Figure 2.1 Management compartments and other sectors at Ross Links

2.1.6 *Data modification for analysing vegetation change*

The final total of polygons (487) and list of vegetation and land cover types in 1988 was higher than expected. The polygon total was even higher in 1998 results (759), despite survey covering a smaller area (only SSSI land). The increase in polygon totals for 1998 results is partly due to due to a wider range of slack types in the post-1989 NVC classification for sand dunes, but it mainly reflects much local vegetation change.

Both the 1988 and 1998 data sets also contained a large number of mosaic polygons which posed problems for analysis of change. It had been proposed to quantify change using an area - area overlay analysis using SPANS Explorer GIS. This was undertaken but the new area layer of fused 1988 and 1998 polygons was very large (4621 polygons). This high total was the result of very slight differences in the coordinate registration of 1988 and 1998 GIS datasets, resulting in a large number of minute 'sliver' polygons (2931 polygons in the overlay are <0.005 ha in extent and have a total area of only 3.52 ha). It would have been a major task to calculate the individual area of each NVC type using either GIS database techniques or spreadsheet analysis, especially since mosaic polygons have to have their total area split between constituent types. Time was not available within the overall programme to do this and an alternative assessment of change was introduced.

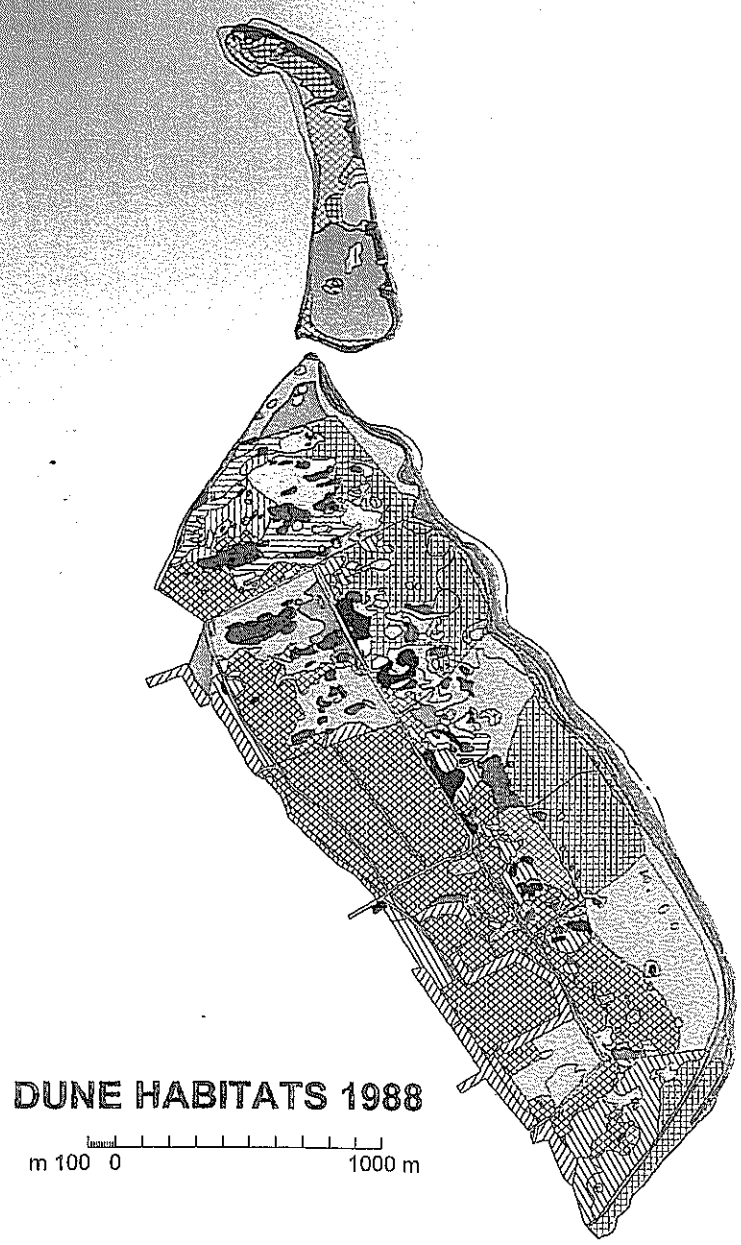
The large number of NVC types and other land covers were first grouped into 27 different dune habitats which reflected conditions and likely aspects of change at Ross Links (Table 2.3). Each polygon in the 1988 and 1998 datasets was then classified into one habitat in this set. In the case of mosaic polygons, the polygon was allocated to a habitat on the basis of likely dominant land cover type. The area of each dune habitat in each of 10 management compartments was then calculated for 1988 and then 1998 data using Structured Query Language (SQL) procedures in SPANS Explorer GIS. Results were exported to a spreadsheet and bar graphs were constructed showing 1988 and 1998 extents (in hectares) per habitat type for each compartment. Results from all compartments were pooled to provide further bar graphs showing change for all of Ross Links. Each bar graph was then interpreted in terms of amounts of change and the likely impact on the nature conservation interest of a particular compartment and all of the SSSI area containing Ross Links.

2.1.7 *Presentation of raw data*

The areas of each habitat type on a compartment basis and for Ross Links as a whole are given in Annex 1. Coloured habitat maps for 1988 and 1998 are given in Figure 2.2. The labelled 1998 NVC map is presented in Annex 2. The 1988 vegetation map should be consulted in Woolven & Radley (1989). GIS data sets of the 1988 and 1998 maps are also saved in MapInfo format (.mid/.mif) and supplied to English Nature on diskette.

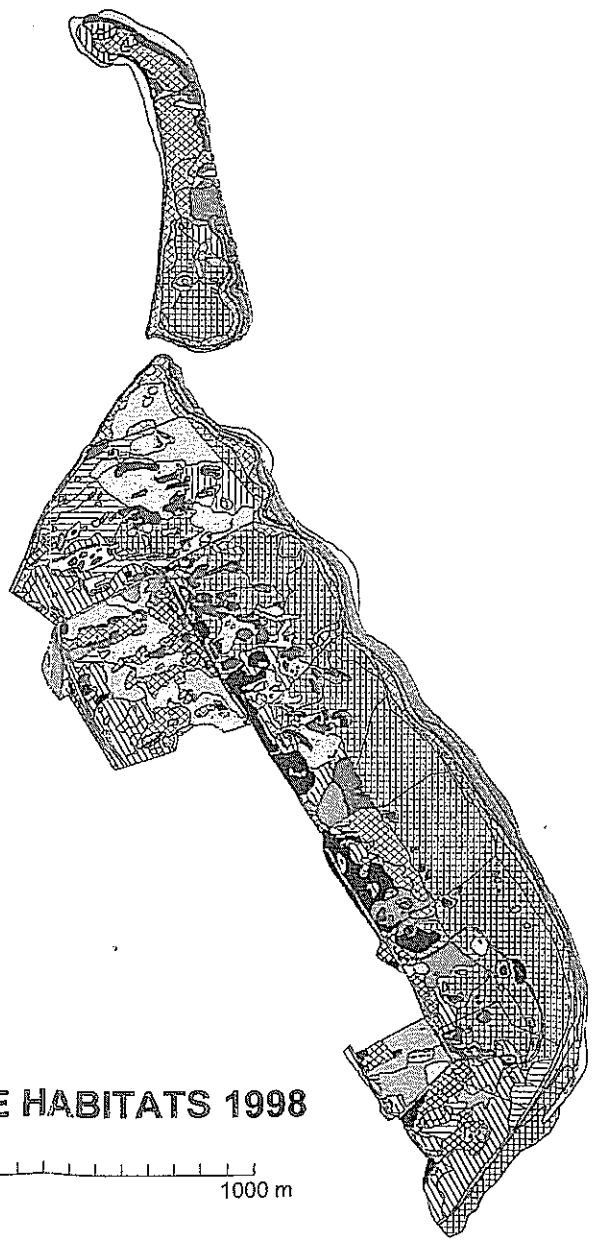
Table 2.3 Habitat types and their constituent NVC and other land cover types

Abbreviated code	Full description	Constituent NVC and other land cover types
01 - BCHSTR	01 Beach and strandline above MHWS	BBS, SD2
02 - BSDBSH	02 Bare sand and bare shingle	BS, BSH
03 - WETSND	03 Wet bare sand (in slacks)	BS (with SD14, SD15, SD16, SD17)
04 - MOBDUN	04 Mobile dune	SD4, SD6, SD10
05 - CALCSF	05 Calcareous semi-fixed dune	SD7, SD9
06 - ACIDSF	06 Acidic semi-fixed dune	SD12z
07 - TRSFFX	07 Transitional fixed - semi-fixed dune	SD7/SD8 (except SD7d and SD8c), SD12/SD12z
08 - FXCALC	08 Calcareous fixed dune	SD8 (except SD8c)
09 - TORTUL	09 *Tortula* fixed and semi-fixed dune	SD7d, SD8c and SD7/SD8 intermediates with these
10 - FXACID	10 Fixed acidic dune	SD12
11 - DRYHTH	11 Dry dune heath	H11
12 - BRAKEN	12 Bracken dominant	U20
13 - BINVGS	13 Bracken-invaded dune grassland	SD7/U20, SD8/U20, SD12/U20
14 - BINVHT	14 Bracken-invaded dry dune heath	H11/U20
15 - WETHTH	15 Wet dune heath	SD16/WH, SD17/WH
16 - SIGRAS	16 Semi-improved grassland	MG6 or MG7 intermediates with SD7, SD8 or SD12
17 - IMPGRA	17 Improved grassland	MG6, MG7
18 - FEEDNG	18 Straw-covered and ruderal-dominated vegetation in areas used for stock feeding	STRAW, RUD, RUDPa, RUDUd
19 - WETSLK	19 Wet slack (high slack bryophyte content, sometimes wet bare sand)	SD14, SD15, SD16c, SD16d, SD17
20 - DRYSLK	20 Dry slack (low bryophyte content, no wet bare sand)	SD16 (except SD16c, SD16d), SD8/SD16, SD12/SD16
21 - RUSHPS	21 Rush pasture	M23, M23/SD17
22 - SALTMS	22 Saltmarsh	SM13, SM16, SM27
23 - CONCRT	23 Concrete floors to stock feeding areas	BBG
24 - PNTATN	24 Plantation	CP
25 - ROAD	25 Road and vehicle track	ROAD
26 - NOLABL	26 No label (1988 survey only)	NO LABEL
27 - OWSWMP	27 Open water (ponds) and swamp	OW, S10, S14, S19



DUNE HABITATS 1988

m 100 0 1000 m



DUNE HABITATS 1998

m 100 0 1000 m

Dune habitats

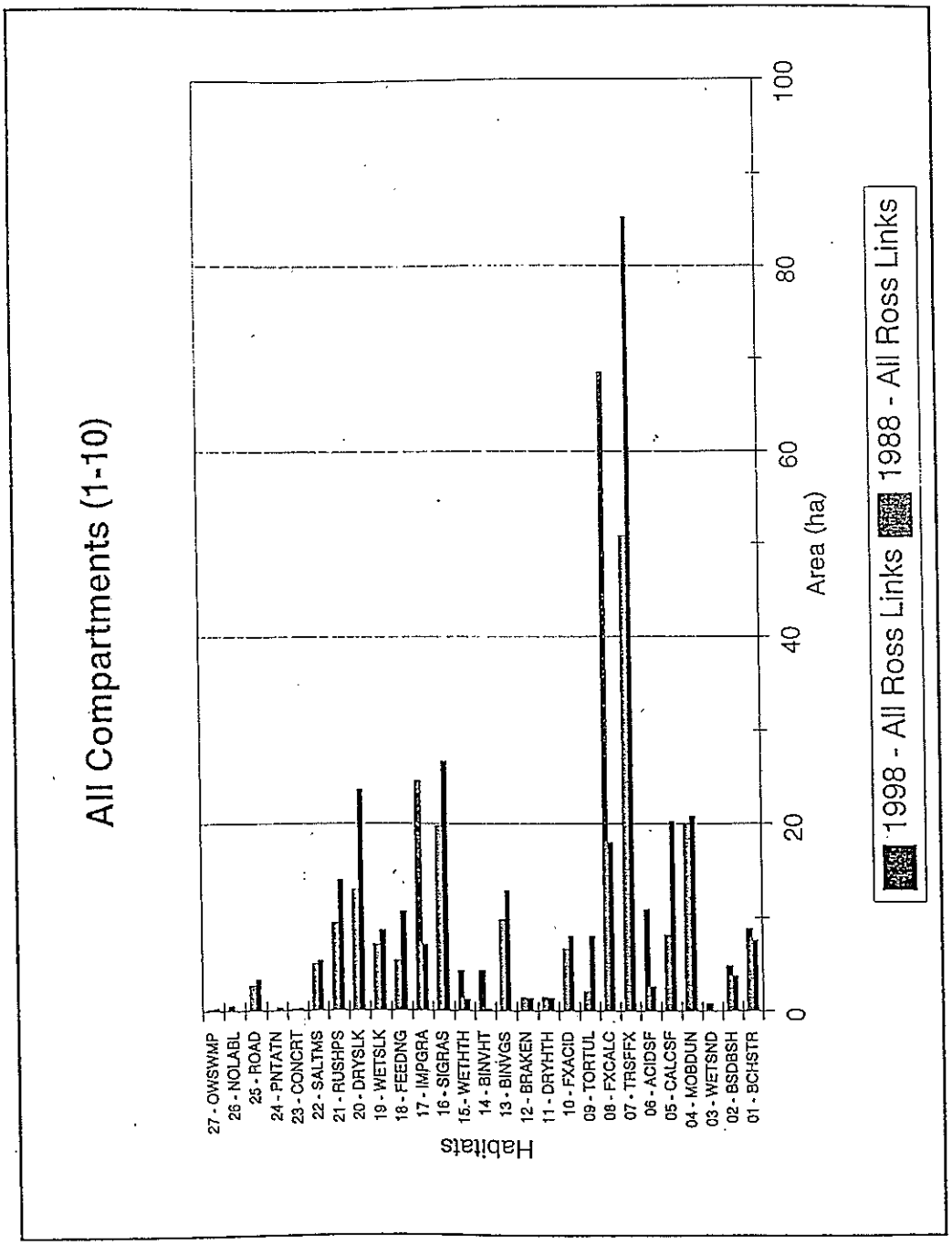
- 01 Beach and strand
- 02 Dry bare sand and shingle
- 03 Wet bare sand in slacks
- 04 Mobile dune
- 05 Calcareous semi-fixed dune
- 06 Acidic semi-fixed dune
- 07 Semi-fixed - fixed dune transition
- 08 Calcareous fixed dune
- 09 Tortula dunes
- 10 Acidic fixed dunes
- 11 Dry heath
- 12 Bracken
- 13 Bracken-invaded grassland
- 14 Bracken-invaded heath
- 15 Wet heath
- 16 Semi-improved grassland
- 17 Improved grassland
- 18 Ruderal vegetation and feed areas
- 19 Wet slack
- 20 Dry slack
- 21 Rush pasture and rushy slack
- 22 Saltmarsh
- 23 Concrete feed areas
- 24 Plantation
- 25 Road or vehicle track
- 26 Unlabelled polygon
- 27 Open water or swamp

Figure 2.2

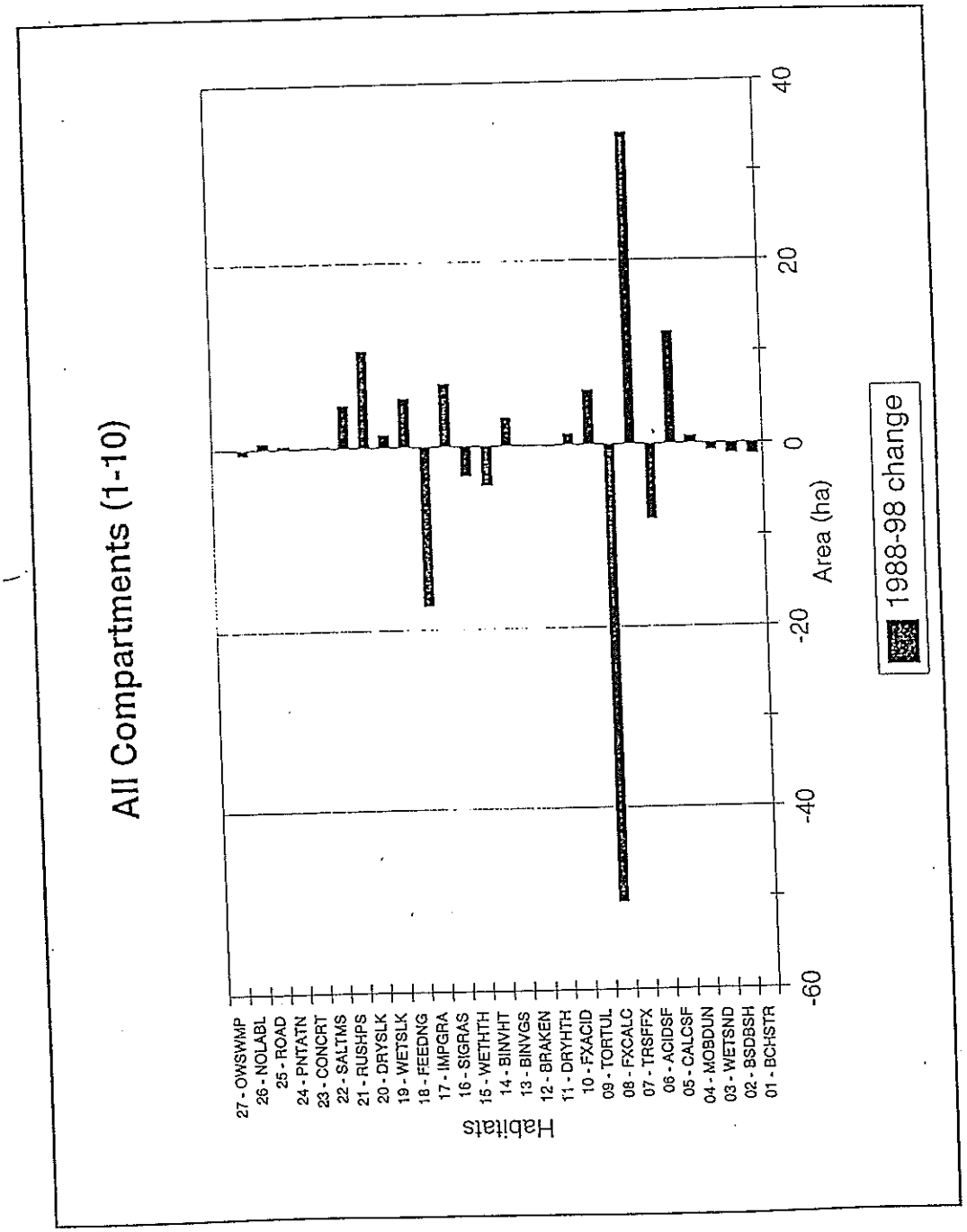
2.2.11 *All Ross Links SSSI Compartments (1 - 10 inclusive)*

Vegetation change for the whole site integrates the patterns described for compartments 1-10 above. The quantitative totals of habitats for all of Ross Links for 1988 and 1998 are given in Annex 1. The survey dates are compared in Graph 2.11, with a change analysis given in Graph 2.12. The following main summaries of change have occurred:

- Improved management and stabilisation of bare ground by vegetation succession have both reduced the area of dry bare sand, bare shingle and wet bare sand in slack floors.
- a small increase in mobile dune area has occurred and there was good field evidence in 1998 to show strong local accretion. There has also been a small increase in mapped saltmarsh area, suggesting continued accretion in the intertidal zone.
- There have been major apparent structural changes in dry dune vegetation, affecting areas with and without stock. These differences over time probably represent difficulties in harmonising the 1988 NVC classification with the current version, as well as rabbit-induced effects which are currently considerable due to high numbers. Bare sand area, *Tortula* dunes and transitional semi-fixed dune - fixed dune vegetation have increased and represent less stable conditions, though there is no evidence of a threat from major deflation (i.e. large and widespread development of blowouts). Stock management appears to play only a small and confined role in these structural changes.
- A slight reduction in the area of dry dune heath has occurred (from 1.53 ha to 1.41 ha) and this habitat might be in slow long-term decline in this site. Much heather *Calluna vulgaris* is in poor condition, grazed to a low height and much invaded by a grass sward. Overall stock grazing numbers might still be too high for this vegetation type, even in the north of Ross Links (Compartment 6).
- Bracken-dominated vegetation has declined slightly but bracken-invaded grassland has increased in area. There has been a marked reduction in the area of bracken-invaded heath which has been converted to bracken-invaded grassland. Dry heath with some bracken cover has probably been reduced considerably.
- Wet heath has been reduced considerably but some of this change is probably due to harmonisation difficulties, rather than real losses. The condition of four-leaved heath *Erica tetralix* is often poor and some wet heath might have been lost in competition from dune willow *Salix repens* which seems to have expanded considerably in response to reductions in grazing levels.
- There has been a very major reduction in the area of improved grassland (from 24.5 ha in 1988 to 7.1 ha in 1998). Much of the change has involved conversion to semi-improved grassland (this has increased from 19.8 ha to 26.6 ha) and there is good evidence that a similar change has affected former ruderal-dominated vegetation in the north of Ross Links. It appears that, within a timescale of 4 - 5 years, substantial improvements can be made in grassland sward nature conservation interest. There is a real prospect that typical dune grassland vegetation (calcareous and acidic) can be re-established within a decade by greatly reducing winter feeding and stocking levels. The semi-improved grassland category has a reputation for being difficult to define but at Ross Links it is easily recognised as vegetation with the major species of typical dune grassland (*Festuca rubra, F. ovina, Agrostis capillaris, Galium verum, G. saxatile, Carex arenaria*) with an additional high cover of improved grassland or ruderal indicators (one or more of *Lolium perenne, Cynosurus cristatus* and *Poa annua*). The time required for the latter species to be removed is still uncertain but present trends suggest that this might be achievable within ten years.
- Ground impacted by feeding (particularly ruderal-dominated vegetation) has increased considerably, from 5.4 ha to 10.7 ha. This is due in part to a slow rate of change for impacted areas along the central road through Ross Links, and the development of fresh impacted ground around new feeding areas.


All Compartments (1-10)
1998 - All Ross Links
1988 - All Ross Links
Area (ha)
0
20
40
60
80
100
Habitats
27 - OWSWMP
26 - NOLABL
25 - ROAD
24 - PNTATN
23 - CONCRT
22 - SALTMS
21 - RUSHPS
20 - DRYSLK
19 - WETSLK
18 - FEEDNG
17 - IMPGRA
16 - SIGRAS
15 - WETHTH
14 - BINVHT
13 - BINVGS
12 - BRAKEN
11 - DRYHTH
10 - FXACID
09 - TORTUL
08 - FXCALC
07 - TRSFFX
06 - ACIDSF
05 - CALCSF
04 - MOBDUN
03 - WETSND
02 - BSDBSH
01 - BCHSTR

Graph 2.11


All Compartments (1-10)
40
20
0
-20
-40
-60
Area (ha)
1988-98 change
Habitats
27 - OWSWMP
26 - NOLABL
25 - ROAD
24 - PNTATN
23 - CONCRT
22 - SALTMS
21 - RUSHPS
20 - DRYSLK
19 - WETSLK
18 - FEEDNG
17 - IMPGRA
16 - SIGRAS
15 - WETHTH
14 - BINVHT
13 - BINVGS
12 - BRAKEN
11 - DRYHTH
10 - FXACID
09 - TORTUL
08 - FXCALC
07 - TRSFFX
06 - ACIDSF
05 - CALCSF
04 - MOBDUN
03 - WETSND
02 - BSDBSH
01 - BCHSTR

Graph 2.12

- Feeding-impacted areas represent sacrifice ground, with stock feeding and grazing impacts much confined to these areas. This allows other vegetation types to improve in nature conservation interest, particularly wetland vegetation. Wet slack, dry slack and rush pasture have all increased in area and reduced grazing has allowed good re-growth of *Salix repens* and *Juncus* x *surrejanus* in particular. These three dune wetland habitats have increased from 26.6 ha in 1988 to 46.4 ha in 1998, a rise of 19.8 ha. This is a considerable benefit compared to less interesting habitats which has been converted to sacrifice ground. The benefits extend beyond simple figures for re-established wetland, since the quality of most dune wetland has probably been improved as a result of reduced grazing.
- There have been very small increases in the areas of concrete feeding areas, plantation and roads.
- There has also been a small increase in open water and swamp habitat, reflecting the excavation of shallow ponds in a few slacks to allow drinking water access by stock. Most ponds in the north of Ross Links show little or no poaching damage around their margins. Ponds in the south where most stock are concentrated have only a modest amount of poached ground.

The results in Graph 2.12 summarise the above changes. In terms of scale, the structural switch from calcareous fixed dune to transitional semi-fixed - fixed dune appears large but may be partly an artefact of harmonising 1988 vegetation with the current NVC. Even if the scale of change here is correct, it has little immediate relevance to nature conservation interest. It is a series of changes between typical dune habitats which are all of high nature conservation value. The switches are also probably reversible, depending largely on rabbit population numbers and their impacts. However, the condition of these habitats which dominate the outer sectors of Ross Links and Old Law should be monitored every 1 - 2 years using fixed point photography. Results should be used to assess the risk of major blowout development due to excessive rabbit numbers. At present this risk is small but has probably increased since 1988.

The remaining findings in Graph 2.12 show neatly the increased benefits that have been produced as a result of the management agreement. Increased nature conservation interest is reflected in reduced improved grassland and larger areas for wet slack, dry slack and rushy pasture. These exceed reduced interest arising from reduction in dry heath and wet heath area, plus the expansion of feeding habitat. The increase in semi-improved grassland is a mix of increased and reduced interest, with the balance tipped towards increased interest as former improved grassland moves towards typical dune grassland swards.

In all, the vegetation maps provide an effective monitoring tool as a result of GIS analysis. The management agreement has already achieved a significant reduction in the area of ground affected adversely by stock feeding and heavy grazing. The combined area of semi-improved grassland, improved grassland and feeding habitat was 49.7 ha in 1988, reducing to 44.4 ha in 1998. This represents a fall from 17.0% to 15.2% of Ross Links area within Lindisfarne SSSI. This underestimates benefits because the semi-improved grassland category represents much ground moving quite quickly towards typical dune grassland. If current management continues, there is a strong probability that such ground of low nature conservation interest will be reduced below 10% of SSSI area. Enhanced interest in dune wetland is shown by 19.8 ha of new mapped wetland (6.8% of the Ross Links area within the SSSI), plus improved condition in most wetland in the north of Ross Links.

2.3 Recommendations

Given the considerable improvements already achieved, it is suggested that re-negotiation of the management agreement in the near future considers amendments in two specific areas, together with monitoring to track change:

1. A further reduction in stocking levels in Compartment 5 and Compartment 6, aiming to stabilise or increase the area of dry and wet dune heath. The bulk of these important dune habitats is in these two compartments and overall condition seems poor. Existing areas are small and are difficult to map precisely, making monitoring via NVC mapping an imprecise tool. A set of new permanent quadrats (2 m x 2 m in size), carefully marked and accurately located, should be established and recorded on an annual basis for key indicator variables. Suggested variables should concentrate on *Calluna vulgaris*, *Erica cinerea* and *Erica tetralix*, recording the following for these species: local shoot and local rooted frequency values in a 10 cm grid within each quadrat, height (cm). A total of at least ten dry heath and ten wet heath quadrats will probably be needed to obtain a realistic picture of trends in these habitats. In addition to quadrats, a small number of transects should be established which extend out from heath into adjacent vegetation. The location of *Calluna vulgaris*, *Erica cinerea* and *Erica tetralix* should be monitored along the transects to detect the possible extension of heath species into adjacent ground. Recording work will probably require two staff field days per year, plus half a day to log and report results. The work does not necessarily require a consultant and could be built into the monitoring programme of English Nature staff.
2. A major reduction or elimination of continued feeding in Compartments 3 and 4 should be implemented, together with reduced stocking levels. This should aim to eliminate or reduce the reduced nature conservation interest around former and current feeding stations. A set of permanent quadrats should be established to record key indicators (bare sand, shoot and rooted frequencies of key species such as *Poa annua, Lolium perenne, Cynosurus cristatus, Senecio jacobaea, Festuca rubra, Ammophila arenaria*). A total of at least five quadrats will probably be needed in each compartment to obtain a realistic picture of trends in these habitats. Recording work will probably require two staff field days per year, plus half a day to log and report results. The work does not necessarily require a consultant and could be built into the monitoring programme of English Nature staff. Results would provide a detailed analysis of the major change from ruderal-dominated or improved pasture to typical dune grassland, to corroborate the rapid rates of changes inferred from GIS analysis.