Definition of Favourable Conservation Status for maritime cliff and slope

Defining Favourable Conservation Status Project

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January 2023

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NATURAL ENGLAND

Acknowledgements

This definition draws heavily on unpublished material prepared by Dr P Doody for Natural England completed in 2020.

We wish to thank the following for help in the production of this definition:

- Chris Hill, University of Southampton; Laurence Jones UKCEH; Gordon Haycock and Pat Doody.
- From Natural England: Nick Williams, Rachael Mills, Susan Wilson and members of the Technical Steering Group in particular Alistair Crowle and Andy Brown.

Executive summary

This document sets out Natural England's view on favourable conservation status for maritime cliff and slope in England.

Favourable conservation status is the situation when the habitat can be regarded as thriving in England and is expected to continue to thrive sustainably in the future. The definition is based on the available evidence on the ecology of maritime cliff and slope. Favourable conservation status is defined in terms of three parameters: natural range and distribution; extent; structure and function attributes (habitat quality).

A summary definition of favourable conservation status in England follows. Section 1 of this document describes the habitat and its ecosystem context, Section 2 the units used to define favourable conservation status and Section 3 describes the evidence considered when defining favourable conservation status for each of the three parameters. Section 4 sets out the conclusions on favourable values for each of the three parameters.

This document does not include any action planning, or describe actions, to achieve or maintain favourable conservation status. These will be presented separately, for example within strategy documents.

The guidance document Defining Favourable Conservation Status in England describes the Natural England approach to defining favourable conservation status.

Summary favourable conservation status definition

Maritime cliff and slope is, by its very nature, restricted to a narrow strip around parts of the English coast. The underlying rocks or drift deposits, the profile and stability of the cliff face, the stratigraphy, and geotechnical characteristics, topography, climate, wind exposure, aspect, maritime influence and soil moisture all influence vegetation development.

The area of maritime cliff and slope has been poorly defined and, as a result, it is not possible to provide a meaningful account of change in area. That said, this habitat has been significantly impacted by coastal protection measures and the extent of cliff-top and slope grassland and heathland has been significantly reduced by agricultural land intensification. In addition, housing and tourist development (for example, car parks, golf courses and caravan sites), as well as roads, other infrastructure and industrial development have also caused substantial losses. Further losses are expected because of climate change and sea level rise. The quality of the remaining areas of accessible cliff-top and slope grassland and heathland has declined as grazing by domestic livestock has decreased or ceased altogether.

Range and distribution

Maritime cliffs and slopes should continue to be found across their natural range and distribution, with the underlying geology (whether dominated by hard, intermediate or soft rock) defining the distribution of the full variation of vegetation types. Full variation of habitats and successional stages means examples of vegetation types referable to the National Vegetation Classification communities described in Annex 1, along with examples of soft cliff vegetation described in Natural England (In Prep).

Extent

As a linear habitat, the length of cliff should be retained at approximately 1,084 km. To achieve favourable conservation status there should be an increase in the current area from 14,081.86 ha to 19,800 ha, which includes opportunities for landward adaption space. Losses associated with free-functioning coastal processes, such as erosion and natural cliff recession, are acceptable but opportunities to extend the area of cliff-top habitat (potentially through habitat creation and roll-back) should be sought to minimise this loss.

Structure and function

Favourable conservation status will be achieved when coastal processes are unhindered by human intervention, with the appropriate variation of habitats and successional stages naturally present within each sediment cell. At least 95% of the favourable area of maritime cliff and slope should meet the structure and function requirements as described in Section 4.3. The average patch size should be maintained (at 46.3 ha) or increased. All species associated with the habitat should be Least Concern when assessed using IUCN criteria.

Table 1. Confidence levels for the favourable values

Favourable conservation status parameter	Favourable value	Confidence in the favourable value
Range and distribution	Maritime cliff and slope habitat is found across its natural range and distribution, with a full variation of associated habitats represented in each sediment cell	High
Extent	The current area of this priority habitat type is 14,081.86 ha; a further 5,700 ha of potential cliff habitat has been identified through the Habitat Potential Mapping exercise - giving a favourable area of approximately 19,800 ha	Moderate

Favourable conservation status parameter	Favourable value	Confidence in the favourable value
Structure and function	At least 95% of favourable area of maritime cliff and slope meet the structure and function requirements set out in Section 4.3.	Moderate

As of September 2021, based on a comparison of the favourable values with the current values, maritime cliff and slope is not in favourable conservation status. Note, this conclusion is based solely on the information within this document and not on a formal assessment of status nor on focussed and/or comprehensive monitoring of status.

Contents

About the Defining Favourable Conservation Status project

Natural England's Defining Favourable Conservation Status (DFCS) project is defining the minimum threshold at which habitats and species in England can be considered to be thriving. Our Favourable Conservation Status (FCS) definitions are based on ecological evidence and the expertise of specialists.

We are doing this so we can say what good looks like and to set our aspiration for species and habitats in England, which will inform decision making and actions to achieve and sustain thriving wildlife.

We are publishing FCS definitions so that you, our partners and decision-makers can do your bit for nature, better.

As we publish more of our work, the format of our definitions may evolve, however the content will remain largely the same.

This definition has been prepared using current data and evidence. It represents Natural England's view of favourable conservation status based on the best available information at the time of production.

1. Habitat definition and ecosystem context

1.1 Habitat definition

The term ‘maritime cliff and slope’ encompasses the range of coastal cliff habitats present in England, whether ‘hard cliffs’ or ‘soft cliffs’, although there can be complex mosaics and intermediate types. In this definition, maritime cliff and slope is broadly equivalent to H1230 Vegetated sea cliffs of the Atlantic and Baltic coast as set out in the EU Interpretation Manual (European Commission 2013).

H1230 Vegetated sea cliffs of the Atlantic and Baltic coast are described as steep slopes fringing hard or soft coasts, created by past or present marine erosion, and supporting a wide diversity of vegetation types with variable maritime influence (Joint Nature Conservation Committee - JNCC webpage). A similar definition is given in the The UK Biodiversity Action Plan (BAP) (Maddock 2007) which defines maritime cliffs and slopes as "comprising sloping to vertical faces on the coastline where a break in slope is formed by slippage and/or coastal erosion.” The definition is expanded to emphasise that there is no accepted minimum height or angle of slope which constitutes a cliff (although Barron and others (2011) used a cliff height for ‘hard’ and ‘soft’ rocks cliffs of over 5 m and 3 m respectively to determine lengths of cliff surveyed in Ireland). Cliff-top vegetation is also included, and that zone extends landward to the limit of maritime influence (taken in this definition to be the limit of salt deposition). Hill and others (2001) define the seaward limit as Mean High Water Ordinary Spring (MHWOS) line. The BAP definition encompasses both ‘hard’ and ‘soft’ rocks. However, there is some variation between the definitions when considering the National Vegetation Classification (NVC) types included. The EU Interpretation Manual identifies 15 NVC communities corresponding to H1230 (MC1-12; H6-H8), the BAP definition lists the same, except for H6. These are both more restricted lists than the list of NVC communities we identify as being present on this habitat (Annex 1).

The recently updated Site of Special Scientific Interest (SSSI) selection guidelines (Rees and others 2019) provides a useful summary of the main coastal cliff types summarised here.

All coastal cliffs erode, whether through wave or wind erosion (abrasion, attrition, solution, or hydraulic action) or rainwater infiltration causing coastal landslip (where the rainwater lubricates the geological strata causing rotational slippage). The rate of erosion is dependent on several factors, notably underlying geology that determines the resistance to, and rate of erosion, as well as the rate and periodicity of erosion and slippage of the cliffs above. Many coastal cliffs are protected by man-made defences or have wide beaches which may reduce the rate of erosion.

Hard cliffs are vertical or steeply sloping, formed of weather-resistant rocks such as granite, sandstone and limestone, but also softer rocks, such as chalk, which erode to a vertical profile. These cliffs typically have a steep cliff face, narrow foreshore zone and rapid removal of toe debris. Erosion of hard cliffs typically is through mass wasting (rockfalls, topples or slides) with material deposited directly on the foreshore. Chalk cliffs (which are restricted in extent) can be considered intermediate between hard and soft cliffs, with characteristics of both.

Hard cliffs support specialised higher plants on ledges and in crevices. The vegetation varies according to wind and salt spray exposure, aspects of the chemistry of the underlying rock, the water content and stability of the substrate. On hard cliffs, true maritime (that is, halophytic) vegetation occurs with the highest exposure to salt spray from waves and winds. In England these are generally on the south-western coasts, although there are examples at Flamborough on the Yorkshire coast where vegetation forms at the base of the cliff in sheltered bays. At the lower levels in the wave splash zone on exposed hard cliffs, lichens are often the main vegetation, and may grade into rocky shore communities (Brazier and others 2019).

Soft cliffs occur where the underlying geology is predominantly boulder clay or other unconsolidated material. Such cliffs are often characterised by slips or areas of slumped cliff face or slopes that gradually become vegetated. Soft cliffs tend to have less steep slopes than hard cliffs and are more easily colonised by vegetation, although colonisation may be short-lived due to frequent slumping and landslips driven by high groundwater pressure and marine erosion. Soft cliff vegetation is formed of the elements on the slopes or cliff faces as well as transitions on the cliff tops. It may develop as a result of two types of erosion; incremental erosion and slope failure. Incremental erosion takes place continuously and involves turves breaking off at the top of the slope to form vegetation 'rafts' which fall off and migrate over time down moderate slopes towards the cliff foot. Slope failure occurs intermittently as stochastic events and involves slumping or landslides of soft cliff soils often along basal slippage planes. The scale of slope failure varies considerably, with small-scale events creating limited areas of bare ground, while mass movement of material can create bare cliffs over a considerable area. Vegetation will colonise bare ground after a slumping event, and depending on how frequently they happen, grassland, bracken, scrub or even mature woodland can develop. Further details on soft cliff vegetation types are given in Natural England (In Prep)

The maritime influence on cliff communities is shown in both vertical and lateral zonation. The effects of salt spray are greatest close to the sea and least at the cliff top, especially where a sloping profile sets this back from the shoreline. Superimposed on this pattern is the effect of local topography. The most maritime sites are those facing the prevailing winds or with the longest 'fetch' of open sea (especially south-west facing cliffs) that deposit salt spray over the cliff face or cliff top; or headlands projecting from the coastline and gullies or blowholes which funnel salt water up the cliff. In some exposed situations salt-deposition may continue for up to 500 m inland, taking in entire islands or headlands (Malloch 1972), although more typically this is within approximately 50 m. As the influence of salt spray decreases inland, the cliff-top vegetation can show a zonation from open communities of drought-tolerant species (therophytes) on thin soils, towards maritime forms of grassland, heathland and para-maritime communities further inland. Both hard and soft cliffs may have extensive areas of bare ground or rock on vertical or gentle slopes between the cliff foot and the cliff-top zone.

The pattern of vegetational variation on maritime cliffs and slopes is determined primarily by the degree of maritime influence, and by the variation in soil depth and moisture. Ratcliffe (1977) recognises three levels of exposure, maritime, sub-maritime and para-maritime, noting:

"the landward limits of coastlands are difficult to define for there is a continuous gradient from marine to non-marine conditions. The gradient is steeper in some places than others so that any boundary defined by an arbitrary distance is likely to unsatisfactory. There is a loose but useful terminology to indicate the relative position along this gradient: *maritime* refers to strong and direct influence of the sea, giving markedly saline soils; *sub-maritime* indicates less direct effect of the sea, though still with soils which are more saline than those far inland; and *para-maritime* describes the inner zone in which the special climatic conditions of the sea coast are influential but the soils are not obviously saline and halophytes are absent".

Ratcliffe goes on to note that "the vegetation of sea cliffs usually grades away from the sea into that of formations characteristic of (when uncultivated) dry lowland habitats, that is into some form of grassland, heath, scrub or woodland. These sub-maritime or para-maritime examples of lowland formations form an essential part of the cliff habitat complex." However, for this definition where the vegetation shows no clear maritime influence the corresponding definition, for example, heathland, calcareous or acid grassland, should also be referred to.

Soil moisture and water availability is also an important influence on maritime cliff vegetation, being determined by a range of factors including rock permeability, slope, soil type and depth and climate (Mitchley & Malloch 1991). Wind exposure can influence both species composition and growth form, for example in exposed situations tightly wind-pruned blackthorn or wild privet scrub can develop supporting a woodland field-layer.

The NVC lists 12 plant communities of maritime cliffs of which 10 occur in England (MC1, MC4-MC12), along with 29 sub-communities. Cliff structure and geomorphological processes are major influences on the development of cliff vegetation, as is the profile and stability of the cliff face. Other influencing factors include the geology of the underlying rock or drift deposit, the stratigraphy and geotechnical characteristics, topography, climate (including temperature and rainfall), wind exposure, aspect, maritime influence and soil moisture. Moving away from the direct influence of salt splash and spray a zonation to increasingly terrestrial types develop. These include grassland and heath communities maintained by grazing, and when absent succession allows the development of scrub and woodland. Maritime cliffs can also support areas of perched saltmarsh, a rare and likely under-recorded habitat type across the UK (Haynes 2016) found for example on the west Cornish coast; and perched and climbing sand dunes (where windblown sand from adjacent dunes accumulates on the cliff-slopes and tops resulting in a form of dune vegetation, for example, Penhale Dunes in Cornwall and Ladder Chine, Isle of Wight). These communities occur on 'hard' and 'soft' rock cliffs, with a further series of wetland mires and swamps on 'soft' rock slumping cliffs. Those communities with a maritime influence are covered by this definition. Annex 1 provides a list of 38 NVC community types plus 2 other vegetation types associated with maritime cliff and slopes. This list is based on the communities identified in the review of UK SSSI Guidelines (Rees and others 2019).

Annex 1 gives an indication of the vegetation complexities associated with a broad classification of maritime cliff and slopes. It is important to note that while the NVC provides a means of understanding and classifying vegetation types, it does not always cover every example of variation. This is particularly true for soft cliffs as explained below:

- The NVC surveys completed for the British Plant Communities series included only a small number of English cliff sites (Rodwell 2000).
- Most of the NVC surveys focused on hard rock cliff types, plant communities associated with softer rocks are less well described. Eastern coasts with soft rocks and little maritime influence were not sampled specifically as 'maritime' communities (Rodwell 2000).
- The Maritime Cliff and Slopes Inventory (Hill and others 2007) which generated or collated the bulk of the vegetation data (2004-2005) including soft cliff habitat, was completed after the publication of the NVC information.
- For some of the most dynamic slopes there may be no equivalent NVC community, and new communities are still to be described.
- "The vegetation of mobile soft cliffs is inadequately described by the NVC at present." JNCC (H1230 habitat account (accessed July 2021).

Natural England (In Prep) notes in the absence of a full formal classification of soft cliff vegetation types the following groups of species: 'soft cliff pioneers'; 'persisters'; 'opportunists'; and 'flushes/wetlands' could be considered.

- 'Soft cliff pioneers' include a suite of species colonising bare ground created by cliff erosion.
- 'Persisters' are described as species present on erosion 'rafts' originating from cliff-top grasslands or other habitats and which persist over time as the raft moves downslope.
- 'Opportunists' are species present on erosion 'rafts' which are present in the turf at the top of the cliff but then invade bare ground beyond the rafts by vegetative means or by seeding to become a wider element of the soft cliff flora.
- 'Flushes and wetlands' - species typically recorded in flushes can be divided based on time elapsed following a landslide: early (less than 5 years), mid (5-10 years) and late succession (more than10 years).

1.2 Habitat status

Maritime cliffs and slopes (encompassing both 'hard' and 'soft' rock cliffs) are listed on Section 41 of the Natural Environment and Rural Communities Act (2006) as habitats of principal importance in England.

The UK has a "special responsibility" for the conservation of maritime cliffs in Europe. For example, the JNCC H1230 webpage notes that the UK supports a significant proportion of coastal chalk exposures (113 km, compared with 85 km in France and shorter lengths in the Baltic). In England, extreme exposure to Atlantic swell and storms, especially in south-west England, and the relatively undefended nature of the coast, provide some of the best examples of maritime 'hard' rock vegetation in Europe. The European Environment Information and Observation Network (Eionet) Forum suggests England has a significant proportion of the European resource of the soft sea cliff habitat, which is estimated at 1,500 km^2 (Haynes 2016).

Table 2. A summary of the conclusions set out in the fourth report for the UK assessment for H1230 (JNCC 2019). Note UK wide data presented here as there is insufficient detail provided in the England only assessment.

Reporting	Overall assessment	Additional information
Range	Favourable	Conclusion on Range reached because: (i) the short-term trend direction in Range surface area is stable; and (ii) the current Range surface area is approximately equal to the Favourable Reference Range.
Area	Unfavourable - Inadequate	Conclusion on Area covered by habitat reached because: (i) the short-term trend direction in Area is decreasing by 1% per year or less; and (ii) the current Area is not more than 10% below the Favourable Reference Area.
Specific structure and functions (incl. typical species)	Unfavourable - Bad	Conclusion on Structure and functions reached because habitat condition data indicates that more than 25% of the habitat is in unfavourable (not good) condition.
Future prospects	Unfavourable - Bad	Conclusion on Future prospects reached because: (i) the Future prospects for Range are good; (ii) the Future prospects for Area covered by habitat are

Reporting	Overall assessment	Additional information
		poor; and (iii) the Future prospects for Structure and functions are bad.
Overall assessment of Conservation Status	Unfavourable - Bad	Overall assessment of Conservation Status is Unfavourable-bad because one or more of the conclusions is Unfavourable-bad.
Overall trend in Conservation Status	Deteriorating	Overall trend in Conservation Status is based on the combination of the short-term trends for Range - stable, Area covered by habitat - decreasing, and because the Structure and functions trend has changed from increasing to decreasing (between 2013 and 2019).

The Eionet Coastal Habitat Group has defined two European Red List Habitats supporting cliffs: B3.1a Atlantic and Baltic rocky sea cliff and shore and B3.4a Atlantic and Baltic soft sea cliff. Both have been assessed as Least Concern in the European Red List of habitats (Janssen and others 2016).

1.3 Ecosystem context

Maritime cliff and slope communities are, by their very nature, restricted to the coast. They occur widely along the Atlantic coast of Europe. Broadly, hard cliffs in England are restricted to the south-west and north-east coasts, whilst soft cliffs and intermediate types are more widely distributed around our shores, found in all coastal counties apart from Lincolnshire as shown in Figure 3.

On the seaward side, the cliff habitat extends to the limit of the supralittoral zone and so includes any splash zone lichens and other species occupying this habitat. In a seaward direction it gives way to rocky, bouldery, stony or sandy shores in the intertidal zone and below the low water mark. These can include some strictly marine priority habitats such as intertidal under-boulder communities, and subtidal sands and gravels. In a landward direction maritime cliff and slope extends to the limit of the influence of sea spray, but typically the natural landward limit of cliff-top vegetation is almost always curtailed by artificial barriers such as agricultural land or urban and industrial developments. Where natural vegetation remains along the inland edge, maritime cliff and slope can adjoin a wide range of other habitats including grasslands, heaths, wetlands, scrub, woodland, bracken and ruderal communities.

Geology

Many of our sea cliffs form iconic ‘cliffscapes’ perhaps none more so than the Seven Sisters of Sussex and the White Cliffs of Dover in Kent, for which the former are often mistaken. The East Devon and Dorset coast is a UNESCO World Heritage Site designated specifically as its cliff exposures provide an almost continuous sequence of rock formations spanning the Mesozoic Era, or some 185 million years of the earth's history. Many cliff sites are widely recognised for their geological or geomorphological interest and the majority are notified as geological SSSIs, identified through the Geological Conservation Review (GCR) series (Ellis 2011; Ellis and others 1996). In England, there are 13 GCR coastal cliff sites (eleven soft rock cliff and two hard rock cliff examples) listed as being important for active geomorphological processes (May & Hansom 2003). A further 345 sites are listed as being important coastal and river cliffs and one site as being an important coastal cliff and foreshore. These sites provide examples from the Silurian to Quaternary sediments. Further details can be found in the GCR database hosted by the JNCC. Many, particularly those on offshore islands, are home to tens of thousands of seabirds, themselves in numbers of international significance.

2. Units and attributes

2.1 Natural range and distribution

Unit: Sediment cells

Sediment cells are discrete lengths of coastline within which the natural processes are relatively self-contained and there are distinct inputs (sources), throughputs (sediment transport) and outputs (sinks or stores) of non-cohesive sediment. They are often determined by the topography and shape of the coastline which directs the movement of the sediment within the cell relative to the dominant wave direction. The boundaries of the sediment cells tend to be headlands and peninsulas which are barriers to the movement of sediments. Maritime cliffs and slopes are connected with the coastal processes operating within these sediment cells. They are shaped by waves (size and direction), tides, nearshore currents, wind, fronting beach width, sediment availability, extreme events, exposure, groundwater, rainfall and air temperature. Sediment cells are defined in the Coastal Geomorphology GCR volume (May & Hansom 2003) based on the mapping by MAFF (1995) and are shown in Figure 1.

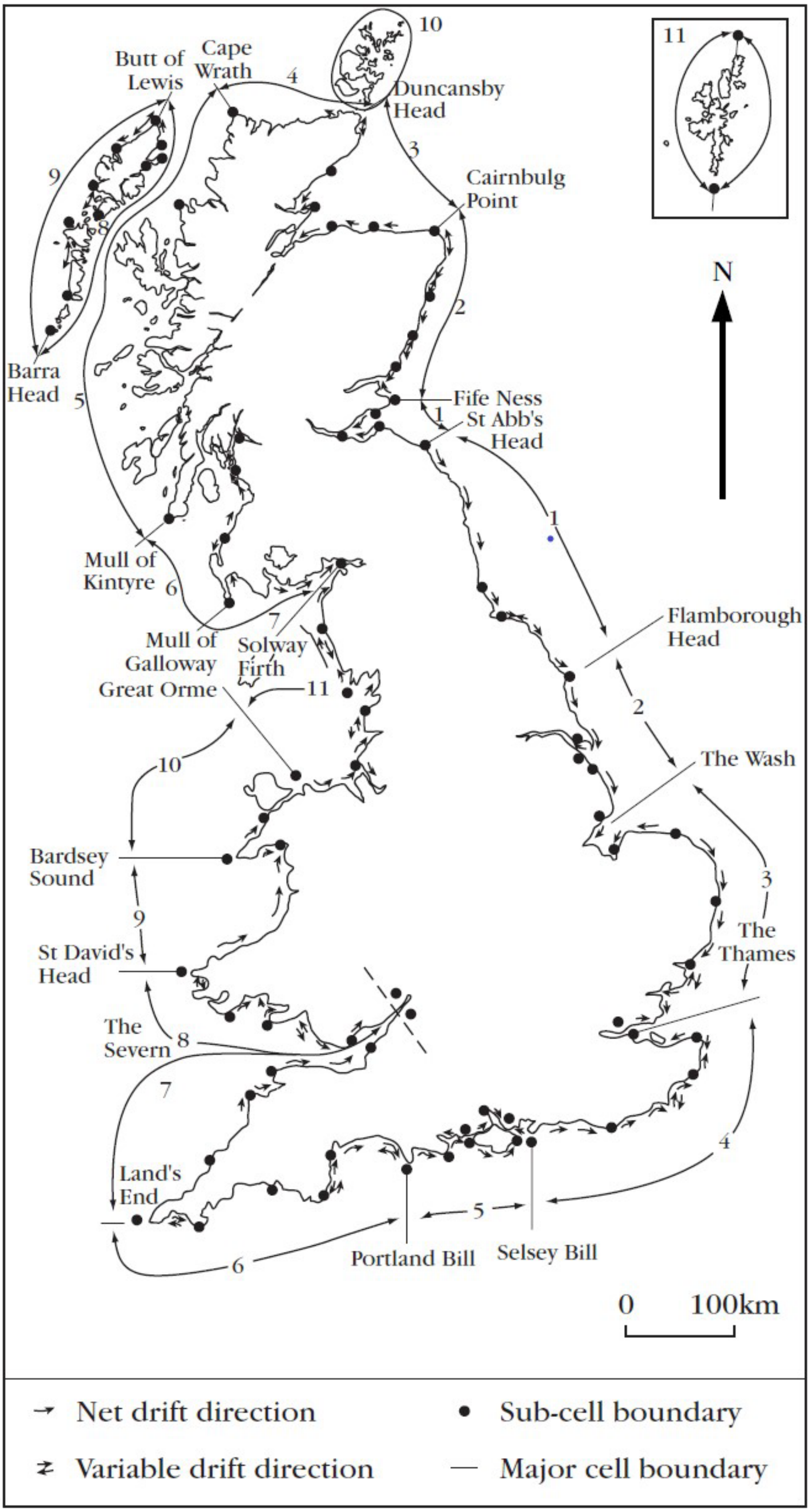

Figure 1. Map of littoral sediment cells and direction of littoral drift. Note that the Scilly Isles are considered as a separate sediment cell, not shown on this map. © Joint Nature Conservation Committee, 2003. By using this data you are accepting the terms of the Open Government Licence ([Open Government Licence (nationalarchives.gov.uk)]).

2.2 Extent

Unit: Hectare (ha) and km

Extent for this definition includes the cliff-face and cliff-top vegetation, which extends landward to the limit of maritime influence (that is, the limit of salt-spray deposition), which in some exposed situations may continue for up to 500 m inland (Section 1.1).

Typically, maritime cliffs and slopes are mapped using ortho-rectified imagery and aerial photography. In steeply cliffed sections there can be an under-estimation of the area of cliff face (although orthorectification procedures, can help minimise this). With the advance in mapping technologies and the availability of high-quality aerial photographs, LiDAR data and digital elevation model (DEM) the use of hectares is increasingly favoured for monitoring purposes to determine change in vegetation types and condition.

Historically, length of cliff was widely used as it was the only metric easily determined from maps. An estimation of area (ha) was derived using the length of cliff multiplied by an assumed width of coastal influence (that is, limit of salt spray). However, as the length of coastline is fractal, (that is, it grows as the scale of the map increases and more detail is included) there is little consensus. The length of coast also varies depending on the position on the shoreline, that is if measured at Mean High Water (MHW) it is greater than if measured along the upper shoreline. The complexities of mapping maritime cliff and slope is outlined in Rees, Curson & Evans (2014).

2.3 Structure and function attributes

Structure and function are linked to both the physical processes, sediment budgets, hydrology, maritime exposure, air and water quality and vegetation, coupled with management measures such as grazing and coast protection measures. Table 3, adapted from Natural England's SAC habitat feature framework (Natural England 2013), indicates which attributes are most important for H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts. These attributes are used in assessing habitat condition but are also important when considering regeneration potential and identifying areas for future roll-back (to take into account cliff recession rates). Those attributes used for monitoring as part of the Common Standards Monitoring (CSM) guidance (JNCC 2004) for maritime cliff and slopes are indicated in the last column.

Table 3. Structure and function attributes and sub-attributes for H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts and maritime cliffs and slopes.

Attribute and Sub-attribute	
Structure and function - Geomorphological naturalness	Yes
Structure and function - Presence of mosaic of microhabitats	No
Structure and function - Vegetation community composition	Yes
Structure and function - Vegetation: undesirable species	Yes
Structure and function - Key structural, influential and distinctive species	Yes
Structure and function - Regeneration potential	No
Supporting processes - Physical features supporting vegetation: crevices, ledges, isolated stacks etc.	No
Supporting processes - Hydrology/ drainage	No
Supporting processes - Maritime exposure including salt spray effects	No
Supporting processes - Water quality	No
Supporting processes - Air quality	No
Supporting processes - Cliff morphology, slope and elevation	No

Doody (2020) provides further discussion on structure and function with regards to the relationship between resistance and exposure to waves, together with the influence of geological structure, cliff morphology, groundwater and surface water drainage, along with vegetation cover that define cliff behaviour.

3. Evidence

3.1 Current situation

Natural range and distribution

Coastal cliffs are present in all English sediment cells. The distribution map (Figure 2 left) and range map (Figure 2 right) show the UK distribution of H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts as included in the Article 17 (2019 report), overlaid with the sediment cells. For further details see the UK Habitats Directive (Article 17) report to the EU (JNCC 2019).

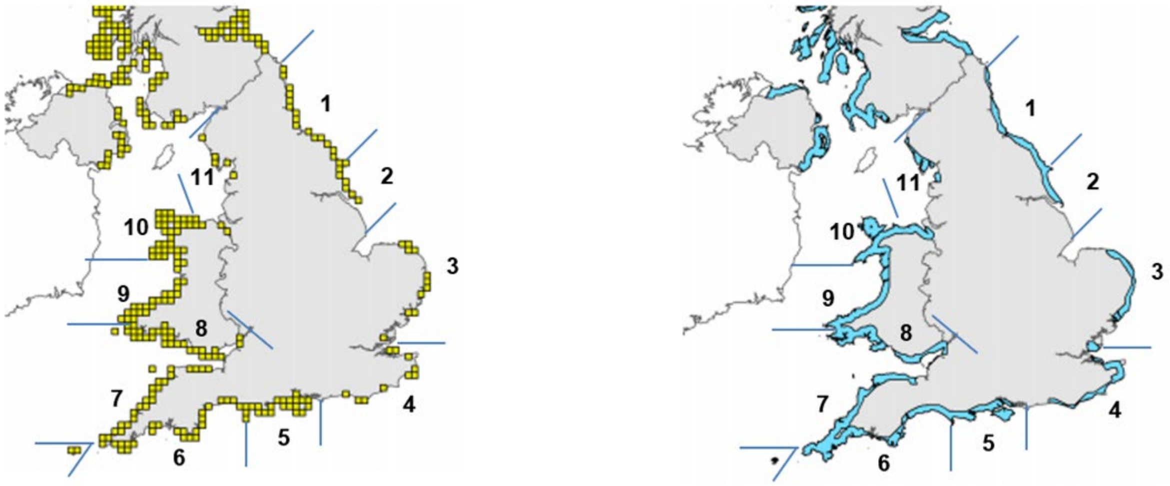

Figure 2. The distribution (left) and range (right) of H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts, overlaid with the sediment cells (numbered 1-11) in England and Wales. Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Contains data © 2017 Oil and Gas Authority. © Joint Nature Conservation Committee 2003. By using this data you are accepting the terms of the Open Government Licence (Open Government Licence (nationalarchives.gov.uk)).

The distribution of soft, intermediate, and hard cliff types is shown in Figure 3. Soft cliff is shown in light blue on the map, intermediate cliff in red and hard cliff in black. Cliffs of unknown type, or coast that is not cliff is shown in grey. Soft cliff and intermediate cliff types are recorded in all English sediment cells (that is, 1-7 and 11) while hard cliff types are found in sediment cells 1, 2, 5, 6, 7 and 11.

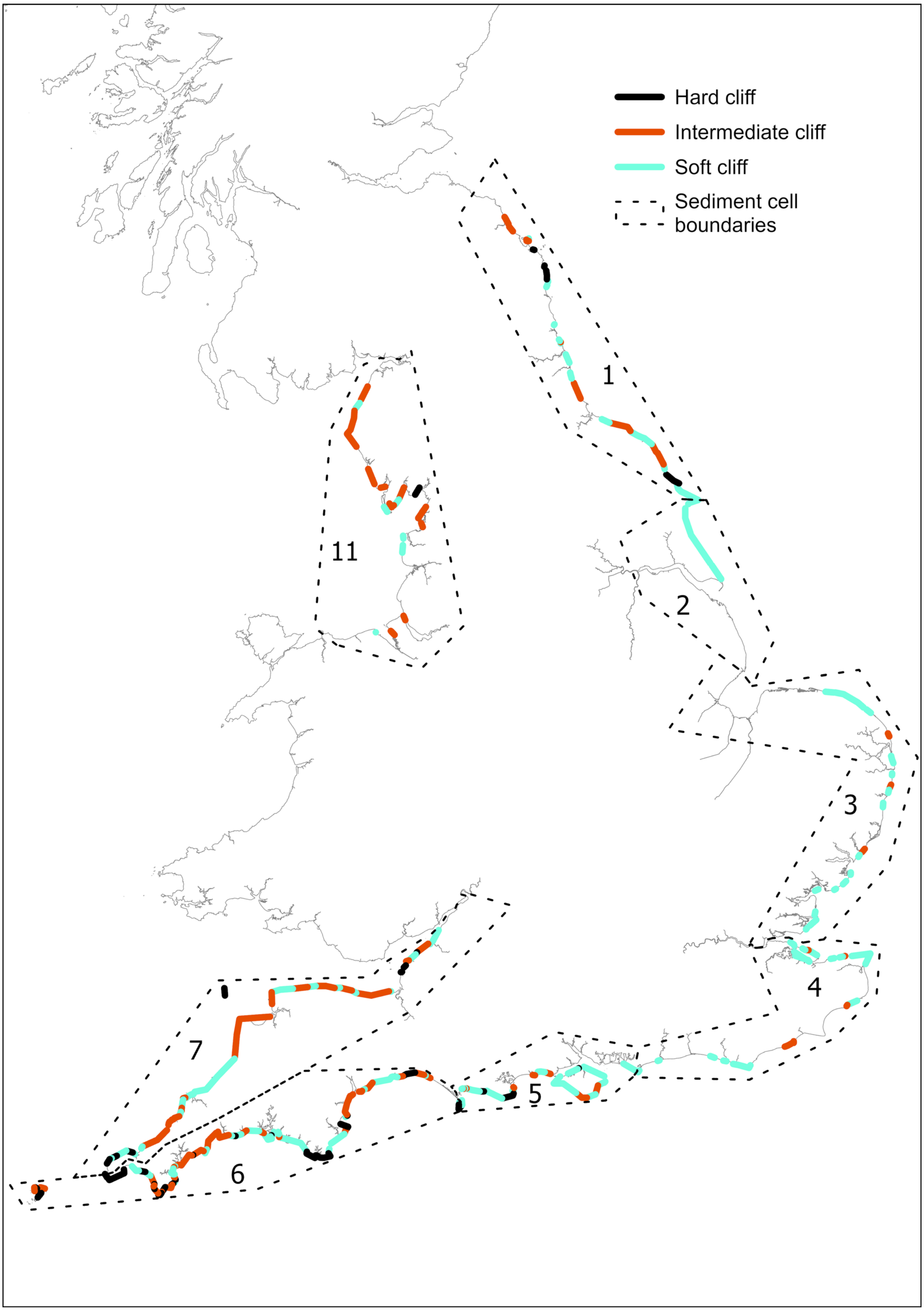

Figure 3. Extent of hard cliff (black), soft cliff (light blue), intermediate types (red), and unknown/not cliff (grey) overlaid with the English sediment cells. Adapted from Hill and others 2007 and May and Hansom (2003).

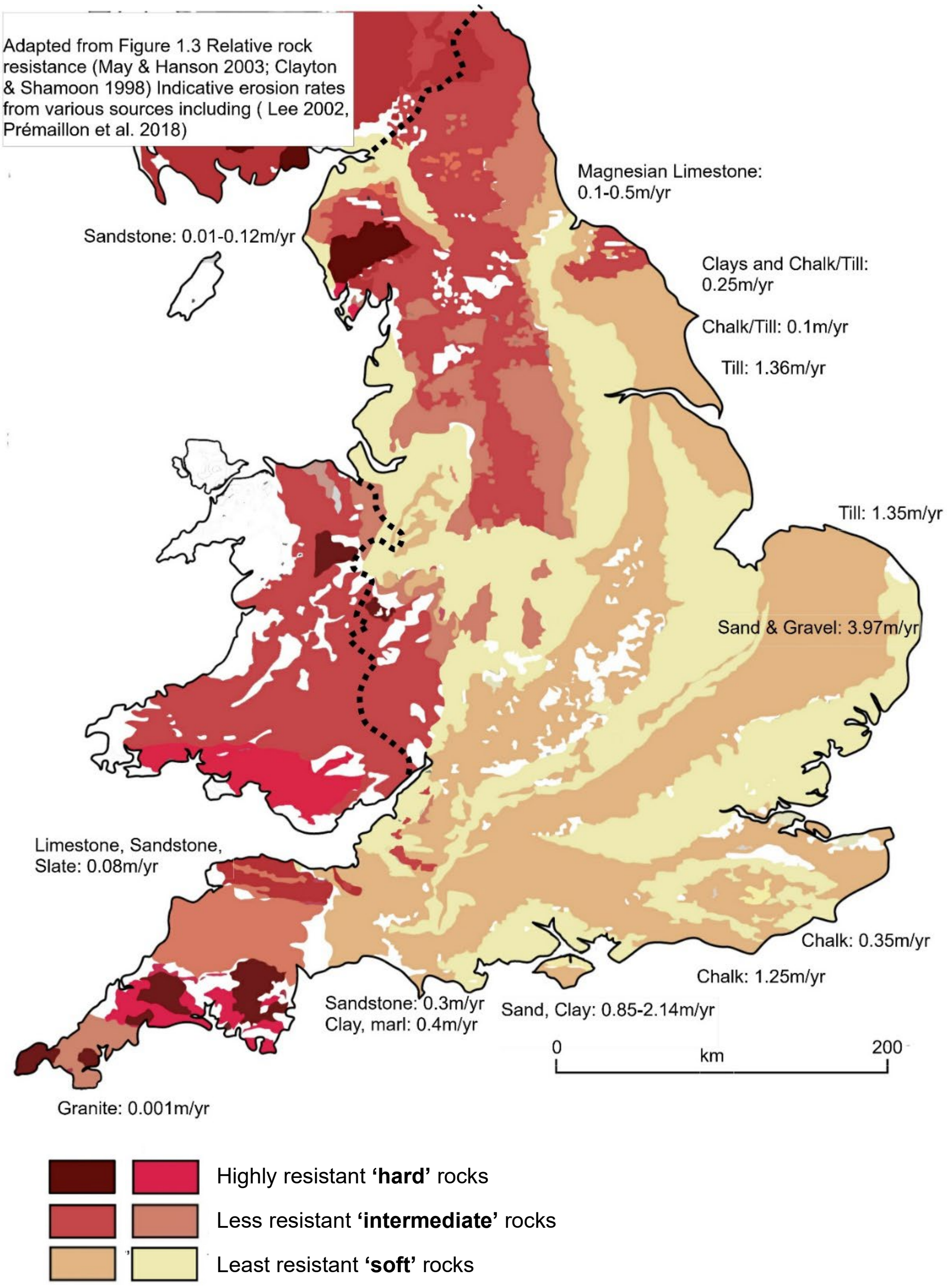

Figure 4. Simplified geology map showing the relative rock resistance divided into hard, intermediate, and soft types. Notations show lithology and indicative rates of erosion. White areas are unclassified. Source: Adapted by Doody (2020).

The distribution of individual NVC vegetation types is shown and described in Rodwell (2000). Many of the maritime cliff NVC communities have a very restricted distribution. For example, MC1 has a Mediterranean distribution restricted to the south and west coast, while MC4 was only recorded at a handful of locations on the south coast, although subsequent studies have found it elsewhere, for example on the Yorkshire coast. The seabird cliff communities, MC6 and MC7, are limited to seabird colonies with the best examples recorded on the Farne Islands, Coquet Island, Bempton Cliffs, Scilly Islands, Lundy and St Bees Head. Those cliff communities dominated by red fescue *Festuca rubra* (MC8-MC12) are generally more widespread.

Extent

Natural England's Priority Habitat Inventory (PHI) identifies 14,081.86 ha of maritime cliffs and slopes incorporating cliff face and cliff top. This area has been identified from various sources including National Maritime Cliff Database; Ordnance Survey 10k raster; OS Landline, Higher Level Stewardship (agri-environment scheme), and incorporates the data gathered by Hill and others (2001, 2007). This figure is also cited in Appendix D Coastal Habitats of Mainstone and others (2018).

Approximately 4,000 km of the UK coastline has been classified as cliff, with an estimated 1,100 km in England (Rees, Drewitt & Cox 2018). England has 255 km of unprotected soft rock cliffs (which is the largest proportion of this habitat type in the UK). Of the 255 km 80% of this is found in six counties - Devon, Dorset, Isle of Wight, East Riding of Yorkshire, Norfolk and Suffolk (Howe 2003).

Approximately a third (32.1%) of England's maritime cliff resource lies within Special Areas of Conservation (SAC). Twenty-one sites are recorded as supporting feature H1230 in England. The UK Habitats Directive (Article 17) report to the EU for H1230, identified between 13,376 and 14,082 ha (depending on the version of the PHI inventory) of this habitat type in England. Of which 4,411 ha lies within the SAC network (as derived from the Standard Data Forms) (JNCC 2019).

The SSSI series for maritime cliff and slope is considered inadequate (Rees & Mills 2016). Only 42% of the mapped extent is included within just 48 SSSIs notified for this feature, yet 203 SSSIs in England contain this habitat. This shows that there are many additional SSSI sites that may qualify for selection but are not currently notified for this feature. In addition, the report noted that existing sites' boundaries may not be adequate to allow for cliff recession due to coastal processes.

Patch size and connectivity

Roughly two-thirds (9,416.65 ha) of the PHI resource lies within a SSSI. The SSSI review showed that 29 sites supported less than 1 ha of maritime cliff and slope habitat, 72 sites supported 1-10 ha, 77 sites supported 11-100 ha and a further 25 sites supported more than 100 ha. The largest sites are all found in the South West including Marsland to Clovelly Coast SSSI (396 ha), Boscastle to Widemouth SSSI (423 ha), Aire Point to Carrick Du (558 ha), South Dorset Coast (576 ha) and Exmoor Coast Heath (601 ha). Lawton (2010, Table 4) gives the number of patches of maritime cliff and slope as 655, with an average patch size of 36.7 ha but a median patch size of 3.3 ha. Because these areas have a skewed size distribution (that is, many are very small), the median (derived by ranking the patches in size order and taking the size of the middle rank) is a better measure of the 'typical' size. Those sites that are larger and are spatially well connected are more likely to have high habitat heterogeneity, supporting a relatively large number of species, enable species dispersal between sites and into the wider landscape, and reduce the edge effect. Lawton (2010) provides further details regarding the size and connectivity of wildlife sites and the consequences on this to wildlife.

Quality of habitat patches

The Article 17 report for H1230 (JNCC 2019) provides an indication of condition (good, not-good and not known) in terms of the structure and function attributes for SAC sites in England (Table 4).

Table 4. Condition of H1230 habitat (in area) within English SAC sites

Condition of habitat	Minimum (ha)	Maximum (ha)
Area in good condition	5,740	5,974
Area in not-good condition	4,145	4,379
Area where condition is not known	3,491	3,729

Threatened species

Maritime cliffs and slopes are known to support several Habitats Directive Annex II/Annex IV species: including sand lizard *Lacerta agilis* (assessed as Endangered in England using IUCN guidelines), natterjack toad *Epidalea calamita* (Endangered), shore dock *Rumex rupestris* (Vulnerable), and petalwort *Petalophyllum ralfsii* (Vulnerable).

Vascular plants

Cliffs support several rare species including oxtongue broomrape *Orobanche artemisiae-campestris* (Vulnerable in England), restricted to unstable chalk cliffs of southern England. The uncommon bird's-eye primrose *Primula farinosa* (Near Threatened) is found along the coastal section of the Magnesian Limestone cliffs in Durham. Therophyte species associated with shallow, free draining soils include several nationally rare winter-annuals. Other species of maritime zone include Nottingham catchfly *Silene nutans* (Near Threatened) and wild asparagus *Asparagus prostratus* (Vulnerable).

One of the more vulnerable plants of hard rock cliffs is Lundy cabbage *Coincya wrightii* (Near Threatened) endemic to Lundy Island off the coast of North Devon. It inhabits sparsely vegetated rock on sea cliffs and is a rapid coloniser of bare soil after disturbance but is a poor competitor against regenerating grass swards (Compton & Key 2000).

In the South and South West, chalk and limestone areas, with accessible steep slopes and some cliff tops, provide important refuges for species of inland calcareous grassland, lost through agricultural intensification, such as Goldilocks aster *Aster linosyris* (Endangered).

Species of acidic grazed grassland include purple milkvetch *Astragalus danicus* (Endangered) a coastal cliff plant mainly in the North East in England.

Non-vascular plants

Maritime cliffs and slope support several rare and restricted bryophytes and lichens.

Lichens can be an important component of the maritime cliff community and are described by Fletcher (1980). Saltwater dependent and salt tolerant lichens are found on rock outcrops and crevices from the splash zone with black, yellow, grey and orange lichens, to the xeric supralittoral zone supporting a number of drought-tolerant species. One important lichen community occurs on soil on windswept cliff edges where species, often near the northernmost limits of their range on shores of the west coast, are dependent on wind-borne humidity. Where deeper maritime soils accumulate, for example in crevices, a rich and characteristic maritime lichen flora can develop with species such as *Cladonia.* Some salt tolerant lichens are found up to 1 km inland on the most exposed sites.

Rare bryophytes include two species more widespread in southern Europe: Levier's beardless-moss *Weissia levieri* (Endangered), growing on south-facing open limestone turf on cliff tops, and cordate beard-moss *Didymodon cordatus* (Endangered) which occurs on one cliff site in North Devon (Porley 2013). The bryophyte triangular pygmy-moss *Acaulon triquetrum* (Endangered) is nationally rare and has a restricted distribution, found on landslips and clifftops requiring open patches in short, tight swards. The NBN[1] record for this species shows it restricted to the southern counties between South Devon and East Sussex. Blackwort *Southbya nigrella* (Vulnerable) is even more restricted and is currently known only from thin soil over limestone on Portland and the Isle of Wight (Atherton and others 2010)[2].

Invertebrates

Many invertebrates found on coastal cliffs have specific habitat requirements and have a restricted distribution. For example, an invertebrate survey of the Norfolk soft rock cliffs recorded 374 invertebrate species of which 17 were Nationally Scarce, and one species, a rove beetle *Bledius filipes*, is only know from there (Telfer 2006).

Soft cliffs often have open conditions maintained by cliff slippages that provide a range of restricted microhabitats, supporting many rare invertebrates including the cliff tiger beetle *Cicindela germanica*, a weevil *Baris analis*, a shore bug *Saldula arenicola* and Glanville fritillary butterfly *Melitaea cinxia* (Endangered). The latter is virtually restricted to coastal

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[1] https://species.nbnatlas.org/species/NHMSYS0000309287#overview [accessed Dec-2020]

[2] https://www.britishbryologicalsociety.org.uk/wp-content/uploads/2020/12/Southbya-tophacea-nigrella.pdf and https://species.nbnatlas.org/species/NHMSYS0000310647 [accessed Dec-2020]

landslips on the southern half of the Isle of Wight and the Channel Islands along with a few coastal locations on the mainland. The large mason bee *Osmia xanthomelana* and long-horned bee *Eucera longicornis* are now restricted to 'soft' rock cliff localities, which amongst other invertebrates are reliant on dynamic coastal processes (Howe 2015). Associated seepages, springs and pools provide wet muds suitable for nest building by solitary bees and wasps. They also support rich assemblages of other rare invertebrates including the craneflies *Gonomyia bradleyi* and *Helius hispanicus* and the water beetle *Sphaerius acaroides*. Other species are confined to certain rock types. For example, fiery clearwing moth *Bembecia chrysidiformis* is restricted to the chalk cliffs of Kent and Sussex and maintaining open conditions and early successional vegetation with abundant foodplant is key to its survival. The water beetle *Ochthebius poweri* occurs predominantly in small seepages on red sandstone cliff faces in south-west England. Other BAP Priority species are the ant *Tetramorium atratulum* (*Anergates atratulus*) and bees *Lasioglossum angusticeps* on coastal landslips and *Nomada errans* occurring on one limestone grassland site, Isle of Purbeck, Dorset (Hill and others 2001).

The hard rock coastal cliffs of south-west England support a western oceanic invertebrate assemblage of European significance. Important species include green snail *Ponentina subvirescens*, weevils such as the highly restricted *Cathormiocerus attaphilus*, the endemic Lundy cabbage flea beetle *Psylliodes luridipennis* and Lundy cabbage weevil *Ceutorhynchus insularis* as well as moths such as Barrett's marbled coronet *Hadena luteago*.

Birds

Seabirds nest on 'hard and intermediate' vertical or near vertical coastal cliffs, which remain stable long enough for breeding to take place. Inaccessibility to human disturbance and freedom from predation are important considerations. Those that are near the rich waters of the North Atlantic and the North Sea often support large colonies of cliff-nesting seabirds such as auks, gulls and gannets. England has, relative to the rest of the UK, few large seabird colonies. However, the chalk cliffs between Flamborough and Filey in Yorkshire are the largest single seabird colony in the UK. The 17 mile stretch of coast designated as Flamborough and Filey Coast Special Protection Area (SPA), and including RSPB Bempton Cliffs, supported over 412,000 seabirds at the latest count including Kittiwake *Ryssa tridactyla* (Critically Endangered).

The chough *Pyrrhocorax pyrrhocorax* (Vulnerable), found in Cornwall, needs unimproved clifftop pasture, with areas of short turf and exposed substrate where invertebrates are plentiful (Meyer 2000).

Confidence: Low – Moderate

3.2 Historical variation in the above parameters

During the last glaciation, much of the north of Great Britain was covered by glaciers, depressing land levels in the north and causing an upward 'bulge' in the unglaciated south and east. Water ‘locked up’ in the glaciers meant that sea levels were much lower than today but on melting, at the end of the glaciation, sea-levels rose rapidly. At about 7,000 years ago sea level rise slowed, reaching its current position some 4-5,000 years ago. In northern England, at least until recently, isostatic adjustment (the rise of the land) outpaced the eustatic change (the rise in sea levels). In south-west England relative sea level has remained more or less static. In south-east England and East Anglia, isostatic adjustment continues to reinforce the eustatic rise in sea level and hence potential for erosion from the sea. Jones and others (2011) note that in the future predicted rates of eustatic sea level rise will greatly exceed isostatic readjustment on all UK coasts (see Section 3.3).

At the end of the last glaciation tundra vegetation was replaced by scrub and woodland as the climate warmed. On some coastal cliffs, extreme maritime exposure and cliff instability prevented the establishment of woodland and allowed plants tolerant of warm temperatures but intolerant of competition to persist (Birks 2008). Sea cliffs became lowland refugia for tundra species, while the open habitats of maritime cliffs also provided opportunities for southern warmth-loving plants to extend their range further north than their normal tolerances allowed. As the slopes became more accessible the vegetation in pre-Neolithic times became susceptible to modification by native herbivores, and later by domestic stock. The importance of herbivores in creating and maintaining an extensive, open non-wooded landscapes (as postulated by Vera 2000, 2002) is likely to have been important in the development of maritime and para-maritime vegetation.

Cliffs have moved landward to a greater or lesser degree for some 4-5,000 years, depending on the resistance of the rock and relative sea level change. There are several publications (as well as the Futurecoast database) that describe the rate of coastal change over a variety of timescales and a wide range of lithologies. Records are available dating back at some sites from mid to late 19th Century to the mid-1990s (for example, Lee 2002). Whilst ‘hard’ rock cliff has probably changed little in the last 50-100 years, rapid episodic change occurs in ‘soft’ rock cliffs. Using LiDAR airborne technology recession rates over periods of 3-4 years ranged from 0.0-0.37 m/year on ‘hard’ rock cliff sites studied in Cornwall. The study showed these rates to be comparable to historic rates determined from the second round Shoreline Management Plans (SMP2) data. There were differences where ‘large failures’ skewed the results of some of the LiDAR data towards the higher end for long-term recession. This study confirmed the rate of retreat is closely aligned to the resistance of rock strength to wave exposure (Earlie and others 2015) and is also affected by thinning of cliff front beach levels (Hurst and others 2016) and presence of defences.

Preventing erosion and flooding has been a human preoccupation for many years. Frequently human interference has altered/ influenced the rate of erosion, especially on the eroding coasts of east and south-east England where infrastructure is located. Structures were already having a significant impact on the coast more than 100 years ago (Wheeler 1903; The Coastal Erosion Commission (Royal Commission1911). The foreshore, base of the cliff and the cliff top may be extensively modified by coastal protection features. Two approaches were particularly associated with eroding cliffs:

coastal protection structures and more recently remedial engineering, including drainage and slope stabilisation. Modification of slope hydrology can disrupt coastal processes particularly on soft cliff sites where it can reduce erosion and slumping. Overall, approximately 45% of the coastline of England has some form of coastal defence (Masselink & Russell 2013). However, most of this is associated with sea walls and embankments designed to protect low-lying land from flooding. It is estimated that in the 100 years up to the 1990s, 860 km of coast protection works had been constructed to reduce erosion (Lee and others 2001).

Coastal protection may affect the natural zonation of a site. Over-stabilisation results in the reduction of bare ground and the loss of early pioneer communities (West 2020), leading to grass dominated swards or the development of scrub and woodland.

Coastal erosion is important as a source of sediment ‘feeding’ adjacent beaches and providing material for the development of sand dunes and shingle structures that offer natural flood management. For example, erosion of the 33 km of cliffs in north-eastern Norfolk, average 25 m high, under natural conditions, supplies well over 50,000 cubic m/year of sediment to the beach system, of which about two-thirds is sand and gravel. This provides material to feed beaches for over 60 km downdrift. Today 70% of the cliffs are defended, and the sediment supply has been reduced to 70-75% of its natural level (Clayton 1989). This has knock on effects on adjacent coast (not protected) where sediment deprivation can lead to enhanced erosion immediately downdrift from the protected coast, referred to as ‘terminal end erosion’. This can reduce sediment supply to coastal systems further afield, for example erosion on the East Coast provides large supplies slit and clay some of which is transported across the North Sea to the German Bight and beyond (Dyer & Moffat 1998).

Historically, accessible areas of coastal cliffs were grazed by domestic cattle and sheep, in addition to native herbivores, which gave rise to species-rich maritime cliff-top grassland and heath. Agricultural intensification, including reseeding and conversion of cliff-top grassland and heath to arable cultivation, has significantly reduced the extent of these habitats. In many areas on both hard and soft rock cliff coasts intensive agricultural land now reaches to the cliff top. In those areas with less resistant cliffs, where semi natural grass or heath survives on the cliff top, continued cliff erosion further squeezes the vegetation into an ever-narrowing strip as the cliff recedes. The quality of the remaining areas of accessible cliff-top and slope grassland has also declined as traditional grazing of cliff slopes is now far less prevalent than it was in the late 1800s (Oates 1999). Grazing by domestic cattle and sheep has decreased or ceased altogether.

Housing and tourist development (car parks and caravan sites), roads and other infrastructure, including industrial development, has also led to substantial losses of maritime cliff and slope.

Natural range and distribution

No areas of maritime cliff and slopes are recorded as being completely lost from English sediment cells over the last 100 years. Historically the natural range (distribution) has changed little over time. The Futurecoast (DEFRA 2002) database shows that the current natural range is virtually unchanged from the historical range at least in so far as the cliff and cliff slope are concerned.

Extent

The area of maritime cliff and slopes is historically poorly defined; and as a result, it is not possible to provide a meaningful account of change in extent (Jones and others 2011). Several ‘desktop’ inventories have been undertaken for England. The first attempt was made by the JNCC as part of the Coastal Resources Survey in the 1980-90s (Barne and others 1998). This measured cliff length using the most up-to-date OS maps at that time, identifying 1,164 km of coastal cliff in England (‘soft’ rock 256 km; ‘hard’ rock 909 km). This was followed by a study by Pye and French (1993) who undertook a systemic review of various data sources to try and provide an estimate of coastal habitat by county and for England. This inventory quantified the area of maritime cliff grassland (which included ‘cliff top’ and ‘vegetated cliffs’) and coastal heath, as 1,895 ha and 426 ha respectively but these figures are very conservative compared to that identified by the later Priority Habitat Inventories (Section 3.1). Further inventories were produced by Hill and others (2001, 2007) which were used to inform the Biodiversity Action Plan (BAP) inventory and form the basis of the Priority Habitat Inventory.

One useful record of coastal change is “The Coasts of England and Wales: Measurements of Use, Protection and Development” (Countryside Commission 1968). Based on local authority information this included a table with detailed figures for “Developed Coastal Frontage”. Summarised for England as follows: Substantially Built-up Areas (566 km); Industrial and Commercial Use (185 km) and Camping and Caravan Sites (106 km). Expressed as a percentage of the coastline of England these were 17.5%, 5.7% and 3.3%. The National Trust Mapping our Shores, 50 years of landscape change at the coast (1964-2014) project suggests that overall, only 4.2% of ‘open coast’ has been lost. Whilst there has been a 42% increase in urban/built up areas this has been largely associated with infill rather than loss on pristine ‘open coast’. The original 1965 survey identified 3,342 miles of ‘pristine land for permanent preservation’ in England, Wales and Northern Ireland, of which 3,139 miles, (or 94%) is now protected by various land designations. This study confirms that a substantial proportion of unprotected cliff coast remains structurally intact (Comber and others 2016).

Quantification of the changes in extent of cliff-top grassland and heath is difficult because of the absence of good base-line surveys. However, comparison between the 1st Edition of the Ordnance Survey 6-inch (1:10,560) County Series maps of 1889 and the more recent 1:10,000 maps was used to provide some insight into the change in use of the coastal cliff tops of North Cornwall from Lands’ End to the Devon border. The study found that there was an overall reduction of 21% “Uncultivated Ground” including “Rough or Heathy

Pasture”. Although there are no other studies specifically for maritime cliff-top grassland; unimproved grassland loss in England and Wales between 1932 and 1984 was estimated at 97% (Fuller 1987) and another study (Ridding and others 2015) identified a 47% loss for four types of semi-natural grassland between 1960 and 2013.

Quality of habitat patches

The Biodiversity Indicator report (Defra 2019), provides trends for the status of threatened habitats in England, using a series of indicators to assess biodiversity change. Indicator 2b, which assesses the change in conservation status of habitats of European importance, notes that for H1230 (synonymous with maritime cliff and slope) both the long and short-term trend shows it is deteriorating (this indicator is based on an evaluation of whether the results obtained in 2019 are better or worse than those obtained in 2013 (short term) and 2007 (long term). In 2007, the conservation status was Bad Improving, in 2013, Bad Stable, and in 2019 Bad Deteriorating.

Trends on SAC and SSSI habitat condition for the UK from between 1994-2006 are also presented based on the second UK Report on Implementation of the Habitats Directive (JNCC 2007), with 50% of the SAC resource and 66% of the SSSI resource considered to be in favourable condition at that time.

Unpublished evidence suggests that large stretches of maritime cliff vegetation are in sub-optimal condition, with coastal slopes dominated by rank, coarse grasses, bramble, bracken, and scrub (Oates 1999).

The original Coast Protection Survey of England provides a comprehensive assessment of those coastal cliffs modified by structures designed to stop or control erosion and, in some cases, dynamic cliff processes. The survey was commissioned by the former Ministry of Agriculture, Fisheries and Food (MAFF). It provides both detailed and summary information on the state of coastal protection structures for England. Figure 5 summarises the findings of the Survey. Defence structures were classified as natural (that is, bank, cliff/scarp, beach ridge or marsh fringe) or man-made. Whilst these data date back to 1993, they provide information which is helpful in identifying sites where natural mobility has been compromised. These show that a relatively high proportion of the ‘hard’ and ‘intermediate’ cliff coastline in the South West (Taunton Region) is unprotected. The greatest length of (estuarine sea defence were not included) defended coast - 3,763 km - is in the south (Tunbridge Wells Region) where the most extensive infrastructure development on cliff tops has taken place. More recently the Coastal Erosion Risk Mapping project (Rogers and others 2008) suggest that 42% of the cliff coast of England and Wales is at risk from erosion. Of this 82% is undefended.

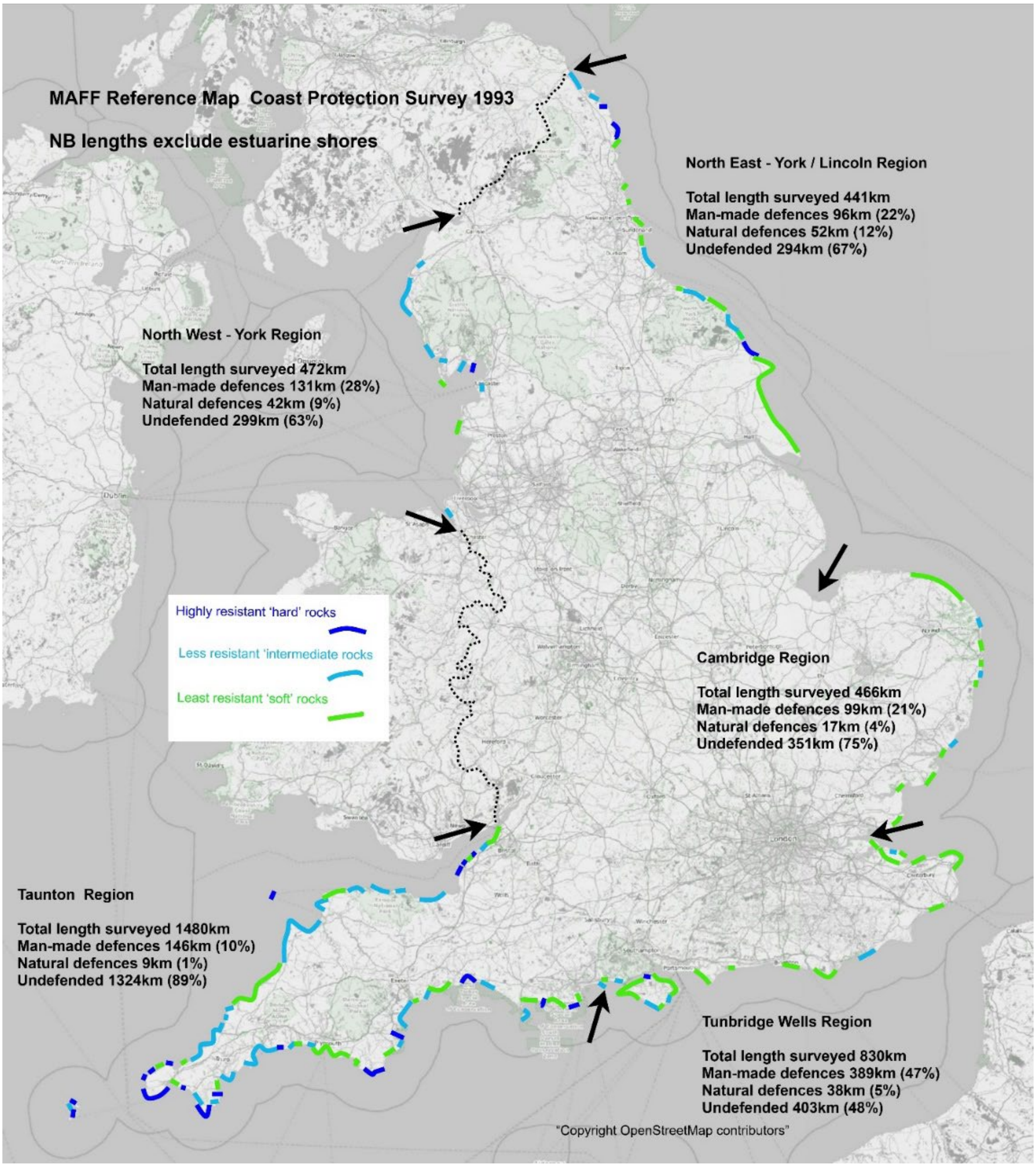

Figure 5. Coastal Protection Survey data summarised for the five Associate Consultant Commissions appointed to carry out data collection and reporting on a regional basis. © OpenStreetMap. This data is available under the Open Database License.

Threatened species

As outlined in Section 3.1 many of the notable species associated with maritime cliff and slope habitat have shown historical declines. For example, the population of Glanville fritillary butterfly is now stable, albeit with only a few breeding areas, but it shows an overall decline of 66% of its distribution since the 1970s, with its decline in part considered to have been caused by coastal defence measures.

Similarly, chough were subject to a huge historical decline, resulting in extinction of the species in England but it has since re-established itself in Cornwall, where its population is increasing.

Confidence: Low- Moderate

3.3 Future maintenance of biological diversity and variation of the habitat

The maintenance of biological diversity and variation of both hard and soft rock cliffs is dependent on unhindered dynamic processes such as erosion and cliff failure. Rees, Curson & Evans (2014) emphasise how important it is to work with coastal processes and manage sediment resources appropriately as the foundation for the habitats and the species they support.

Updating a list produced by JNCC (2007) the main pressures affecting maritime cliff and slopes include:

- Sea defence and coast protection works.
- Changes in drainage patterns.
- Climate change.
- Modification of cultivation practices and abandonment of pastoral systems.
- Over- and under-grazing.
- Pollution.
- Non-native and invasive species.
- Urbanised areas (human development).
- Recreational pressures (such as, walking, horse riding, dog walking and use of non-motorised vehicles).

Cliff and slope erosion is important for constantly exposing new surfaces for recolonisation by plants and allows early successional vegetation types to be maintained. Therefore, maintaining free-functioning cliff/ slope erosion/deposition processes is vital to the continued conservation status of the habitat. The approach to coastal protection is changing. There is increasing realisation that in some areas protecting the coast is not always cost effective even where houses are threatened. Managed realignment has taken place at the village of Happisburgh in Norfolk - existing groynes have been removed, allowing the cliff to recede once again and the loss of the village to resume. The second round Shoreline Management Plans[3] suggest that 'No Active Intervention' is now the preferred short-term policy along much of the 'resilient' and 'intermediate' cliff coasts in England. For a few cliff sites Managed Realignment (M) is proposed. Figure 6 shows the management policies proposed by the Shoreline Management Plans either No Active Intervention, Managed Realignment or Hold the Line. Note the policy of 'Hold the Line' (H) in the South, South West and North East is largely offering protection to coastal villages and towns. While along the eroding east and south-east coasts rather longer stretches are protected typically using softer interventions, such as groynes and breakwaters, to slow coastal processes.

On 'soft' rock slopes unimpeded drainage is often critical to retaining their invertebrate interest. Key habitats include bare sand or glacial till, extensive swards of leguminous and ruderal plants and hydrological features including seepages, pools and reedbeds. The most obvious threats to invertebrates are cliff-protection and stabilisation schemes including artificial drainage.

[3] https://www.gov.uk/government/publications/shoreline-management-plans-smps/shoreline-management-plans-smps

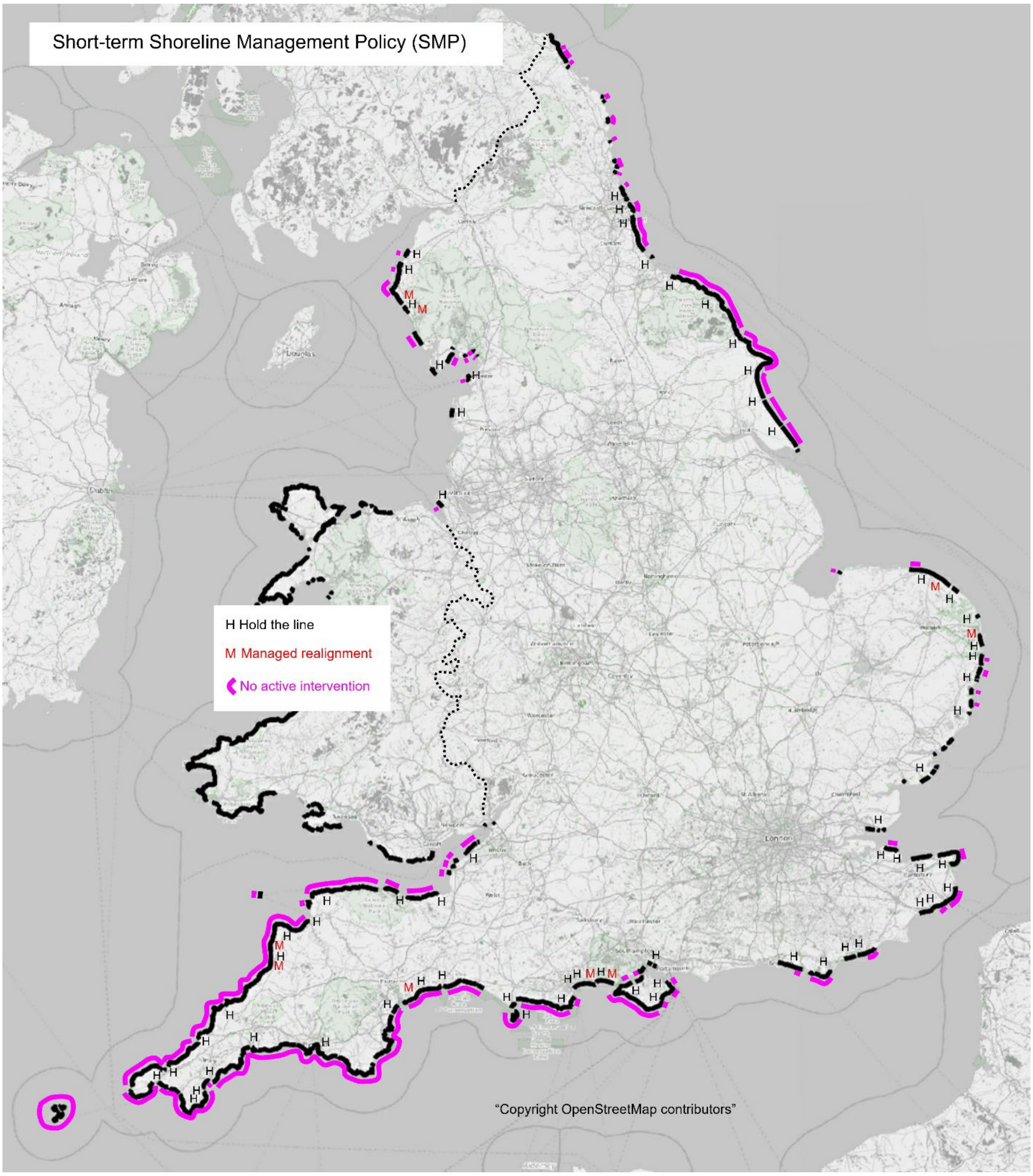

Figure 6. Shoreline management policy as proposed by second generation SMPs as compiled by Doody (2020). © OpenStreetMap. This data is available under the Open Database License.

Maritime cliffs are considered to be highly sensitive to climate change (Natural England & RSPB 2019). Marine erosion is a critical natural function of both hard and soft cliffs, however climate change is likely to increase erosion rates and alter cliff profiles through sea level rise, increased storminess and more frequent extreme events, increased annual average temperatures with hotter and drier summers and increased winter rainfall (Natural England & RSPB 2019).

The Committee on Climate Change (2018) estimate that by the 2080s over 100,000 properties may be at risk from coastal erosion[4]; and approximately 1,600 km of major roads, 650 km of railway line, 92 railway stations and 55 historic landfill sites are at risk of coastal flooding or erosion by the end of the century. Power plants, ports, gas terminals and other significant assets are also at risk. The report goes on to say that a strategic long-term approach to managing the coast is needed; and key to this will be engaging affected communities and stakeholders well in advance so that adaptation policies (which can take many years to implement) can be put in place.

The Futurecoast (DEFRA 2002) database of coastal cliff behaviour units includes sensitivity to climate change and cliff recession potential. Rising sea levels, which has the effect of eroding the beach, steepening the foreshore and as a result exposing the cliff to greater erosion pressures is very important on soft rock cliffs. It is very likely that currently eroding stretches of soft rock cliff will experience increased erosion rates due to sea-level rise (Masselink & Russell 2013), therefore these retreating coastlines are particularly vulnerable. Changes to the regularity and severity of storms and wave climate could alter patterns of undermining and the removal of basal sediments and increase direct abrasive forces from wave and wind action. Increased rainfall in the future may also lead to increased slope failure, particularly affecting the movement of groundwater in softer lithologies (Burden and others 2020). For example, the exceptional period of rainfall and winter storms experienced between April 2012 and March 2014 caused increased coastal erosion and many new cliff falls and landslides on the south coast (Moore & Davis 2015). This highlights that habitat loss and fragmentation due to a combination of coastal retreat and lack of space for cliff-top habitats to roll back is a serious risk to both coastal slope vegetation and invertebrates reliant on cliff-top habitat. The quality of some of the vegetation types, although on a more limited scale, may also be affected by climate change. An increase in rainfall may affect therophyte communities as the area of bare ground on hard rock cliffs rises because of erosion to more than 10%, the target area in the CSM Guidance. Overall, increased erosion may be favourable for over stabilised habitats, but unfavourable for those already eroding where there is a lack of space for cliff-top habitats to roll back.

The most recent UKCP18 (Met. Office 2018) provides projected sea level rise projections at four UK capital cities by 2100 relative to 1981-2000. For example, in London, the range for a low emission scenario (RCP[5]2.6) and high emission scenario (RCP8.5) is 29-70 cm and 53-115 cm respectively. For reference, mean sea level around the UK has risen by approximately 1.5 mm per year on average from the start of the 20th century equivalent to an increase of 16.5 cm, (excluding the effect of vertical land movement). However, the rate

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[4] There are currently around 8,900 properties located in areas at risk from coastal erosion in England

[5] Representative Concentration Pathways

of sea level rise has increased recently, exceeding 3 mm per year for the period 1993–2019.

In many areas a reduction in grazing has led to significant loss in the quality of the habitat. Freed from suppression by grazing, successional change leads to domination by coarse grasses, bracken *Pteridium aquilinum* and scrub, often exacerbated by low levels of added nitrogen from fertiliser drift and/or aerial deposition. This eventually displaces maritime and para maritime grassland and heath on both 'hard' and 'intermediate' cliffs. Grazing is the most significant management issue affecting the quality of remaining maritime cliff vegetation and transitions to grassland and heathland along large stretches of cliff tops and accessible slopes especially in south and south-west England.

Fertilizer and pesticide run-off from intensively managed cliff tops or adjacent land can affect water quality. Nutrient enrichment from these sources can alter vegetation communities (Whitehouse 2007). Nitrogen deposition is considered the main source of air pollution that could affect maritime cliff and slope specifically increasing the biomass of grass species which has an adverse effect on the cover and diversity of flowering plants. Nitrogen deposition also results in the loss of sensitive lichen species.

Control of invasive alien species is a significant issue on hard rock cliffs. Purple dewplant *Disphyma crassifolium* (Preston & Croft 1995) and hottentot fig *Carpobrotus edulis* (Campoy and others 2018) are two invasive plants the latter significant on Cornish cliffs where its expansion requires extensive control. Other invasive plant species occurring on cliffs are: evergreen oak *Quercus ilex,* garden privet *Ligustrum ovalifolium, Cotoneaster* species, rhododendron and Spanish bluebell *Hyacinthoides hispanica.* Invasive predators such as brown rat can have a significant impact on nesting seabirds. The spread of invasive species may be boosted by climate change with warmer temperatures.

Increasing problems include cliff-top 'gully' erosion caused by trampling pressures along coastal footpaths. This introduces weakness in the cliff and can, especially during periods of high rainfall, cause the cliff to collapse. The increase in human usage has also had the knock-on effect of discouraging farmers from grazing animals on cliff tops and slopes because of losses due to dog worrying. Horse riding, rock climbing and fires also cause adverse change in natural and semi-natural maritime cliff habitat.

Natural range and distribution

Geology is one of the key attributes that determines the natural range and distribution of maritime cliff and slope, and consequently this is unlikely to change significantly in the future. Therefore, to achieve favourable conservation status in terms of conserving the biological diversity and variation associated with this habitat the natural range and distribution needs to be maintained.

Extent

To achieve favourable conservation status for coastal cliff habitat, unhindered dynamic coastal processes such as erosion and cliff failure must be allowed. For example, erosion of soft cliff sites is vital for constantly renewing geological exposures and recycling the botanical succession of this habitat (Jones and others 2011). In terms of area, this means providing, through habitat creation and roll-back, space for natural cliff recession. In hard cliff areas the extent of cliff habitat lost through erosion is unlikely to change significantly. However, at soft or intermediate cliff locations cliff recession rates through erosion can be highly significant. Natural England has provided advice to Defra and others regarding cliff recession distances relating to the re-drawing of designated site boundaries, and a 'historical projection' methodology employed by Lee (2012) has been adopted. Cliff recession predictions can therefore change, either from current cliff recession rates changing, for example through better or more complete data, as well as future (and historic) sea level rise rates being updated. Previous projections can be superseded and revised with new data to give updated projections.

Natural England believes that a boundary that includes space for predicted coastal change over longer timescales provides a suitable balance between a short-term boundary requiring frequent re-notifications and a boundary that would include land of less demonstrable scientific interest. This rationale, based on predictions over 50 years, was tested by a judicial review at Easton Bavents (Suffolk) that upheld the approach Natural England had adopted. A similar approach was undertaken on the Isle of Wight where the re-notification of a cliff SSSI included a strip of cliff-top land to allow for the future functioning of the cliff system. The approach ensured that the geomorphological and biological features of interest would still be within the site boundary even when the cliffs retreated (Whitehouse 2007).

The favourable area will fall within the current range (including historic and current occurrences) but will need to increase to reverse historical losses, offset the effects of ongoing coastal squeeze and allow unhindered dynamic coastal processes and roll-back. Due to the lack of data on the past extent of maritime cliff and slope habitat it is not possible to determine the amount of new habitat needed to address historical losses.

The Habitat Potential Mapping layer for maritime cliff and slope highlights opportunities around the English coast for future creation and restoration. The current layer (which is still under development) has identified approximately 5,700 ha of potentially suitable habitat, excluding large areas of built development that represent an immovable constraint. It uses data from the maritime cliff and slope PHI, CORINE Land Cover data for major developments and infrastructure, Futurecoast (DEFRA 2002) backshore geomorphology data, and the Environment Agency national lidar data composite (to identify cliff over 2 m in height. A standard 50 m wide zone was used to ensure proposed areas have sufficient landward adaptation space. Areas identified as suitable include agricultural land, various types of green space such as sport and leisure facilities (for example, golf courses), temporary developments including holiday accommodation, and degraded or semi-improved habitats which are not currently classified as maritime cliff and slope.

The favourable area is the current area - 14,081.86 ha – plus the area identified by the Habitat Potential Mapping – 5,700 ha – giving a favourable area of 19,800 ha (figure rounded).

Quality of habitat patches

To retain the natural structure and function of the cliff and hence its biological, geological and geomorphological value, it is important that coastal protection measures, cliff stabilisation, or modification to cliff hydrology are kept to a minimum, so as to allow free functioning coastal erosion and deposition.

In some places, cliff-top vegetation has been reduced to a narrow strip with most of the natural zonation destroyed. This prevents cliff-top biological communities from retreating in response to cliff erosion, subjecting them to a form of coastal squeeze (Jones and others 2011).

On the most exposed cliffs where sea water-splash and spray are key to determining the vegetation type there is unlikely to be any need for specific maintenance, although the control of invasive species may be necessary/ desirable (see above).

More sympathetic management of cliff slopes and cliff tops is needed to reconnect sites and their associated invertebrate populations, to reduce a dependence upon the cliff slope and to increase the availability of suitable nesting and foraging habitats (Howe 2015). Whitehouse (2007) notes this could be achieved through the creation of buffer zones flexible enough to move inland with the retreating cliff to avoid coastal squeeze, thus maintaining the area of cliff-top habitat. Buffers need to be sufficiently wide so that the effects of insensitive management are minimised.

Confidence: High

3.4 Constraints to expansion or restoration

Coastal habitats can only be recreated or restored at the interface of land and sea and where there are appropriate sediment types present. This limits potential locations and can lead to conflicts with plans for other habitats present behind sea defences or on cliff tops. The main aim would be to seek to restore the appropriate biotic and abiotic processes, allowing colonisation from adjacent habitats. In some cases the only option might be to remove hard coastal defences (Lee and others 2001), and/or encourage the development of a range of cliff-top vegetation within the zone of maritime influence.

The potential for restoration, particularly on eroding 'soft' coasts is restricted by the presence of infrastructure, including housing and industry. However, even here building new or maintaining existing coast protection structures may not be cost effective. As a result, options for managed realignment on cliff coasts include allowing the erosion of cliff frontages. As noted by Jones and others (2011), managed realignment has the potential to give cliffs room to migrate inland with rising sea levels and use their sea defence characteristics to reduce the cost of hard defences which can be set back behind the natural habitat, if required. The number of managed realignment sites shown in Figure 6 suggests the use of this option is increasing. Three of the top ten sites identified as Coastal Change Management Areas (CCMAs) "likely to be affected by physical change to the shoreline through erosion, coastal landslip, permanent inundation or coastal accretion'" are glacial cliffs (Royal Haskoning 2019). Relocating coastal infrastructure from the base of cliffs or from cliff tops landward, to take account of erosion, rising sea levels and climate change may also represent further opportunities for habitat creation.

On 'hard' and 'intermediate' cliffs grazing management is key to re-creating maritime grassland and heath. There are many examples of restoration. A two-year study by Sawtschuk and others (2010, 2012) showed that by using a combination of restoration techniques it was possible to achieve natural vegetation recovery of degraded maritime cliff and slope habitat.

Booker and others (2018) and Bell and others (2019) provide examples of successful control of rats predating on seabird colonies.

Confidence: Moderate - High

4. Conclusions

4.1 Favourable range and distribution

The current natural range and distribution of maritime cliff and slope (see section 3.1) is the favourable range and distribution, with maritime cliff and slope being present in all the English sediment cells. The underlying geology, whether dominated by hard, intermediate or soft rock, defines the distribution of vegetation types.

4.2 Favourable extent

As described in Section 2.2 measuring extent of maritime cliff and slope is difficult and there is considerable variation in the published values. The PHI for maritime cliff and slope of 14,081.86 ha represents the best indication of the current area.

As a linear habitat, the length of cliff should be retained at approximately 1,084 km (based on Burden and others 2020). To achieve Favourable Conservation Status there should be an increase in the area. Losses associated with free functioning coastal processes such as erosion are acceptable but opportunities to extend the extent of cliff-top habitat should be sought to minimise this loss. The favourable area is the current area - 14,081.86 ha – plus the area identified by the Habitat Potential Mapping – 5,700 ha – giving a favourable area of 19,800 ha (figure rounded).

4.3 Favourable structure and function attributes

Favourable Conservation Status will be achieved when coastal processes can occur unhindered by human interventions; with a full variation of habitats and successional stages that are naturally present within each sediment cell. Full variation of habitats and successional stages means examples of vegetation types referable to the NVC communities described in Annex 1, along with examples of soft cliff vegetation described in Natural England (In Prep).

Structure and function attributes

The structure and function attributes for Favourable Conservation Status of maritime cliff and slopes and H1230 are based on those set out in Table 3. These are:

- Geomorphological naturalness: natural coastal processes occur.
- Presence of mosaic of microhabitats: the diversity and range of microhabitats and bare areas is determined by active coastal processes/ landslips. Open, bare ground which should be typically over 10% of the area for hard cliff sites and over 75% for soft cliff sites. Because of the unstable nature of this habitat this value is likely to fluctuate, but

the aim should be to ensure conditions prevail that allow newly exposed soils to be constantly produced.

- Vegetation community composition: the range of appropriate vegetation community types should be present. The diversity and number of community types present will depend on the cliff type. In many instances, sites may require management to maintain or restore the vegetation composition, while in others coastal processes will dictate the vegetation communities that develop.

- Undesirable species: there should be a low frequency and/or cover of undesirable (negative indicator) species, for example those that are characteristic of nutrient enrichment, and non-native invasive species.

- Key structural, influential, and distinctive species: presence determined by the environmental conditions.

- Regeneration potential: semi-natural vegetation whether on the cliff face or cliff top is maintained, through coastal processes and, where required through habitat creation and management. Key to this is to ensure there is sufficient space for natural cliff recession potentially through roll-back to help offset habitat losses caused by climate change, sea-level rise and coastal squeeze.

- Physical features supporting vegetation: the natural associated physical components of the vegetated cliff feature (crevices, ledges, isolated stacks) are present with changes to them determined by natural processes only.

- Hydrology/ drainage: at a site, unit and/or catchment level (as necessary) natural hydrological processes provide the conditions necessary to sustain the feature within the site.

- Maritime exposure including salt spray effects: exposure to maritime effects, such as salt spray, both from regular inputs and storm events depends on the proximity of the habitat to the sea, position relative to the prevailing wind direction and frequency of inputs from storm events.

- Water quality: Natural water chemistry and water nutrient status.

- Air quality: concentrations and deposition of air pollutants are at levels that enable the ecosystem to function naturally. Sources of atmospheric pollution should be at or below the site-relevant Critical Load or habitat Critical Level values. Jones and others (2016) note, however, that critical loads are not available for all habitat types including hard and soft maritime cliff communities. It is recommended that experimental or survey work is undertaken to establish these critical loads.

- Cliff morphology, slope and elevation: the natural processes that determine cliff morphology, slope and elevation are operating.

Patch size and connectivity

Average patch size of coastal maritime cliff and slopes should be maintained at 46.3 ha (or increased), to reflect the current range in patch sizes (Section 3.1).

Quality of habitat patches

At least 95% of the favourable area of the habitat meets the structure and function requirements as described above.

Threatened species

All species partially or wholly dependent on this habitat should be Least Concern, when assessed using IUCN criteria (or considered to be Least Concern if not formally assessed), as regards to this habitat.

Monitoring

Various ways of monitoring structure and function may be deployed, including vegetation surveys on the ground or using remote sensing techniques. The CSM guidance (JNCC 2004) sets out the attributes that need evaluation at site level following Favourable Condition Tables (FCTs) and Conservation Objectives. However, as noted in Table 3 there are several additional attributes that are important for maritime cliff and slope habitat, these are:

- Presence of a mosaic of microhabitats
- Regeneration potential
- Physical features supporting vegetation: crevices, ledges, isolated stacks etc;
- Hydrology/drainage
- Maritime exposure including salt spray effects
- Water quality
- Air quality
- Cliff morphology, slope and elevation
- Effects of climate change and sea level.

Specific survey methodologies should be followed to record the presence/populations of threatened species.

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Annex 1 SSSI Guidelines – Coastlands chapter 1a. Coastal Habitat Classification and selection unit recommendations

NVC code	Main (and	Community name or	NVC	Most relevant
H2	Maritime cliff and slope	*Calluna vulgaris-Ulex minor* heath	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
H4	Maritime cliff and slope	*Ulex galli-Agrostis curtsii*	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
H6	Maritime cliff and slope	*Erica vagans - Ulex europaeu*s heath	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
H7	Maritime cliff and slope	*Calluna vulgaris-Scilla verna* heath	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
H8	Maritime cliff and slope	*Calluna vulgaris-Ulex galli*i heath	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
MC1	Maritime cliff and slope	*Crithmum maritimum-Spergularia rupicola* maritime rock-crevice community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
MC2	Maritime cliff and slope	*Armeria maritima-Ligusticum scoticum* maritime rock-crevice community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
MC3	Maritime cliff and slope	*Rhodiola rosea-Armeria maritima* maritime cliff-ledge community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
MC4	Maritime cliff and slope	*Brassica oleracea* maritime cliff-ledge community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts

NVC code	Main (and other) coastal habitat type community occurs in	Community name or NVC sub-communities if relevant	NVC Volume	Most relevant Habitats Directive Annex I habitat type(s) associated with community
MC5	Maritime cliff and slope (*Coastal Vegetated Shingle*[6])	*Armeria maritima-Cerastium diffusum* ssp. *diffusum* maritime therophyte community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
MC6	Maritime cliff and slope (*Coastal Vegetated Shingle*[5])	Atriplex prostrata-Beta vulgaris ssp. maritima sea-bird cliff community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
MC7	Maritime cliff and slope	*Stellaria media-Rumex acetosa* sea-bird cliff community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
MC8	Maritime cliff and slope (*Coastal Vegetated Shingle*[7]*; machair)*	*Festuca rubra-Armeria maritima* maritime grassland	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks; H21A0 Machairs;
MC9	Maritime cliff and slope (*Machair*)	*Festuca rubra-Holcus lanatus* maritime grassland	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H21A0 machairs
MC10	Maritime cliff and slope (*Machair*)	*Festuca rubra-Plantago* spp. maritime grassland	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H21A0 machairs
MC11	Maritime cliff and slope	Festuca rubra-Daucus carota ssp. gummifer maritime grassland	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts

[6] Sneddon & Randall (1993)

[7] Sneddon & Randall (1993) and Ferry, Lodge & Waters (1990)

NVC code	Main (and other) coastal habitat type community occurs in	Community name or NVC sub-communities if relevant	NVC Volume	Most relevant Habitats Directive Annex I habitat type(s) associated with community
MC12	Maritime cliff and slope	*Festuca rubra-Hyacinthoides non-scripta* maritime bluebell community	Volume 5	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
MG5	Maritime cliff and slope (*Coastal Vegetated Shingle*)	*Cynosurus cristatus–Centaurea nigra* grassland	Volume 3	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
MG6	Maritime cliff and slope (*Machair*)	*Lolium perenne–Cynosurus cristatus* grassland	Volume 3	Not applicable
MG7	Maritime cliff and slope (*Machair*)	*Lolium perenne* leys and related grasslands	Volume 3	Not applicable
MG9	Maritime cliff and slope	*Holcus lanatus–Deschampsia cespitosa* grassland	Volume 3	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
S25	Maritime cliff and slope	*Phragmites australis–Eupatorium cannabinum* tall-herb fen	Volume 4	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
No NVC code	Maritime cliff and slope	*Tussilago farfara-Festuca rubra* community (new variation/gap at community level)[8]	No NVC code	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
No NVC code	Maritime cliff and Slope	*Phragmites australis, Phragmites australis-Calamagrostis epigejos - Equisetum telmateia, Phragmites australis - Equisetum telmateia* pioneer wetland types not described in National Vegetation Classification,	No NVC code	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts

[8] Rodwell and others (2000).

NVC code	Main (and other) coastal habitat type community occurs in	Community name or NVC sub-communities if relevant	NVC Volume	Most relevant Habitats Directive Annex I habitat type(s) associated with community
U4	Maritime cliff and slope (*Coastal Vegetated Shingle*[5])	*Festuca ovina - Agrostis capillaris - Galium saxatile* grassland offers the closest match.	Volume 3	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
U20	Maritime cliff and slope	*Pteridium aquilinum - Galium saxatile* community.	Volume 3	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
M13	Maritime cliff and slope	*Schoenus nigricans-Juncus subnodulosus* mire	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
M22	Maritime cliff and slope	*Juncus subnodulosus-Cirsium palustre* fen-meadow	Volume 2	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
W1	Maritime cliff and slope (*Coastal Vegetated Shingle*[6])	*Salix cinerea–Galium palustre* woodland	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
W2	Maritime cliff and slope	*Salix cinerea-Betula pubescens-Phragmites australis* woodland	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
W10	Maritime cliff and slope	*Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
W21	Maritime cliff and slope (*Coastal Vegetated Shingle*[5])	*Crataegus monogyna–Hedera helix* scrub	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
W22	Maritime cliff and slope (*Coastal Vegetated Shingle*[5])	*Prunus spinosa-Rubus fruticosus* scrub	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks

NVC code	**Main (and other) coastal habitat type community occurs in**	**Community name or NVC sub-communities if relevant**	**NVC Volume**	**Most relevant Habitats Directive Annex I habitat type(s) associated with community**
W23	Maritime cliff and slope (*Coastal Vegetated Shingle*[6])	*Ulex europaeus-Rubus fruticosus* scrub	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
W24	Maritime cliff and slope (*Coastal Vegetated Shingle*[6])	*Rubus fruticosus-Holcus lanatus* underscrub	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
W25	Maritime cliff and slope (*Coastal Vegetated Shingle*[5])	*Pteridium aquilinum-Rubus fruticosus* underscrub	Volume 1	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
CG1	Maritime cliff and slope (*Coastal vegetated shingle*)	*Festuca ovina-Carlina vulgaris* grassland	Volume 3	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
CG2	Maritime cliff and slope (*Coastal Vegetated Shingle*[5])	Festuca ovina-Avenula pratensis grassland	Volume 3	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; H1220 Perennial vegetation of stony banks
A5	Maritime cliff and slope	*Ceratophyllum demersum* community	Volume 4	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
A9	Maritime cliff and slope	*Potamogeton natans* community	Volume 4	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts

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Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected, and England's traditional landscapes are safeguarded for future generations.

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Citation

Louise Denning. 2023. Definition of Favourable Conservation Status for Maritime cliff and slope. RP2961. Natural England.

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Catalogue code: RP2961

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