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# The National Coastal Change Assessment

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## Synopsis:

Before the NCCA, the Scottish Government, its public bodies and Local Authorities had no national overview of the risks from, or resilience to, coastal erosion. The NCCA has collated the first national evidence base for changes to our soft coast between the 1890s, 1970s and the modern shoreline.

Over 3,000 georectified maps have been compared via 2 million data points along Scotland's soft coast. Together with the OS we have revised their modern maps, some of which hadn't been updated in decades. It is now possible to see how the coast has changed over the last 130 years via publicly-available web-maps at dynamiccoast.com.

NCCA also comprises 11 reports which identify key coastal changes and a National Overview considers the erosion footprint and coincident assets to enable integrated assessments for mitigation and adaptation.

NCCA incorporated research findings on the inherent erodibility of the coastal zone (Fitton, et al., 2016), to improve our understanding of risk and resilience. Whole coast assessment has identified the proximity of coastal assets to provide greater context to vulnerability assessments.

For the first time, NCCA allows coastal erosion and flood risk to be considered together, to support wider improvements in Flood Risk Management alongside strategic whole coast planning assessments.

## Methods:

High Water Mark of Ordinary Spring Tides in the 1890s and Mean High Water Springs from the 1970s and Modern data have been compared. The scale and rates of coastal change have been quantified nationally.

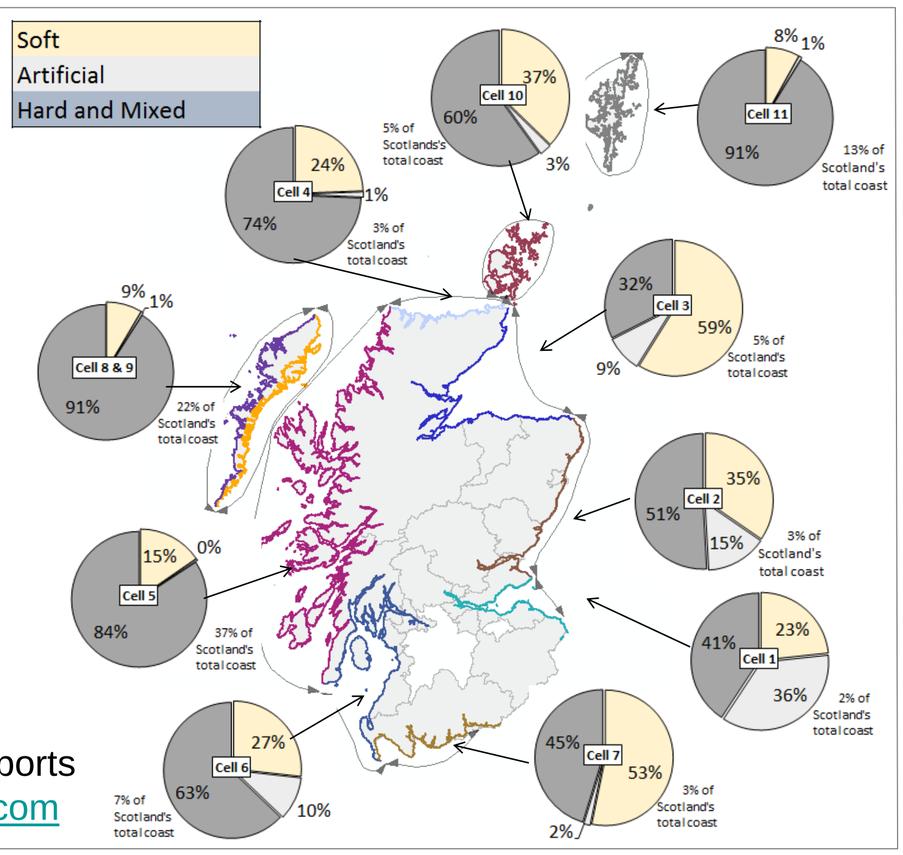
Where erosion is significant (i.e. greater than 10 m or faster than 0.5myr) the recent rate has been projected landward to consider which assets are at increased risk, should change past rates continue. See Vulnerability Assessment.

To appreciate the distribution of assets around the entire coast, a Whole Coast Assessment was carried out to intersect asset data (Roads, Rail, Houses & Designated Sites) with various coastal types and rates of erosion.

## Results:

Coastal Type
- Hard & Mixed
- Soft (erodible)
- Artificial

Categorised by air photos to enable analysis to concentrate on dynamic shores.




More results & reports at dynamiccoast.com

## Erosion & Flooding

For the first time erosion and flood risk can be considered together.

The NCCA provides intelligence on change for flood maps, informs an update schedule of surveys, and informs the benefit provided by enhanced or reduced protection offered by natural structures.

By understanding coincident assets, NCCA informs joint solutions and empowers Flood Risk Management, informs Shoreline Management Plans, Local Development Plans & National / Local Marine Plans.

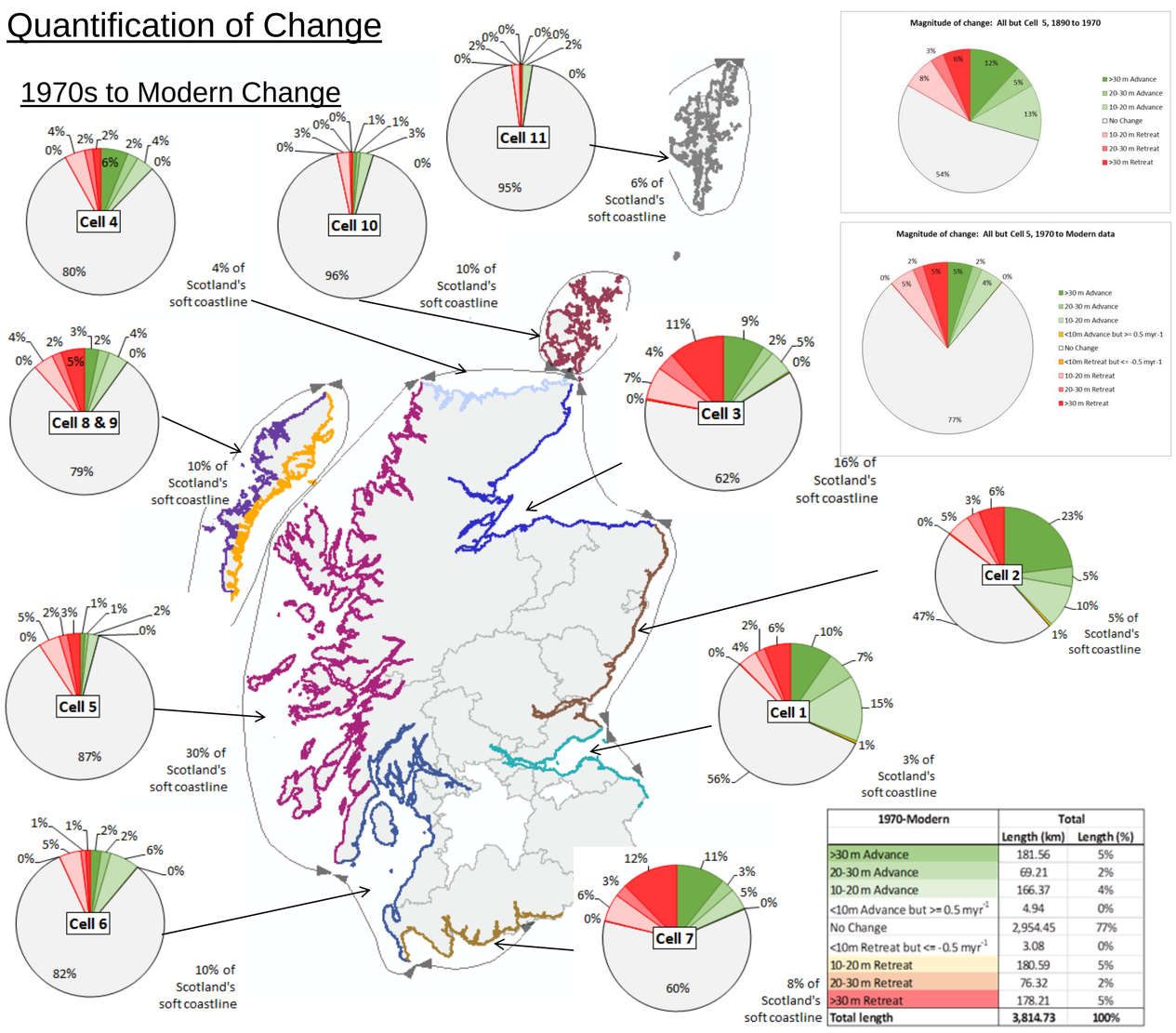
## Results:

### Whole Coast Assessment *e.g. 202km of roads lie within 10m of MHWS*

| Asset / Receptor | Unit | National | 100m All | 100m Hard & Mixed | 100m Soft | 100m Artificial | 100m erodable (UPSM40+) | 50m All | 50m Hard & Mixed | 50m Soft | 50m Artificial | 50m erodable (UPSM40+) | 10m All | 10m Hard & Mixed | 10m Soft | 10m Artificial | 10m erodable (UPSM40+) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Airport | | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Community Serv. | | 10,847 | 194 | 106 | 59 | 29 | 101 | 75 | 47 | 19 | 9 | 43 | 1 | 1 | 0 | 0 | 0 |
| Non Residential Property | # | 336,648 | 18,005 | 8,587 | 4,569 | 4,849 | 10,260 | 8,895 | 4,353 | 2,221 | 2,321 | 4,914 | 433 | 174 | 94 | 165 | 236 |
| Residential Prop | | 2,513,029 | 57,720 | 3,062 | 17,944 | 16,714 | 35,583 | 23,943 | 9,874 | 6,815 | 7,254 | 14,602 | 394 | 97 | 100 | 197 | 292 |
| Septic Water Tanks | | | 3,011 | 1,768 | 1,197 | 46 | 1,199 | 1,641 | 953 | 663 | 25 | 722 | 342 | 206 | 128 | 8 | 170 |
| Utilities | | 28,053 | 830 | 371 | 232 | 227 | 457 | 306 | 135 | 78 | 93 | 179 | 23 | 9 | 6 | 8 | 13 |
| Rail | | 2,967 | 159 | 43 | 88 | 27 | 125 | 101 | 26 | 57 | 18 | 59 | 14 | 2 | 9 | 3 | 8.8 |
| Roads | km | 42,294 | 2,789 | 1,495 | 1,059 | 235 | 2,005 | 1,694 | 934 | 630 | 130 | 746 | 202 | 111 | 72 | 18 | 89 |
| Clean Water Network | | | 1,809 | 970 | 608 | 232 | 836 | 921 | 504 | 300 | 118 | 444.8 | 86 | 49 | 21 | 15 | 40.49 |
| Cultural Heritage | | 110,161 | 2,085 | 921 | 931 | 233 | 1,013 | 1,000 | 466 | 426 | 108 | 507 | 127 | 59 | 53 | 15 | 69 |
| Environment | | 2,555,908 | 43,090 | 27,698 | 15,178 | 214 | 14,406 | 23,631 | 14,987 | 8,506 | 138 | 8,594 | 4,049 | 2,458 | 1,549 | 42 | 1,729 |
| SEPA 200yr | | | 23,441 | 10,686 | 11,646 | 1,109 | 12,426 | 19,121 | 9,971 | 8,427 | 723 | 9506 | 8,870 | 5,642 | 2,977 | 251 | 3,836 |
| SEPA 1000yr | | | 25,560 | 11,690 | 12,626 | 1,245 | 13,545 | 20,678 | 10,834 | 9,045 | 799 | 10,237 | 9,262 | 5,910 | 3,084 | 268 | 3,982 |
| Runway | | 692 | 14 | 0 | 11 | 3 | 11 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Battlefields | | | 607 | 89 | 211 | 306 | 230 | 154 | 21 | 79 | 54 | 116 | 29 | 4 | 10 | 15 | 22 |
| Gardens of Designed Lanscape | ha | | 1,154 | 531 | 574 | 49 | 509 | 559 | 263 | 273.36 | 23 | 0 | 99 | 47 | 48 | 4 | 2 |
| Properties in Care | | | 50 | 22 | 26 | 2 | 23 | 27 | 13 | 14 | 1 | 12 | 4 | 2 | 2 | 0 | 0 |
| Scheduled Monuments | | | 849 | 505 | 327 | 17 | 331 | 475 | 293 | 171 | 11 | 190 | 85 | 50 | 33 | 2 | 39 |
| Marine Protected Areas | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| National Nature Reserves | | | 1,584 | 1,084 | 499 | 0 | 534 | 875 | 589 | 286 | 0 | 331 | 185 | 121 | 64 | 0 | 78 |
| Special Areas of Conservation | | | 8,650 | 5,689 | 2,932 | 29 | 3,121 | 4,919 | 3,201 | 1,702 | 17 | 1,908 | 1,065 | 678 | 382 | 4 | 441 |
| Sites of Special Scientific Interest | | | 22,314 | 15,189 | 7,044 | 82 | 6,925 | 13,007 | 8,791 | 4,165 | 50 | 4,367 | 2,857 | 1,894 | 950 | 13 | 1,071 |

### Quantification of Change

#### 1970s to Modern Change










| 1970-Modern | Total | |
|---|---|---|
| | Length (km) | Length (%) |
| >30 m Advance | 181.56 | 5% |
| 20-30 m Advance | 69.21 | 2% |
| 10-20 m Advance | 166.37 | 4% |
| <10m Advance but >= 0.5 myr$^{-1}$ | 4.94 | 0% |
| No Change | 2,954.45 | 77% |
| <10m Retreat but <= -0.5 myr$^{-1}$ | 3.08 | 0% |
| 10-20 m Retreat | 180.59 | 5% |
| 20-30 m Retreat | 76.32 | 2% |
| >30 m Retreat | 178.21 | 5% |
| Total length | 3,814.73 | 100% |

### Vulnerability Assessment.

NCCA identifies where, and how much, erosion is anticipated; establishes what the coincident assets are; and empowers integrated approaches to risk management for development of joint mitigation and adaptation plans.

| | Coincident assets / factors | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Assets etc at risk from erosion | Airports | Buidings | Roads | Rail | Fresh Water Network | Septic Water | Cultural Heritage | Natural Heritage | Flood risk | PVA | Examples |
| Airports | | - | - | - | - | - | - | xx | xxx | - | Islay & Benbecual Airport |
| Buidings | - | | - | - | x | - | x | x | xxx | xx | Southeness (Solway) |
| Roads | - | - | | - | - | - | x | xx | xxx | - | Strone Point (Clyde), Monifieth (Tay), Balephetrish Bay (Tiree) |
| Rail | - | - | - | | - | - | - | - | xxx | - | Corpach (Loch Linnhe), Brora (Moray Firth) |
| Fresh Water Network | - | x | xxx | - | | - | x | - | xxx | xx | Broughty Ferry (Tay), Toward (Clyde), Elie (Fife), Inellan (Clyde) |
| Septic Water | - | xxx | xx | - | - | | - | xx | xxx | xxx | Corpach (Loch Linnhe), Western Isles Orkney, Wemyss (Fife) |
| Cultural Heritage | - | x | x | - | - | - | | xxx | xxx | xx | Dysart, St Andrews & Wemyss (Fife), Dalmeny (Forth), Dunrobin (Moray) |
| Natural Heritage | - | - | - | - | - | - | x | | xxx | xx | Solway, Culbin Sands & Dornoch (Moray), Tiree, |
| Flood risk | - | - | x | - | - | - | x | xxx | | x | Solway, Uists, Culbin Sands & Golspie (Moray Firth), Barry Links (Tay) |
| PVA | - | xxx | x | - | xx | - | x | xx | xxx | | Southerness (Solway), Prestonpans (Forth), Broughty Ferry (Tay) |
| Key | - no coincident | | | | | | xx often coincident | | | | |
| | x some coincidence | | | | | | xxx high coincidence | | | | |

## Conclusions:

- Across Scotland 12% of soft coast is erosional, 11% accretional and 77% stable since the 1970s.
- Within some coastal cells there is an as increased in extent of erosion since the 1970s (Cell 1, 2, 3 & 11 i.e. east coast & Shetland).
- Within many coastal cells there is a reduction in the extent of accretion since the 1970s (Cell 1, 2, 3, 4, 6, 7, 8&9,10 & 11).
- All Scottish shores have assets at risk, often with coincident assets, so integrated management approaches are urgently needed.
- Next steps are to inform National Flood Risk Management Assessment 2; FRM Act Sect.19 (resilience of natural flood protection structures); and Mitigation & Adaptation Plans for Cultural and Natural Heritage interests.

## References:

Fitton, Hansom & Rennie, 2016 A national coastal erosion susceptibility model for Scotland. Ocean & Coastal Management. 132:80-89