Natural England Research Report NERR003

Maritime Cliff and Slope Inventory 2004/2005

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C.T. Hill, R.H.E. Downes, and A.J.P. Harfoot

GeoData Institute, University of Southampton

Southampton, SO17 1BJ

www.geodata.soton.ac.uk

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Project manager

Sue Rees
Maritime Team
Sue.rees@naturalengland.org.uk

Contractor

GeoData Institute
University of Southampton
Southampton
SO17 1BJ
www.geodata.soton.ac.uk

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Summary

A national inventory of Maritime Cliff and Slope is important in delivering a range of benefits, from the implementation of Biodiversity Action Plans (BAPs) to the management of local designated sites and strategic coastal management.

This project extends previous work covered in the Maritime Cliff and Slope Inventory (Hill and others 2002). There were a number of objectives:

- Review additional surveys from 2000 to present to map gaps in coverage, specifically with regard to soft cliffs.
- Carry out the review of the reports to provide an overview report, to identify the variation and conservation importance of soft cliff habitats to update Pye and French (1992) figures.
- Review the generic specification ENRR 426 based on experience and updating where necessary.
- To collate recent GIS and electronic data outputs into a single system to form the basis of a national inventory.

Former English Nature area teams were contacted to collate all Maritime Cliff and Slope surveys undertaken since 2000. Survey extents were mapped in a geographic information system (GIS), along with those of the pre-2000 surveys (where location or survey extent information was available), to establish the location of all Maritime Cliff and Slope survey date. The Draft Maritime Cliff and Slope Inventory for England and the JNCC Maritime Cliff Database (1986-1989) were used to estimate areas of soft cliff in England. Together, these datasets can be used to infer areas of soft cliff with no known survey.

ENRR 426 established a survey, digitisation and attribution standards specification, and quality constraints, to which surveyors should adhere. All of the post-2000 surveys were subjected to rigorous assessment and it was evident that the previous specification was not followed in a consistent manner. There were wide discrepancies between datasets in terms of format, quality and attribution that limit the desired potential to draw separate surveys into a common national maritime cliff and slopes inventory.

To produce, as far as possible, a nationally consistent dataset of post-2000 Maritime Cliff and Slope surveys it was necessary to ‘clean’ the survey data. Datasets were subject to both manual and automated quality assurance (QA) procedures, before collating them into a single national dataset. Whilst this has been possible for most of the surveys reviewed some did not follow standard NVC procedures (using IHS or Phase 1 classes) that can only be drawn into a consistent dataset at a higher class level.

This review has produced recommendations for a revised specification to help future project officers and others that may commission or carry out maritime cliff and slope surveys to achieve the standards required:

- A specification has been refined, which clearly states the requirements of GIS datasets produced in Maritime Cliff and Slope surveys. Surveyors undertaking new maritime cliff and slope surveys should be supplied with a copy of this.
- MapInfo templates have been provided to ensure that data transferred to GIS is in a consistent format. These should be kept in a central location on the Natural England server, accessible to all Natural England Area Teams. The templates need to be supplied to contractors undertaking future Maritime Cliff and Slope habitat surveys.
- QA procedures have been written so that Natural England project officers are able to QA data received by contractors, which is essential before the contract is closed. It is recommended that no data be accepted before all these checks confirm the compliance

with the data formats and attributes. This will ensure a higher quality end product, which can be more easily added to the national dataset.

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1 Introduction

1.1 Developing a standard approach to mapping and managing data on maritime cliffs and slopes will help fulfil many conservation objectives, from the local management of sites to the strategic achievement of targets under Biodiversity Action Plans. This highlights the need for a national overview of maritime cliff data.

1.2 Historically, cliff and slope surveys are undertaken locally and fulfil a site-specific use. They are variable, using different survey methodologies, mapping standards, data analyses and presentation approaches. Such variation may well be justified by the scope and rationale for the surveys, but often the variation is the result of a lack of advice for achieving standardisation, lack of awareness of the value of such standards and the lack of specification of such within commissioned work. A common element within these surveys is their geography; surveys relate to specific locations. Often the surveys are not reported in the same way, at different resolutions, with varied approaches to mapping points or boundaries and with different procedures and values for attributes. This data cannot be used to develop a national overview of the resource.

1.3 In 2002, English Nature (now Natural England) adopted a standard specification for surveys of cliff and slope and for its mapping and recording in a GIS framework in the generic specification introduced in ENRR 426 (Maritime Cliff and Slope Inventory (Hill and others (2002). This established survey, digitisation and attribution standards, and quality constraints, to which surveyors should adhere. The rationale for this standard was the desire to be able to draw together local surveyed site based information into a national inventory that formed a single dataset. This extends and complements the types of overview; lower resolution surveys and data capture programmes of the Biodiversity Action Plan mapping for priority habitats – that seek to identify the scale of the habitat resource.

1.4 Since the introduction of the ENRR 426 generic standard, a number of soft cliff surveys have been undertaken for the former English Nature area teams that have employed these standards to a greater or lesser extent. The problem with standards is that the operational environment changes, information requirements change and the input data and methods evolve. Hence it is often necessary for the standards to evolve in line with these changes to ensure that the survey and data capture is still relevant to survey objectives. The review of surveys undertaken since the publication of the generic guidance helps to establish the ability of the surveyors to capture data to these standards, allows review of the scale of the mapped resource and provides an opportunity to introduce updates to the approaches used for mapping and attribution of the surveys.

1.5 The collation of the existing GIS layers of cliff surveys into a single data layer also provides a basis for evaluating and resolving data quality issues, raising awareness of these limitations and offers scope for providing standard data entry advice and modules to enhance future survey supply and integration.

1.6 This report should be used by Natural England project officers and contractors that make use of data on coastal habitats. It is especially useful for Natural England officers that commission surveys and those contractors that may carry out the survey work. It covers issues that are not just specific to Maritime Cliff and Slope surveys. Many of the principles are generic and relate to a range of habitats.

1.7 A key aim of this report is to communicate the importance of achieving standards within surveys. A benefit of this will be to vastly improve data quality and achieve consistent formats. This will facilitate the sharing and understanding of data and the update of a national dataset.

2 Aims

2.1 The project aims are:

a) Review additional surveys from 2000 to present to map gaps in coverage, specifically with regard to soft cliffs (section 3).
b) Carry out the review of the reports to provide an overview report, to identify the variation and conservation importance of soft cliff habitats to update Pye and French figures (section 4).
c) Review the generic specification ENRR 426 based on experience and updating where necessary (section 5).
d) To collate recent GIS and electronic data outputs into a single system to form the basis of a national inventory (section 6).

3 Review of soft cliffs survey coverage carried out by English Nature from 2000

Introduction

3.1 National surveys and inventories are important components in the delivery of coastal habitat conservation. Maritime cliff and slopes have not been covered by any systematic national survey across the UK, and many individual surveys have focused on hard cliffs. In England, numerous coastal cliffs are on softer substrate, forming a very different coastal habitat due to the influence of physical coastal processes and cliff recession. These soft cliffs are important for the conservation of many Biodiversity Action Plan (BAP) priority species (Simonson and Thomas 1999), and therefore surveying, monitoring and inventory of this habitat is required (Rees 2002).

3.2 The Maritime Cliff and Slope Inventory (Hill and others 2002) collated information on the individual surveys carried out on maritime cliff and slopes up to 2000, for both hard and soft cliff habitats. Other site surveys have been commissioned since then, particularly for soft cliff areas, although there are known to be gaps in the survey coverage. Highlighting where the gaps are and the extent of future habitat mapping requirements is a key objective of this study.

Approach

3.3 In order to identify the gaps in survey coverage the following datasets are required:

- Extent of soft cliffs in England.
- Existing surveys:

  Pre-2000 survey locations

  Post-2000 survey locations

3.4 These requirements are not met by any existing data collections or national mapping. Therefore further processing of data and collation of survey information is required to provide these inputs.

Extent of soft cliffs

3.5 No single national dataset is available that categorises the cliff habitats or even maps their extent within England. Ordnance Survey data describes topographic features but does not semantically define the “cliff” in the way that habitat surveyors may conceive the extent.

3.6 Classification of cliffs into hard and soft categories provides a coarse hierarchical classification, which is not easy to practically establish. Cliffs and their geology do not break down easily into binary classes as the bulk of the cliff sections will be somewhere in between the classic hard and soft geologies. A more complex set of criteria and variables would provide a more sophisticated way of categorising the habitat types. Nevertheless, an attempt has been made here to provide a national classification.

3.7 From a geological viewpoint, soft cliffs tend to be formed of unconsolidated material and unstable geological structures and therefore can have high rates of retreat. Chalk and other soft limestone strata are best considered as soft cliff types because they are prone to mass failure due to cliff undercutting.

3.8 In order to identify the extent of cliff and then to categorise the individual reaches a number of datasets have been used together to generate a “first pass” categorisation.

Classification

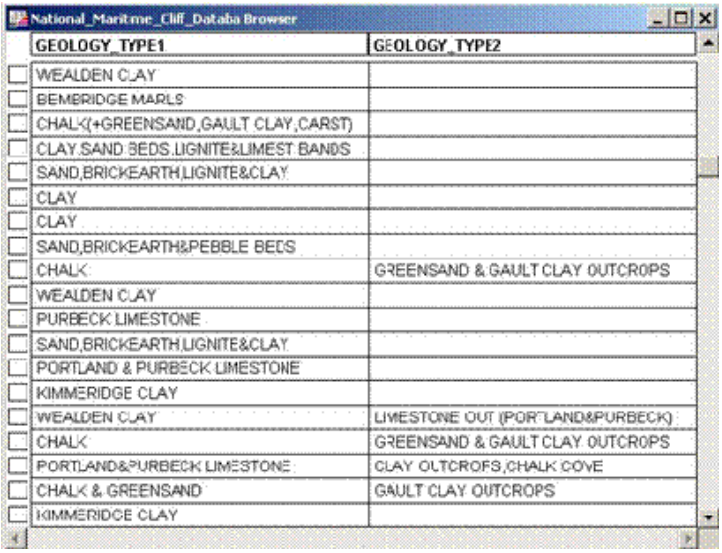
3.9 The following classification is designed to provide an indication to the extent of soft cliffs. It is a geological classification based on existing digital datasets. Table 3 1 shows the two datasets used to derive the extent of soft cliffs in England.

Table 1. Datasets used to derive extent of soft cliffs in England

Dataset name	MapInfo file name	Source
Draft Maritime Cliff and Slopes Inventory for England (BAP dataset)	Maritime cliff and slope_ v1_1.tab	Natural England website
Joint Nature Conservation Committee (JNCC) Maritime Cliff Database (1986-1989):	National_Maritime_Cliff_Database.tab	JNCC dataset showing start and end nodes of 1781 cliff sections covering the coastline of Britain

3.10 The ‘Draft Maritime Cliff and Slope Inventory for England’ dataset (BAP dataset) was provided by Natural England and is downloadable from Natural England’s website. This is a prototype GIS inventory of the Biodiversity Action Plan (BAP) maritime cliff and slopes. The data is based on two sources: Natural England’s Site Information System (ENSIS) and the JNCC Maritime Cliff Database. The cliff areas were digitised as polygons (1274 polygons in total) and define the distribution and extent of maritime cliff and slopes within England. This dataset has been used as the basemap for the assessment of the total area of cliffed habitat, but is subject to some uncertainties. The dataset uses a detailed boundary to define the area of cliff but has no cliff classification and few classificatory attributes.

3.11 On the other hand the Maritime Cliff Database, a dataset from the Joint Nature Conservation Committee (JNCC), defines cliff sections crudely by a series of start and end points. Each section has a number of categories for the cliff type and geology. The dataset contains information on the primary and secondary geology of each section. Figure 1 shows a sample of the geology types recorded in the dataset.


National_Maritime_Cliff_Databa Browser

GEOLOGY_TYPE1	GEOLOGY_TYPE2
WEALDEN CLAY	
BEMBRIDGE MARLS	
CHALK(+GREENSAND,GAULT CLAY,CARST)	
CLAY,SAND BEDS,LIGNITE&LIMEST BANDS	
SAND,BRICKEARTH,LIGNITE&CLAY	
CLAY	
CLAY	
SAND,BRICKEARTH&PEBBLE BEDS	
CHALK	GREENSAND & GAULT CLAY OUTCROPS
WEALDEN CLAY	
PURBECK LIMESTONE	
SAND,BRICKEARTH,LIGNITE&CLAY	
PORTLAND & PURBECK LIMESTONE	
KIMMERIDGE CLAY	
WEALDEN CLAY	LIMESTONE OUT (PORTLAND&PURBECK)
CHALK	GREENSAND & GAULT CLAY OUTCROPS
PORTLAND&PURBECK LIMESTONE	CLAY OUTCROPS,CHALK COVE
CHALK & GREENSAND	GAULT CLAY OUTCROPS
KIMMERIDGE CLAY	

Figure 1. Sample of geology types from JNCC Maritime Cliff Database browser

3.12 The primary geology types ('GEOLOGY_TYPE1') recorded in this dataset were used to form a simple classification of the cliff sections. The classes underlie the complexity of any coastal cliff section, which may have multiple exposed strata, varying degrees of hardness, structure and erosion mechanisms and reaction (acidic/basic). Given the limitations the primary geology types were classified as:

- Those that are definitely characteristic of hard cliffs.
- Those that are definitely characteristic of soft cliffs.

Appendix 1 gives details of this classification.

The classification was then used to categorize each cliff section as:

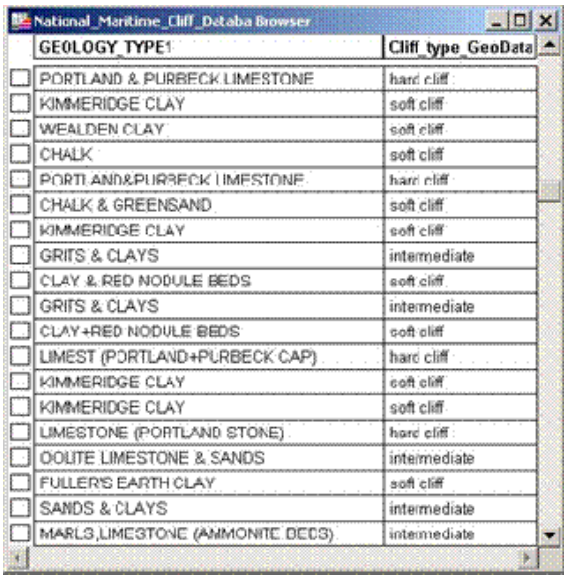
- hard cliff
- intermediate
- soft cliff

The following rules were adhered to when categorizing each cliff section:

- Cliff sections with a primary geology type as soft only, were classed as 'soft cliff'.
- Cliff sections with a primary geology type as hard only, were classed as 'hard cliff'.
- Where the geology was deemed as neither hard nor soft, the cliff section was classed as 'Intermediate'.
- Where the cliff section had a mixture of hard and soft geology, this was classed as 'Intermediate'.

Cliffs such as chalk might be treated as hard, but following the BAP approach have been categorised as soft, due to the propensity for mass failure.

Figure 2 illustrates the classification.


National_Maritime_Cliff_Databa Browser

GEOLOGY_TYPE1	Cliff_type_GeoData
PORTLAND & PURBECK LIMESTONE	hard cliff
KIMMERIDGE CLAY	soft cliff
WEALDEN CLAY	soft cliff
CHALK	soft cliff
PORTLAND&PURBECK LIMESTONE	hard cliff
CHALK & GREENSAND	soft cliff
KIMMERIDGE CLAY	soft cliff
GRITS & CLAYS	intermediate
CLAY & RED NODULE BEDS	soft cliff
GRITS & CLAYS	intermediate
CLAY+RED NODULE BEDS	soft cliff
LIMEST (PORTLAND+PURBECK CAP)	hard cliff
KIMMERIDGE CLAY	soft cliff
KIMMERIDGE CLAY	soft cliff
LIMESTONE (PORTLAND STONE)	hard cliff
OOLITE LIMESTONE & SANDS	intermediate
FULLER'S EARTH CLAY	soft cliff
SANDS & CLAYS	intermediate
MARLS,LIMESTONE (AMMONITE BEDS)	intermediate

Figure 2. Sample of classification of cliff sections into cliff types

3.13 The classified cliff sections from the JNCC database were then used to classify the cliff polygons from the BAP dataset (illustrated in Figure 3):

- Where BAP cliff and slope extents coincided with the JNCC cliff sections, these were classified as the appropriate cliff type.
- Where the BAP cliff and slopes extents did not coincide with any JNCC cliff sections, these were not classified, and were attributed as 'unknown' at this stage.

Figure 3. Application of classification to the BAP dataset

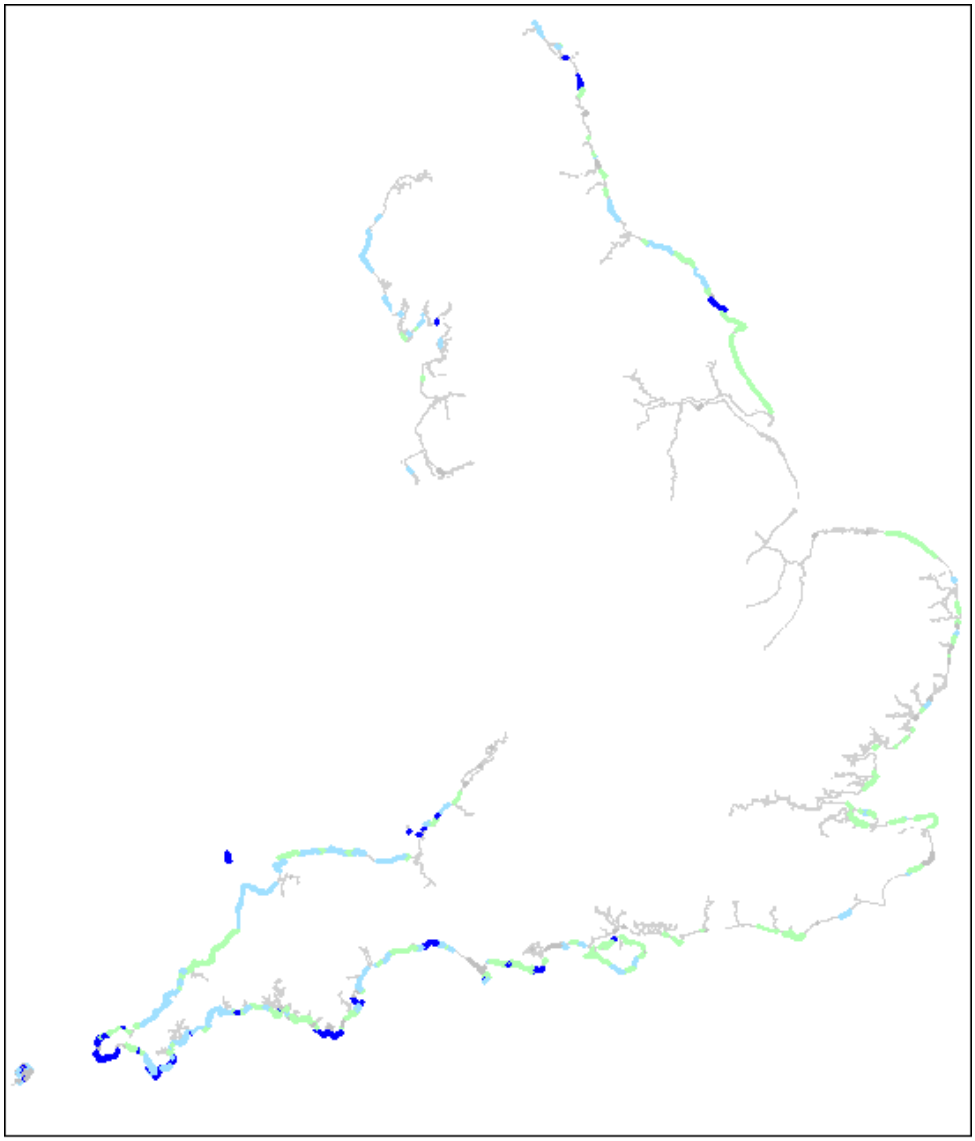


Figure 4. Extent of soft cliff and slopes in England

3.14 Figure 4 shows the extent of soft cliff and slopes in England using the above classification. This is a simple classification and its limitations need to be understood. These are described below.

Limitations

3.15 Some cliff areas in the BAP dataset are not covered by the JNCC database, and therefore the geology has not been classified in the same way. These are shown in grey in Figure 3 and Figure 4.

3.16 The BAP dataset may show areas of the coastline as cliff/slope that may not necessarily be correct. For example, Figure 5 shows an area (edged green) on the Isle of Wight that is shown on the BAP dataset as cliff or slope. The Ordnance Survey (OS) 1:25000 raster may not be consistent with the definition of a maritime cliff and slope profile, in this instance, low lying areas of the Bembridge harbour mouth.

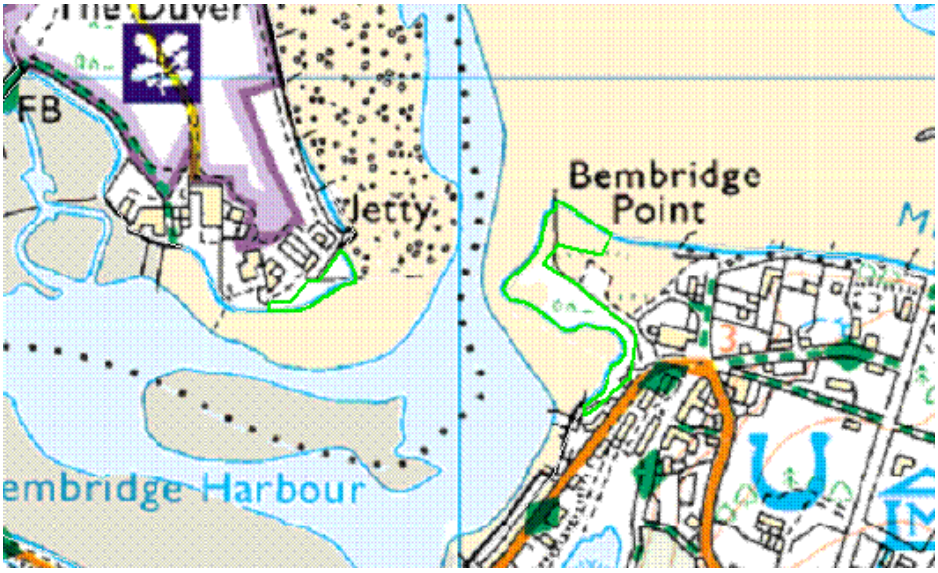


Figure 5. Area on the Isle of Wight mapped as cliff/slope that may not be correct

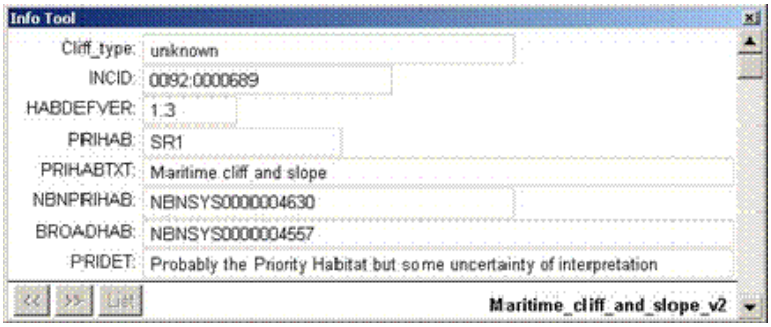


Figure 6. Attributes of cliff/slope polygon at Bembridge Point

3.17 This is also confirmed by the attributes of these polygons, as shown in Figure 3 6. An explanation of the attributes can be found in Appendix 2. It is noted in the 'PRIDET' field that maritime cliff and slope is 'probably the Priority Habitat but some uncertainty of interpretation'. The metadata for the Draft Maritime Cliff and Slope Inventory data records that there was an 'inclusion rather than exclusion' policy where there was uncertainty over the presence of cliff and slope. Therefore it is probable that there is an overestimate of the extent of maritime cliff and slopes in England.

3.18 The BAP dataset acknowledges that it is based on a range of secondary data sources and there may be uncertainty of classification. There are clear areas for further clarification and improvements to the BAP inventory mapping.

Surveys undertaken by English Nature after 2000

Approach

3.19 Former English Nature area teams with coastal cliffs in their locality were contacted to establish whether they had information on cliff surveys that had been undertaken post 2000. Where surveys had been conducted, survey information was requested (both the report and GIS data where available). Appendix 3 gives the area teams contacted and their details.

Table 2. Former English Nature Area teams and the number of cliff surveys undertaken between 2000 - 2005

Former English Nature Area teams	Number of surveys undertaken between 2000 - 2005
Northumbria	0
Cumbria	0
Cheshire and Lancashire	0
North and East Yorkshire	2
Humber to Pennines	N/A
East Midlands	0
Peak District and Derbyshire	N/A
North Mercia	N/A
Herefordshire and Worcestershire	N/A
Bedfordshire and Cambridgeshire	N/A
Norfolk	1
Suffolk	0
Essex, Hertfordshire and London	0
London	N/A
Kent	1 (not English Nature – Kent County Council)
Sussex and Surrey	1
Thames and Chilterns Team	N/A
Hampshire and Isle of Wight	5
Wiltshire	N/A
Dorset	2 (not English Nature - Charmouth Heritage Coast Centre)
Somerset and Gloucestershire	0
Devon	2
Cornwall	7
Total	**18 (+3)**

3.20 Table 2 shows the number of known surveys to have been undertaken on both hard and soft cliffs post 2000. Table 3 lists the names of the surveys and the information provided by the area team officer (ie copy of the report and digital data if available).

Table 3. Name of survey and information held by GeoData

Former English Nature Area teams	Ref no.	Survey name	Information provided / status
Cornwall	1	Carricknath to Porthbean	Digital data/ report
	2	Godrevy Head to St Agnes	Digital data/ report
	3	Bude Coast and Steeple point to Marsland Mouth	Digital data/ report
	4	Polruan to Polperro	Digital data/ report
	5	Rame Head to Whitsand Bay	Digital data/ report
	6	Tintagel Cliffs	Interim report
	7	Boscastle to Widmouth	Interim digital data and report
Devon	8	Axmouth to Lyme Regis Undercliff NNR Vegetation Survey 2002-2003	Digital data/ report
	9	Axmouth to Lyme Regis SSSI A brief invertebrate Survey of Culverhole and Goat Island	Report
Dorset	10	Black Ven - Charmouth Heritage Coast Centre	Report
	21	Invertebrate Survey of Golden Cap Estate (cliffs)	Report
Hampshire and Isle of Wight	11	Soft Cliff Vegetation Survey - South Coast of the Isle of Wight	Digital data/ report
	12	Invertebrate Survey of proposed SSSI at Luccombe to Shanklin Chine, Isle of Wight	Report
	13	Isle of Wight Soft Cliff Survey: Hanover Point to St Catherine's Point	Report
	14	Isle of Wight Soft Cliff Survey: St Catherine's Point to Shanklin	Digital data/ report
	15	Invertebrate survey of Niton to St Lawrence and Puckaster Cove to Ventnor, Isle of Wight	Report
Kent	16	Kent supralittoral rock	Digital data/ report
Norfolk	17	Surveys of Overstrand Cliffs SSSI and cSAC*, Norfolk	Digital data/ report
North and East Yorkshire	18	Maritime cliff vegetation of Robin Hood's Bay to Beast Cliff	Digital data/ report
	19	Maritime cliff vegetation of Flamborough Head	Digital data/ report
Sussex and Surrey	20	Hastings Cliff	Report

*Note: all candidate Special Areas of Conservation (cSACs) were formally adopted as Sites of Community Interest in December 2004. These were designated by Defra as Special Areas of Conservation (SACs) in April 2005

3.21 Metadata for the above surveys has been recorded to National Biodiversity Network (NBN) standards.

3.22 Survey extents have been recorded in MapInfo from GIS data and survey reports where available. Appendix 4 shows the source of information for each survey extent. The survey extents were mapped using the BAP dataset as the basemap for the purposes of showing where the

surveys are located (see Figure 7). The NBN survey extents are recorded as bounding coordinates derived from the survey macro-polygons where digital data is available.

Figure 7 shows a map of the post 2000 survey locations. A key to the numbers can be found in Table 3 in the 'Ref No.' column.

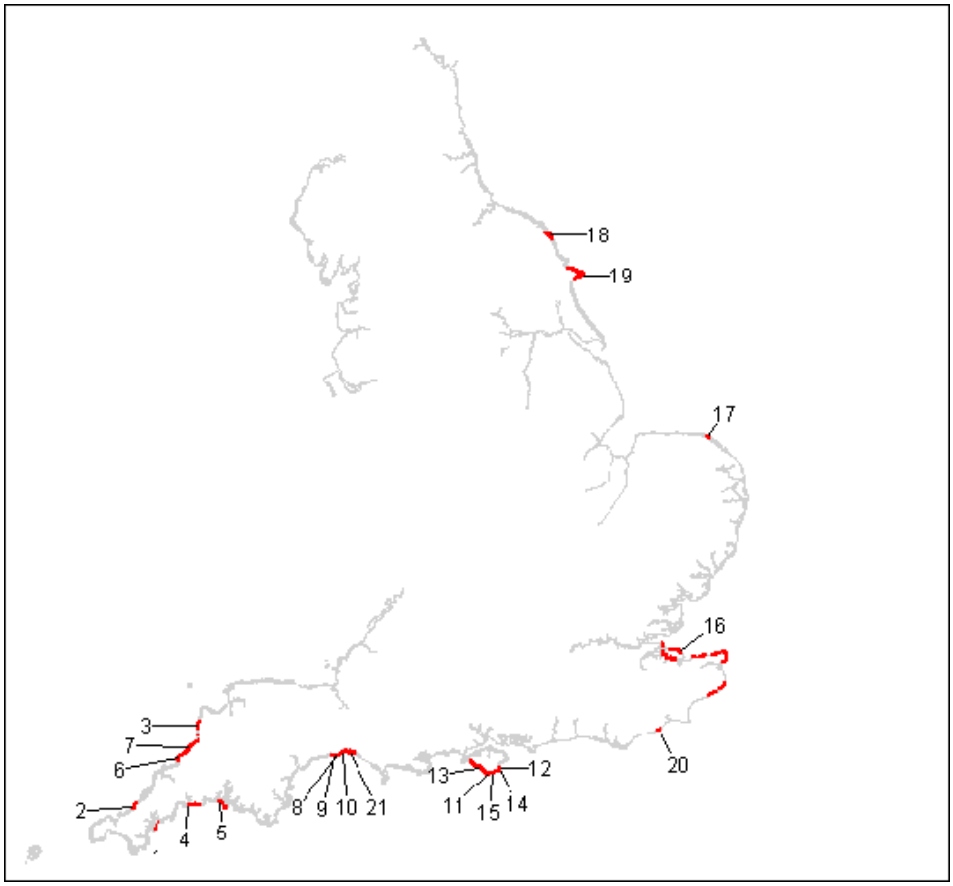


Figure 7. Location of surveys undertaken by English Nature post 2000 (see Table 3 for reference numbers)

Limitations

3.23 There is a discrepancy between the BAP cliff and slope extents and actual extents of the surveys conducted. This is illustrated in Figure 8. The 'Soft Cliff Vegetation Survey - South Coast of the Isle of Wight (2002)' boundary extends much further inland than the cliff extent shown on the BAP dataset. Such a mismatch occurs between other habitat surveys and BAP datasets. This may imply that areas of maritime cliff and slope are not being surveyed and or areas outside the maritime cliff and slope areas are being mapped.

3.24 The discrepancy between the extents of the two datasets may occur for a number of reasons:

- A more limited specification of BAP habitats is used to identify the BAP macro-polygon.
- Some of the surveys are of SSSIs and therefore the survey extent is that of the SSSI rather than that of the cliff and slope.
- Habitat surveys are based on regional objectives and are therefore likely to be based on logical survey extents.

3.25 It is worth evaluating the extent of the BAP GIS data layer prior to devising the habitat mapping specification for a site. This relates to the proposals within ENRR 426 to identify the macro-polygons of maritime cliff and slope habitats prior to further surveys. However, the varied objectives for the survey of wider areas than a single BAP habitat probably over-ride the convenience of mapping solely within single BAP habitats and the macro-polygons for maritime

cliff and slope would allow the specific BAP habitat extents to be calculated from the wider surveys. More widely categorising any survey within a Site of Special Scientific Interest (SSSI) into the BAP habitat boundary polygons has benefits in attempts to collate data nationally. This differs from merely cross-matching cover classifications to different classification types, since in some situations the community types overlap within what are partly morphologically separated BAP habitats. For example, maritime cliff and slope communities may be equivalent in cover terms to non-cliff situations without the maritime influence. For example, National Vegetation Classification (NVC) calcareous grassland (CG) classes may occur in cliff sections and beyond the cliff top inland, but would be treated as different BAP habitats.

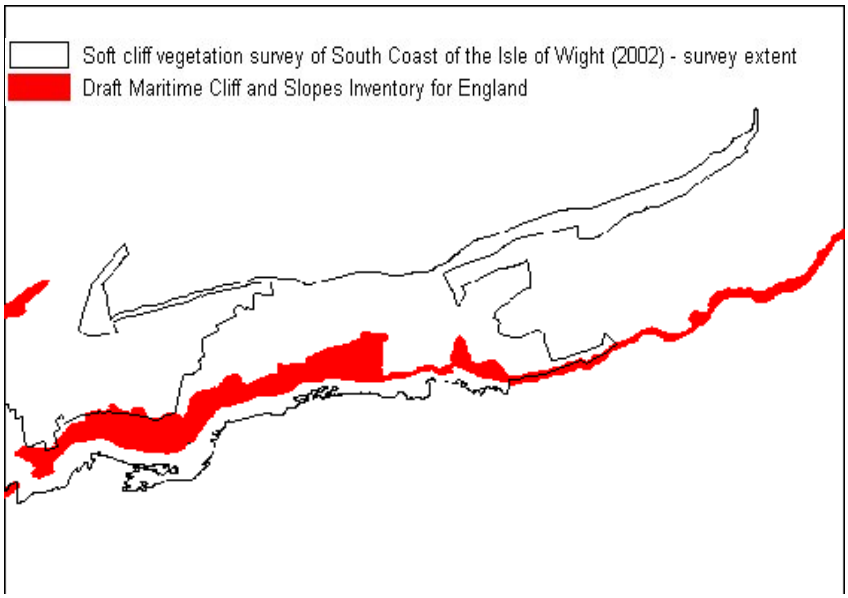


Figure 8. Discrepancy between survey digital data and the BAP dataset extent of cliff and slopes

Surveys undertaken before 2000

Approach

3.26 English Nature commissioned a project in 2000 (Hill and others 2002) to collate all maritime cliff and slope surveys up to 2000, both hard and soft cliff surveys. Surveys were from a number of sources, including a large number of biological surveys undertaken by the National Trust. Metadata was recorded in a database, MetaTagger, which included information on the survey locations. As part of this previous project, survey extents in Cornwall were captured as a line in MapInfo from maps in survey reports (survey polygon data were not recorded in a GIS at this time).

3.27 Since the project in 2000, the National Trust has produced a digital dataset of the biological surveys undertaken on National Trust properties (pre and post 2000) for each region (Appendix 5 lists the National Trust regions). This data has been acquired for use in this project and will be discussed in more detail in section 3.6. The National Trust data collated in the previous project will therefore be removed from the datasets for the purposes of this study, as the 'new' digital dataset post-dates them.

3.28 For this current assessment of the extent of surveys, pre-2000 survey locations have been derived from:

- Existing GIS survey extents (polylines/regions) for Cornwall minus National Trust surveys.
- Survey location information (coordinates) in MetaTagger minus National Trust surveys.

3.29 Appendix 6 shows the information including the National Trust data. Table 4 shows the breakdown of National Trust surveys within the pre-2000 datasets.

Table 4. Pre-2000 surveys and number of those which are National Trust surveys

Details of survey locations	No. NT surveys	No. non-NT surveys	Total No. surveys
Mapped previously as polylines – Appendix 3 of report 426 (Figure 9)	79	13	92
Coordinates given in MetaTagger (Figure 10)	98	10	108
No locational information in MetaTagger	12	57	69
Total	189	80	269

3.30 Table 4 shows that a high proportion, 70%, of the surveys undertaken before 2000 were National Trust surveys. 80 surveys were not undertaken by the National Trust. From these, 23 have information about their location and 57 have no location information.

3.31 Those with location information are shown in Figure 9 and Figure 10.

Figure 9. Pre-2000 survey locations in Cornwall from Hill and others (2002) minus National Trust surveys

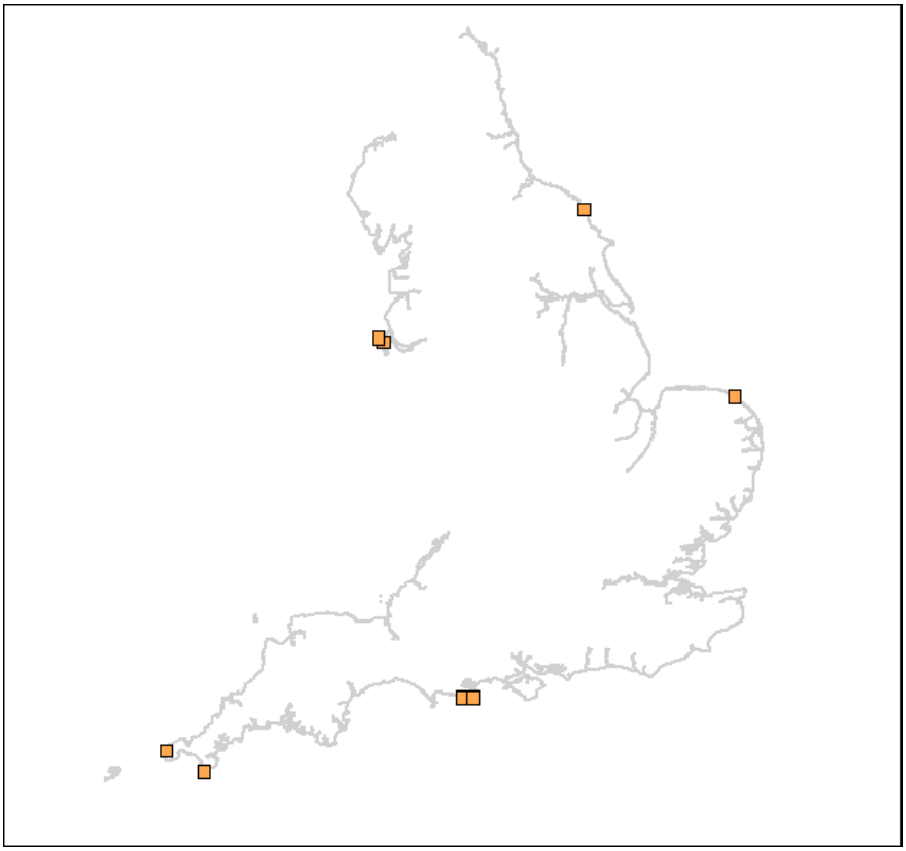


Figure 10. Pre-2000 survey locations derived from survey coordinates in MetaTagger, minus National Trust surveys

3.32 However, there are limitations with the above data, as the full area extent of all pre-2000 surveys is not known. These limitations are detailed below.

Limitations

3.33 Some of surveys in Appendix 3 of report ENRR 426 are not mapped as polylines – they are mapped as ellipses showing the approximate survey location – see Figure 11.

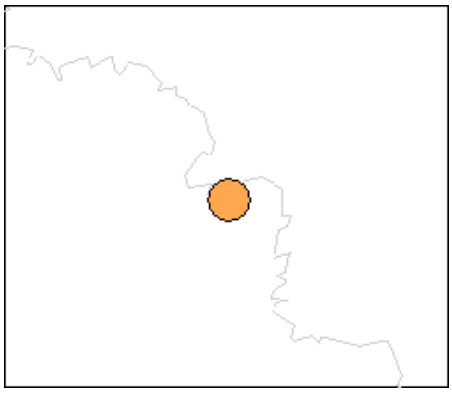


Figure 11. Survey extent represented as an ellipse

3.34 Also, those mapped as polylines follow the coastline and therefore the full survey extent is not known, ie it is not known how far the survey extends inland (whether the survey extends to the defined inland boundary of the cliff as shown in the BAP dataset). The ENRR 426 did not attempt to map the area extents of the surveys, but digitised pilot areas to assess the requirements for data capture standards.

3.35 Table 4 shows that 57 surveys are not National Trust surveys and have no location information recorded in MetaTagger. Where co-ordinates have been used to show survey locations, no information is known about the survey extent. These were those surveys where the presence of a survey was known but no mapped extent data was received. Therefore, soft cliffs with no known surveys cannot be identified with confidence.

National Trust surveys

3.36 The National Trust have created a digital dataset of the biological surveys for each of their regions (see Appendix 5) which:

‘apart from a few recent surveys, a small number of which may be coastal, the data is the most recent available for each property.’

(Peter Jackson pers comm., NT Land & Property Data Officer)

3.37 The National Trust surveys are updated on the requirements of the properties/National Trust regions balanced against national nature conservation priorities. Consequently some surveys may not be updated for many years, whereas over the same period of time others may be updated completely or partially on more than one occasion.

3.38 It is believed that about 80-85% of the land owned by the National Trust has been surveyed at some stage since the Biological Survey Team was created in 1979. (Peter Jackson pers comm., NT Land & Property Data Officer).

3.39 Figure 12 shows the extent of National Trust biological surveys in England. There are a total of 258 National Trust Surveys recorded in the digital dataset, distinguished by the property name and date of the survey.

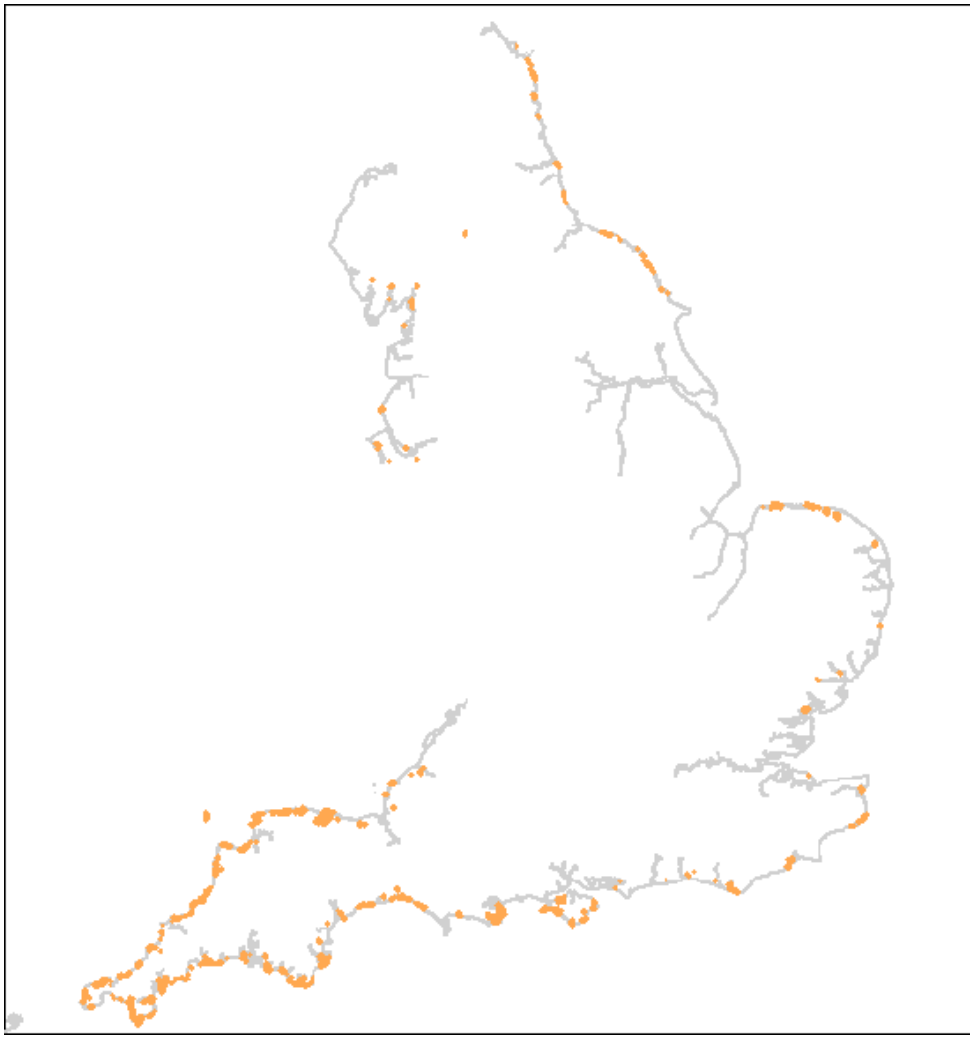


Figure 12. National Trust Surveys (1979-2005)

Limitations

3.40 Surveys cover the National Trust estate and are therefore unlikely to cover the exact area of cliff depicted in the BAP dataset. However, a large number of National Trust properties are located on the coast, and therefore areas of the cliff may be surveyed by virtue of this.

3.41 The specification for National Trust surveys is not the same as those that were carried out by English Nature. National Trust surveys typically use a Phase 1 classification, rather than NVC classes, but are of a high standard.

Identifying soft cliffs with no known survey

Approach

3.42 By using all of the above information a map can be produced which suggests areas of soft cliffs where surveys may not have been undertaken, or at least where no NVC or Phase 2 surveys have been undertaken. However, there are many limitations in the datasets used, the formats of the data and their classifications, and it is suggested that further GIS collation work needs to be undertaken before areas of soft cliff with no known surveys can be identified consistently. Proposed future actions are summarised in section 3.45 (summary of recommendations).

3.43 Figure 13 indicates the total extent of the habitat mapping surveys through the collation of the various datasets. Figure 14 shows the extent of soft cliffs in England. The extent of cliffed coastline was derived from the Draft Maritime Cliff and Slope Inventory for England and the

JNCC Maritime Cliff Database (1986-1989). The two figures can be compared to indicate the areas of soft cliff that have no known survey. This is illustrated more clearly at a local level in Figure 15. However, the quality of the extent of the soft and hard cliff (Figure 13) is not well mapped, and not in a consistent way to enable effective spatial comparison with the location of all known surveys (Figure 14).

3.44 Further comparison between the known surveys and the extent of cliffed coastline, and particularly soft cliff coastline, may be undertaken within the GIS system. The reporting of the extent of additional survey to be conducted for a complete inventory must take into consideration a number of limitations of the data, the classification of the cliff types, the landward extent of the maritime cliff habitat and the ages and character of the surveys.

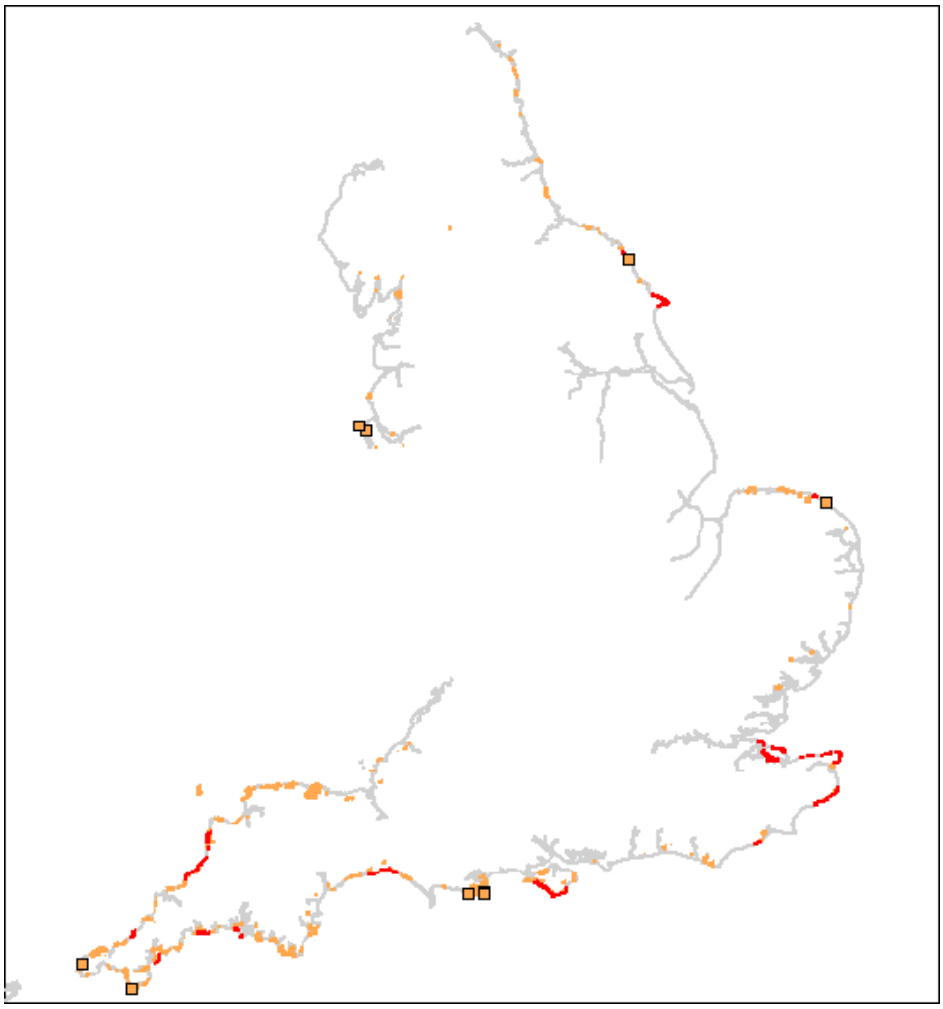


Figure 13. Location of all known surveys (where information available)

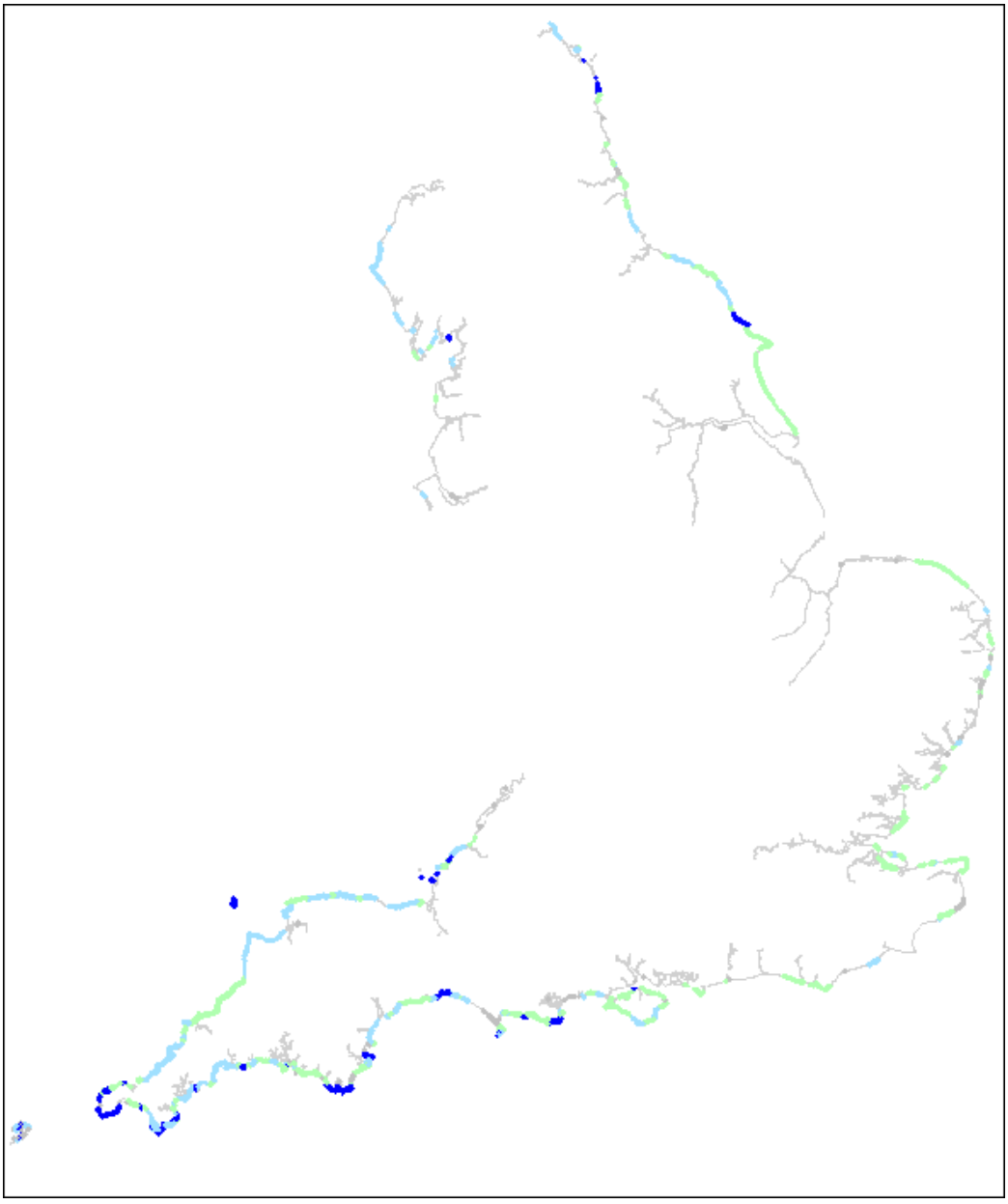


Figure 14. Extent of soft cliff and slopes in England

Figure 15 shows the Isle of Wight area in larger detail. It depicts the areas where surveys are known to have taken place (shown in orange and red), and the areas of soft cliff (shown in green). Hard cliff areas have not been included within this analysis. Therefore, it is possible, when these two layers are overlain, to identify those areas where no known survey has been undertaken.

Figure 15 shows four main areas where it appears that there is no survey coverage. The most substantial of these is area 3, located in the Northeast of the Isle of Wight.

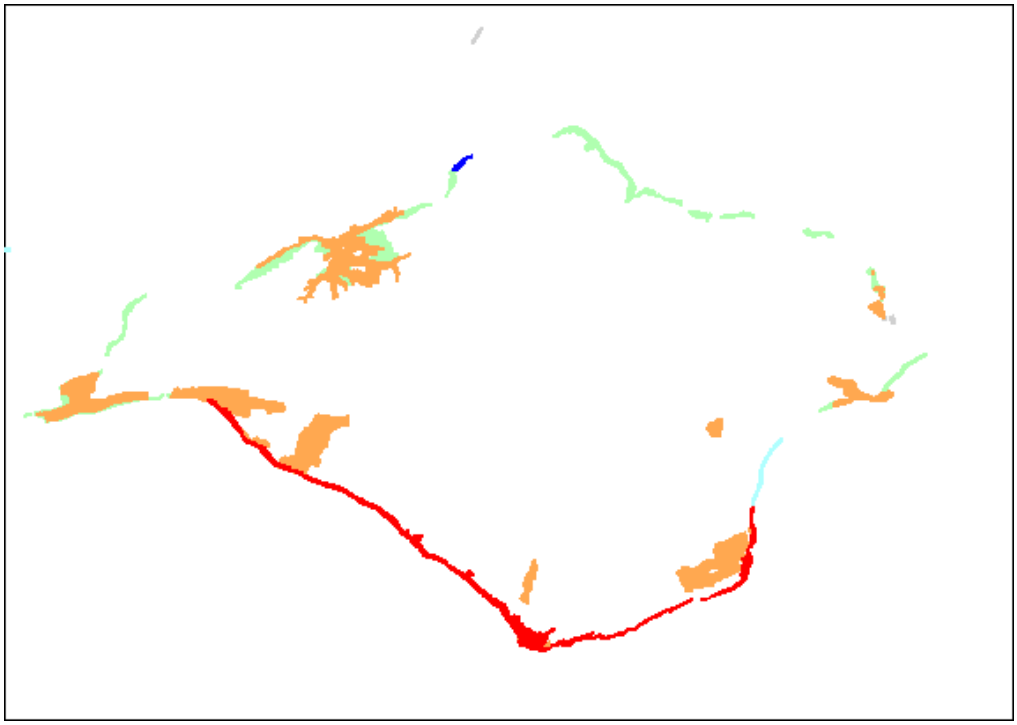


Figure 15. Location of known Isle of Wight surveys and the extent of soft cliff and slopes

Summary of recommendations

3.45 In order to undertake an accurate gap analysis of the area of soft cliff with no known survey, the following actions are needed:

Identification of the extent of maritime cliff and slope habitat:

- Improvement to the mapping and categorisation of the maritime cliff and slope habitat – useful to both BAP and habitat mapping programmes.
- Validation of the pilot mapping of the maritime cliff and slope inventory data is needed to confirm the status of the cliff sections provisionally mapped. Local conservation officer input might well provide an effective way of confirming the quality of the categorisation.
- It should be noted that the BAP inventory GIS dataset identifies (subject to limits) the scope of the BAP habitats for maritime cliff and slope. It does not reflect the wider areas surveyed within the cliff surveys conducted under the generic standards, which encompass other habitat types. This need not be a limitation and the more detailed surveys may be used to update or validate the BAP inventory dataset, which was largely developed from secondary data.

Identification of the extent of soft cliff:

- Classification of areas of cliff that are not covered by the JNCC dataset into hard/soft/intermediate. It may be worth eventually updating the JNCC dataset or replacing it with a more comprehensive GIS layer.
- Improvement to the categorisation of cliffs into hard/soft/intermediate. Other attributes would help to develop a more ecologically meaningful categorisation and could incorporate multiple

classifications based on features such as slope, aspect, reaction, erosion rates etc. These issues are discussed further in section 4.

Identification of existing survey extents:

- Digitise survey extents for pre-2000 surveys that are not National Trust surveys – 80 surveys:

  Identify those surveys for which GeoData already hold the survey reports and digitise survey extents from this information.
  Identify those surveys for which no locational information is held by GeoData and assess scope for obtaining information.

- Identify the area (%) covered by National Trust surveys – although not the same survey specification as English Nature Surveys.
- Also, an appropriate format/system for the survey metadata needs to be discussed and implemented. This may need to assess the feasibility of including the metadata for the pre-2000 surveys as well.

4 Review of post 2000 survey reports

Post 2000 survey sites

4.1 This section reviews the survey reports from the post 2000 cliff surveys to identify the main habitat types (section 4.6 definition of soft cliffs), including the degree of maritime influence and the relevance of coastal processes and other environmental factors in maintaining the habitats. It reviews the definition of soft cliffs based on these surveys and the conservation significance of soft cliffs as part of the range of variation of cliff habitats. In addition to the later section (section 5) section 4 collates the mapping issues identified through the surveys themselves, including the surveys and mapping techniques and based on the survey reporting.

4.2 The surveys collated within this post 2000 review and any nature conservation designations are listed in Table 5. The JNCC website provides more data on European sites - www.jncc.gov.uk/page-1457.

Table 5. Survey type and designations

Ref no.	Former English Nature Area team	Survey name	Survey type	Nature Conservation Designations covering all or part of survey area*
1	Cornwall	Carricknath Point to Porthbean Beach SSSI	NVC	SSSI
2	Cornwall	Godrevy Head to St Agnes SSSI	NVC	SSSI, SAC
3	Cornwall	Bude SSSI & Steeple Point to Marsland Mouth SSSI. National Vegetation Survey 2002	NVC	SSSI, SAC
4	Cornwall	National Vegetation Survey of Polruan to Polperro Candidate Special Area of Conservation (cSAC): Cornwall	NVC	SSSI, SAC
5	Cornwall	National Vegetation Classification Survey of Rame Head and Whitsand Bay SSSI, Cornwall, 2002	NVC	SSSI
6	Cornwall	National Vegetation Classification Survey of Tintagel Cliffs SSSI, Cornwall 2002	NVC	SSSI, SAC
7	Cornwall	Interim Report. National Vegetation Classification survey of Boscastle to Widemouth SSSI, Cornwall 2003	NVC	SSSI, SAC
8	Devon	Axmouth to Lyme Regis Undercliff NNR Vegetation Survey 2002-2003	Vegetation	SSSI, NNR, SAC
9	Devon	Axmouth to Lyme Regis SSSI A brief invertebrate Survey of Culverhole and Goat Island	Invertebrate	SSSI, NNR, SAC

Table continued…

Ref no.	Former English Nature Area team	Survey name	Survey type	Nature Conservation Designations covering all or part of survey area*
10	Dorset	Black Ven - Charmouth Heritage Coast Centre	List of flora	SSSI, SAC
11	Hampshire and Isle of Wight	Soft Cliff Vegetation Survey - South Coast of the Isle of Wight	Phase 1/ NVC	SSSI, SAC
12	Hampshire and Isle of Wight	Invertebrate Survey of proposed SSSI at Luccombe to Shanklin Chine, Isle of Wight	Invertebrate	SSSI, SAC
13	Hampshire and Isle of Wight	Isle of Wight Soft Cliff Survey: Hanover Point to St Catherine's Point	Phase 1	SSSI, SAC
14	Hampshire and Isle of Wight	Isle of Wight Soft Cliff Survey: St Catherine's Point to Shanklin	Phase 1	SSSI, SAC
15	Hampshire and Isle of Wight	Invertebrate survey of Niton to St Lawrence and Puckaster Cove to Ventnor, Isle of Wight	Invertebrate	SSSI, SAC
16	Kent	Kent supralittoral rock	Phase 1 / IHS	SSSI, SAC
17	Norfolk	Surveys of Overstrand Cliffs SSSI and cSAC, Norfolk	Phase 1/ NVC	SSSI, SAC
18	North and East Yorkshire	Maritime cliff vegetation of Robin Hood's Bay to Beast Cliff	NVC	SSSI, SAC
19	North and East Yorkshire	Maritime cliff vegetation of Flamborough Head	NVC	SPA, SAC, SSSI
20	Sussex and Surrey	Soft Cliff Vegetation Survey - Hastings Cliffs cSAC, West Sussex	Phase 1/ NVC	SSSI, SAC
21	Dorset	Invertebrate Survey of Golden Cap Estate (cliffs)	Invertebrate	SSSI, SAC

* SAC designations primarily for the Annex I habitat 'Vegetated Sea Cliffs of the Atlantic and Baltic coasts'

4.3 Twenty-one surveys were obtained from English Nature area teams for the purpose of this project. The surveys listed include a number of invertebrate and non-NVC surveys. The surveys have concentrated on the soft cliff community surveys undertaken since 2000, however, some of these sites (eg Tintagel Cliffs) may classify as hard geologies even though some softer less stable habitats are present. A summary of survey type is shown below in Table 6.

Table 6. Summary of post-2000 survey types

Total number of surveys supplied by English Nature teams	21
Number of surveys commissioned by English Nature	18
Number of invertebrate surveys	4
Number of vegetation surveys	17
Number of 'NVC' surveys	9

4.4 The area of the surveys often covers a wider area than is strictly classified as maritime cliff and slope, although the cliff top and woodland communities often associated with the cliff surveys may be important in their own right, they may not have a strictly maritime influence.

4.5 The surveys cover a range of soft cliff geologies, rates and nature of geomorphological processes. Most sites are generally free from coast protection/stabilisation works. Any particular site is more complex than can be reviewed here and thus the major characteristics only are summarised in Table 7. Within a single site the edaphic factors, slope, exposure and hydrology, grazing etc will be likely to be very variable and thus only major trends are identified here. Note that these sites are generally free of extensive coast protection works.

Table 7. Summary of the geological and morphological characteristics of the post 2000 cliff surveys

Ref no.	Survey	Geology and geomorphological processes
1	Carricknath Point to Porthbean Beach	Head deposits over hard cliff platform Devonian interbedded greywackes and slates overlain by periglacial head deposits. Cliffs are in the head deposits with hard cliff platform. Flushes contribute to erosion and slumping. SE aspect, sheltered
2	Godrevy Head to St Agnes	Devonian slates, shales and sandstones. Streams cutting down to the shoreline. Sheer cliffs with upper cliff erosion of Pliocene clay and sand. Localised calcareous windblown sands and cliff slope flushes. Metaliferous waters Zonation based on distance from exposure, S, N, NW aspect
3	Bude SSSI & Steeple Point to Marsland Mouth	Generally W aspect, but with substantial areas of stream valley systems of non-maritime communities (not surveyed)
4	Polruan to Polperro, Cornwall	Devonian slates dipping steeply Generally stable hard rock cliff. Complex of cliff and cliff top, flush ledge and crevice, therophyte and maritime scrub communities habitats SE aspect, 150m AOD. Two steep coombe streams and flushes.
5	Rame Head and Whitsand Bay	50m AOD Complex of shallow bays, coves, rocky islands Generally stable with rocky face and steep on the lower cliff face, with areas of slippage and clitter slopes SW aspect
6	Tintagel Cliffs	Lower Carboniferous and upper Devonian, Generally NW aspect. Up to 70m AOD, Stable structure with rocky outcrops Complex of caves, geos, arches, stacks and islands, ledge and crevices, clitter. Streams interrupt cliffline. Quarries in upper cliff sections
7	Boscastle to Widemouth	Hard cliffs and habitats of offshore islands, cliffs and coastal margins.

Table continued…

Ref no.	Survey	Geology and geomorphological processes
8	Axmouth to Lyme Regis Undercliff	Triassic, Jurassic and Cretaceous Cert to mid Chalk Complex of slopes ridges and troughs with detached blocks and landslips. Little management, some clifftop cutting to prevent scrub extension
9	Axmouth to Lyme Regis	Invertebrates
10	Black Ven	1957 -1958 mudflows
11	South Coast of the Isle of Wight	Greensand inner cliff (non maritime), coastal cliff southern end sandstone at 20m AOD with slumped faces further east with slumping from the undercliff. Undercliff of Upper Greensand. Slippages, especially within the Greensand.
12	Luccombe to Shanklin Chine	Invertebrates
13	Hanover Point to St Catherine's Point	Repeats earlier (1996) survey Sand and clay 3-50 m steep crest with slumped slope with mud slides and debris cones at beach level. Chines where stream gorges occur down to beach level. High erosion rates in some locations prohibit vegetation development.
14	St Catherine's Point to Shanklin	Sandstone, clays and chalk, includes the urban area of Ventnor. S aspect
15	Niton to St Lawrence and Puckaster Cove to Ventnor	Invertebrates
16	Kent	Phase 1 habitat survey using IHS classification
17	Overstrand Cliffs	Quaternary till, sands, gravels and clays with chalk rafts of the Cromer Ridge. Extensive land slipping on the boulder clay unit, marine undercutting, but some slowing due to shore parallel groynes on the beach. NE and E aspect Unmanaged cliff top, up to 65m.
18	Robin Hood's Bay to Beast Cliff	Boulder clays underlain by Lower Lias shales and Upper Lias alum shales overlain by sandstone and calcareous deposits. Southwards the cliff is a sandstone upper cliff, shales and clay lower cliff. Varied base poor and base rich strata. NE aspect High erosion rates at northern end of site, slumping and retreat. Further south slumping is confined to undercliff. No stock grazing

Table continued…

Ref no.	Survey	Geology and geomorphological processes
19	Flamborough Head	Chalk overlain by glacial drift and western end boulder clays Generally NE and SE aspects Stable chalk with actively eroding drift with numerous flushes with slumping, generally steep face with shallowing drift but gentler slope at Speeton. Mobile boulder clays. Rapid cliff retreat in soft cliff, and rockfall in higher cliffs. Up to 140m AOD Mesotrophic Seabird influence on vegetation, no stock grazing
20	Hastings Cliffs	Lower Hastings beds. Actively eroding soft cliffs with cliff falls Wooded ghylls S aspect.
21	Dorset Golden Cap Estate	Invertebrates

Table 8. Coverage of NVC types and other vegetation in English Nature surveys (post 2000) of maritime cliff and slopes in England

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
Software used		-	Match	Match & Tablefit	-	-	-	Tablefit	Mavis	Tablefit	Tablefit	-	-	Mavis	
Ph 1	A1								40.00					26.93	66.94
Ph 1	A1.1.1					0.13									0.13
Ph 1	A2					0.00					1.78				1.79
Ph 1	A2.1		0.45			0.76	0.37		13.45	15.23				38.26	68.52
Ph 1	A2.2		0.35						7.03					31.13	38.52
Ph 1	B1													11.66	11.66
Ph 1	B2.1									3.23					3.23
Ph 1	B2.2								18.03	27.32				5.59	50.94
Ph 1	B3.1								4.36						4.36
Ph 1	B4									11.34					11.34
Ph 1	C1.1								0.59						0.59
Ph 1	C1.2								3.02						3.02
Ph 1	C3.1								6.49	10.02	0.11				16.62
Ph 1	D													0.74	0.74
Ph 1	E2.2	0.02													0.02
Ph 1	E2.3						0.01								0.01
Ph 1	E3									1.01					1.01
Ph 1	F1								0.38						0.38
Ph 1	G1		0.07							0.27					0.33
Ph 1	H1						0.75								0.75
Ph 1	H4						1.23								1.23
Ph 1	H8		7.90			0.04	12.06							29.96	49.95

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
Ph 1	H8.1			0.54		0.57	16.48		0.67	6.54			12.57		37.37
Ph 1	H8.2									2.60	1.02		1.06		4.68
Ph 1	H8.3									1.17					1.17
Ph 1	H8.4									3.57	6.95			1.18	11.70
Ph 1	I1.2			17.10		0.24	18.21								35.56
Ph 1	I2.2		1.56												1.56
Ph 1	J1.1									0.30					0.30
Ph 1	J1.2						0.15								0.15
Ph 1	J2.1	0.09													0.09
Ph 1	J3					0.01				12.82					12.83
Ph 1	J4		0.05			0.67	3.12			4.29				1.57	9.71
NVC	CG							0.13							0.13
NVC	CG1e							0.28							0.28
NVC	CG2		0.62									3.77			4.40
NVC	CG6a							0.81							0.81
NVC	CG7a												0.28		0.28
NVC	H10											9.49			9.49
NVC	H4a		75.54												75.54
NVC	H4b		3.64												3.64
NVC	H4c		11.34												11.34
NVC	H7					0.07	0.82								0.89
NVC	H7a		6.60	10.08			5.72								22.40
NVC	H7b		11.89				2.73								14.61
NVC	H7d					0.38									0.38
NVC	H7e		8.57	0.24			10.48								19.29
NVC	H8		7.90			0.04	12.06							29.96	49.95

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
NVC	H8a		43.03	3.38			35.99								82.40
NVC	H8b						36.08								36.08
NVC	H8c						4.56								4.56
NVC	H8d		13.99				5.50								19.49
NVC	M22a												0.20		0.20
NVC	M23a			0.34											0.34
NVC	M23b				0.08		0.38					0.11			0.57
NVC	M24						0.01								0.01
NVC	M25		0.61				0.84								1.45
NVC	M25a						0.08								0.08
NVC	M25c						0.20								0.20
NVC	M27		0.60	0.75											1.35
NVC	M27b						0.55								0.55
NVC	M27c						0.32						0.03		0.36
NVC	M28						0.02								0.02
NVC	M28a					0.01									0.01
NVC	M36						0.01								0.01
NVC	MC						0.32								0.32
NVC	MC1					0.14									0.14
NVC	MC10			0.52			0.32								0.84
NVC	MC11				5.00	0.58	3.64								9.23
NVC	MC11a					0.44	0.56								1.00
NVC	MC11b					1.11							0.80		1.91
NVC	MC11c					0.20									0.20
NVC	MC12		0.04		0.04										0.08
NVC	MC1a	0.17	0.21	0.12	8.26	1.39	1.34								11.48

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
NVC	MC1b		0.81			0.28	0.09								1.18
NVC	MC4a				0.24										0.24
NVC	MC4b							0.14							0.14
NVC	MC5	0.07			0.42	0.85	0.41								1.75
NVC	MC5a				0.06	0.01									0.07
NVC	MC5b			3.57		0.13									3.69
NVC	MC5c				7.45	1.68	1.65								10.78
NVC	MC6				0.99		0.08						2.94		4.01
NVC	MC7						0.14								0.14
NVC	MC8					0.53	0.83								1.36
NVC	MC8a	0.80	0.79		4.83	1.82	12.63						10.88		31.76
NVC	MC8b	0.79	0.34		0.29	0.18	0.24								1.84
NVC	MC8d			0.27		0.05	1.85						5.16		7.34
NVC	MC8e	0.09	0.66			0.15	1.45						1.18		3.54
NVC	MC8f	0.04	0.46	8.01		0.06	0.41						0.99		9.96
NVC	MC8g		0.29				0.44								0.73
NVC	MC9					0.16	0.53					0.97	4.14		5.80
NVC	MC9a		0.28				0.21								0.49
NVC	MC9b	0.75	2.77	2.25		0.11	0.78								6.66
NVC	MC9c	1.45		16.60		0.17	2.37								20.59
NVC	MC9d					0.02	1.30								1.33
NVC	MC9e					0.09	1.38								1.47
NVC	MCx		0.85												0.85
NVC	MG						1.32								1.32
NVC	MG1				2.58	0.21	0.59				0.63				4.02
NVC	MG10						0.46								0.46

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
NVC	MG10a						0.39								0.39
NVC	MG12a											1.33	7.51		8.84
NVC	MG1a	0.02				0.24	0.95					8.18	18.63		28.02
NVC	MG1b			0.93											0.93
NVC	MG1c			0.03			0.05					0.08			0.16
NVC	MG5				21.95										21.95
NVC	MG5a											8.08	9.80		17.88
NVC	MG5b			5.09		0.03									5.12
NVC	MG5c						0.83								0.83
NVC	MG6				0.09										0.09
NVC	MG6a						0.08					1.01			1.08
NVC	MG6b			3.45											3.45
NVC	MG6c						0.35								0.35
NVC	MG7			0.23		0.54	0.04								0.80
NVC	MG7a						1.78								1.78
NVC	MG7b						0.07								0.07
NVC	MG7e				1.04	0.40	0.02								1.46
NVC	MC1a		0.06												0.06
NVC	OV20a					0.04									0.04
NVC	OV21						0.05								0.05
NVC	OV23					0.02									0.02
NVC	OV24				0.09	0.05	0.06								0.20
NVC	OV24a											0.09	5.87		5.96
NVC	OV24b					0.63							0.01		0.64
NVC	OV25		0.11			0.05	0.02								0.17
NVC	OV25a					0.15									0.15

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
NVC	OV26					0.02									0.02
NVC	OV26b					0.00									0.00
NVC	OV26d											0.18	0.13		0.32
NVC	OV27					0.02									0.02
NVC	OV27b					0.11						0.22	0.22		0.56
NVC	S23				0.03	0.02	0.01								0.06
NVC	S25a	0.81					0.16								0.96
NVC	S26				0.13	0.04									0.17
NVC	S26b											0.04	0.71		0.75
NVC	S3	0.02			0.04		0.02								0.08
NVC	S4					0.12									0.12
NVC	S4diii	0.06													0.06
NVC	SD1	0.01													0.01
NVC	SD18										1.74				1.74
NVC	SD2	0.14			0.29	0.15					0.12		0.02		0.71
NVC	SD7	0.02				0.03					0.19				0.24
NVC	SD7c										0.48				0.48
NVC	SM18					0.06									0.06
NVC	U16											1.56			1.56
NVC	U1f					0.75	0.05								0.79
NVC	U2b											5.33			5.33
NVC	U4						0.20								0.20
NVC	U4b				2.56	12.79	13.85								29.21
NVC	U4c						0.21								0.21
NVC	W						0.59								0.59
NVC	W1		1.38		0.32		3.59					0.80			6.08

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
NVC	W10						36.06								36.06
NVC	W10b		0.20												0.20
NVC	W10c				0.97										0.97
NVC	W12b							0.02							0.02
NVC	W21				2.40	0.14	1.31								3.85
NVC	W21a						5.75					9.09	10.09		24.93
NVC	W21b						5.96								5.96
NVC	W21c					0.08	4.78								4.86
NVC	W21d							1.91							1.91
NVC	W22		0.33	0.07		9.78	3.47								13.65
NVC	W22a	4.13			39.95	17.08	27.54								88.69
NVC	W22b						0.01								0.01
NVC	W22c			11.13		0.16	2.09					1.59	0.15		15.12
NVC	W23	0.03			0.06	1.57	2.94								4.60
NVC	W23a						0.35								0.35
NVC	W23b					4.73	6.51					1.38	1.42		14.04
NVC	W23c		24.85	14.25	33.09	5.72	17.06				4.82				99.79
NVC	W24			3.19	0.33	1.28	0.45				0.50				5.74
NVC	W24a	0.55	3.03		0.03	0.97	1.24					0.51			6.32
NVC	W24b					0.34	0.45						3.35		4.15
NVC	W25	4.17		8.87		4.85	10.29				1.80				29.98
NVC	W25a					0.33	6.55								6.88
NVC	W25b		7.34	17.00	35.53	9.37	51.44					38.11	0.07		158.87
NVC	W25c				0.59	0.07									0.66
NVC	W5c											0.44			0.44
NVC	W6										1.66				1.66

Table continued…

		Survey (Habitat areas in hectares)													
Survey system	Habitat code	Carricknath to Porthbean	Godrevy to St Agnes	Bude and Steeple Point to Marsland Mouth	Polruan to Polperro	Rame Head and Whitsand Bay	Boscastle to Widemouth	Axmouth to Lyme Regis	South Coast Isle of Wight	St Catherines to Shanklin	Overstrand Cliffs Norfolk	Robin Hoods Bay to Beast Cliff	Flamborough Head	Hastings Cliff	**Total**
NVC	W7									0.92					0.92
NVC	W8	0.17					8.43			20.51					29.10
NVC	W8d							0.85							0.85
NVC	W8e											0.26			0.26
NVC	W9a											21.72			21.72
Other	AF**												0.61		0.61
Other	AG**											19.84	7.03		26.87
Other	AP**											0.15			0.15
Other	AR**												4.53		4.53
Other	BS**												2.30		2.30
Other	ET**											0.18			0.18
Other	Melampy-rum arvense								0.52						0.52
Other	No data		2.34		1.51	0.44	2.04	0.11	0.01	0.90					7.34
Other	non-NVC							2.89							2.89
Other	PB**												0.98		0.98
Other	SS**												2.49		2.49
Other	WW**											18.58			18.58

Definition of soft cliffs

4.6 The classification of cliffs put forward in ENRR 426 was based on the need for:

- the consistent capture of information for use in the inventory.
- for use in relation to BAP implementation and reporting.
- for work in relation to SSSI selection and other statutory site protection.
- to reduce the degree of overlap with other habitat inventories for BAP habitats on both the shoreward and landward edges of the areas.

4.7 Where inventories of habitats are operated separately, without the adjacent BAP habitats incorporated in the mapping programme the opportunity for overlapping classifications is present. The sequencing of surveys also affects the distinction, especially in dynamic cliff systems where cliff falls and slips may cause genuine overlaps with earlier classifications of other habitat inventories. For example, the inland limit of active cliff will alter over time and overlap with the cliff top communities from earlier mapping programmes. Recognising this within the scope of the comparison of habitats will help to prevent double-counting of the areas. This overlap occurs also at the shoreward edge where MNCR (Marine Nature Conservation Review) (Connor and others 1995) based surveys overlap with lower cliff and maritime slope habitat classifications. Classifications within EN426 incorporated intertidal biotopes from the Marine Nature Conservation Review (Connor and others 1995) for supralittoral and littoral fringe rock.

4.8 Ideally the classifications are sufficiently distinct to avoid the overlap in mapping such that the ‘macro polygons’ are unique; or if this is not the case that at least the boundaries to the classifications may be resolvable at a later date.

4.9 The definitions used within ENRR 426 recognise the limitations of the divisions into hard and soft cliffs and intermediate variations are inevitable, due to structural, compositional and cliff behavioural terms. Thus many of the ‘soft cliff’ surveys in Cornwall could be treated as either ‘hard’ or ‘soft’ due to a layered cliff structure, with head materials over the top of hard cliffs. The different nature of hard and soft cliffs required the separate sets of attributes (from ENRR 426 Table 4-9) and rules for fixing the inland limit of the habitat. On soft coasts the limit of current or recent instability is suggested. The limit of land enclosure is suggested for narrow strips of cliff top on coast with intensive agriculture or development.

4.10 The classification issue matters less as the inventory becomes more complete since the BAP Maritime Cliff and Slope habitat does not itself make this distinction. The inventory collation helps to define this extent, but earlier advice suggested that the ‘macro-polygons’ for cliff survey should be defined before surveys are conducted. This has rarely been undertaken as the surveys are usually tied to wider extents (see section 3.23 limitations), such as the extent of the SSSIs, which may include other BAP Priority habitats. Demarcating the polygons outside the maritime cliff and slope habitats may be possible from the surveys at a later date.

Table 9. Soft Maritime Cliff and Slopes BAP Priority Habitat (UK- wide applicability – updated from ENRR 426)

Components	Phase 1	NVC/ Phase 2
[1]**Cliff top** - Abandoned ground (semi- natural vegetation, improved grassland, scrub, woodland, buildings, gardens, roads)	Many Phase 1 habitat types are possible	Usually MG1, U4, U20, W25, W21- W24
[2]**Cliff slope** - Mud and clay with <10% vegetation cover	H8. 2 maritime soft cliff	Not described in National Vegetation Classification
Early succession vegetation on drier ground	J1. 3 Ephemeral/ short perennial is perhaps closest but no Phase 1 category adequately describes the successionnal character of this ground	*Tussilago farfara, Agrostis stolonifera - Tussilago farfara, Holcus lanatus, Ononis repens- Daucus carota- Holcus lanatus, Rumex acetosella- Ulex europaeus* grassland not described in National Vegetation Classification. OV class.
Early succession vegetation on wetter ground	G1 Standing water, F1 Swamp – including classes of alien species and habitat types not adequately described in Phase 1 (eg pampas grass, hottentot fig)	A5, A9 *Phragmites australis, Phragmites australis- Calamagrostis epigejos - Equisetum telmateia, Phragmites australis - Equisetum telmateia* pioneer wetland types not described in National Vegetation Classification, OV18, on wetter locations OV26, OV27.
Late succession vegetation on drier ground	Many Phase 1 habitat types are possible: H8. 4 Coastal grassland, drier types of acidic (B1), neutral (B2) and calcareous (B3) grassland, scrub (A2) and woodland A1.1.1	MC5, MC8, MC9, MC11, H2, H11, CG1, CG2, U1, MG1, MG5, MG6, MG7, W21- W24, W10, W12
Late succession vegetation on wetter ground	G1 Standing water, F1 Swamp, B5 Marsh/ Marshy grassland, A2, Scrub, A1.1.1 Semi- natural broadleaved woodland	A5, A9, S19, S4, S25, M22, MG9, MG11, MG12, W1, W2
Dunes at cliff-foot	H6 - Sand dune	SD10
Coastal vegetated shingle	H3 Shingle/ gravel above high- tide mark	SD1, other NVC and non- NVC vegetation on shingle
Strandline	H5 Strandline vegetation	SM28
Coast protection works (if present)	Not included in Phase 1 system but suggest identify types present in other coastal protection surveys (e. g. MAFF categories of groynes, rock armour, cliff drainage, etc.)	

[1]**Cliff top** - gentle to flat slopes immediately inland of the cliff slope, generally extending inland to the limit of the active cliff process zone, perhaps with a short additional arbitrary width to allow for safety and management purposes. The inner boundary will move over time as the cliff retreats inland. Abandoned cliff top which was formerly arable or improved grassland may have a succession to rank grassland or scrub. Significant salt spray influence is often absent. Cliff tops with such a succession should be included to allow its use in management of the eroding soft cliffs.

[2]**Cliff slope** - generally steep to vertical slopes above littoral zone, ascending to cliff- top. Evidence of landslips common to extensive, with bare ground common. Opensurface extent varied, depending on speed of cliff retreat and speed of vegetation succession in colonising bare soil. Long- term successions in areas with little mass movement can support woodland. Highly varied soil moisture content, with dry to very wet conditions occurring over very short distances. Flush, tufaceous flush, spring and chine/glen may be present. Spray- influenced vegetation often rare. Marine sorting of sediment at cliff foot can create small areas of shingle and dune, with some sand blown on to cliff face (extents very small compared to climbing dunes on some hard cliff systems).

Update of Pye and French (1992) figure for the length of unprotected soft cliff

4.11 The original estimates of unprotected soft cliff and maritime cliff grassland (Pye and French 1992) were based on the analysis of the data from the MAFF sea defence survey 1988 and from the CoastWatch database (1988). Despite revision and redevelopment of the database to the National Flood and Coastal Defence Database (NFCDD), the Environment Agency indicates that the data is held regionally and is incomplete or not updated from these earlier surveys. There is no updated map of the extent of cliff protection works (Ian Walker pers comm) and no later CoastWatch survey or similar database has been generated from which to establish the extent of maritime cliff grassland areas or linear extent. The current collation of data (from 2000) does not allow effective summary estimates of the extent of unprotected soft cliff or MC classes. Pye and French's two classes will overlap, and unprotected soft cliff will often be accompanied by the specific NVC (MC) class maritime cliff grassland cover.

4.12 In order to establish the true extent of unprotected soft cliff the first generation of Shoreline Management Plans, produced by the coastal defence groups, could be analysed; but would need extensive collation. The second generation of Shoreline Management Plans; using standard GIS data structures and templates for the description of coastal defence infrastructure (Defra 2006), should eventually provide a useful dataset of cliff protection; the target for completion of these is 2010. The Futurecoast study (Defra 2002), on the prediction of future coastal evolution, together with aerial digital video and aerial photographic coverage would provide the basis for updating Pye and French (1992) figures and creating a dataset of protected and unprotected lengths.

4.13 The quality of the estimates from Pye and French are reliant on the source data (varied sources from 1988 – 1992) and the capture method (mapped to 1:50,000 scale maps). The original reliability of the source data, their age and the potential for additional cliff defences, where MAFF (1994) estimated 90km of additional soft cliff defences would be needed, suggests that update of the Pye and French estimates is needed, but current data does not enable this to be done in the same way that will provide a comparable figure.

Conservation importance of soft cliffs and variation of cliff habitats

4.14 The conservation importance of maritime cliff and slope of soft cliffs is related closely to the dynamics of the sites, their often rapid turnover based on high retreat rates and diverse floristic and invertebrate communities promoted by the complex ecological gradients. These include the geology and soil types, water relations, slope and aspect, and the degree of maritime exposure. The threats to the status include the extent of agricultural or other human impact that also affects the community structure.

4.15 Vegetation of disturbed ground and open areas rarely match any NVC classifications. These habitats, however, can be diverse and are able to support a range of species, including invertebrates. Sites can also be designated as SSSI if they meet the criteria for geomorphological features.

4.16 The nature of the soft cliffs, especially where they remain unprotected, and their often rapid retreat rates means that their communities are often natural or semi-natural and are some of the least modified communities. However, they are widely affected by other factors, such as natural cliff recession (seen as a natural agent of change) as well as coast protection or other stabilisation works and other human actions on the cliffs.

4.17 Of the surveys conducted, within SSSI the cliffs are not affected by built development, but a number of other factors are relevant and may pose a threat to the conservation status of the

sites. Pye and French (1992) summarised the extent of impacts. High rates of erosion and slumping, agricultural 'improvement' on the cliff top, grazing and recreational use are all prevalent in the soft cliff areas. An influence not specifically noted by Pye and French, is the colonisation of alien plants (Axmouth and Lyme Regis), within the early successional and swamp classes colonising bare ground after slippages. In these cases the generation of monospecific stands may alter the conservation status of the sites, reducing the diversity of the areas. This has resulted in the allocation of the community to low or no-affinity to existing descriptions of the NVC communities and the presence of stands of bamboo, pampas grass and Carpobrotus edulis (hottentot fig). Closer examination of these classes from the national datasets will allow the extent of this impact – but only if the cover classes specifically note these impacts; which may be unlikely without further examination of the quadrat data.

Survey and mapping issues

Survey and mapping techniques

4.18 The experience built up by the field surveyors and ecologists recorded within the reports has been used to identify specific challenges and approaches used to collect and manage the field survey information. This information is summarised in Table 10. This experience is supplemented by the quality assurance tests undertaken within the scope of this survey on the separate spatial and attribute data supplied by the contractors.

Table 10. Summary of survey and mapping issues identified by the survey teams

Ref no.	Survey	Survey and mapping issues identified within the surveys
1	Carricknath Point to Porthbean Beach	Panoramic photos taken from vantage points Aug - Oct 2003 survey
2	Godrevy Head to St Agnes	Panoramic views of cliff faces where possible from vantage points June – Oct survey
3	Bude SSSI & Steeple Point to Marsland Mouth	Trial survey in April, full surveys in Aug. Rope work inspections. Lack of Land-Line features. Contour base maps are recommended, but were not used in this case.
4	Polruan to Polperro	August survey, Oblique photographs used to help preliminary boundary definition. Access restrictions and impenetrable vegetation. Recommend supply of standard colour scheme and need additional coding for NVC classes not included in the list. Mapping is to NVC community type not NVC community level.
5	Rame Head and Whitsand Bay	Limited access over MOD ranges
6	Tintagel Cliffs	Time and access limitations, binocular survey. Small areas not identified separately (but minimum parcel not determined). 'Key areas' ledge, crevice and rocky outcrops may add community types. Some areas not covered for H+S reasons. Remote surveys made actual demarcation of the boundaries more difficult (and inferred boundaries are recorded in the dataset).

Table continued…

Ref no.	Survey	Survey and mapping issues identified within the surveys
7	Boscastle to Widemouth	Part mapped to NVC sub-community level, part mapped to NVC community level, due to late surveys. Distinction between field survey and visual survey is marked within the GIS spatial information. Mapping uses dominant code for colour and where mosaics occur the areas have been mapped as the two dominant NVC colour codes. Printout is generally as a broad habitat classification.
8	Axmouth to Lyme Regis Undercliff	Descriptions are linked directly to each polygon. Attempted to develop DAFOR across polygon rather than just quadrats. Recommended later surveys (July Aug) to capture late seasonal development.
9	Axmouth to Lyme Regis	Invertebrates
10	Black Ven	Used range of sources to map out the basemap, including 1999 and 2001 EA Lidar images. Surveying will use an orthomap based on 2001 photo. Surveys limited to most dynamic sections of the area
11	South Coast of the Isle of Wight	Divided into three units inner cliff, coastal cliff and undercliff for survey purposes. Mapped to Phase 1 then divided into NVC communities.
12	Luccombe to Shanklin Chine	Invertebrates
13	Hanover Point to St Catherine's Point	Repeat survey, only mapped the changes requiring cross reference to earlier surveys (1996). Erosion means that SSSI notification maps are c 20 m out. Changes to habitats noted especially at cliff top and fence-line retreat, otherwise few qualitative changes related to slips. Recommendations made for SSSI boundary revisions, to include all cliff-top maritime grassland and all chines.
14	St Catherine's Point to Shanklin	Access permission restrictions August survey and limited to semi-natural communities Mapping codes used Phase 1 + some NVC codes Habitats of same type incorrectly linked to single polygon in MapInfo.
15	Niton to St Lawrence and Puckaster Cove to Ventnor	Invertebrates
16	Kent	Phase 1 survey, IHS and Priority Habitat surveys mixed together with land formation and management classes. Class structure not appropriate to this compilation, as does not include community levels, but appropriate at Phase 1 level and Broad Habitat mapping.
17	Overstrand Cliffs	Rapid Phase 1 used to plan NVC, Combined invertebrate, Inaccessibility and H+S issues.

Table continued…

Ref no.	Survey	Survey and mapping issues identified within the surveys
18	Robin Hood's Bay to Beast Cliff	Use of oblique aerial photographs. Initial aerial survey using microlight. Survey July and Aug. GPS fixes may not be better than 20-30m accuracy in places. Problems of two dimensional mapping.
19	Flamborough Head	Rope surveys. Sea survey (horizontal surveys of cliff face communities), uses overlapping images of the cliff from offshore vessel as a basis for mapping. Output has included the sea images and hyperlinked images and text to the surveys. Challenge of depiction on near vertical faces, representation in GIS and underestimates of habitat extent.
20	Hastings Cliffs	Accessibility restrictions June surveys Phase 1 survey with NVC in semi natural communities. Mapped to the 1:25,000 map Phase 1 surveys areas subsequently divided into NVC sub-community levels. Pioneer communities not surveyed in detail. Habitat quality assessment using Ratcliffe criteria Survey results include assessment of ecological value of each site and brief management advice.

4.19 Of these factors affecting the survey many are unlikely to be improved upon within any new survey specification or GIS/ Data management strategy. For example, the problems of restricted access affected many of the surveys.

4.20 Areas of some land cover are not vegetated, and may be recorded as bare ground, but may have further classifications, such as recording as clitter, but may also use classes such as bare, bare rock, bare soil. These additional, morphological, classes for description of the bare ground may be of interest in predicting the types of pioneer and secondary vegetation cover that may colonise the surfaces in the future.

4.21 The implication of 2D mapping on a sloping surface of the cliff and slope community, with the inherent underestimates of community areas has affected most surveys, and was recognised within the earlier maritime cliff and slope inventory (Hill and others 1999). The introduction of and increasing availability of high resolution terrain datasets along with high resolution orthorectified aerial images for the UK coast offers the opportunity to reappraise the approaches to assisting the field surveyors. Only one survey, Black Ven in Dorset, appears to have been able to make effective use of these sources. Costs of capture of this information for community mapping are rarely available, and only if the data are already available is it likely to be used. Such data also offer the opportunity to update what are often outdated basemaps, especially where the cliffs are more dynamic. Wherever possible these terrain resources should be used to improve the accuracy of mapping habitat boundaries.

4.22 In undertaking resurvey, Hanover Cliffs, the survey only covered the more dynamic sections. This approach may be appropriate in terms of effective assessment of change within a dynamic cliff environment, but careful assessment of other habitats may be necessary at longer intervals to confirm the stability of the more stable sections of cliff. These communities may themselves be secondary and changing towards a ‘climax’ community or being altered by slower processes than are detected between surveys.

4.23 Many of the community classes mapped are identified as having only a low or no affinity to the NVC classes. Within the earlier, pre-2000 surveys this was often equated with the surveys having been undertaken prior to the publication of the open vegetation communities (OV) of Rodwell (2000). However, in many of the sampled sites in the post 2000 surveys the presence of non-NVC classes is often equated with open vegetation communities and invasive communities of

disturbed habitats that are not represented within the OV or MC NVC community classes; this typically occurring on the dynamic slippages. Often these sites have affinity with the community occupying the areas prior to the slip, although this may be affected by the form of the slippage. For example, within the Axmouth to Lyme Regis active slips at Pinhay Warren the non-NVC areas have affinity to the W8 Acer pseudoplatanus dominated woodland communities that suffered slip within the Lias sandy silts, with remnants of these communities and secondary woodland regeneration of Acer and Fraxinus and scrub (W21d) regeneration communities. The accumulation of quadrat data for these early successional types may allow the separation of new OV classes within the national Vegetation Classification, such as a the provisional Agrostis stolonifera – Tussilago farfara community.

4.24 From this review of problems the following recommendations are made to add to the survey specifications:

- Where bare ground is recorded classify the morphological nature of the exposure (clitter, slumped sand, rock fall etc).
- Wherever possible, and prior to survey seek access to Lidar and aerial photographic imagery to assist with the mapping of macro and survey polygons.
- Resurvey active sections, but also more stable sections but on a longer timeframe.
- Even where there are low or no affinities to existing NVC classes it may be possible within the mapping to identify classes of disturbed communities that will eventually lead to classification of these areas into NVC community types; or enable recognition of the likely secondary or climax vegetation community.
- Where the survey identifies maritime cliff and slope and cliff top communities outside the boundary these should be identified and surveyed. Where the survey relates to a designation boundary proposals for boundary modification should be made, based on an analysis of recession rates for the site.
- Where a site is surveyed and the habitat is classified by means of visual survey from a vantage point rather than direct access, the quality of the categorisation may be lower than for on site survey. This quality status should be recorded within the spatial dataset as an attribute of the polygon.

Review of NVC categories

4.25 The results of the post 2000 surveys illustrate a range of sites, geologies, exposures and community assemblages and varied extent of maritime exposure. A number of the surveys identify communities that do not match to NVC communities, typically those of open habitats and pioneer communities that have not been addressed by NVC associations. A number of the sites include hard cliff communities often with lower cliff levels of hard rock overlain by more erodible tills. This introduces components of hard and soft cliff maritime communities including ledge and crevice communities (eg MC 1 and MC5 communities). Zonation of maritime communities and maritime grasslands is often restricted by the area affected by salt spray (MC 8, MC9 and MC 11).

4.26 The land cover within the SSSIs has generally been surveyed rather than solely a survey of the specific maritime cliff and slope priority habitat or NVC Maritime Cliff (MC) community classes. Nevertheless, the surveys may extend beyond the confines of an SSSI site in some instances where cliff communities occur outside the site boundary.

Table 11. Summary of NVC classes of maritime cliff and associated communities

Ref no.	Survey	NVC community matches
1	Carricknath Point to Porthbean Beach	Major communities are Festuca rubra – Armeria maritima (MC8a, MC8b), Festuca rubra - Holcus lanatus – (MC9a and MC9c). Smaller areas of maritime therophyte Armeria maritima –Cerastium diffusum (MC5b). Extensive flush systems with Phragmites. Harder rocks at base of cliff with epilithic lichens. Shingle and strandline communities, and reed swamp flush communities and tufaceous flushes (lacking the reed swamp). Scrub communities include W22a, W24a and W25 underscrub.
2	Godrevy Head to St Agnes	Armeria flush community – non NVC community on bare mud and open water. Calcareous grassland variants based on shell sand. Variants on the North and South facing slopes.
3	Bude SSSI & Steeple Point to Marsland Mouth	Absence of Hyacinthoides non-scripta from MC12 Festuca rubra-Hyacinthoides non-scripta communities – were classed as MC9 (Festuca rubra – Holcus lanatus)
4	Polruan to Polperro	Dominated by W22 Prunus spinosa – Rubus fruticosus scrub and other W23, W25 scrub and mesotrophic grasslands.
5	Rame Head and Whitsand Bay	Restricted maritime influence with lower cliff maritime communities
6	Tintagel Cliffs	OV34 variant 'chive pan' community Allium schoenoprasum spring community
7	Boscastle to Widemouth	Part community level and part sub-community level mapping. Coastal woodlands difficult to fit into NVC communities. Further sub-communities may be identified.
8	Axmouth to Lyme Regis Undercliff NNR	Specific non-NVC communities on slip substrates with bryophyte dominated communities on wet slips.
9	Axmouth to Lyme Regis	Invertebrates
10	Black Ven	Did not use NVC due to slip community, and limited to most dynamic sections.
11	South Coast of the Isle of Wight	Appears to classify maritime cliff and slope as slopes with less then 10% vegetation cover.
12	Luccombe to Shanklin Chine	Invertebrates
13	Hanover Point to St Catherine's Point	Mapping was to Phase 1 only. Much of the steeper cliff erosion is too rapid to establish vegetation. Repeat survey of J. Cox 1996 survey.
14	St Catherine's Point to Shanklin	Quercus ilex holm oak communities present not covered by NVC, but classified as W10 Quercus robur – Pteridium aquilinum Rubus fruticosus woodland.
15	Niton to St Lawrence and Puckaster Cove to Ventnor	Invertebrates

Table continued…

Ref no.	Survey	NVC community matches
16	Kent	Non NVC classification (IHS/Phase 1 mix)
17	Overstrand Cliffs	Tussilago farfara Community on bare landslip material. Dry grassland communities, influenced by blown sand and calcicolous with Anthyllis vulneraria / Lotus corniculatus. Acid variant of the dry grassland community associated with very steep slopes with a lichen/bryophyte crust (U1f variant)
18	Robin Hood's Bay to Beast Cliff	Pioneer vegetation non NVC. Includes willow woodland along drainage lines with Salix cinerea and Salix caprea. Early succession and slip vegetation with Agrostis stolonifera / Tussilago farfara. Equisetum telmaetia dominated flushes, associated with eroding cliffs.
19	Flamborough Head	Maritime and calcareous influence. Includes a number of non-classified and variants Agrostis stolonifera flush and slump community with Juncus articulatus, Eupatorium cannabinum. Mapped separately, early succession vegetation with Agrostis stolonifera/ Tussilago farfara. Arrenatherum elatius / Teucrium scorodonia. scree slope vegetation (MG1 variant), Brachypodium sylvatica. Rich cliff grassland. (MC11 variant), Calcicolous grassland (Festuca rubra, Carex flacca. Sanguisorba minor. Tussilago farfara. (CG6a variant). Successional vegetation of rapidly eroding slopes similar to other successional community.
20	Hastings Cliffs	Mapping to community and sub-community level. Pioneer and early succession communities dominate the cliff face. Main community types associated with the glens are Quercus robur – Pteridium aquilinum – Rubus fruticosus. (W10); Scrub of Crataegus monogyna – Hedera helix (W21), Prunus spinosa – Rubus fruticosus (W22) and Salix cinerea – Galium palustre (W1). Grasslands Festuca ovina – Agrostis capillaris – Rumex acetosella (U1) are acidic and associated with heathland Calluna vulgaris – Festuca ovina and Calluna vulgaris – Ulex minor (H1 and H2). Maritime cliff and slope are Festuca rubra – Armeria maritima MC8 and Atriplex prostrata – Beta vulgaris (MC6). Pioneer communities not mapped / surveyed in detail. Other communities include improved / neutral grasslands.

4.27 As described within the previous inventory report the value of the Malloch survey quadrats in determining the NVC communities recommends that a similar quadrat database from the more recent surveys to allow for re-analysis of the NVC types and for potential identification of new NVC codes. The evidence from the quadrat records conducted for the post 2000 surveys suggests that the recording formats is very variable and uses a range of software, without current guidance for the submission of the information despite clearer guidance on the spatial datasets.

4.28 The pioneer communities are poorly represented within the NVC open vegetation community types and presents problems for the mapping of communities consistently, although it is recognised that these are transient, their presence on a dynamic cliff and slope area is evidence of colonisation and coastal change and generators of diversity. Such disturbance inevitably disrupts the formation of NVC communities, but there is potential to treat some disturbance communities as such in their own right or as mosaics, although the small scale variation may be

difficult to represent especially within a 2D representation of the 3D habitat. Suggested associations occurring in the Isle of Wight (P1 Tussilago farfara, Tussilago farfara – Agrostis stolonifera (P2) and Phragmites australis (P4a) pioneer inundation communities have been provisionally described (Cox 1999). Formalisation of these types may need to be subject to the assessments using the collated quadrat database, but are likely to be reflected in other soft-cliffed areas, as illustrated by similar pioneer forms in Norfolk, Isle of Wight and Flamborough.

4.29 There is a risk in a number of these surveys that the maritime cliff and slope communities in particular have been underestimated, either by virtue of the accessibility of steeper cliffs and the limitations of mapping to 2D framework when the communities are necessarily associated with slopes, often steep to moderate slopes. Sites are often composed of multiple strata within a single site, eg Hastings cliffs where hard and soft cliff and slopes affect the same SSSI communities and where rates of cliff instability and processes vary.

Recommendations

4.30 The review of the experiences and site surveys highlights a number of issues additional to the re-specification and clarifications of the survey data management issues. Survey methodological issues are reviewed within section 4.18 (survey and mapping techniques). Additional recommendations are made that will help to improve the ability to categorise and collate information from individual surveys into an inventory.

1) Surveys should record the length of time for individual site surveys as assistance to planning and costing further work undertaken to augment the inventory. These timescales will vary with the complexity of the sites and the resolution of the habitat blocks, and recording these times will help in planning new surveys.
2) There should be a linkage made, wherever possible, between geomorphological surveys, vegetation surveys and surveys of invertebrates. This would allow the data sources and locational information on habitat parcels to be appreciated, with the potential to relate morphological conditions and ecological colonisation.
3) The general cartographic presentation of the mapping associated with the survey reports is often of variable quality. Although the GIS data would allow this to be reworked into a common format it is worth attempting to standardise the outputs and information content. As a minimum an overview map should be provided; to include a scale bar or scale and the map should have a labelled grid of at least 1km scale.
4) The original specification within the Maritime Cliff and Slope Inventory recommended that ‘mapping of maritime cliff and slope habitat should start with the development of a set of generalised regional zonation diagrams using experienced maritime cliff surveyors’. This task has not always been undertaken in the surveys, but if it were it would allow the classification of hard or soft cliff or the introduction of sub-classes.
5) A number of the surveys conducted for the South West employed a separate methodology (English Nature 2002) under a framework arrangement from 2002 and extended to 2007 for NVC surveys within the South West Region. The extent to which any future framework established by Natural England accords with the Maritime Cliff and Slopes inventory method needs to be assessed.
6) Survey of the sites should firstly assess the extent of maritime cliff and slope communities regardless of whether they occur within the notified site boundaries. The dynamic nature of cliff vegetation and soft cliffs in particular, means that landward cliff recession will result in the vegetation also migrating. In some cases, depending on where SSSI boundaries are drawn, the habitat of conservation significance (including geological features) can move beyond the designated area. New survey data is essential in these cases to cover the whole extent of the feature.

5 GIS and data format review of post 2000 surveys

Introduction

5.1 This section has assessed the generic specification of the survey and data capture based on the experience of the surveys conducted following the release of the ENRR 426. It reviews the GIS and data management approaches and errors that have been located following automated and manual analysis. The implications of adopting the survey and data methods proposed within ENRR 426 have also been influenced by other projects, such as The NBN South-West England Pilot Project.

5.2 It is often the case that data have not been fully Quality Assured and that digitising errors and classification errors affect datasets. These generate a number of potentially unforeseen difficulties when creating a national dataset.

Survey type

5.3 Not all surveys have been undertaken to NVC standards – some use a Phase 1 approach. Also, within surveys, a mixture of NVC and Phase 1 classifications has been used.

5.4 Not all of site (extent of maritime cliff and slope) has been surveyed in some cases. For example, Axmouth to Lyme Regis.

Completeness of datasets

5.5 Datasets are not complete in terms of:

- The specified data layers, for example, only two surveys generated macro-polygons. Appendix 10 shows which layers are present in each of the surveys.
- The specified MapInfo table formats (see Appendix 11 to Appendix 15). The majority of surveys do not adhere to the required format.
- Missing attributes, for example target notes.
- Missing photos corresponding to the MapInfo photo layer.

Coordinate system

5.6 All the MapInfo tables should use the Ordnance Survey National Grid to store spatial information. This coordinate system is listed as 'British Coordinate Systems – British National Grid' in MapInfo.

5.7 Some MapInfo tables are unprojected Lat/ Long files.

Naming conventions

5.8 Naming conventions:

- Inconsistent site names, for example some use a shortened form of the site name (StA) and some use the SAC code (UK0030086).
- Inconsistent naming of tables.

Attributes

5.9 In many cases, the attributes are incorrect, for example, the unique ID has been configured incorrectly. It is essential that this is correct so that all features in the national dataset have a unique reference.

For example: Polruan to Polperro

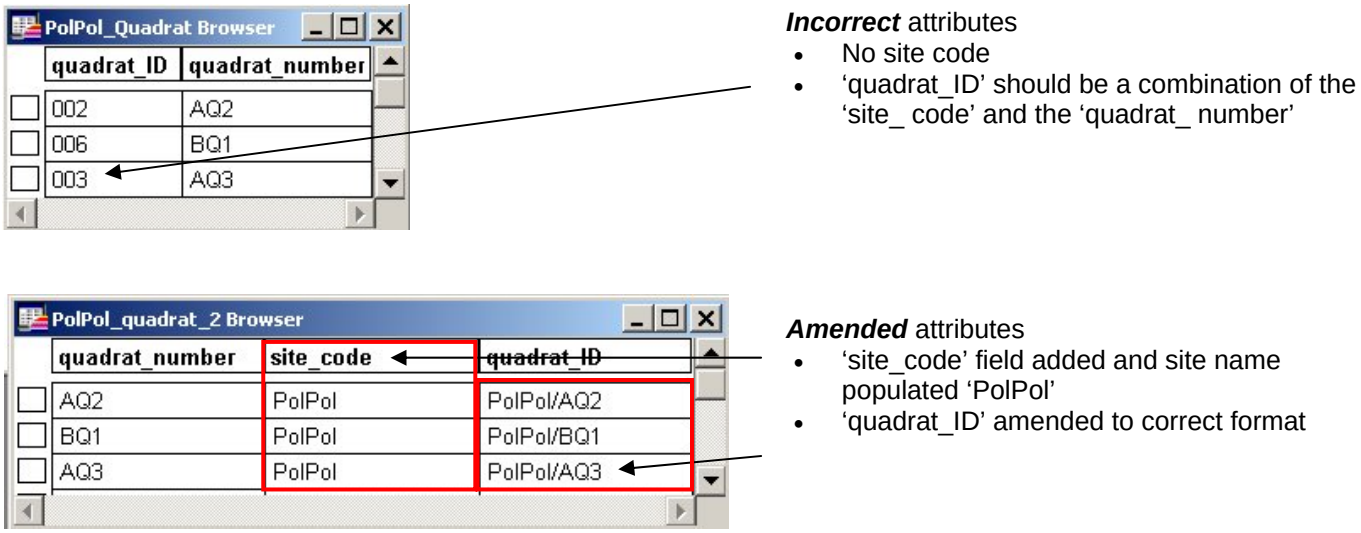


Figure 16. Incorrect attributes: unique IDs. Example Polruan to Polperro

Vegetation layer

5.10 There are many digitising issues with the vegetation polygons and data are generally of poor topological quality:

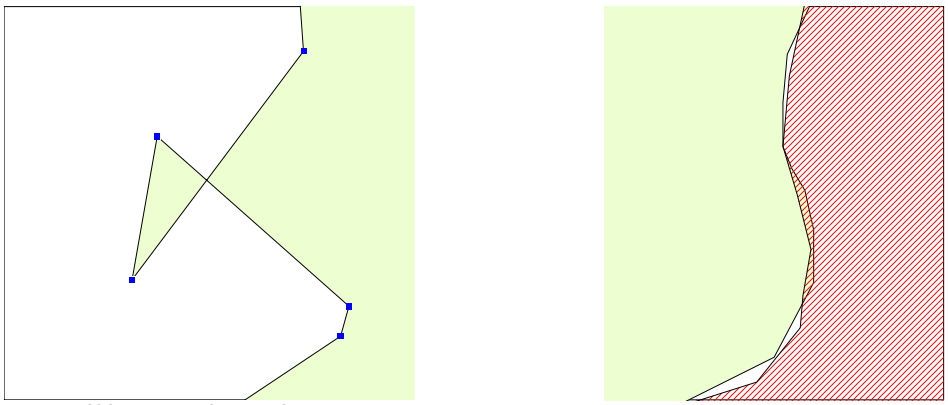
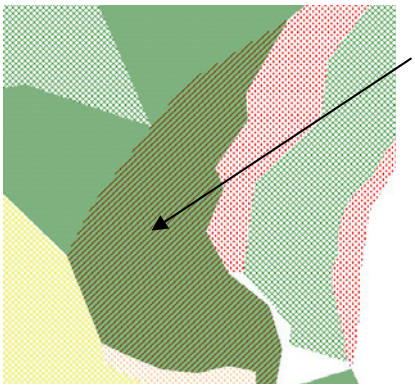


Figure 17. Self intersecting and overlapping polygons and slivers

5.11 There are examples of intentionally overlapping polygons within the same table, which may lead to double counting of the area. An example of intentionally overlapping polygons is shown in Figure 18.



A recent landslip polygon overlapping a secondary woodland polygon.

In this example, the landslip data should be treated independently from vegetation data and should be placed in a separate layer.

Figure 18. Intentionally overlapping polygons. For example St. Catherines to Shanklin

5.12 In general, polygons have not been snapped to Ordnance Survey (OS) landline – this may be due to poor quality digitisation or that it is not appropriate due to the vegetation boundaries not matching a feature shown on the OS basemap.

5.13 In the non-NVC surveys there is an inconsistent recording of vegetation eg Axmouth to Lyme Regis contains no vegetation in the MapInfo table – there is a reference to a word document, containing lots of text regarding the vegetation for each polygon; Hastings consists of phase 1 and NVC quadrats; St. Catherines to Shanklin contains no textual reference to the vegetation type – the polygons are colour coded which represents the vegetation type – the key is contained within the survey report.

Mosaics

5.14 The specification contained within ENRR 426 states that where vegetation mosaics are present the vegetation type should be entered as 'mosaic' in the 'veg_type' field within the vegetation layer. Details of the mosaic composition should be recorded in a secondary MapInfo attribute table. This will contain only text and have no map features. The attribute table corresponds to the main vegetation layer by the 'poly_ID'. An example of the correct structure is shown in Figure 19.

Vegetation layer:

RamWht_NVC Browser

site_code	poly_ID	vegetation_type
RamWht	RamWht/083	mosaic
RamWht	RamWht/084	MC5
RamWht	RamWht/085	mosaic
RamWht	RamWht/086	MC8a
RamWht	RamWht/087	MC8a
RamWht	RamWht/088	MC8a
RamWht	RamWht/089	mosaic

Vegetation mosaic present - the polygon is attributed with 'mosaic' in the vegetation_type field

Corresponding mosaic composition layer:

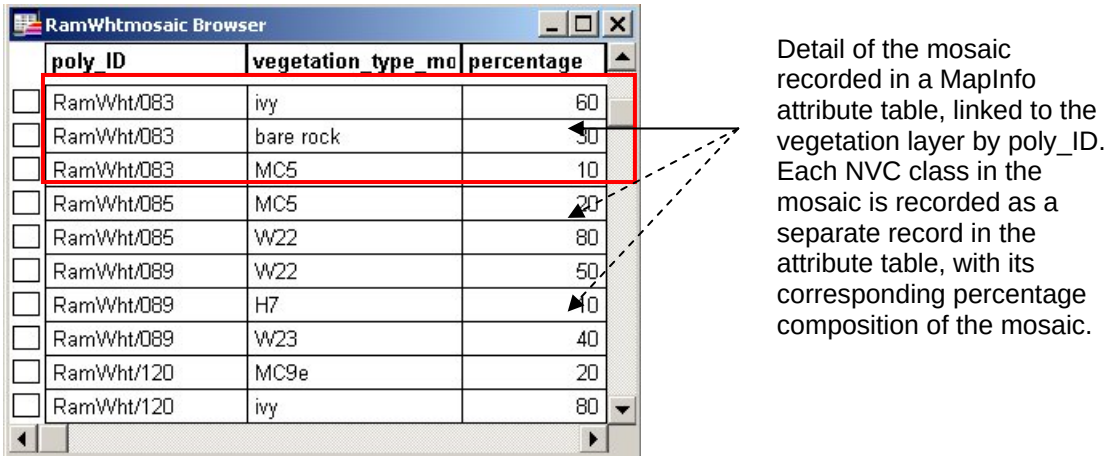
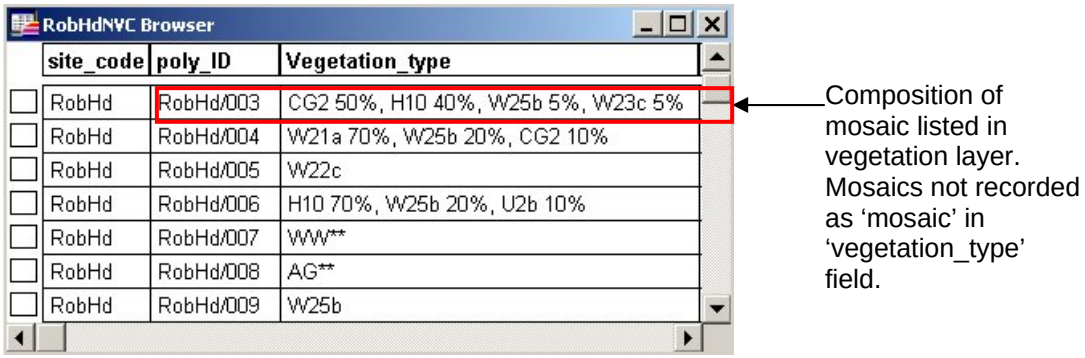


Figure 19. Mosaic compositions recorded as per the specification ENRR 426. Example, Rame Head and Whitsand Bay

5.15 In many cases, the specification regarding mosaics has not been adhered to within the post 2000 surveys, and there are a number of different formats that have been adopted. These are illustrated below in Figure 20 to Figure 22.

Vegetation layer:



Corresponding mosaic composition layer:

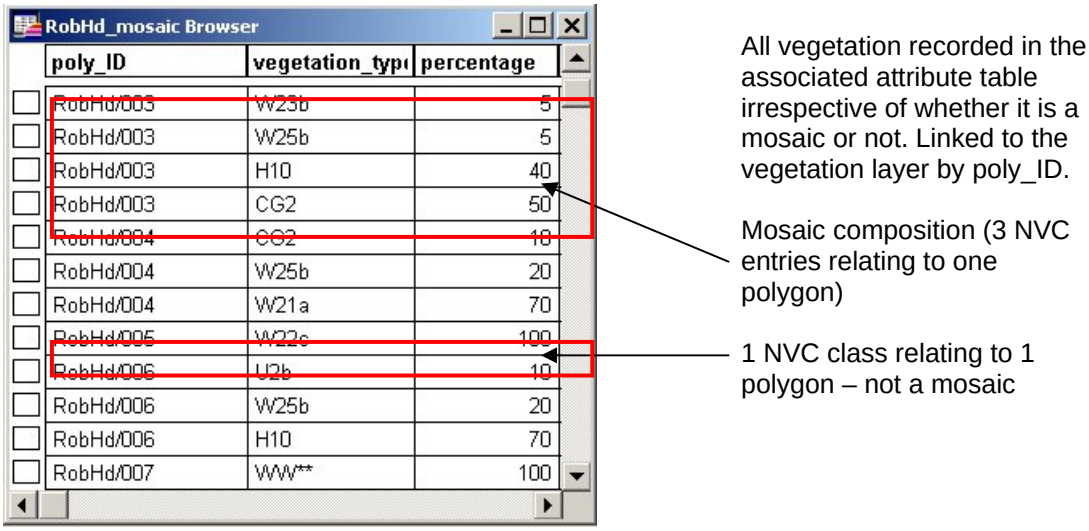
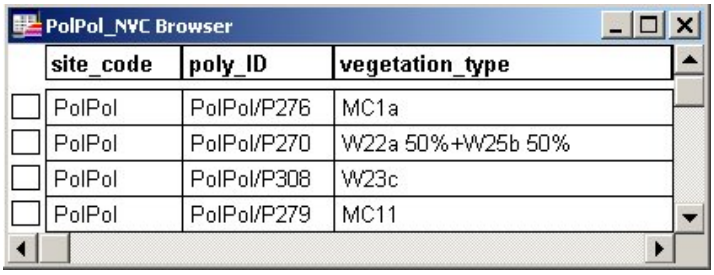


Figure 20. An alternative format adopted to record mosaics. Example, Robin Hood's Bay to Beast Cliff.

Vegetation layer:



PolPol_NVC Browser

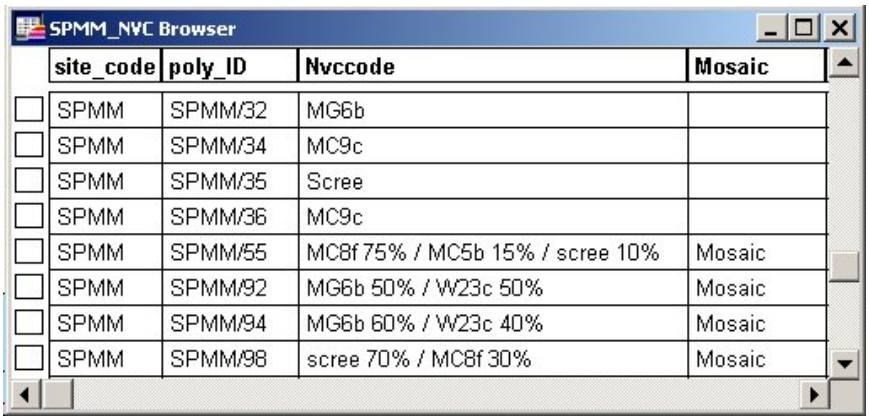
site_code	poly_ID	vegetation_type
PolPol	PolPol/P276	MC1a
PolPol	PolPol/P270	W22a 50%+W25b 50%
PolPol	PolPol/P308	W23c
PolPol	PolPol/P279	MC11

No corresponding mosaic composition layer.

Where mosaics occur, the constituting NVC classes have been listed in 1 table entry relating to the polygon.

Figure 21. An alternative format adopted to record mosaics. Example, Polruan to Polperro

Vegetation layer:



SPMM_NVC Browser

site_code	poly_ID	Nvccode	Mosaic
SPMM	SPMM/32	MG6b	
SPMM	SPMM/34	MC9c	
SPMM	SPMM/35	Scree	
SPMM	SPMM/36	MC9c	
SPMM	SPMM/55	MC8f 75% / MC5b 15% / scree 10%	Mosaic
SPMM	SPMM/92	MG6b 50% / W23c 50%	Mosaic
SPMM	SPMM/94	MG6b 60% / W23c 40%	Mosaic
SPMM	SPMM/98	scree 70% / MC8f 30%	Mosaic

No corresponding mosaic composition layer.

Where mosaics occur, the constituting NVC classes have been listed in 1 table entry relating to the polygon. There is an additional column recording which polygons are mosaics

Figure 22. An alternative format adopted to record mosaics. Example, Bude and Steeple Point to Marsland Mouth

Quadrats

5.16 Quadrat points that lie outside the survey location (wrong grid references), for example, Axmouth to Lyme Regis.

5.17 The data that is associated with the quadrat is in a variety of different formats (Appendix 12). For example:

- Separate Excel/Word document for each quadrat, for example Axmouth to Lyme Regis.
- One single Excel/Word document with all quadrat information in a list format (per quadrat), for example Flamborough Head.
- One Excel spreadsheet with separate worksheets for each community, for example Carricknath Point to Porthbean Beach.
- One Excel spreadsheet: species/quadrat no, for example Robin Hood's Bay to Beast Cliff.

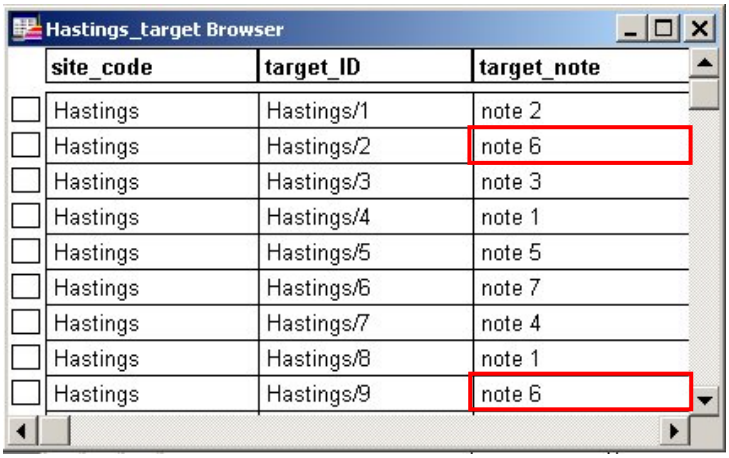
5.18 The most appropriate format for this data needs to be discussed.

- The 'quadrt_no' field should not be used to reference the quadrat data as it is not nationally unique– the 'quadrat_ID' field needs to be used to reference the quadrat information so that the ID is unique across the national dataset – this would require re-referencing the associated quadrat data.
- Hastings and the South Coast Isle of Wight surveys have utilised quadrats within the survey but a digital dataset has not been generated.

Targets

5.19 Targets:

- Wrong projection, for example South Coast Isle of Wight.
- Target point file but no target notes, for example Rame Head and Whitsand Bay – the target notes for the Rame Head points are missing in the digital dataset – they are recorded in the report. Other target notes are missing altogether or in a digital survey report.
- There are instances were the 'target_ID' does not correspond to the reference in the report, for example Godrevy Head to St. Agnes. The report references the target notes by OS grid reference, ie SW7048 1, SW7148 2 etc. This reference will need to be generated for the target_ID.
- Duplicate target notes – a target noted relates to multiple target points:



site_code	target_ID	target_note
Hastings	Hastings/1	note 2
Hastings	Hastings/2	note 6
Hastings	Hastings/3	note 3
Hastings	Hastings/4	note 1
Hastings	Hastings/5	note 5
Hastings	Hastings/6	note 7
Hastings	Hastings/7	note 4
Hastings	Hastings/8	note 1
Hastings	Hastings/9	note 6

For example, Hastings Cliff.

Target note 6 relates to two target points.

Figure 23. Duplicate target notes. For example Hastings Cliffs

- Target notes in the report not corresponding with the number of target points in the digital layer, for example Godrevy Head to St. Agnes.

Photographs

5.20 Survey photos and their MapInfo layers have a number of issues (shown in Appendix 14):

- There is a photo point file but no corresponding photos, for example Hastings Cliffs.
- There are photos but no corresponding MapInfo point file of their locations, for example Godrevy Head to St Agnes.
- Photo bearings are missing in some cases.
- Photo_ID – at present this is not a unique reference in the national dataset - this needs to be amended to a combination of the site code and ID number so that there is a unique reference across the national dataset – this would require re-referencing the associated photos.

6 Review of generic specification set out in ENRR 426

Introduction

6.1 Inventories of maritime cliffs and slope habitats and communities have been addressed by various projects in England; potentially providing conflicting survey and data standards. The creation of the maritime cliff and slope characterisation was undertaken by Doody which created a database of cliff sections round the UK. The English Nature metadatabase project collected the information of past cliff surveys (Hill and others 2002) and in 2003 a UK BAP Priority Habitat inventory was conducted as part of The NBN South-West England Pilot Project.

6.2 Extensive surveys have been conducted on the National Trust estate, much of which includes cliffed sections. Although they have used standard methodologies and mapping, these differ from those established by English Nature. The target for integrating these surveys relies on being able to match the data or to be able to convert or cross reference habitat mapping definitions. Varied techniques, classification, data acquisition and data management approaches have been adopted across these surveys. Both the English Nature metadatabase and the BAP inventory published survey methodologies and data capture standards, and the two procedural standards are assessed below as the basis for a revised specification, which are reviewed below. Within the piloting of approaches for BAP habitat inventories a national maritime cliff and slope inventory dataset was generated, which may also be relevant to setting standards and geographic attributes of any new survey and data management procedure.

6.3 The Doody survey (JNCC) did not attempt to map cliff habitats, but identified within a data layer the start and end points of the cliff sections and categorised the cliffs in terms of geology. The survey was a rapid inventory of the extent of both hard and soft cliff in England. This survey did not propose survey methodologies or data management procedures for subsequent surveys and is therefore not considered further within this section. The key guidance and specification advice is considered in section 4.3.

Maritime Cliff and Slope Inventory 2002

6.4 The maritime cliff and slope inventory (Hill and others 2002) established a standard (‘generic standard’) for recording spatial information on the habitats associated hard and soft cliffs surveys within a GIS. The standard covered digitisation, the data model for describing spatial information and the polygon attribution. The standard did not cover metadata generation related to the surveys although the project was associated with metadata generation using NBN standards. The survey and data management standard was refined into a standard specification for cliff surveys as a basis for the ‘generic specification for cliff surveys’.

6.5 The objective of the standard was to ensure that surveys for cliff and slope habitats were developed in a consistent fashion, such that the information from different surveys could be drawn together into a habitat mapping resource and so that surveyors were provided with unambiguous approaches to recording information. The standards were supported by supply of background data (Land-Line) and 1:10,000. The standard acknowledged the future availability of OS MasterMap (as NTF), but did not provide guidance as how to incorporate it within the surveys methodology as distinct from using OS land-Line.

6.6 The generic standard set out a methodology to be followed by the surveyors for recording of vegetation mosaics within the polygon attributes and target notes:

- Generate macro polygons within MapInfo.

- Generate sub-habitats within macro polygons using Phase 1 classes within unvegetated and NVC within vegetated areas.
- Generate quadrat location data as a separate point layer.
- Generate target note data as a separate layer.

Standards for Habitat Inventories (2003)

6.7 The Biodiversity Action Plan priority habitat maps developed by the south west pilot (Burke and others 2003) also established an example contract specification based on the assessment of the standards for habitat inventories in general. Based on the assessment of the surveys since 2000 this specification has not been used for any of the recent maritime cliff and slope surveys, although there are few surveys since the standard was published.

6.8 The south west pilot set an example standard specification for data capture, based on generic advice for GIS and attribute data capture. The standards for data capture cover, habitat definition, digitising standards, polygon attribution, and metadata.

Maritime Cliff and Slope Inventory 2003 – Digital data

6.9 A prototype GIS inventory was established for the Biodiversity Action Plan. This project generated a GIS dataset covering the overall cliff and slope resource within England. The dataset is based on the boundaries within Natural England's Site Information System (ENSIS) and from the JNCC Maritime Cliff Database, as described in section 3.3.1.The JNCC dataset is a GIS layer of start and end points of cliff sections with details of the primary and secondary geology.

6.10 The 2003 data layer was generated by the Environment Agency. It is a polygon with limited attributes that defines sections of cliff and slop running from the cliff base to the cliff top. The GIS layer contains divisions within the sections of cliff based on the ENSIS data layers. ENSIS only contains information on SSSI sites. Non-SSSI areas of cliff have been captured from base maps (1:10,000) Land-Line, UKP aerial photos, National Trust boundaries and LIDAR datasets. The mappable areas were based on the Priority Habitat Definition Statement Maritime Cliff and Slope, from the SW Pilot. A minimum mappable area of 0.25 ha was used. Attributes are limited to audit of the digitisation process, based on ArcView 3.1 the Exegesis Data Capture Tool.

Evaluation of 'standards' options

6.11 Evaluation of these varied habitat mapping standards in relation to site surveys illustrates the different objectives for the survey types. The BAP and habitat inventory mapping standards are limited to priority habitats and are less interested in the site management that is the target of the Maritime Cliff and Slope resource mapping. The 'standards for habitat inventories' (the BAP priority habitat mapping standards), are at a greater level of generalisation, with area derived largely from secondary data and summarise the qualification of parcels to BAP habitats only. In contrast the 'generic standard' in ENRR 426 is used within the scope of habitat mapping covering all habitats within a study area regardless of their BAP status. It seeks to establish methods for survey using primary field data collection, classification (principally to NVC) and the development of a complete habitat map in GIS format with associated attributes. The 'generic standard' defines a procedure that is applicable to a resource and site management focused survey, generally using Phase II level habitat demarcation and attribution.

6.12 The use of the words 'inventory' within both methods confuses the clear distinctions that lie between these surveys and the mapping and data standards employed.

6.13 A further guidance note, Common Standards Monitoring Guidance for Maritime Cliff and Slope Habitats (JNCC 2004) helps to define a standard approach for assessing the condition of SSSIs notified for their cliff and slope habitats. This guidance sets conservation targets for the communities but also sets guidance for the survey period (June to September) and the monitoring requirements, which may also be valuable to general habitat surveys. The guidance does not provide spatial standards, but should be referenced when undertaking maritime cliff

surveys. Integration of some of the recording requirements for monitoring may be achievable through the habitat surveys.

Revising the 'generic standards'

6.14 The rationale for introducing changes to the survey and data standards is based on changes since the ENRR 426 was published, to allow more effective use of the data and update the data recording procedures. This evaluation relies on the comparative assessment of the two standards (generic standard and the standard for the habitat inventory) and the role that they play in providing habitat level data. The changes to the procedures are also needed to improve the quality of the datasets resulting from the field surveys, as evidenced by the initial assessment of the surveys undertaken against the generic standard.

6.15 It is possible that the national inventory formed from individual surveys will be uploaded to the DEFRA SPIRE GIS data repository. The SPIRE (Spatial Information Repository programme) has strict spatial and attribute data quality standards that the revisions to the survey data specifications will largely conform to. This should ease the upload process.

6.16 The generic standard (Hill and others 2002) has been used in around twenty cliff and slope surveys since 2000.

6.17 The key factors affecting changes to the standards are:

- Adoption of the OS Master Map as the standard mapping base within Natural England.
- Creation of the BAP GIS dataset and its relevance to setting boundaries for maritime cliff and slope surveys.
- Requirements for the habitat data captured within the GIS to be attributed effectively for the multipurpose objectives.
- Requirements for greater quality control on the GIS datasets.
- Introduction of more widely available digital aerial photographs and detailed terrain mapping (eg LIDAR) with potential to update the OS basemaps and improved locational detail, especially on rapidly changing cliffs.
- Increasing availability of digital field GIS systems and field computers for map and species data recording.
- Options to add survey types other than vascular plant communities within the survey framework (eg invertebrates).
- Desire to have greater geomorphological description and habitat management influences on of the cliff sections.
- Altered approaches to handling habitat mosaics and habitat reporting requirements.
- Desire to be able to combine data from varied, yet standardised surveys to form a comprehensive inventory of surveys.

6.18 Although satellite based remote sensing data offers opportunities to add a further survey dataset and potential for some automation of the mapping procedures the scope has not been added here. The vertical nature of the sites makes shadowing a particular issue and few remote sensing surveys have attempted to classify the range of cliff communities. It therefore seems unlikely that this survey technique will form a standard input to habitat mapping.

Survey procedures

6.19 The ecological standards for field survey should remain unchanged from the previous specification ENRR 426 but geographic elements of the recording will alter. These are:

- Define the mapped extent to encompass whole OS MasterMap polygons.

- Mapping of macro polygons should be undertaken from the best available data sources, this will include using recent aerial photographs and Lidar data where available.
- Orthorectified aerial photographs overplotted with OS Master Map's linework will help update information for field mapping and provide the basis for effective field mapping to whole polygons. This approach replaces the use of 1:10,000 scale raster data for mapping in the field. The orthorectifed aerial images provide for more accurate location where habitat features can be seen (eg trees, paths etc) that may form habitat limits but are not within the OS data.
- Define macro-polygons and sub-habitats within the macro polygons.
- Habitats defined to NVC community classes.
- Use of at least 5 quadrats to characterise the community types using standard quadrat sizes and recording attributes (Rodwell 2000).
- Record features such as flushes, stream and spring outflows, pools, saltpans, structures, shingle and sand ridges etc.
- Characterisation of bare areas using Phase 1 mapping.
- Extension of the mapping to cover non-BAP cliff and slope communities within the mapped extent (this is likely to include other BAP communities such as sand dunes, vegetated shingle, grassland and swamp vegetation, and woodland and scrub communities).
- Target notes represented as uniquely referenced points.
- Photo locations represented as uniquely referenced points.
- Point locations should be recorded as 12 figure grid references (recording to the nearest metre) to facilitate use within GIS and accurate locational recording.

Digitising specification

6.20 Adoption of OS MasterMap as the base map for GIS data capture allows new approaches to attribution. The object based dataset allows attribution of the polygons, but often the habitat boundaries may not match the field or parcel boundaries demarcated by the OS MasterMap polygons. Adopting OS MasterMap polygons should help establish a better quality dataset, without common digitising errors or loops and overlaps etc. These errors affect the quality of the data but may be more critical where datasets are converted to other GIS formats. The scale of the source data (at 1:1250, 1:2500 and 1:10,000) inherent within MasterMap defines the scale of the data capture.

6.21 Digitising specification proposals:

- OS MasterMap (OS MM) polygons should be used as the basis for defining the extent of the area to be mapped. Mapping should extend to the full OS polygon boundary.
- Where a habitat divides an OS MM polygon the boundary should be defined, either by GPS or aerial photographic mapping. OS MM boundaries may not match habitat boundaries and additional lines will need to be digitised to represent the parcel boundaries. Wherever possible the linework within OS MM should be followed (in the same fashion as when employing Land-Line).
- Where field computers are used for mapping the same standards should apply and the digitisation standards should be maintained. Where maps are created in paper format they should be digitised as a polygon layers within the GIS (MapInfo). Where paper maps are digitised aerial digital georectified aerial photographs should be used within the GIS to assist in delimiting the boundaries.
- Each macro polygon should be assigned a unique reference code.
- All habitat sub-polygons should fit wholly within macro-polygon boundaries.
- All data should be fully validated through automated and manual techniques to clean any overlaps, loops etc.
- Target Notes, Quadrat Point and photo points should be digitised as three separate point layers within the GIS. The x and y coordinate information is not extracted to the relevant

table, unless this is a specific requirement, the point feature retains this information and associates the table attributes with the location.

- Where digitising, only one feature type (line, point or area) should be recorded within a single layer. Habitat, quadrat, target note and photo location data should be recorded as separate data layers.

Data Provision

6.22 Natural England will supply:

- digital SSSI boundaries;
- OS MasterMap data; and
- digital orthorectified aerial photography.

6.23 The dataset version supplied will be the most recent available to Natural England for the survey area in each case.

6.24 Availability of other spatial data should be investigated from other agencies:

- LIDAR
- more recent orthorectified aerial photography.

Quadrat data records

6.25 Data records for the quadrats have not been defined in detail. ENRR 426 identified the scope for recording the data within a relational database, but did not specify a particular system. Recorder 2000 (JNCC) offers interoperation with NBN and a number of other advantages such as established species and taxon dictionaries. Surveys conducted using the generic standard have generally not employed Recorder 2000 as the basis for handling the quadrat data, which is more typically incorporated within standard NVC programmes – Tablefit or Match.

6.26 Recorder 2000 has only limited GIS and spatial data entry modules, although there is now mapping at 1:50,000 available for use within the package that helps locate survey data records. The geographic elements of Recorder 2000 do not allow digitisation of polygons and does not allow integration of aerial orthorectified images and the 1:50,000 data is not at a scale suitable for the habitat mapping. The analytical requirements of the GIS are needed for the quality assurance of the resulting polygon data and for the supply of GIS data.

6.27 Recorder 2000 and other survey recording packages, such as MapMate (Teknica) are therefore suitable for the species recording of surveys but not of the polygon and spatial data.

6.28 Additional taxon surveys, (invertebrates etc) can use the same basic spatial recording framework as used for vegetation. Alternatively, given accurate locational records collected within Recorder 2000, MapMate or other survey software programmes the species data can be associated with the spatial data through GIS processing. Often the spatial recording levels and features within other taxa recording may be more detailed than the vegetation survey requirements (related to micro habitats). Such finer resolution locational information may be handled as features of the habitat polygons and recorded as part of the survey location within the survey recording package (Recorder etc) rather than forming separate sub-habitat polygon data. Such sites may be below the minimum mapping area (for BAP habitats this is 0.25 ha) yet the ability to associate species with a finer level description of the microhabitat may be important to the analyses. Equally, these features (flushes, seepage, microhabitats) can be recorded as target notes, where a habitat polygon is not appropriate. Subsequent taxon surveys can be associated with the areas concerned through spatial queries.

6.29 A wide range of other survey information may be collected coincident or subsequently to the vegetation survey. Using the same spatial template for mapping and recording data in the field would enhance the potential to link such data resources. In particular, invertebrate surveys are

often a feature of soft cliff habitats. Where a vegetation survey has been conducted the information should be made available to the invertebrate surveyors.

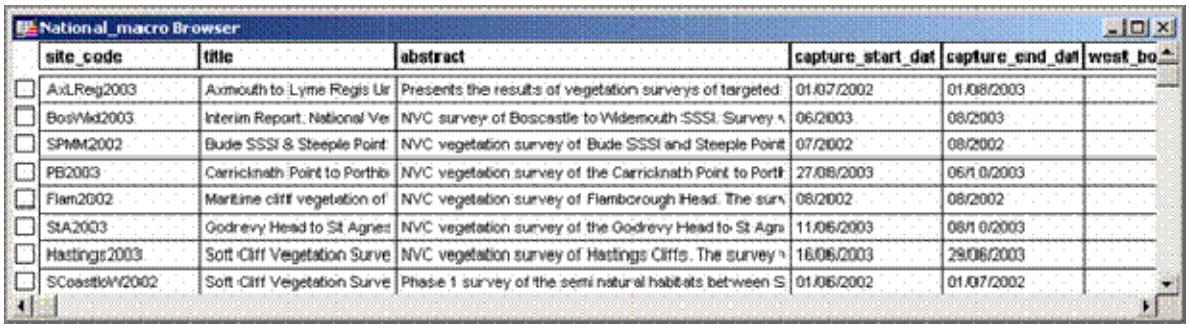
Attribution

6.30 Macro Polygon data:

- The macro polygon should be attributed with aspects of the survey metadata, allowing it to be used as a index or discovery layer.

6.31 Macro polygon data should have the following attributes:

- site_code (Character) a site code for the surveyed area (site name plus survey year)
- title (Character) The full survey title
- abstract (Character) A brief overview of the survey
- capture_st (Character) The start date of the survey fieldwork
- capture_en (Character) The end date of the survey fieldwork
- report_dat (Character) The survey report production date
- NE_LAT (Character) The Natural England area team that commissioned the survey
- NE_officr (Character) The Natural England officer responsible for the survey
- originator (Character) The name of company undertaking the survey on behalf of English Nature


National_macro Browser

site_code	title	abstract	capture_start_dat	capture_end_dat	weait_bo
AxLReg2003	Axmouth to Lyme Regis Ur	Presents the results of vegetation surveys of targeted	01/07/2002	01/08/2003	
BosWid2003	Interim Report: National Ve	NVC survey of Boscastle to Widemouth SSSI. Survey	06/2003	08/2003	
SPMM2002	Bude SSSI & Steeple Point	NVC vegetation survey of Bude SSSI and Steeple Point	07/2002	08/2002	
PB2003	Carricknath Point to Porthlo	NVC vegetation survey of the Carricknath Point to Portl	27/08/2003	06/10/2003	
Flam2002	Maritime cliff vegetation of	NVC vegetation survey of Flamborough Head. The surv	08/2002	08/2002	
StA2003	Godrevy Head to St Agnes	NVC vegetation survey of the Godrevy Head to St Agn	11/06/2003	08/10/2003	
Hastings2003	Soft Cliff Vegetation Surve	NVC vegetation survey of Hastings Cliffs. The survey	16/06/2003	29/08/2003	
SCoastlotW2002	Soft Cliff Vegetation Surve	Phase 1 survey of the semi natural habitats between S	01/06/2002	01/07/2002	

Figure 24. Example: Macro polygon layer attributes

6.32 Vegetation data:

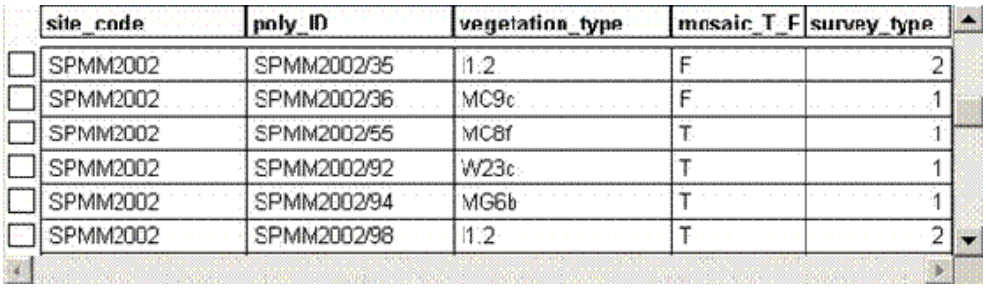
- Habitat polygons should have a unique reference number.

6.33 Habitat / vegetation GIS data should have the following attributes:

- site_code (Character) a site code for the surveyed area (site name plus survey year).
- poly_ID (Character) unique habitat polygon code based on sequential numbering of the polygons. This code should include the site code and a sequential number – in order to act as a link field within recording of mosaics.
- veg_type (Character) NVC code (eg MC8a, H8c). This may include Phase 1 type habitat codes (the alphanumeric code should be used). Any codes used should be recorded within the reporting. The codes should be recorded as case-sensitive. Where the data are mosaic this attribute should record the dominant component of the mosaic.
- mosaic_T_F (Logical) A flag to indicate whether the polygon is a mosaic.
- survey_typ (Small integer) This indicates the classification used for the polygon, for example, NVC or Phase 1. The codes to be used are shown below:

Table 12. Codes used for Habitat Classification Systems

Survey Classification system	survey_typ code
N/A (free text or non-standard classification)	0
NVC	1
NCC Phase 1	2
MNCR	3
IHS	4

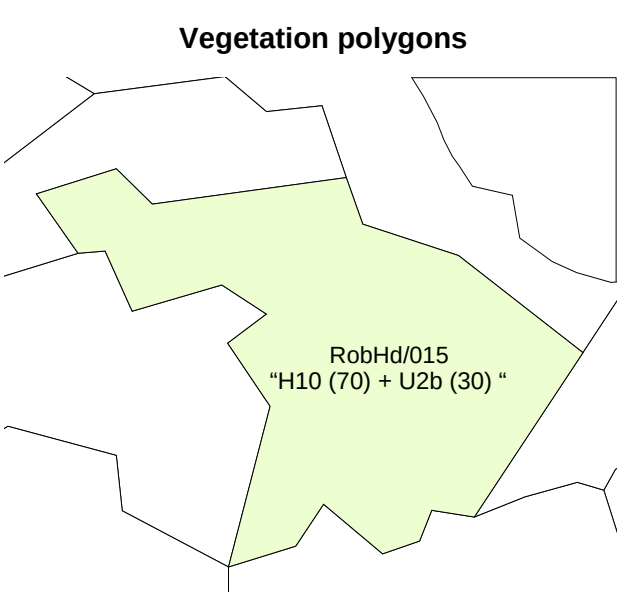


site_code	poly_ID	vegetation_type	mosaic_T_F	survey_type
SPMM2002	SPMM2002/35	i1.2	F	2
SPMM2002	SPMM2002/36	MC9c	F	1
SPMM2002	SPMM2002/55	MC8f	T	1
SPMM2002	SPMM2002/92	W23c	T	1
SPMM2002	SPMM2002/94	MG6b	T	1
SPMM2002	SPMM2002/98	i1.2	T	2

Figure 25. Example: vegetation layer attributes

6.34 Vegetation mosaics are likely to be a feature of the mapping of cliff habitats. The approach within the Generic Standard published by English Nature (ENRR 426) was to use a 'string' data entry of mosaics (eg MC1 (5) + MC8a (95). This is the approach used for paper based field survey, and in some instances the field mapping approach has been transferred to the GIS digital data. Currently, data provided to Natural England in this format requires additional post processing to break the mosaic classes into a separate table. Such a text string recording system is not easily comprehended by a GIS, and will hinder the creation of thematic maps and querying of the data. In addition, the text string system does not allow the effective integration or isolation of different survey systems.

6.35 The method proposed in the ENRR 426 was to include a secondary MapInfo table to record these variables indicated by "mosaic" within the primary habitat table. The secondary table does not have separate polygons but links via the poly_id field. Each vegetation polygon may have one or more entries in the secondary table, reflecting the mosaic composition, this is illustrated below:



Secondary (mosaic) table

Poly_ID	Veg_type	Percentage
RobHd/014	W25b	50
RobHd/014	MG1a	50
RobHd/015	H10	70
RobHd/015	U2b	30
RobHd/016	W25b	100
RobHd/017	W1	100

Figure 26. Illustration of vegetation polygon to mosaic table relationship

6.36 To present a complete record of vegetation cover, all vegetation polygons should have an entry in the secondary table, whether they are homogenous or a mosaic. The structure of the secondary table is as follows:

- **poly_ID** (Character) matching the poly_ID in the primary table.
- **veg_type_m** (Character) NVC vegetation code for one component of the polygon vegetation (or other survey system code where necessary, eg MNCR for littoral habitats falling within the survey area).
- **percentage** (Small Integer) the percentage cover of the vegetation component.
- **survey_typ** (Small integer) This indicates the classification used for the polygon, for example, NVC or Phase 1. ‘1’ should be used for NVC and ‘2’ for Phase 1. A list of the possible codes is given in Table 12.

poly_ID	vegetation_type_mo	percentage	survey_type
SPMM2002/55	MC8f	75	1
SPMM2002/55	MC5b	15	1
SPMM2002/55	I1.2	10	2
SPMM2002/56	H7a	100	1
SPMM2002/57	W22c	100	1
SPMM2002/58	H7a	100	1

Figure 27. Example: mosaic layer attributes

6.37 Each habitat may have multiple mosaic fields and thus any poly_id may have multiple records. The total percentages of habitats across all the instances of each poly_id must equal 100. The poly_ids listed in the vegetation polygon layer must exactly match those in the secondary table. Attributes should be 100% correct and all fields populated.

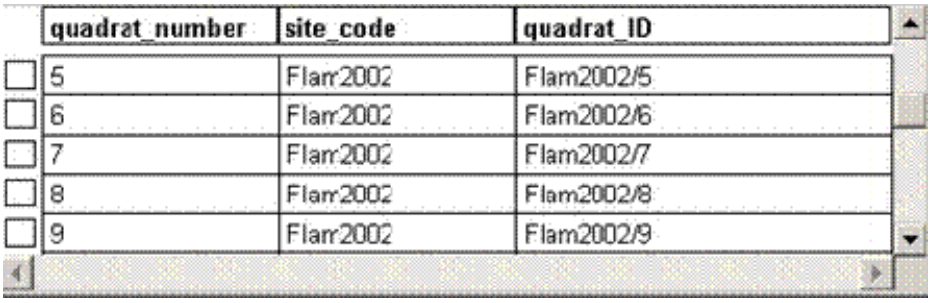
6.38 Where habitat polygons cross into intertidal communities it may be appropriate to adopt MNCR coding structures, which may subsequently want to be separated from the maritime cliff and slope data through spatial query. Within BAP surveys such overlap would allocate areas to other priority habitats rather than treat the data within the same inventory, and a similar capability of the site surveys may be appropriate.

6.39 Quadrat data:

- Record as a point table in MapInfo.

6.40 Attributes:

- quadrt_no (character) unique quadrat number / code.
- site_code (character) site code attribute.
- quadrat_ID (character) unique alpha-numeric value based on site code and sequential number.



	quadrat_number	site_code	quadrat_ID
☐	5	Flam2002	Flam2002/5
☐	6	Flam2002	Flam2002/6
☐	7	Flam2002	Flam2002/7
☐	8	Flam2002	Flam2002/8
☐	9	Flam2002	Flam2002/9

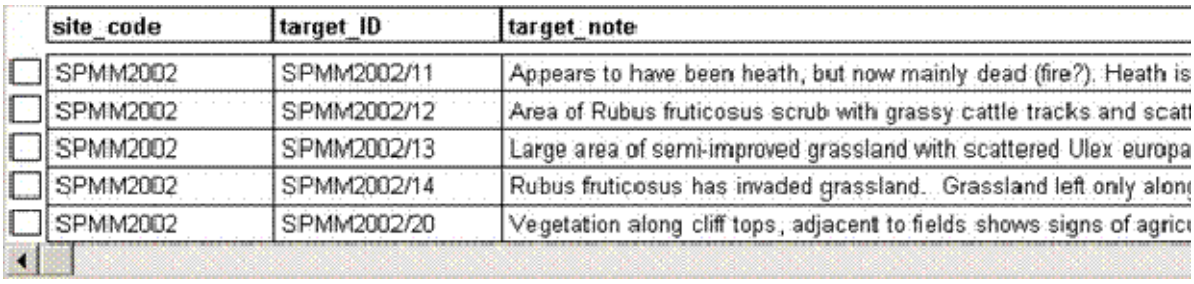
Figure 28. Example: quadrat layer attributes

6.41 Target note data:

- Record as a point table in MapInfo to match the locations of the notes.

6.42 Attributes:

- site_code (character) site code attribute.
- target_ID (character) unique alpha-numeric value based on site code and sequential number.
- targ_note (character) free text note. The target note should be limited to 254 characters.



	site_code	target_ID	target_note
☐	SPMM2002	SPMM2002/11	Appears to have been heath, but now mainly dead (fire?). Heath is
☐	SPMM2002	SPMM2002/12	Area of Rubus fruticosus scrub with grassy cattle tracks and scatt
☐	SPMM2002	SPMM2002/13	Large area of semi-improved grassland with scattered Ulex europa
☐	SPMM2002	SPMM2002/14	Rubus fruticosus has invaded grassland. Grassland left only along
☐	SPMM2002	SPMM2002/20	Vegetation along cliff tops, adjacent to fields shows signs of agricu

Figure 29. Example: target note layer attributes

6.43 Photograph locations:

- A single habitat polygon may have multiple photographs associated with it. These are equivalent to graphic target notes. MapInfo allows the association of the photo with the GIS.
- Record as a point table in MapInfo to match the locations of the notes.

6.44 All photos should be stored within the format suitable for on screen viewing, this is illustrated below:

- **site_code** (character) site code attribute .
- **poly_ID** (character) match the poly_ID from the primary table.
- **photo_ID** (character) unique reference number for the photos – this will allow hotlinking to the photo images.

- **photo_DEG** (numeric) orientation of the photo based on the full compass bearing.
- **targ_note** free text note. To record the view taken within the photo. The target note should be limited to 254 characters.

site_code	poly_ID	photo_ID	photo_DEG	target_note
AxLReg2003	AxLReg2003/2	1003733CHP11	0	Culverhole flush west side Polygon 5
AxLReg2003	AxLReg2003/3	1003733CHP12	0	Culverhole Slipping clay in SX scrub Polygon 4
AxLReg2003	AxLReg2003/3	1003733CHP13	0	Culverhole SX scrub open flush Polygon 4
AxLReg2003	AxLReg2003/14	1003733HPP01	90	Humble Point Polygon 1
AxLReg2003	AxLReg2003/14	1003733HPP02	270	Humble Point Polygon 1

Figure 30. Example: photo layer attributes

6.45 Photographs should be hotlinked in MapInfo using the Photo_ID attribute. The hotlinked images as delivered should make use of the 'relative path' hotlink option to ensure that the links are maintained irrespective of the datasets' location on CD or a network file system.

6.46 It is important to set a minimum resolution for the photo's to ensure a quality standard. It is now anticipated that all photography will be digitally originated and that the photographs will be named following the Photo_ID code. The standard set by the Generic Standard was for images to be at least 1024x768 equivalent to a 3 megapixel image. This would still be the minimum photographic resolution, but higher resolutions are now more achievable (5 megapixel 2592x1944) and should be used where the detail dictates. Where photographs are taken from a distance the higher resolution allows greater zooming before there is loss of image quality and this may be useful in many cliff situations where access is more difficult. Photographs should be provided wherever possible as .tiff images, although some digital cameras do not support .tiff output.

6.47 Where images are of poor contrast or brightness they should be processed to enhance the view. This post-processing should be used sparingly, and it is better to take a better colour balanced image at source than process the image later.

Accuracy

6.48 Rarely are differential GPS available for the cliff surveys and sub-metre accuracy may not be achievable. In mobile cliff locations where the form of the cliff has changed since last mapping this will potentially misalign sites within a basemap. Unless new basemap data sources are available to provide a more accurate basemap any changes to the cliff form will need to be mapped based on GPS coordinates and interpretation.

6.49 Currently, it is assumed that new polygon layers would be developed in MapInfo ver.7 and would not be a spatial database record linked through OS MasterMap TOIDs. No system currently exists within Natural England to allow such data management and where surveys are conducted by a range of surveyors separate data management is required. Any combining of data into such a data management approach can be undertaken by Natural England by post processing if required; such processing will be facilitated by accurate following of the mapping procedures.

6.50 Standards for accuracy include:

- Where boundaries follow OS mapped features the line work should faithfully follow and be "snapped" to the data.
- Where a full polygon forms a parcel to be mapped within the cliff survey that polygon should be selected and attributed.
- Where mapping boundaries follow SSSI boundaries these should be faithfully followed.
- Where boundaries do not follow the OS MasterMap mapped features the features should accurately follow the lines on the original hardcopy maps (field maps). The accuracy standards should be equivalent to 2m in the field and should accurately follow the form of the line from the original maps.

- Data within MapInfo tables should be ‘packed’ to remove deleted polygons or points.

6.51 Surveyors should be aware that Natural England would conduct data accuracy compliance tests on data received, and that the survey data may not be accepted where inaccuracies are located. Many of these checks can be operated digitally, and therefore should be run prior to the delivery of data. A list of compliance checks that can be performed on the data in Mapinfo can be found in the following document associated with this report:

- Maritime Cliff and Slope Inventory: digitising guidelines and QA procedures.

Metadata

6.52 Having generated a survey of a maritime cliff and slope it will be valuable to contribute to the ongoing population of the metadata records for surveys and the depiction of the extent of surveys covered in this detail. The spatial extents will be already provided within the data submission as the accumulated polygon boundaries of the mapped area. Creation of a metadata record to NBN standards would allow the survey record to be maintained centrally and ported to NBN. It is not proposed that a metadata generation package would be needed by each surveyor, but a standard form should be completed that populates all mandatory metadata fields.

6.53 Create an NBN compliant metadata record:

- Metadata records should record the source data and dates used (eg OS MasterMap, Lidar, orthorectified aerial photographs). A template and sample metadata entry should be provided to assist surveyors in creating a suitable record.

Outputs

6.54 Outputs:

- All data are to be provided in MapInfo table format, based on the template tables. Note that the format must be compatible with the current version of Mapinfo Professional in use by Natural England, this should be confirmed by the contractor prior to delivery.
- Data are to be provided on CD.
- All photographs should be provided named as the corresponding photo_ID and provided on CD.
- If paper maps were used to record the survey, scans of these should also be provided on CD for reference.

7 Collation of GIS data for post 2000 surveys

Introduction

7.1 The combination of post-2000 survey datasets to generate a national dataset should be a relatively straightforward task. However, as explained in section 5 and the appendices, there are many errors in the datasets that have ostensibly followed the ENRR 426 specification that need to be resolved before this can be undertaken. This section describes the processing steps that have been undertaken to consolidate the data.

Approach

Surveys included in the national dataset

7.2 The first task was to establish the surveys that could be included within the national dataset. All vegetation surveys with digital data have the potential to be included; these are shown in Appendix 7. Most of the surveys use the NVC classification to classify vegetation; however, some polygons were classified using a Phase 1 classification and some surveys were predominantly Phase 1 (see Appendix 8). This provides some difficulty in establishing a national dataset with a consistent classification system. After discussions with former English Nature officers, it was decided to include all potential surveys in the National dataset, irrespective of the classification system used. A column was added to the vegetation layers to record the type of classification. This method gives the most comprehensive national dataset whilst still enabling vegetation analysis to be undertaken.

7.3 The following surveys were included in the National dataset:

- Axmouth to Lyme Regis NNR;
- Boscastle to Widemouth;
- Bude and Steeple Point to Marsland Mouth;
- Carricknath Point to Porthbean Beach;
- Flamborough Head;
- Godrevy Head to St Agnes;
- Hastings Cliffs;
- Isle of Wight - South Coast;
- Isle of Wight - St Catherine's Point to Shanklin;
- Overstrand Cliffs;
- Polruan to Polperro;
- Rame Head and Whitsand Bay; and
- Robin Hood’s Bay to Beast Cliff.

Format of existing data

7.4 Survey data should consist of various MapInfo layers set out in specification ENRR 426. This consists of the following layers:

- Macro-polygon boundary (polygon).
- Vegetation data (polygon).
- Mosaic data (attribute table).

- Quadrat data (point).
- Target note data (point).
- Photo data (point).

7.5 Appendix 10 shows the conformance of surveys to the specification, with regard to whether the specified layers above exist, for each survey.

7.6 The specification also defines the MapInfo table structures that should be adhered to for each of these datasets. Appendix 11 to Appendix 15 detail the conformance of each dataset to the required format. These will be discussed in more detail below.

Amendments to datasets

7.7 All MapInfo tables were re-named using a standard naming convention, set out in the new specification located at the back of this report:

- 'Maritime Cliff and Slope Inventory: MapInfo Table Specification'

7.8 This involves the use of site names and the survey year. The existing site names, amended site names and their site codes are shown in Appendix 9.

7.9 Each dataset was amended so that the MapInfo table adhered to a standard/consistent format as set out in the new specification. Any digitising errors, described in section 5 were also corrected, with a combination of automatic and manual checks.

7.10 The 'Maritime Cliff and Slope Inventory: Digitising Guidelines and QA Procedures' at the back of this report details the approach that should be taken to produce datasets conforming to the Maritime Cliff specification.

7.11 Appendix 16 gives an indication of the level of digitising errors in each of the datasets.

Generation of macro-polygons

7.12 Appendix 15 shows the number of surveys for which a macro-polygon boundary exists – two out of thirteen surveys.

7.13 Specification in ENRR 426 defines macro-polygons as:

- 'Boundaries delimiting the spatial extent of maritime cliff and slope habitat, captured either from paper maps or in digital format using a field computer.'

7.14 For the purposes of this project, the missing macro-polygons have been generated from the vegetation survey extents, ie from the vegetation polygon datasets in MapInfo. This may not correspond to the spatial extent of maritime cliff and slope habitat.

Creation of national dataset

7.15 The amended datasets were combined to generate the national dataset, consisting of six MapInfo tables:

- National_macro.TAB: Macro-polygon boundary.
- National_vegetation.TAB: NVC polygons.
- National_mosaic.TAB: Mosaic attribute browser (containing all NVC polygons).
- National_quadrat.TAB: Quadrat locations (point data).
- National_target.TAB: Target note locations (point data).
- National_photos.TAB: Photo locations (point data).

Conclusion

7.16 In order to maintain the national dataset, it is essential that all future surveys adhere to the new specification set out in this report. This will enable surveys to be appended to the national dataset with relative ease.

7.17 Two documents have been produced which aim to ensure that future maritime cliff and slope surveys conform to the GIS specification:

- 'Maritime Cliff and Slope Inventory: MapInfo Table Specification'.
- 'Maritime Cliff and Slope Inventory: Digitising Guidelines and QA Procedures'.

7.18 These are available as Technical Information Notes from the Natural England website at www.naturalengland.org.uk. Natural England officers must ensure that the specification is used, and that datasets received from external contractors are subject to the QA procedures detailed in the document.

Recommendations

7.19 There are a number of additional tasks that need to be addressed in order to increase the accuracy and usefulness of the national dataset. These are detailed below.

Vegetation/mosaic additional tasks

- Some surveys have included intentionally overlapping polygons – this issue needs to be addressed.

Quadrat additional task

- The need for removing 'quadrat_no' needs to be discussed – the 'quadrat_ID' field needs to be used to reference the quadrat information so that the ID is unique across the national dataset – this would require re-referencing the associated quadrat data.

- The documents associated with the quadrat data are not in a common format, as detailed in section 5. A common format needs to be established (potentially a database) and the existing data needs to be re-formatted. Where quadrat data is not in digital format, this needs to be requested from the Natural England teams, for example, for Polruan to Polperro, and converted into digital format.

Photo additional tasks

7.20 Appendix 14 shows that there are many issues surrounding photos taken in surveys. Six surveys have no photos or a MapInfo photo layer. Three have photos and a MapInfo photo layer. Three surveys have photos but no MapInfo photo layer. One survey has a MapInfo photo layer, but no photos. There are a series of tasks that could be undertaken to improve these datasets, and the scope of this needs to be assessed:

- The poly_ID attributes need to be checked – are they referencing the correct polygon in vegetation layer – does the polygon exist? Missing IDs need to be filled in.
- Missing photo_DEGS need to be filled in. It may not be possible to do this - Natural England area teams need to be contacted to establish the viability of this task.
- It needs to be checked that the photo_ID has a corresponding photo with the correct ID.
- Missing photos need to be located – contact Natural England area teams.
- MapInfo point files need to be created where none exist but there are survey photos. Can the location of the photos be established?

- Some photo target notes are missing – do these exist?
- Photo_ID – this needs to be amended to a combination of the site code and ID number so that there is a unique reference across the national dataset – this would require re-referencing the associated photos.

Outstanding datasets

- Tintagel cliffs – The final dataset has not been supplied to GeoData and is still with the contractor. The project officer is seeking clarification from the contractor.

Additional datasets

7.21 The habitat survey work undertaken on the Isle of Wight as part of the Buglife coastal soft cliffs project was undertaken in 2005 and the full analysis of the relationship between the vegetation and invertebrate communities was published in 2007 (Colenutt and Wright 2007).

7.22 The survey specification was similar to that in ENRR 426 so the datasets should be able to be added to the national dataset with relative ease. However, this should not be assumed, and the scope of adding them will need to be established when the data are assessed for adherence to the specification and in terms of digitising quality.

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SPALDING ASSOCIATES (ENVIRONMENTAL) LTD. 2002. National Vegetation Classification Survey of Tintagel Cliffs SSSI, Cornwall 2002.

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SPALDING ASSOCIATES (ENVIRONMENTAL) LTD. 2001. National Vegetation Survey of Polruan to Polperro candidate Special Area of Conservation (cSAC) Cornwall 2001.

Appendix 1 Classification of geological types into hard and soft cliffs

Table A. Geology classed as definitely ‘Soft cliff’:

Alluvium	Coal	Loam	Sediment
BCL	Drift	Marl	Shale
Brickearth	Greensand	Mudstone	Silt
Chalk	Greywackes	Mylonised	Siltstone
Clay	Lias	RBD	Slate

Table B. Geology classed as definitely ‘Hard cliff’:

Amphibolite	Ferruginous	Ironstone	Psammite
Andalusite	Gabbro	Keratophyre	Purbeck
Andesite	Garnet	Limestone	Pyroxene
Antigoritite	Gneiss	Meta-	Qu-
Basalt	Granite	Mugearite	Quartz-Dolerite
Conglomerate	Granodiorite	Olivine	Schist
Diabase	Granophyre	Oolite	Spilitic
Diorite	Granulite	Orthogneiss	Torridon
Epidiorite	Green	Pelitic	Tuffs
Felsite	Hornblendite	Porphy	

Appendix 2 Maritime Cliff and Slope (BAP) dataset attributes

Table C. Maritime Cliff and Slope (BAP) dataset attributes

Field name	Full name	Generated
Incidid	Incremental ID	Automatic
Habdefver	Habitat definition version	Drop down list
Prihab	IHS code	Automatic, when complete Prihabtxt
Prihabtxt	Priority Habitat	Drop down list
Nbnprihab	NBN code	Automatic, when complete Prihabtxt
Broadhab	Broad Habitat	Drop down list, or automatic when complete Prihabtxt
Pridet	Priority qualifier	Drop down list
Interpqual	Reliability of priority habitat interpretation	Drop down list
Pridetcom	Determination comment	
Phabfeanot	Additional habitat features comment	
Targetnote		Ignore (not visible on the DCT screens)
Ihsmainhab	Integrated Habitat System	Drop down list
Ihsmatrix1		Drop down list
Ihsmatrix2		Drop down list
Ihsform1		Drop down list
Ihsform2		Drop down list
Ihsman1		Drop down list
Ihsman2		Drop down list
Ihsmhabtxt		Drop down list
Ihsmat1txt		Drop down list
Ihsmat2txt		Drop down list
Ihsfrm1txt		Drop down list
Ihsfrm2txt		Drop down list
Ihsmantxt1		Drop down list
Ihsmantxt2		Drop down list
Ihsversion		Preset
Source1	Source 1 reference no.	Automatic
Source1txt	Title of source	Looked up from Metatagger

Table continued…

Field name	Full name	Generated
S1captdate	Capture date	
S1habclass	Classification	Drop down list
S1habtype	Type	Drop down list - dependent on classification selected
S1boundary	Boundary	Drop down list
S1habid	Habitat ID	Drop down list
Source2	Source 2 reference no	Automatic
Source2txt	See Source 1	
S2captdate		
S2habclass		
S2habtype		
S2boundary		
S2habid		
Source3	Source 3 reference no	Automatic
Source3txt	See Source 1	
S3captdate		
S3habclass		
S3habtype		
S3boundary		
S3habid		
Bsmapscale	Base mapping scale (approx)	Drop down list
Digquality	Digital quality	Drop down list
Fileref	File ref	
Siteref	Site ref	
Createdate	Date polygon created	Automatic - audit trail
Createdby	Polygon creator	
Moddate	Date polygon modified	
Modby	Polygon modifier	
Versionno	Polygon version no.	
Determiner	Polygon checked by	
Hablayname	Layer polygon was committed to	
Commit	Polygon committed - yes / no	
Tempref		

Appendix 3 Natural England Area team contact details as of October 2007

Table D. Natural England Area team contact details as of October 2007

Area team	Address	Phone Number
Cornwall	Natural England, Pydar House, Pydar Street, Truro, Cornwall, TR1 1XU	01872 245045
Devon	Natural England, Level 2, Renslade House, Bonhay Road, Exeter, EX4 3AW	01392 889770
Dorset	Natural England, Government Buildings, Prince of Wales Road, Dorchester, Dorset, DT1 1PY	01305 257086
Hampshire and Isle of Wight	Natural England, 1 Southampton Road, Lyndhurst, Hampshire, SO43 7BU	02380 286410
Kent	Natural England, Sterling House, Ashford Road, Maidstone, Kent, ME14 5BJ	01622 765222
[1]Norfolk	Natural England, Vancouver House, County Court Rd, King's Lynn, Norfolk, PE30 5EJ	01553 660371
[1]North Yorkshire	Natural England, Asquith House, Leyburn Business Park, Harmby Road, Leyburn, North Yorkshire, DL8 5QA	01969 623447
[1]West Yorkshire, South Yorkshire, East Riding of Yorkshire, North & North East Lincolnshire	Natural England, Government Buildings, Otley Road, Lawnswood, Leeds, LS16 5QT	01132 303750
Northumbria	Natural England, Quadrant, Newburn Riverside, Newcastle, NE15 8NZ	01912 295500
Suffolk	Natural England, Government Buildings, 100 Southgate Street, Bury St Edmunds, Suffolk, IP33 2FE	01284 762218
Surrey	Natural England, Government Buildings, 98 - 122 Epsom Road, Guildford, Surrey, GU1 2LD	01483 452050
Sussex	Natural England, Phoenix House, 32-33 North Street, Lewes, East Sussex, BN7 2PH	01273 476595

[1]Alternative addresses are listed on the Natural England website.

NB Office locations and phone numbers may have changed since October 2006.. Please refer to the Natural England website www.naturalengland.org.uk for latest contact details and a complete list of Natural England Area teams.

Appendix 4 Mapping the extent of post 2000 surveys - data sources

Table E. Mapping the extent of post 2000 surveys - data sources

Ref. No	Survey Name	Source	Comment
1	Carricknath Point to Porthbean Beach SSSI	Digital data - porthbean_vegetation.tab	Should there be a gap in cliff coverage?
2	Godrevy Head to St Agnes SSSI	Digital data - st_agnes_vegetation	
3	Bude SSSI & Steeple Point to Marsland Mouth SSSI. National Vegetation Survey 2002	Digital data - nvchab.tab	Should there be a gap in cliff coverage?
4	National Vegetation Survey of Polruan to Polperro Candidate Special Area of Conservation (cSAC)	Digital data - PolPol_NVC.tab	
5	National Vegetation Classification Survey of Rame Head and Whitsand Bay SSSI, Cornwall, 2002	Digital data - WhitsandBay_NVC_Primary.tab and RameHd_NVC_Primary.tab	Should there be a gap in cliff coverage?
6	National Vegetation Classification Survey of Tintagel Cliffs SSSI, Cornwall 2002	Map in report (GIS data incomplete)	
7	National Vegetation Classification survey of Boscastle to Widemouth SSSI, Cornwall 2003	Digital data - BosWid_NVC.tab	Survey does not extend as far seaward as that shown on maritime cliff and slope dataset
8	Axmouth to Lyme Regis Undercliff NNR Vegetation Survey 2002-2003	Map in report	
9	Axmouth to Lyme Regis SSSI A brief invertebrate Survey of Culverhole and Goat Island	Description in report	Estimate of location. No information regarding extent given in report
10	Study of Black Ven. Biodiversity Grant Scheme (Maritime Cliff and Slope). Report to English Nature	LIDAR image and description in report	Estimate of location

Table continued…

Ref. No	Survey Name	Source	Comment
11	Soft Cliff Vegetation Survey - South Coast of the Isle of Wight	Digital data - BOUNDA~.tab	Different survey boundary to cliff boundary - survey boundary is much wider (extends further in land)
12	Invertebrate Survey of proposed SSSI at Luccombe to Shanklin Chine, Isle of Wight	No digital data or map but grid refs given in report	
13	Isle of Wight Soft Cliff Survey: Hanover Point to St Catherine's Point	No digital data - digitised from map in report	
14	Isle of Wight Soft Cliff Survey: St Catherine's Point to Shanklin	Digital data - St Catherines to Shanklin.tab	Should there be a gap in cliff coverage? - south coast survey covers gap
15	Invertebrate survey of Niton to St Lawrence and Puckaster Cove to Ventnor, Isle of Wight	No digital data or map but grid refs given in report	Two survey areas overlap - mapped as one
16	Kent	Digital data - supralitterol rock.tab	Included all coast within Kent and Medway as assumed county wide survey
17	Surveys of Overstrand Cliffs SSSI and cSAC, Norfolk	Digital data - NVC_polygons.tab	
18	Maritime cliff vegetation of Robin Hood's Bay to Beast Cliff	Digital data - Vegmap.tab	
19	Maritime cliff vegetation of Flamborough Head	Digital data - NVC.tab	
20	Soft Cliff Vegetation Survey - Hastings Cliffs cSAC, West Sussex	Description and grid refs given in report	
21	Invertebrate Survey of Golden Cap Estate (cliffs)	Map in report	

Appendix 5 National Trust regions and constituent counties

Table F. National Trust regions and constituent counties

National Trust region	Constituent counties
Devon & Cornwall	Devon, Cornwall
East of England	Bedfordshire, Cambridgeshire, Essex, part of Hertfordshire, Norfolk, Suffolk
East Midlands	Derbyshire, Leicestershire, S Lincolnshire, Northamptonshire, Nottinghamshire, Rutland
North West	Cheshire, Cumbria, Greater Manchester, Lancashire, Merseyside
South East	East Sussex, Kent, Surrey, West Sussex
Thames & Solent	Berkshire, Buckinghamshire, Hampshire, part of Hertfordshire, Isle of Wight, Greater London, Oxfordshire
West Midlands	Birmingham, Herefordshire, Shropshire, Staffordshire, Warwickshire, Worcestershire
Wessex	Bristol, Bath, Dorset, Gloucestershire, Somerset, Wiltshire
Yorkshire & North East	County Durham, N Lincolnshire, Newcastle & Tyneside, Northumberland, Teeside, Yorkshire

Appendix 6 Pre-2000 survey info (including National Trust)

Table G. Number of pre-2000 surveys and availability of location information (including National Trust)

Details of survey locations	No. surveys
Mapped previously as polylines - Appendix 3 of report 426 (Figure 9)	92
Coordinates given in Metatagger (Figure 10)	108
No locational information in Metatagger	69
Total	**269**

Metatagger records a total of 269 surveys undertaken prior to 2000. The table above shows those surveys where location information is known.

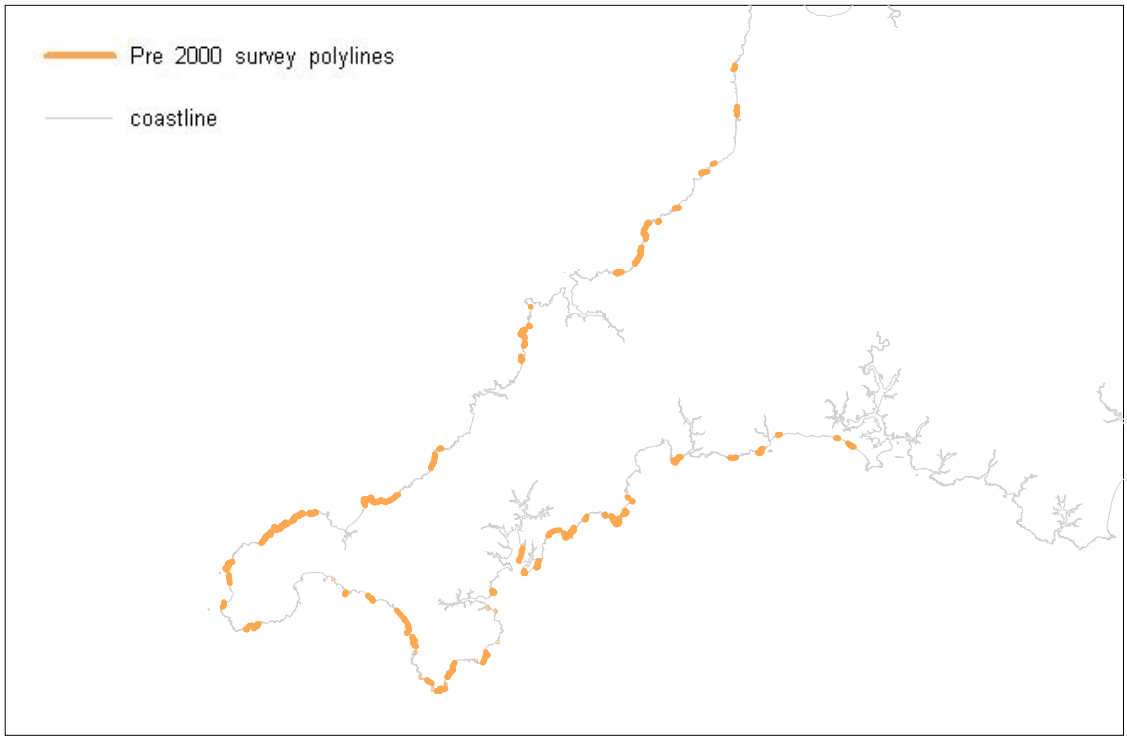

Figure A. Pre-2000 survey locations in Cornwall from Hill and others (2002)

The figure above shows the 92 surveys captured in Cornwall. Survey locations have been digitised as polylines that follow a coastline basemap.

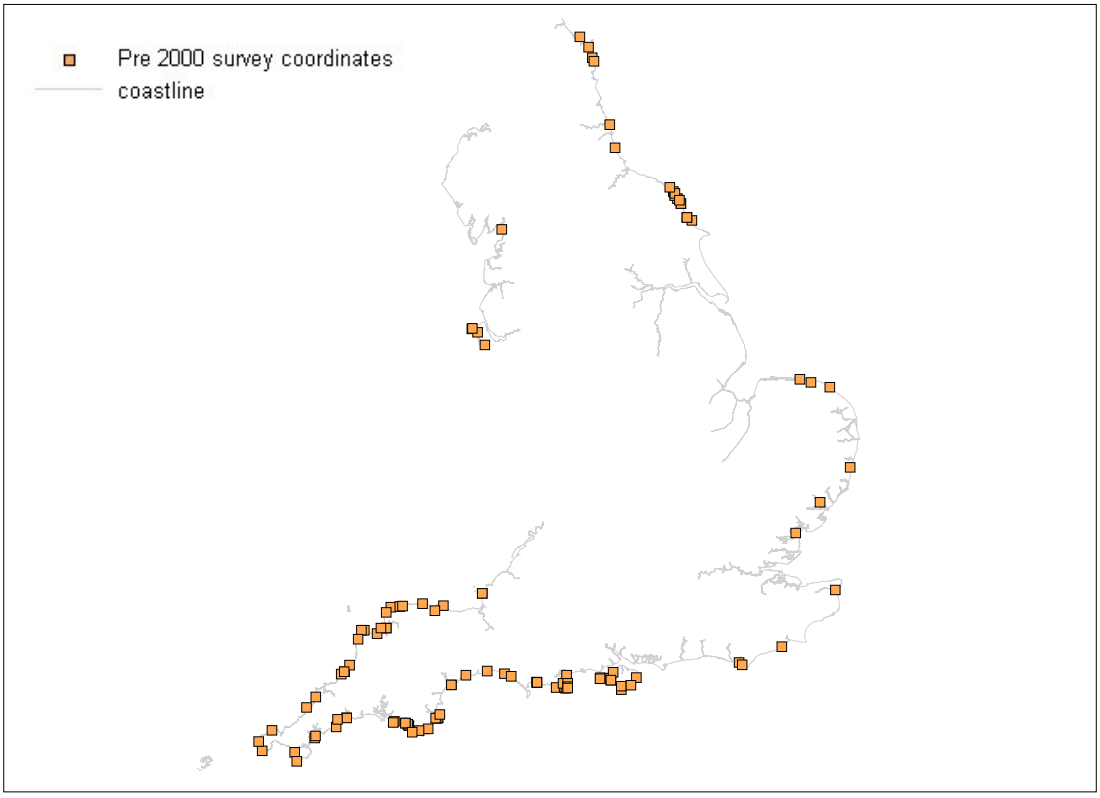

Figure B. Pre-2000 survey locations derived from survey coordinates in Metatagger

The figure above shows the location of those pre-2000 surveys that have coordinates recorded in Metatagger (108 surveys).

Limitations

Some extent information related to the National Trust surveys relates to a property location rather than the cliff extent. The figure below illustrates one such example. In these cases examination of the mapping would be required to capture an effective extent of cliff surveys adjacent to the property.

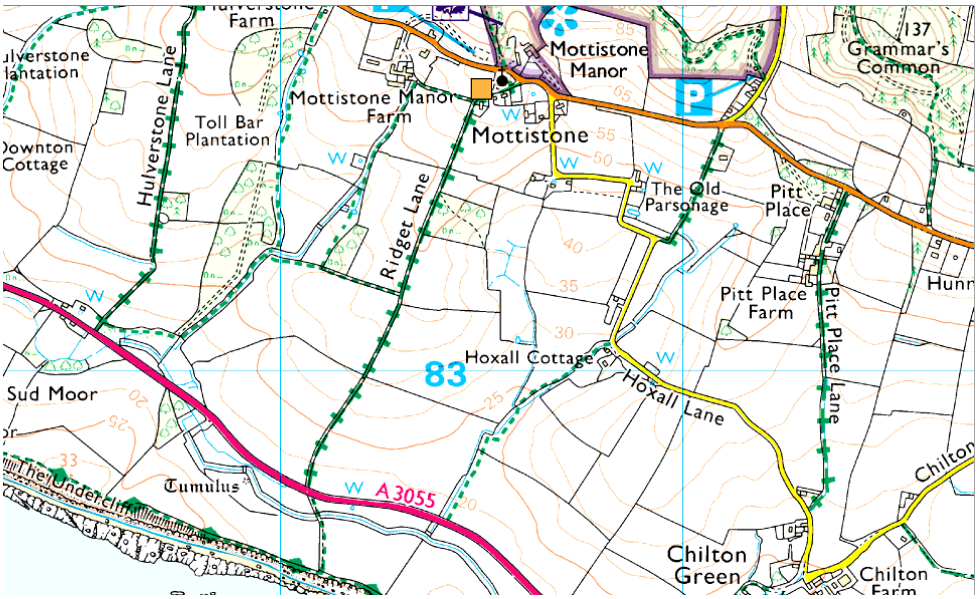

Figure C. Coordinates recorded for National Trust (NT) survey (NT property location)

Appendix 7 Post-2000 surveys with digital data available and those with potential for inclusion in the national dataset

Table H. Post-2000 surveys with digital data available and those with potential for inclusion in the national dataset

Survey	In national dataset?	
Axmouth to Lyme Regis NNR	Y	
Boscastle to Widemouth SSSI	Y	
Bude SSSI and Steeple Point to Marsland Mouth SSSI	Y	
Carricknath Point to Porthbean Beach SSSI	Y	
Flamborough Head	Y	
Godrevy Head to St Agnes SSSI	Y	
Hastings Cliffs cSAC	Y	
Isle of Wight - Hanover point to St Catherine's point	N	The survey only maps changes from 1996 survey
Isle of Wight - South Coast	Y	
Isle of Wight - St Catherine's Point to Shanklin	Y	
Kent supralittoral rock	N	Supralittoral rock layer extracted from Phase 1 habitat survey
Overstrand Cliffs SSSI and cSAC	Y	
Polruan to Polperro	Y	
Rame Head and Whitsand Bay SSSI	Y	
Robin Hood's Bay to Beast Cliff	Y	
Tintagel Cliffs SSSI	N	Final GIS layers not available yet

Appendix 8 Existence of NVC polygons within vegetation data

Table I. Existence of NVC polygons within vegetation data

Survey	NVC polygons?
Axmouth to Lyme Regis NNR	N
Boscastle to Widemouth SSSI	Y
Bude SSSI and Steeple point to Marsland Mouth SSSI	Y
Carricknath Point to Porthbean Beach SSSI	Y
Flamborough Head	Y
Godrevy Head to St Agnes SSSI	Y
Hastings Cliffs SAC	N - phase 1 and NVC quadrats
Isle of Wight - South Coast	N - phase 1
Isle of Wight - St Catherine's Point to Shanklin	N - no attributes but phase 1 in report
Overstrand Cliffs SSSI and SAC	N - phase 1 and some NVC
Polruan to Polperro	Y
Rame Head and Whitsand Bay SSSI	Y
Robin Hood’s Bay to Beast Cliff	Y

Appendix 9 Survey site names

Table J. Survey site names

Survey	Existing site name	New site name	Site code
Axmouth to Lyme Regis NNR	1,003,733	AxLReg	AxLReg2003
Boscastle to Widemouth SSSI	BosWid	BosWid	BosWid2003
Bude SSSI and Steeple point to Marsland Mouth SSSI	SPMM	SPMM	SPMM2002
Carricknath Point to Porthbean Beach SSSI	PB	PB	PB2003
Flamborough Head	TA17ER2	Flam	Flam2002
Godrevy Head to St Agnes SSSI	StA	StA	StA2003
Hastings Cliffs cSAC	-	Hastings	Hastings2003
Isle of Wight - South Coast	-	SCoastIoW	SCoastIoW2002
Isle of Wight - St Catherine's Point to Shanklin	-	StCatSkn	StCatSkn2001
Overstrand Cliffs SSSI and cSAC	-	Overstrand	Overstrand2003
Polruan to Polperro	PolPol	PolPol	PolPol2001
Rame Head and Whitsand Bay SSSI	RamWht	RamWht	RamWht2002
Robin Hood’s Bay to Beast Cliff	UK0030086	RobHd	RobHd2003

Appendix 10 Conformance of datasets to specification ENRR 426

Table K. Conformance of datasets to specification ENRR 426

Survey	Macro-polygon boundary	Vegetation data (MapInfo polygons)	Mosaic (MapInfo attribute table)	Quadrat data (MapInfo point file)	Target note data (MapInfo point file)	Photo layer (Mapinfo point file)
Axmouth to Lyme Regis NNR	N	Y (ref to word doc. containing veg description)	N	Y	N (could produce with macropoly info?)	Y
Boscastle to Widemouth SSSI	N	Y	Y	Y	Y	N
Bude SSSI and Steeple point to Marsland Mouth SSSI	N	Y	N (in veg layer)	Y	Y	N
Carricknath Point to Porthbean Beach SSSI	N	Y	N	Y	Y	N
Flamborough Head	N	Y	Y	Y	Y	Y
Godrevy Head to St Agnes SSSI	N	Y	N	Y	Y	N
Hastings Cliffs cSAC	Y	Y	N	N	Y	Y
Isle of Wight - South Coast	Y	Y	N	N	Y	N
Isle of Wight - St Catherine's Point to Shanklin	N	Y	N	N	N	N
Overstrand Cliffs SSSI and cSAC	N	Y	N	Y	Y	N
Polruan to Polperro	N	Y	N (in veg layer)	Y	Y	N
Rame Head and Whitsand Bay SSSI	N	Y	Y	Y	Y	N
Robin Hood's Bay to Beast Cliff	N	Y	Y	Y	Y	Y

Appendix 11 Vegetation data: conformance to specification ENRR 426

Table L. Vegetation data: conformance to specification ENRR 426

Survey	site_code	poly_ID	veg_type	Mosaic information	Mosaic layer
Axmouth to Lyme Regis NNR	N	N	Info in word docs		
Boscastle to Widemouth SSSI	Y	Y	Mosaic format incorrect		
Bude SSSI and Steeple point to Marsland Mouth SSSI	N	N	Mosaic format incorrect		
Carricknath Point to Porthbean Beach SSSI	Y	Y			
Flamborough Head	N	N			
Godrevy Head to St Agnes SSSI	Y	Y			
Hastings Cliffs cSAC	N	N	Text description		
Isle of Wight - South Coast	N	N	Text description		
Isle of Wight - St Catherine's Point to Shanklin	N	N	Polygons colour coded - key in report		
Overstrand Cliffs SSSI and cSAC	N	N	Phase 1 and some NVC		
Polruan to Polperro	N	N	Mosaic format incorrect		
Rame Head and Whitsand Bay SSSI	Y	N			
Robin Hood's Bay to Beast Cliff	N	N	Mosaic format incorrect		

Appendix 12 Quadrat data: conformance to specification ENRR 426

Table M. Quadrat data: conformance to specification ENRR 426

Survey	quadrat_ number	site_code	quadrat_ID	Format of associated quadrat information
Axmouth to Lyme Regis NNR	Y	N	N	Separate Excel/Word document for each quadrat
Boscastle to Widemouth SSSI	Y	Y	Y	(Final report not available yet)
Bude SSSI and Steeple point to Marsland Mouth SSSI	Y	N	N	Paper report
Carricknath Point to Porthbean Beach SSSI	Y	N	N	1 Excel spreadsheet with separate worksheets for each community
Flamborough Head	Y	Y	Y	1 Excel spreadsheet – list of all quadrats in 1 worksheet
Godrevy Head to St Agnes SSSI	Y	Y	N	1 Excel spreadsheet with separate worksheets for each community
Hastings Cliffs cSAC	No MapInfo quadrat data available			
Isle of Wight - South Coast	No MapInfo quadrat data available			
Isle of Wight - St Catherine's Point to Shanklin	No quadrats in survey			
Overstrand Cliffs SSSI and cSAC	N	N	N	Separate Excel spreadsheet for each phase 1 habitat
Polruan to Polperro	Y	N	N	Paper report
Rame Head and Whitsand Bay SSSI	Y	Y	N	Paper report
Robin Hood's Bay to Beast Cliff	Y	Y	Y	1 Excel spreadsheet: species/quadrat no.

Appendix 13 Target data: conformance to specification ENRR 426

Table N. Target data: conformance to specification ENRR 426

Survey	site_code	target_ID	targ_note
Axmouth to Lyme Regis NNR	No MapInfo target data available		
Boscastle to Widemouth SSSI	Y	Y	Y
Bude SSSI and Steeple point to Marsland Mouth SSSI	N	N	Y
Carricknath Point to Porthbean Beach SSSI	N	N	Y
Flamborough Head	Y	Y	Y
Godrevy Head to St Agnes SSSI	Y	N	Digital report
Hastings Cliffs cSAC	N	N	Missing from report as well – ref ID no.
Isle of Wight - South Coast	N	N	Missing from report as well – ref ID no.
Isle of Wight - St Catherine's Point to Shanklin	No target notes in survey		
Overstrand Cliffs SSSI and cSAC	N	N	Y
Polruan to Polperro	N	N	Y
Rame Head and Whitsand Bay SSSI			Rame Head missing – in report
Robin Hood's Bay to Beast Cliff	Y	Y	Y

Appendix 14 Photo data: conformance to specification ENRR 426

Table O. Photo data: conformance to specification ENRR 426

Survey	site_code	poly_ID	photo_ID	photo_DEG	target_note	Photos
Axmouth to Lyme Regis NNR	N	N	Y	Y	Y	Y
Boscastle to Widemouth SSSI	No MapInfo photo data available					N
Bude SSSI and Steeple point to Marsland Mouth SSSI	No MapInfo photo data available					N
Carricknath Point to Porthbean Beach SSSI	No MapInfo photo data available					Y
Flamborough Head	Y	Y	N	Y	N	Y
Godrevy Head to St Agnes SSSI	No MapInfo photo data available					Y
Hastings Cliffs cSAC			Y			N
Isle of Wight - South Coast	No MapInfo photo data available					N
Isle of Wight - St Catherine's Point to Shanklin	No MapInfo photo data available					N
Overstrand Cliffs SSSI and cSAC	No MapInfo photo data available					N
Polruan to Polperro	No MapInfo photo data available					N
Rame Head and Whitsand Bay SSSI	No MapInfo photo data available					Y
Robin Hood's Bay to Beast Cliff	Y	Y	Y	Y	N	Y

Appendix 15 Existence of macro-polygon boundary

Table P. Existence of macro-polygon boundary

Survey	Macro-polygon
Axmouth to Lyme Regis NNR	N
Boscastle to Widemouth SSSI	N
Bude SSSI and Steeple point to Marsland Mouth SSSI	N
Carricknath Point to Porthbean Beach SSSI	N
Flamborough Head	N
Godrevy Head to St Agnes SSSI	N
Hastings Cliffs cSAC	Y
Isle of Wight - South Coast	Y
Isle of Wight - St Catherine's Point to Shanklin	N
Overstrand Cliffs SSSI and cSAC	N
Polruan to Polperro	N
Rame Head and Whitsand Bay SSSI	N
Robin Hood's Bay to Beast Cliff	N

Appendix 16 Level of digitising errors in the datasets

Table Q. Level of digitising errors in the datasets

Survey	Macro-polygon
Axmouth to Lyme Regis NNR	4
Boscastle to Widemouth SSSI	1
Bude SSSI and Steeple point to Marsland Mouth SSSI	3
Carricknath Point to Porthbean Beach SSSI	4
Flamborough Head	4
Godrevy Head to St Agnes SSSI	4
Hastings Cliffs cSAC	4
Isle of Wight - South Coast	5
Isle of Wight - St Catherine's Point to Shanklin	4
Overstrand Cliffs SSSI and cSAC	2
Polruan to Polperro	3
Rame Head and Whitsand Bay SSSI	2
Robin Hood's Bay to Beast Cliff	2

1 = high quality digitising

5 = poor quality digitising

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