Indicators and trends

Monitoring climate change adaptation

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Indicator name				Version
NB10b: Extent of key semi-natural habitats: coastal habitats				**29/04/16**
Indicator type:	**Risk/opportunity**	**Impact**	**Action**	
	X			

SCCAP Theme	SCCAP Objective	CCRA risk/opportunity
Natural Environment	N2: Support a healthy and diverse natural environment with capacity to adapt	Cross-cutting

At a glance

- Scotland's coastline is extensive and diverse; in many areas coastal habitats are of exceptionally high quality.
- Scotland's coastal habitats are particularly noted for their extensive dune systems including machair, one of the rarest habitats in Europe and found only in Scotland and Ireland.
- Coastal habitats provide a range of ecosystem services of significant benefit to the economy and society, including carbon sequestration, flood protection and seascapes supporting tourism.
- Coastal habitats are particularly sensitive to climate change, as they are subject to changes in rainfall, temperature and storminess as well as coastal erosion and sea-level rise.
- This indicator measures the extent of coastal habitats in Scotland, and reports on the five coastal priority habitat types recognised by the UK Biodiversity Action Plan.

Latest Figure

UK BAP priority habitats	Estimated Extent
Coastal sand dunes (including machair)[1]	50,000 ha
Coastal saltmarsh[2]	7,704 ha
Coastal vegetated shingle[3]	1,120 ha
Maritime cliff and slopes[1]	1,778.5 km
Machair[1]	18,452 ha

Source:
1. SNH: Ellis & Munro, 2004
2. SNH: Haynes, 2016
3. SNH: Murdock et al 2011; 2014

Trend

UK BAP priority habitats	Trend
Coastal sand dunes	Trend unknown
Coastal saltmarsh	Trend equivocal
Coastal vegetated shingle	Trend unknown
Maritime cliff and slopes	Trend unknown
Machair	Trend equivocal

Source: Jones et al, 2011

Why is this indicator important?

Scotland's coastline is extensive (about 18,000km) and, as a result of geology, glaciation and large variation in tidal range and wave exposure, exceptionally diverse. It also contains over 790 islands. The relative lack of development in areas such as the Highlands and Islands means that many coastal habitats are in an outstanding condition (Ellis & Munro, 2004).

Scotland's coastal habitats are particularly noted for their extensive dune systems including machair which is found only in Scotland and Ireland and is one of the rarest habitats in Europe. Much of Scotland's machair is now internationally recognised for its conservation importance, and is included in Natura 2000, the EU network of protected areas under the Habitats Directive (H.R. Wallingford, 2012). Scotland's coastline is also noted for its salt marshes which are structurally and biologically distinct from those in England (Ellis & Munro, 2004).

Coastal habitats provide a range of ecosystem services of significant benefit to the economy and society, including carbon sequestration, flood protection and seascapes that support tourism (Jones et al, 2011). The total value of the ecosystem services provided by the UK's coast is estimated at £48 billion (adjusted to 2003 values). The ecosystem services of greatest financial value are tourism and leisure (cultural) and coastal defence (regulating), but the relative importance of these services differs according to location (ibid).

Climate change will impact coastal habitats in a number of ways. Sea level rise will cause inundation, accelerated erosion, more frequent and extensive flooding and saline intrusion. The ability of coastal habitats to provide sea defence will come under increasing pressure (Ellis & Munro, 2004). The dynamic, natural state of coastal margin habitats that supports their rich biodiversity depends on the key natural processes of supply and transport of sediment. The supply of sediment may be affected by sea level rise and coastal erosion; this may be either positive or negative subject to the local context. In either case, there will be an impact on the extent or character of habitats necessitating a management response (Jones et al, 2013).

This indicator measures the extent of coastal habitats in Scotland, and reports on the five coastal priority habitat types recognised by the UK Biodiversity Action Plan: 1) coastal sand dunes, 2) coastal saltmarsh, 3) coastal vegetated shingle, 4) maritime cliff and slopes, and 5) machair.

Related indicators:
NB10a Extent of key semi-natural habitats: terrestrial
NB11 Extent of key habitats: deep peat

What is happening now?

UK BAP priority habitats	Extent (best estimate)	Source	Alternative estimate	Source
Coastal sand dunes (includes machair)	50,000 ha	SNH: Dargie, 2000 (Ellis & Munro, 2004); BARS		
Coastal saltmarsh	7,704 ha	SNH: Haynes, 2016	7,766 ha	SNH: Burd (1989) plus SNH knowledge (Ellis & Munro, 2004)
			6,000 ha	BARS (2003): Partial survey; most area-based and vegetation data from 1980s (The National Archives, 2011)
			6,567 ha	Posford Duvivier Environment, 1998 (Ellis & Munro, 2004)
Coastal vegetated shingle*	1,120 ha	SNH: Murdock et al, 2011; Murdock et al, 2014	2,045 ha plus 700km	BARS (2005): Mix of data in length and hectares; incomplete survey except for Solway (The National Archives, 2011)
			670 ha plus 162.5 km	Ellis & Munro, 2004: amalgamated from various surveys
Maritime cliff and slopes	1,778.5 km	SNH: Posford Duvivier Environment, 1998	2,372 km	BARS (Pre-1995): Partial survey, from Coasts & Seas of the UK (JNCC publication) (The National Archives, 2011)
Machair*	18, 452 ha	SNH: Dargie, 2000 and Angus (Ellis, 2004)	19,698 ha	Dargie, 2000 (Ellis, 2004)
			14,500 ha	3rd UK Habitats Directive Report (JNCC, 2013)

Table 1 Estimated extent of coastal priority habitat types

Table 1 shows the estimated extent of the five coastal priority habitat types in Scotland (with UK figures for comparison) recognised by the UK Biodiversity Action Plan.

Data on the extent of coastal habitats is compiled from a variety of sources, and differing definitions

or classifications of habitats (Jones et al, 2011). Therefore there are still significant knowledge gaps for some habitats. Alternative estimates are also included in Table 1 where available.

Coastal sand dunes: 50,000 ha
The sand dune vegetation survey of Scotland (Dargie, 1997-2000) included both coastal sand dune and machair. Some known small areas of sand dunes were not included (Ellis & Munro, 2004).

Coastal salt marsh: TBA
From 2010-2012 all known saltmarshes larger than 3 hectares were surveyed across the Scottish mainland and islands, compiling the first comprehensive national survey of this habitat. All saltmarsh and brackish swamp has been mapped using the National Vegetation Classification (Haynes, 2016).

Coastal vegetated shingle: 1,120 ha
Due to the lack of comprehensive data on the extent of coastal vegetated shingle in Scotland, Scottish Natural Heritage (SNH) commissioned an inventory to draw together existing data, supported by field validation work across a number of sites (Murdock et al, 2011; Murdock et al, 2014).

Maritime cliff and slopes: 1,778.5 km
There are uncertainties in existing data. The estimate produced by Posford Duvivier Environment (1988, in Ellis & Munro, 2004) correlates well with OS 1:50,000 maps however it does not include some known cliff areas, e.g. on the Berwickshire coast (Ellis & Munro, 2004). The current estimate of 1,778.5 km accounts for just under 10% of Scotland's total estimated coastline.

Machair: 18,452 ha
The estimated extent of machair is from an unpublished dataset held by Stewart Angus, based on Dargie's (2000) Sand Dune Vegetation Survey of Scotland. Accurate and consistent measurement of machair is difficult because of the difficulty of classifying machair habitat at the edges of its range (Ellis & Munro, 2004).

What has happened in the past?

It is difficult or impossible to identify trends for coastal habitats due to the limitations of existing data detailed above. The trends shown in Table 2 are identified for coastal habitats in Scotland in the UK National Ecosystem Services Assessment:

Habitat type	Trend
Coastal sand dunes	Trend unknown
Coastal saltmarsh	Trend equivocal
Coastal vegetated shingle	Trend unknown
Maritime cliff and slopes	Trend unknown
Machair	Trend equivocal

Table 2 Trends in extent of coastal priority habitat types

Source: Jones et al, 2011.

At a UK level, 'coastal margin habitats have declined by an estimated 16% since 1945 due to development and coastal squeeze, but this is poorly quantified. All habitats have been affected by coastal development for industry, housing and tourism. Sand Dunes and Saltmarsh have also been affected by agricultural development (including forestry). Although the introduction of greater statutory protection in the 1980s has slowed the rate of loss and fragmentation of many sites, coastal margin habitats are still being lost today.' (Jones et al, 2011).

The Third UK Habitats Directive Report (JNCC, 2013) states that no trends were identified in the extent of machair for the period 1987 to 2012.

What is projected to happen in the future?

Sea level rise and climate change, together with pollution and continued development pressures, present a major threat to our coastal margins in the coming decades. Vulnerability to such threats is increased by the linear nature of the habitat; it is subjected to pressure from every side (Jones et al, 2011). Climate change therefore impacts them not only through changes in temperature, rainfall and the frequency and severity of storms, but also through sea level rise and coastal erosion (Jones et al, 2013). Increased frequency of gales and storm surges may also change the structure of coastal habitats (Ellis & Munro, 2004).

Coastal erosion is currently occurring on about 12% of the Scottish coastline, one of the lowest levels in Europe (H.R. Wallingford, 2012); however changes in rates of erosion and accretion may lead to habitat loss, particularly where landward migration of sand dunes and salt marshes is constrained by coastal defence structures and other development (coastal squeeze). Coastal erosion is a particular problem for Scotland's inner and developed firths that are composed of soft coastlines and rare habitats (Ellis & Munro, 2004). The composition and range of shallow marine habitats may therefore change as sea levels increase.
Future losses will increase throughout the UK as storm erosion events increase in magnitude and sea-level rise further outstrips isostatic readjustment.

Appropriate management may enhance both biodiversity and other ecosystem services. Sustainable management options include:

- Allowing Coastal Margin habitats room to migrate inland with rising sea levels in order to mitigate coastal squeeze ('managed realignment').
- Managing sediment supply by allowing erosion to contribute new sediment to the coast, and allowing natural transport processes to proceed where possible.

Maintaining or encouraging natural formation of early successional habitats where these are threatened or have disappeared (Jones et al, 2011).

Limitations

Major knowledge gaps remain regarding the extent of Scotland's coastal habitats (Jones et al, 2011). There is a lack of standardised information, with multiple estimates using different methodologies and definitions of habitat types. Some habitats, such as sand dunes, saltmarsh and machair, are highly dynamic and their extent will vary significantly, for example seasonally (Angus, S., personal communication. 22 July 2015). SNH is developing a Habitat Map of Scotland (one of the objectives of the 2020 Challenge for Scotland's Biodiversity, part of the Scottish Biodiversity Strategy). This will

bring together all the habitat information available for Scotland, with habitats classified by the European Nature Information System (EUNIS)[1]. The complete map will be available by 2019 (SNH, 2015). Provided this data is updated regularly, e.g. reporting for the EU Habitats Directive, the 2019 Habitat Map should provide a baseline against which to measure future trends.

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Further information

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Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	Extent of key semi-natural habitats: coastal habitats
Indicator contact: Organisation or individual/s responsible for the indicator	Ruth Monfries, Royal Botanic Garden Edinburgh/CXC
Indicator data source	Biodiversity Action Reporting System (BARS). Various surveys and estimates, collated in the SNH Commissioned Report No. 44. *A preliminary review of the condition and extent of BAP priority habitats across Scotland* (Ellis & Munro, 2004)
Data link: URL for retrieving the indicator primary indicator data.	http://jncc.defra.gov.uk/page-5379-theme=default http://www.snh.org.uk/pdfs/publications/commissioned_reports/F00NA02.pdf

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	
Frequency of updates: Planned or potential updates	Uncertain; depends on UK reporting requirements for the EU Habitats Directive
Spatial coverage: Maximum area for which data is available	Scotland
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	There remains a lack of strong data on the extent and trends of coastal habitats in Scotland, except for Vegetated Shingle.
Spatial resolution: Scale/unit for which data is collected	Hectare
Categorical resolution: Potential for disaggregation of data into categories	By priority habitat types and, for some habitats, by geographical region
Data accessibility: Restrictions on usage, relevant terms & conditions	Publically accessible and free of charge

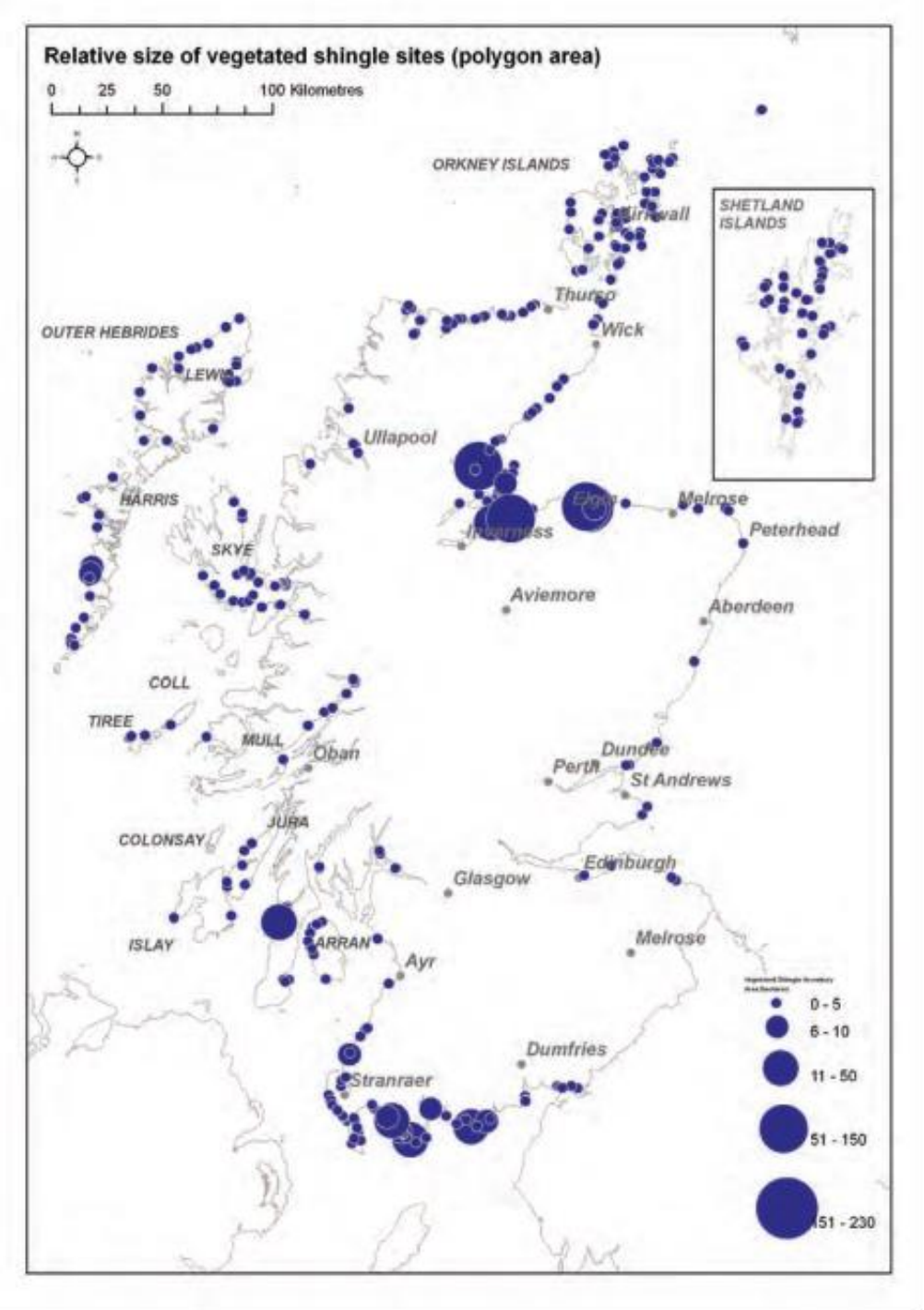
Table 3 Contributing data sources

Contributing data sources Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.
Biodiversity Action Reporting System (BARS). http://jncc.defra.gov.uk/page-5379-theme=default

Table 4 Indicator methodology

Indicator methodology The methodology used to create the indicator data
Inventory of vegetated shingle: This initial inventory draws principally on the Sneddon and Randall Surveys of the 1990s (Sneddon and Randall, 1993), but also upon more localised studies for the Solway coast and from NVC and Phase 1 habitat data. The assessment of the remaining coastline was guided by Scottish Natural Heritage's shingle (substrate not vegetation) database and through aerial photography and field validation.

Appendix Two: Map showing size and distribution of vegetated shingle in Scotland



Source: Murdock et al, 2001.