Scotland's Dynamic Coast – The National Coastal Change Assessment

www.dynamiccoast.com

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Please click …

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to view full screen.

Driver for the research: ***We didn't have answers or evidence to these questions***

- Knowledge gap

  "What is the extent and location of the eroding and potentially erodible coastline in Scotland?"

  "What is the extent and rate of coastal change over time?"

  "Where are the vulnerable areas of coast?"

  "What social, economic and cultural heritage assets may be effected?"

- Policy implementation gap

  "How can we use and improve the policy mechanisms to increase society's resilience."

  "How can we maximize benefits with minimum costs"

…so what are the key policies?

3

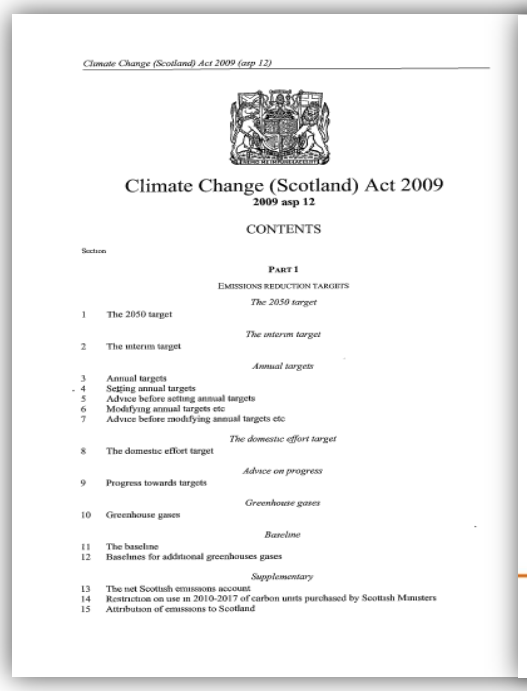
Climate Change Act (2009)

Places a duty on Scottish Government to address the risks in UK CCRA via the Climate Change Adaptation Programme

"Clear leadership …. and clear duties!"

Flood Risk Management Act (2009)


(Scottish Cabinet)


Climate Change (Scotland) Act 2009 (asp 12)

Climate Change (Scotland) Act 2009
2009 asp 12

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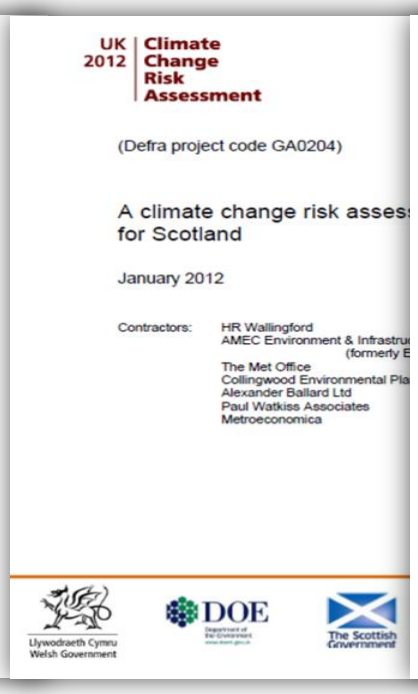

UK 2012 Climate Change Risk Assessment

(Defra project code GA0204)

A climate change risk asses
for Scotland

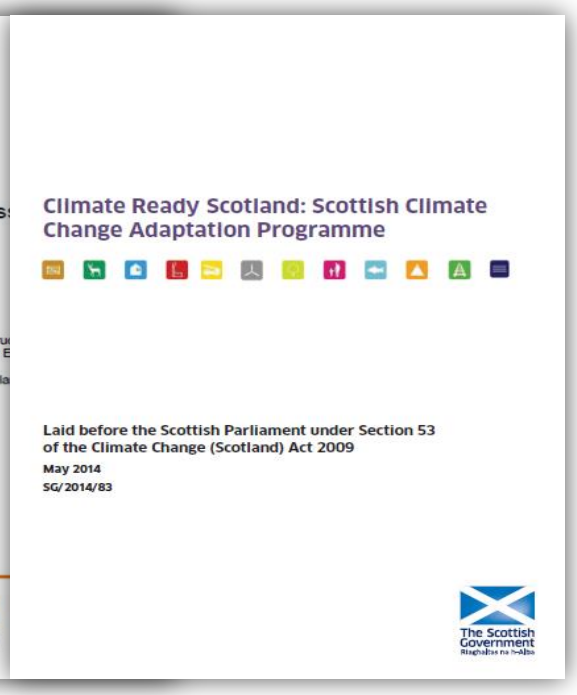
January 2012

Contractors: HR Wallingford
AMEC Environment & Infrastru
(formerly E
The Met Office
Collingwood Environmental Pla
Alexander Ballard Ltd
Paul Watkiss Associates
Metroeconomica

Llywodraeth Cymru Welsh Government

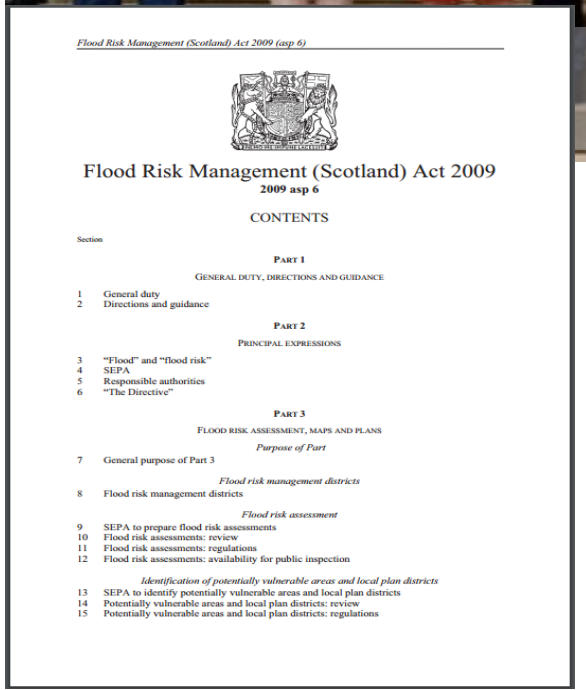
DOE

The Scottish Government


Climate Ready Scotland: Scottish Climate Change Adaptation Programme

Laid before the Scottish Parliament under Section 53 of the Climate Change (Scotland) Act 2009
May 2014
SG/2014/83

The Scottish Government


Flood Risk Management (Scotland) Act 2009 (asp 6)

Flood Risk Management (Scotland) Act 2009
2009 asp 6

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4

What is expected …

- rising sea level, more coastal erosion and associated increases in coastal flooding to increasingly affect Scotland's soft coastlines, its assets and its communities.
- maps of past erosion, current state and future erosion conditions are required.
- put in place Adaptive Measures for our natural & cultural heritage
- consider implications of coastal erosion for all of Scotland's assets

(UK CC RA & SCCAP)

Scotland's National Coastal Change Assessment

December 2014 to March 2017

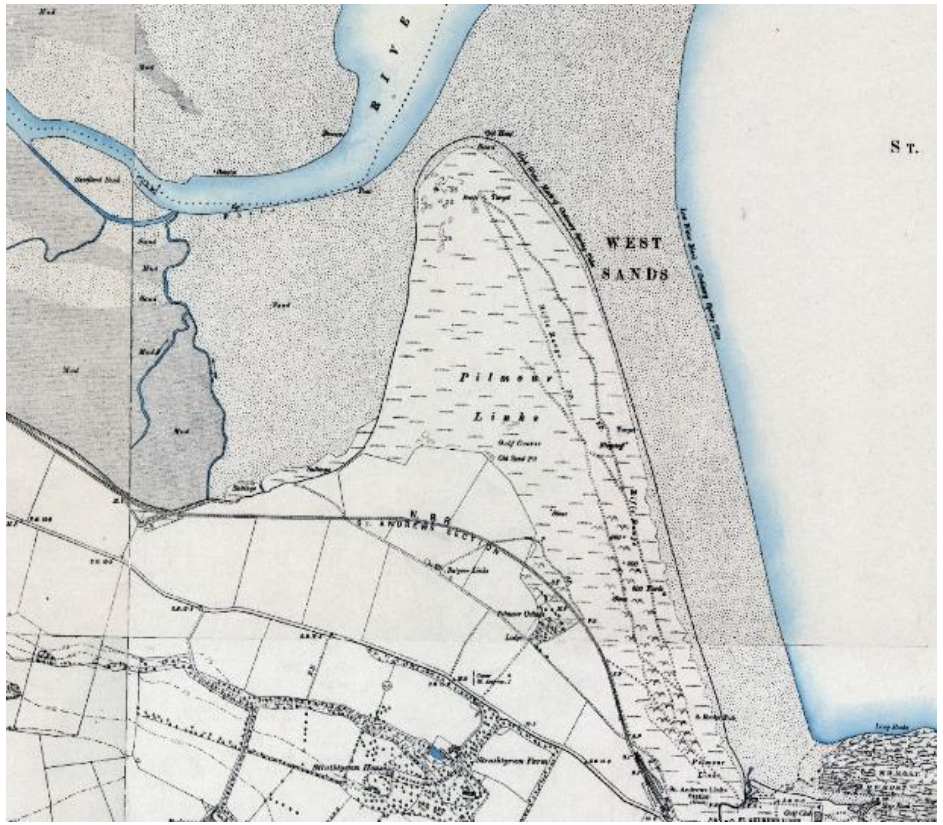
www.dynamiccoast.com

(Steering Group)

(Funder)

How do we appreciate past erosion?

- Compare geo-rectified historical and modern mapping, to allows past rates of change to be established
- The recent rates are projected forward to consider future implications
- Past ≠ Future? But it is least likely to be challenged legally
- This underpins Shoreline Management Plans (where they exist). But projected erosion only extends within erodible land.



(St Andrews)

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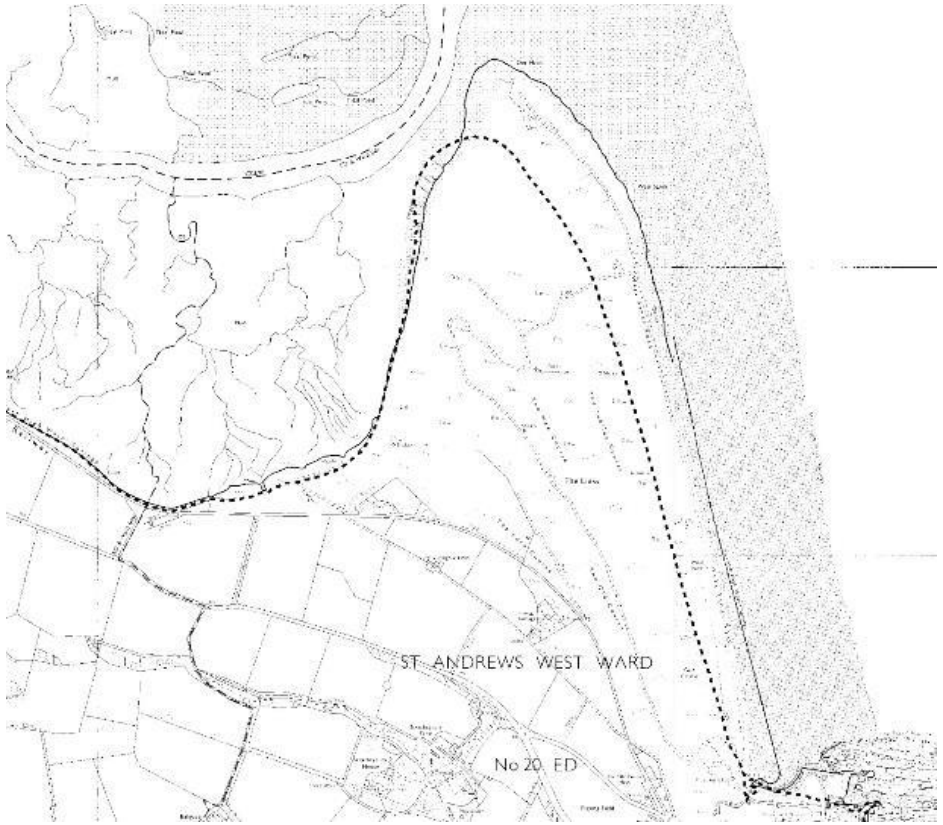

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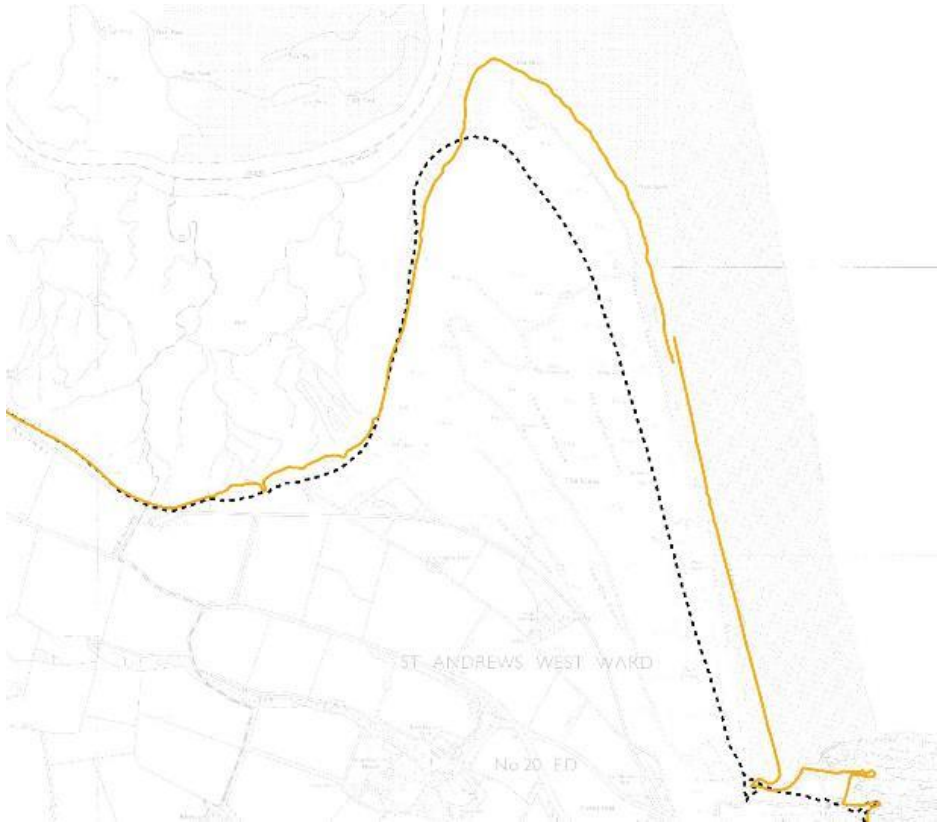

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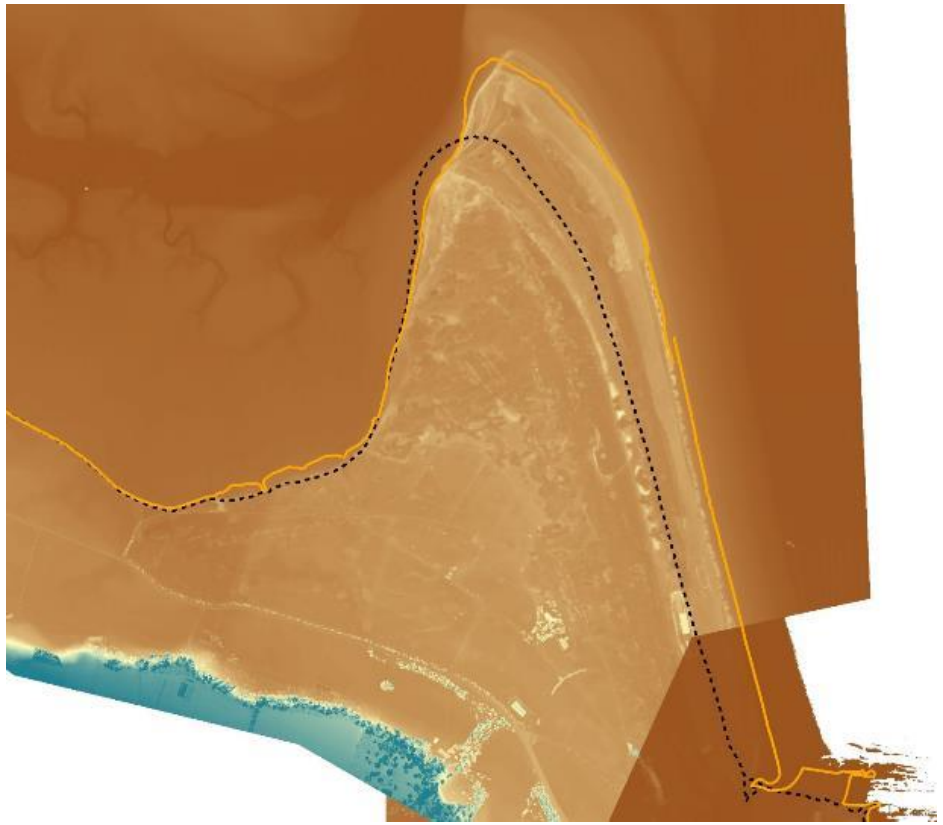

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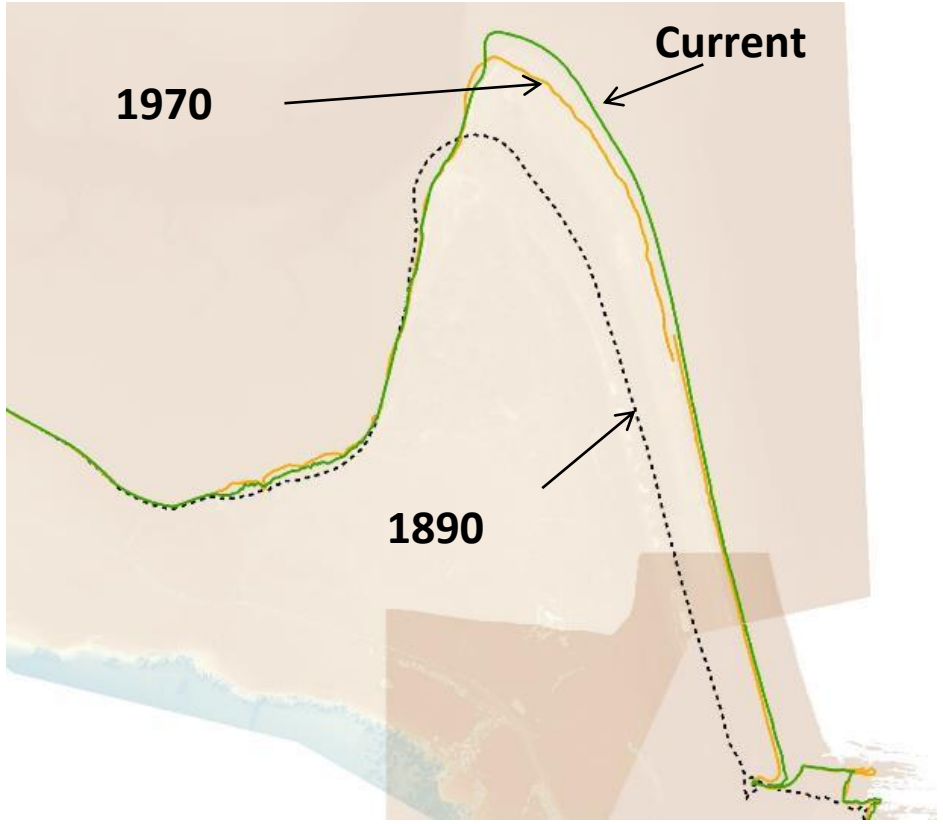

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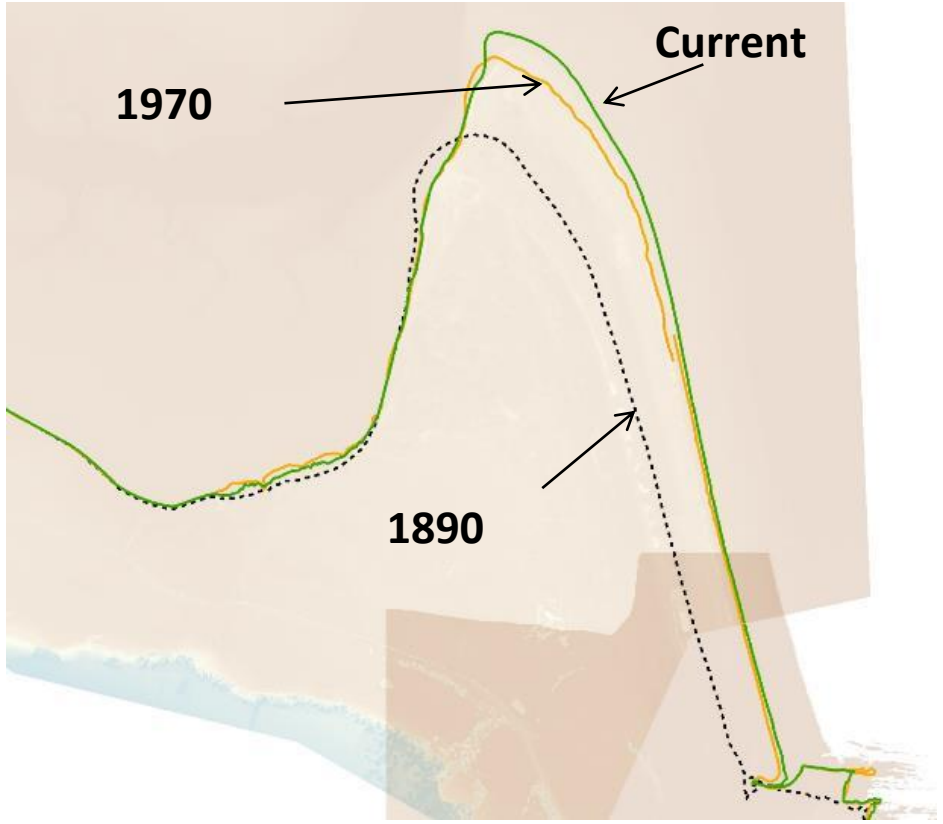


(St Andrews)

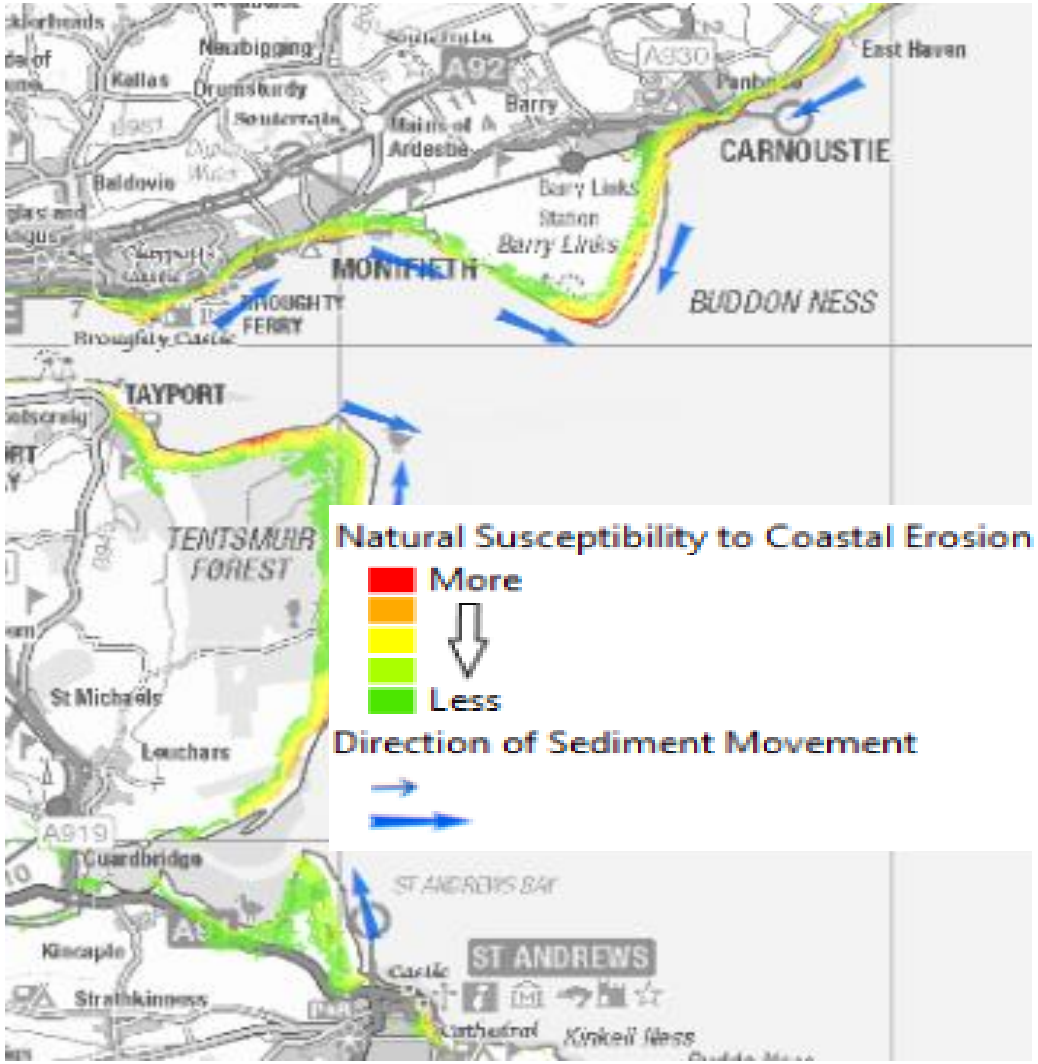
Coastal Erosion Susceptibility Model

- *'inherently susceptible to erosion'*
  - surface altitude,
  - rock head altitude,
  - coastal proximity,
  - wave exposure,
  - sediment supply.

- Available on SEPA's website

  http://map.sepa.org.uk/floodmap/map.htm

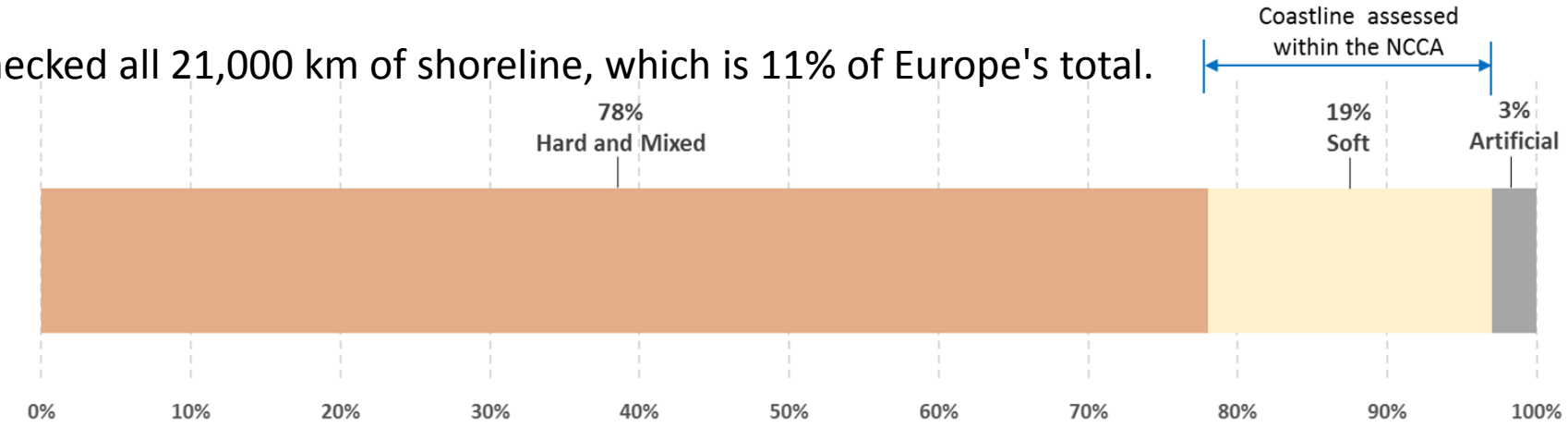
- **For more info see poster session**



(SEPA's flood maps, Uni of Glasgow & SNH research. Funded by Crew)

Complexities

- Where is the soft coast? …. We checked all 21,000 km of shoreline, which is 11% of Europe's total.



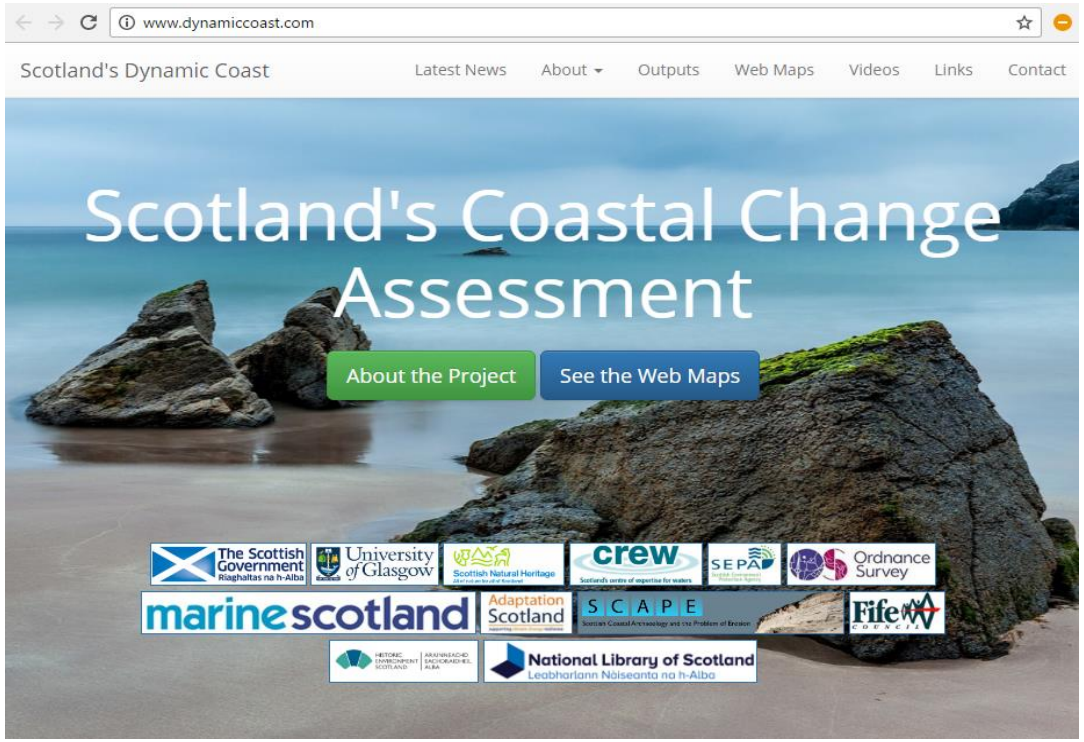
- Is the OS mapping right? …. We checked all 4,000 km of soft coast.

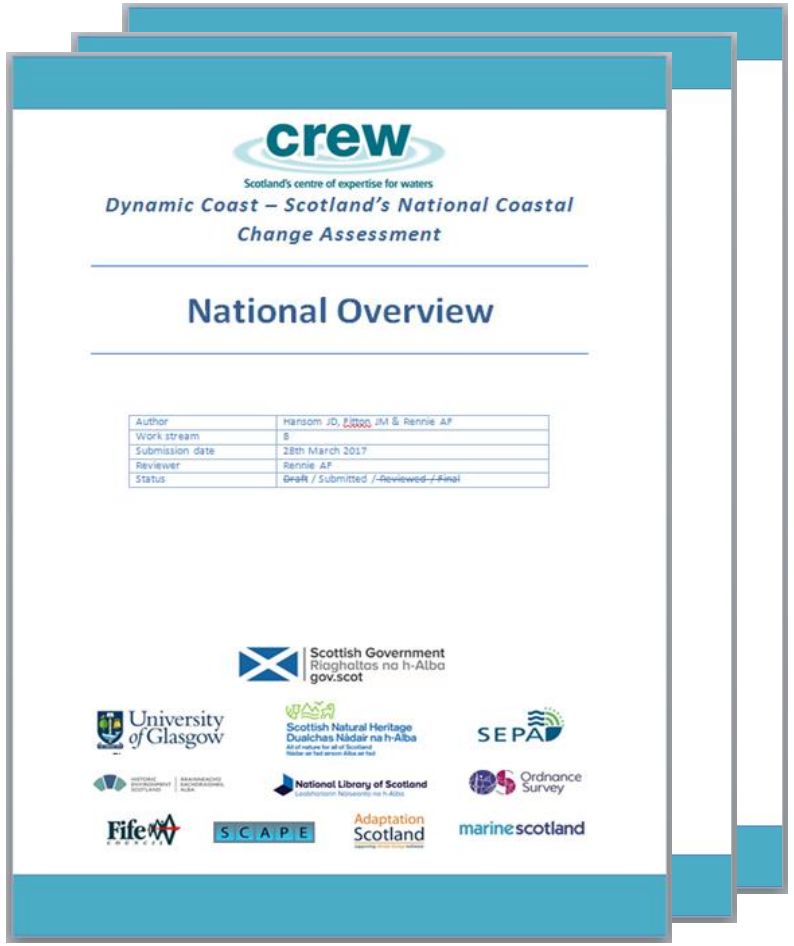
  …. Some was out of date, but it has been re-flown. Progress continues 17% soft

- We've used LiDAR to update MHWS, which will be incorporated within OS data.
- Terabytes of data analyzed to appreciate our dynamic coast at a level of detail never achieved before
- 50 project partners … *'all of society's interests'* …. ?

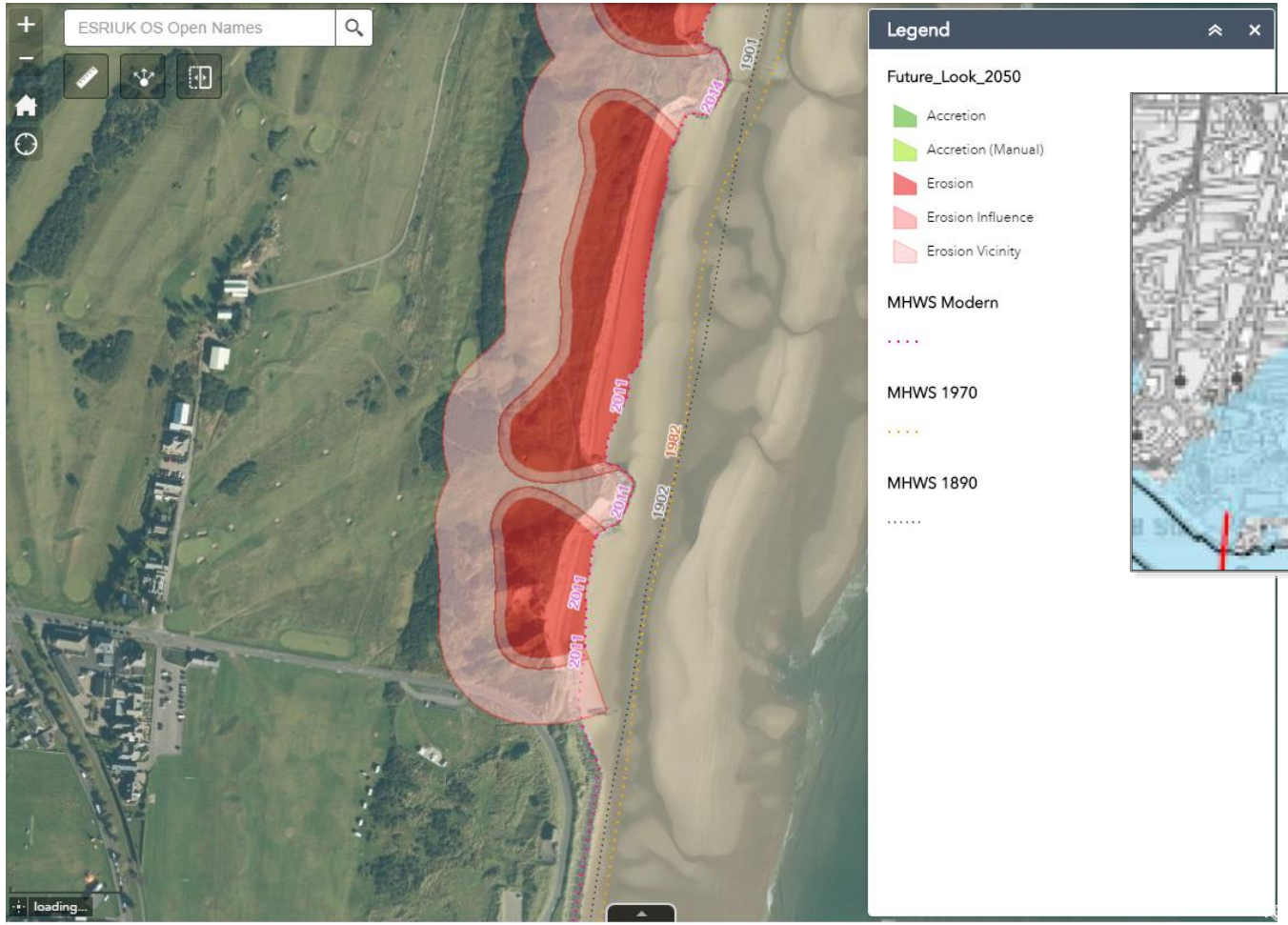
Results … what format?

- Webmaps … **DynamicCoast.com**
- Reports … Cell Report detailing significant change
- *Local Authorities, Government & Public Bodies' mapping systems*

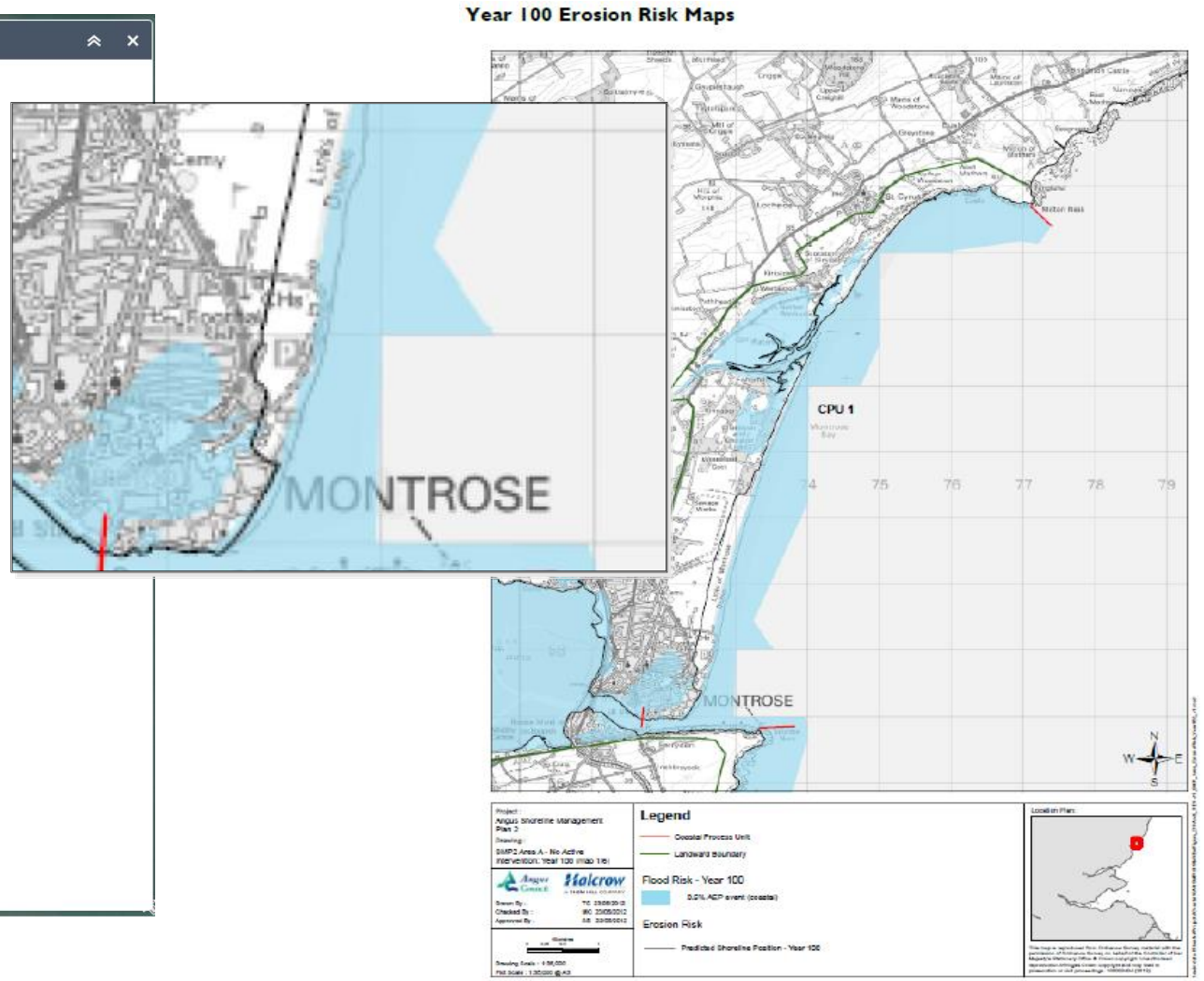




Results … web map

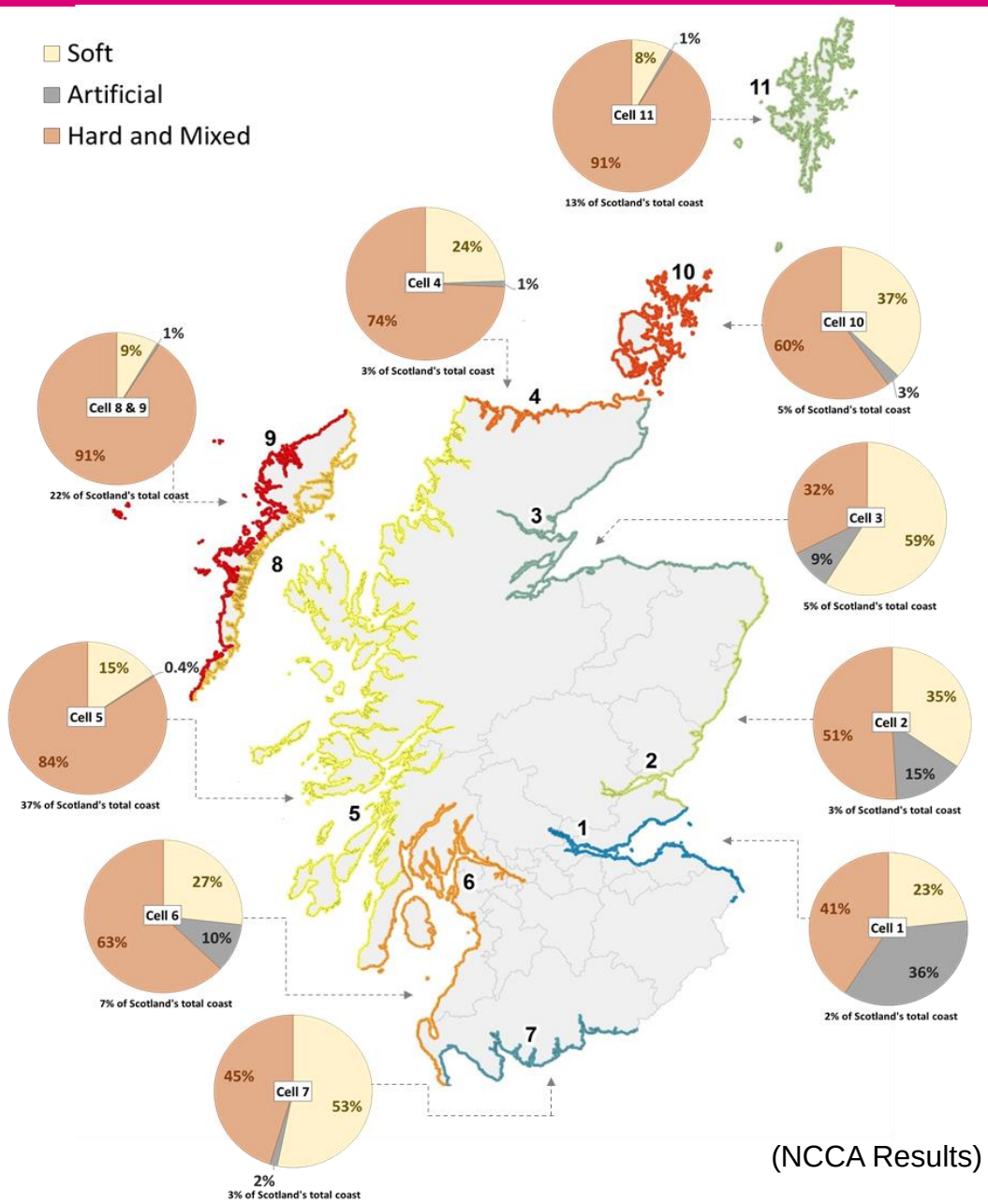


Angus Council SMP2



http://www.angus.gov.uk/downloads/file/2840/appendix_c1_flood_risk_maps%20page%2037%20of%2042

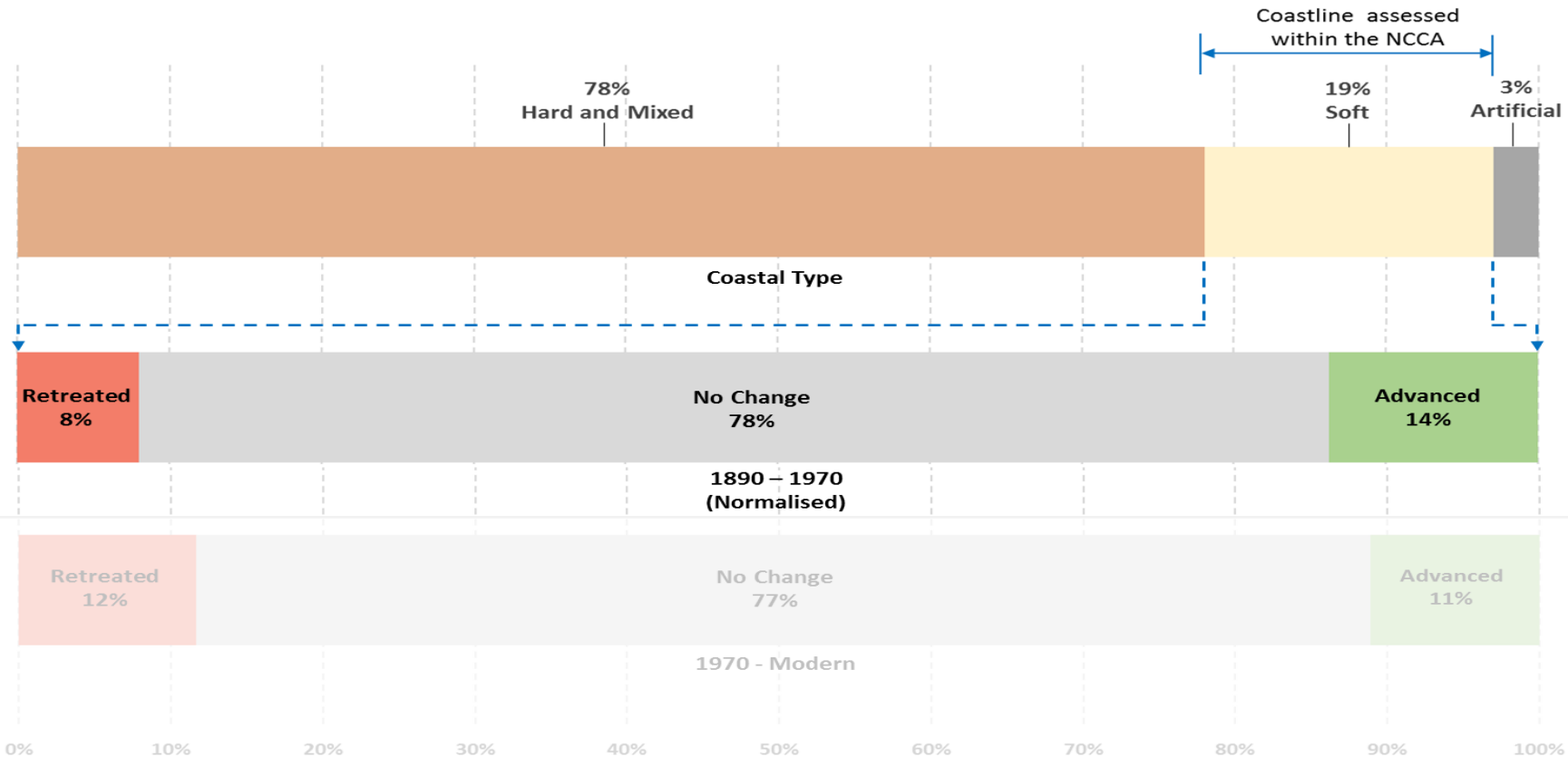
Character of Scotland's Coast



(NCCA Results)

Results: national

(normalised for time period)



Generally:
¾ of soft coast is stable
changes on the other ¼

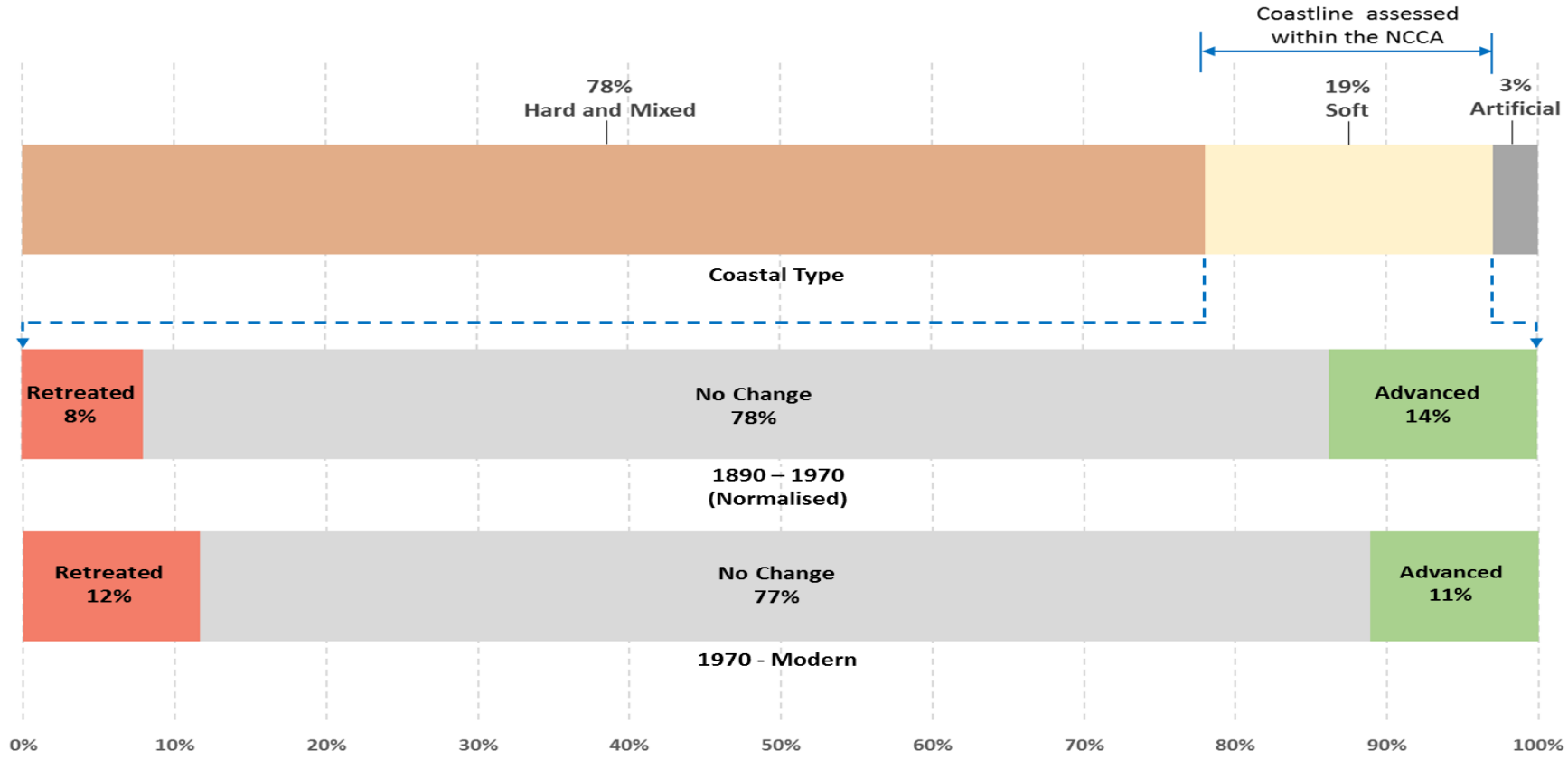
Since the 1970s:
39% ↑ in extent of erosion
22% ↓ in extent of accretion

Doubling of erosion & accretion rates

But:
National picture dilutes more significant changes and patterns

Results: national

(normalised for time period)



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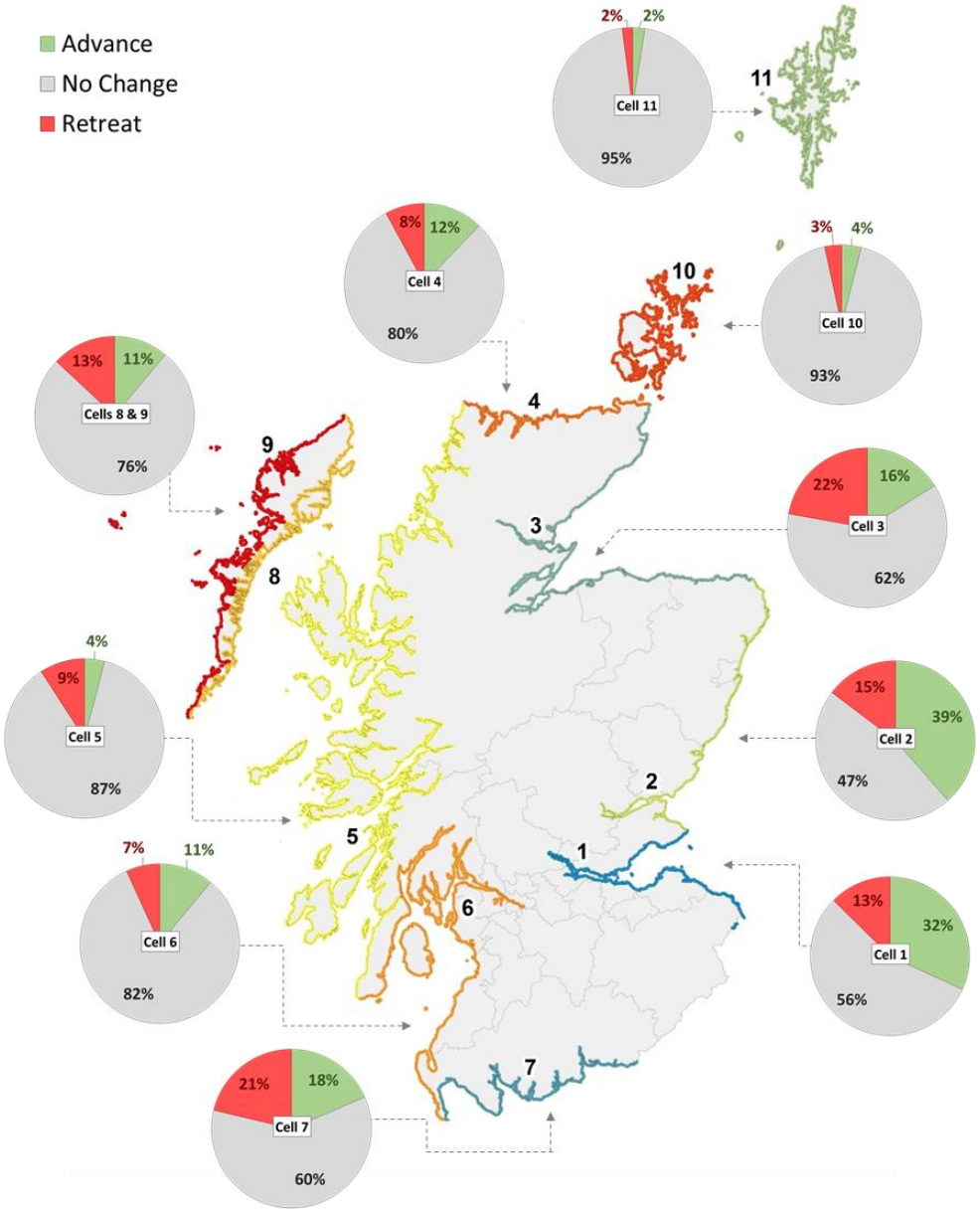
Results: regional / cells since 1970s

More enclosed cells:
Surrounding rocky shores protect soft sections
(soft coast stability: lots of grey)

More exposed cells:
Soft sections less protected
(soft coast mobility: less of grey)



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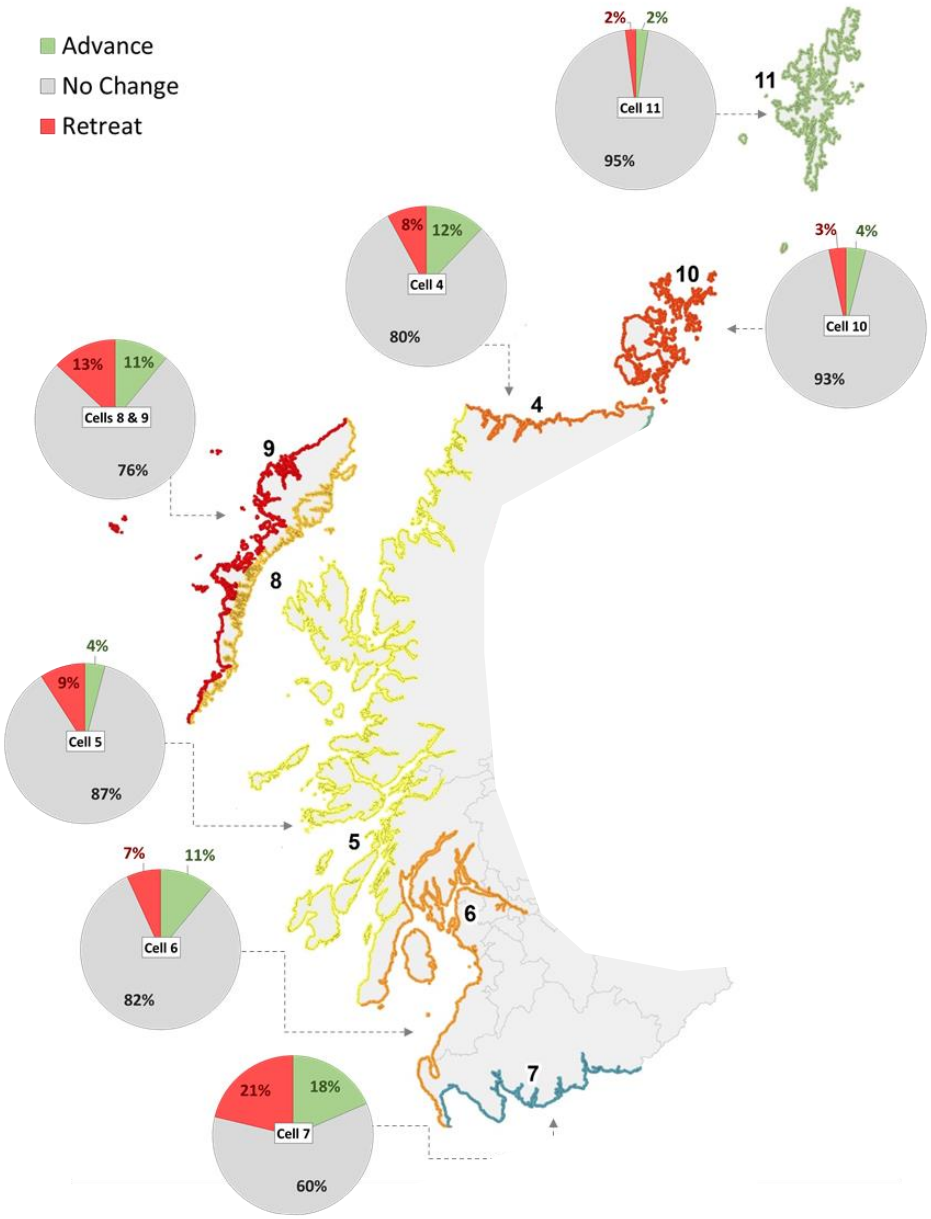
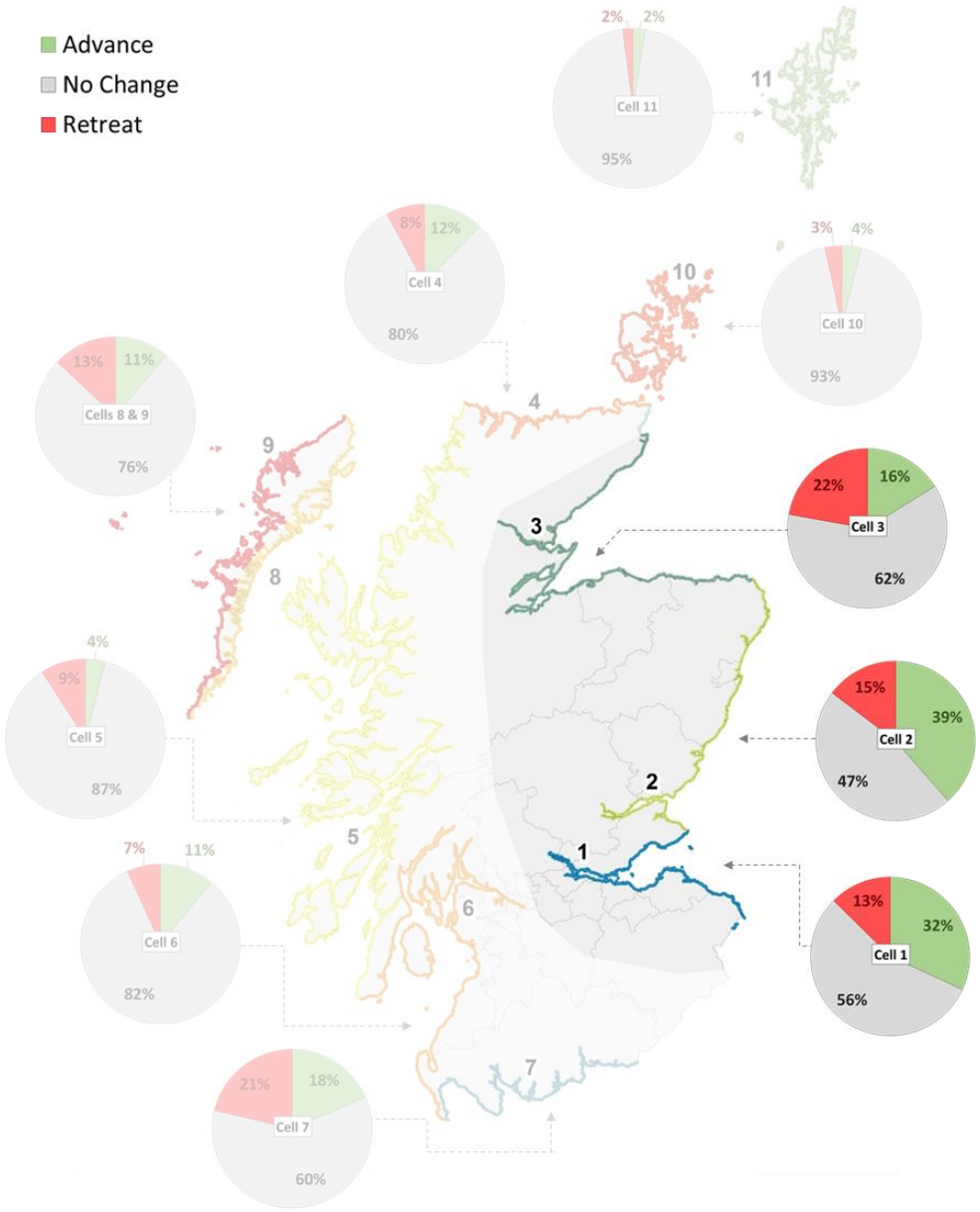


Results: regional since 1970s

More enclosed cells:
Surrounding rocky shores protect soft sections
(soft coast stability: lots of grey)

More exposed cells:
Soft sections less protected
(soft coast mobility: less of grey)

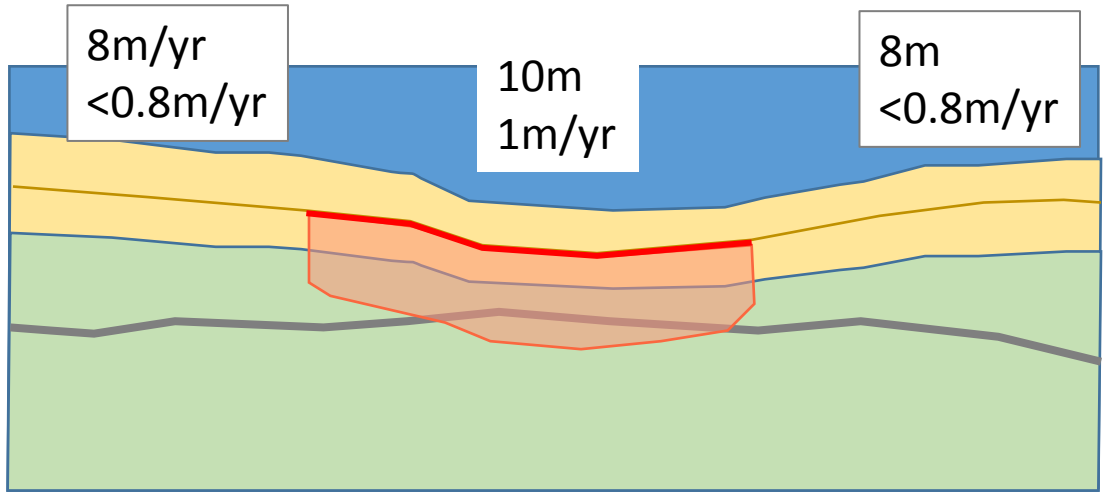
Interpretation:
The natural protective function of the adjacent rocky shore influences soft coast mobility



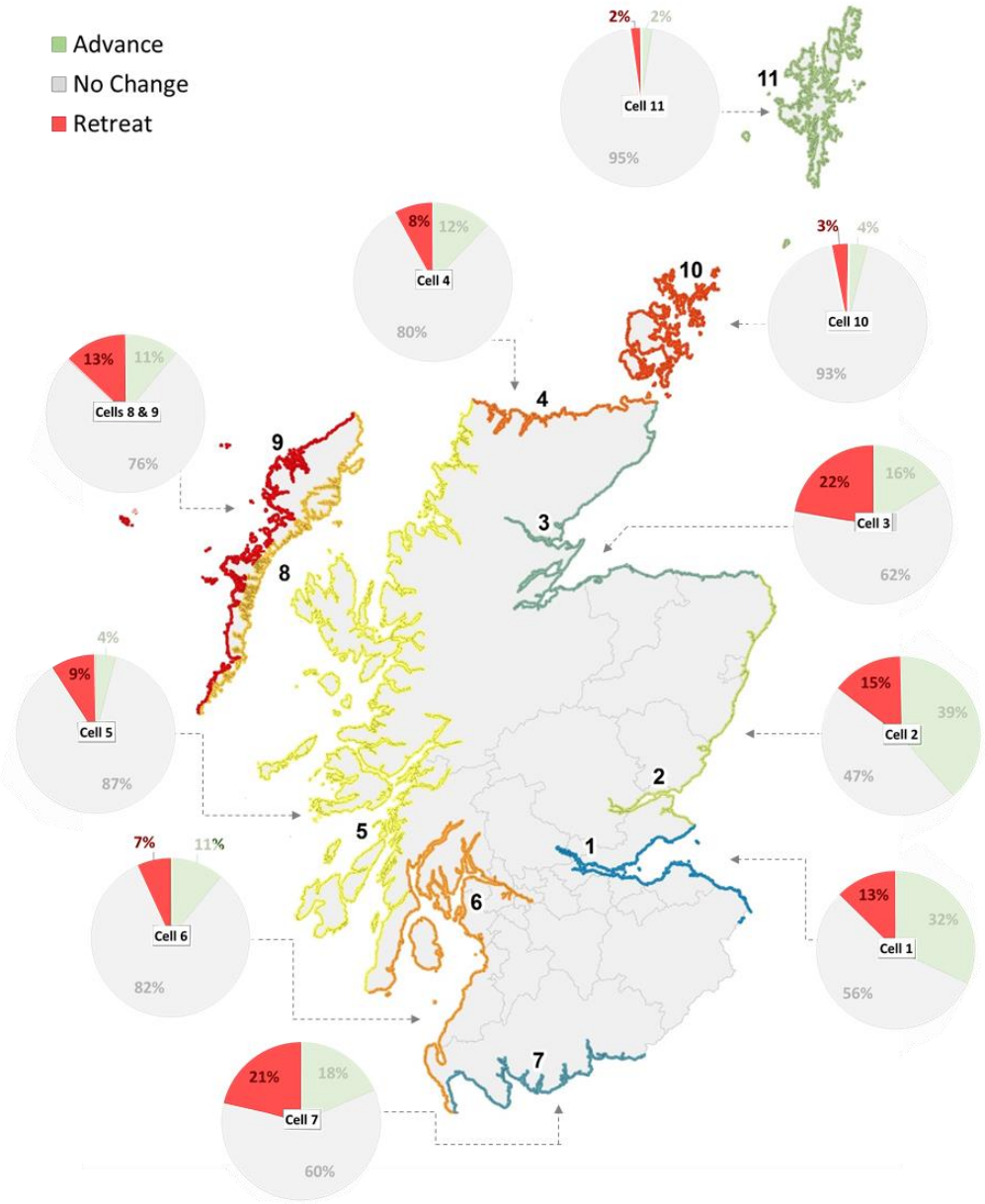
Results: Vulnerability Assessment

What lies behind recently eroding areas?

Where erosion > 10m and if recent erosion rates continues to 2050:
50 buildings
5.2 km of roads
1.6 km of railway
2.4 km of water pipes
… expected to be eroded



Are the assets clustering together?



Results: Vulnerability Assessment

What assets are coincident?

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 coincidence	xx	often coincident	
	x	some coincidence	xxx	high coincidence	

Results: Vulnerability Assessment

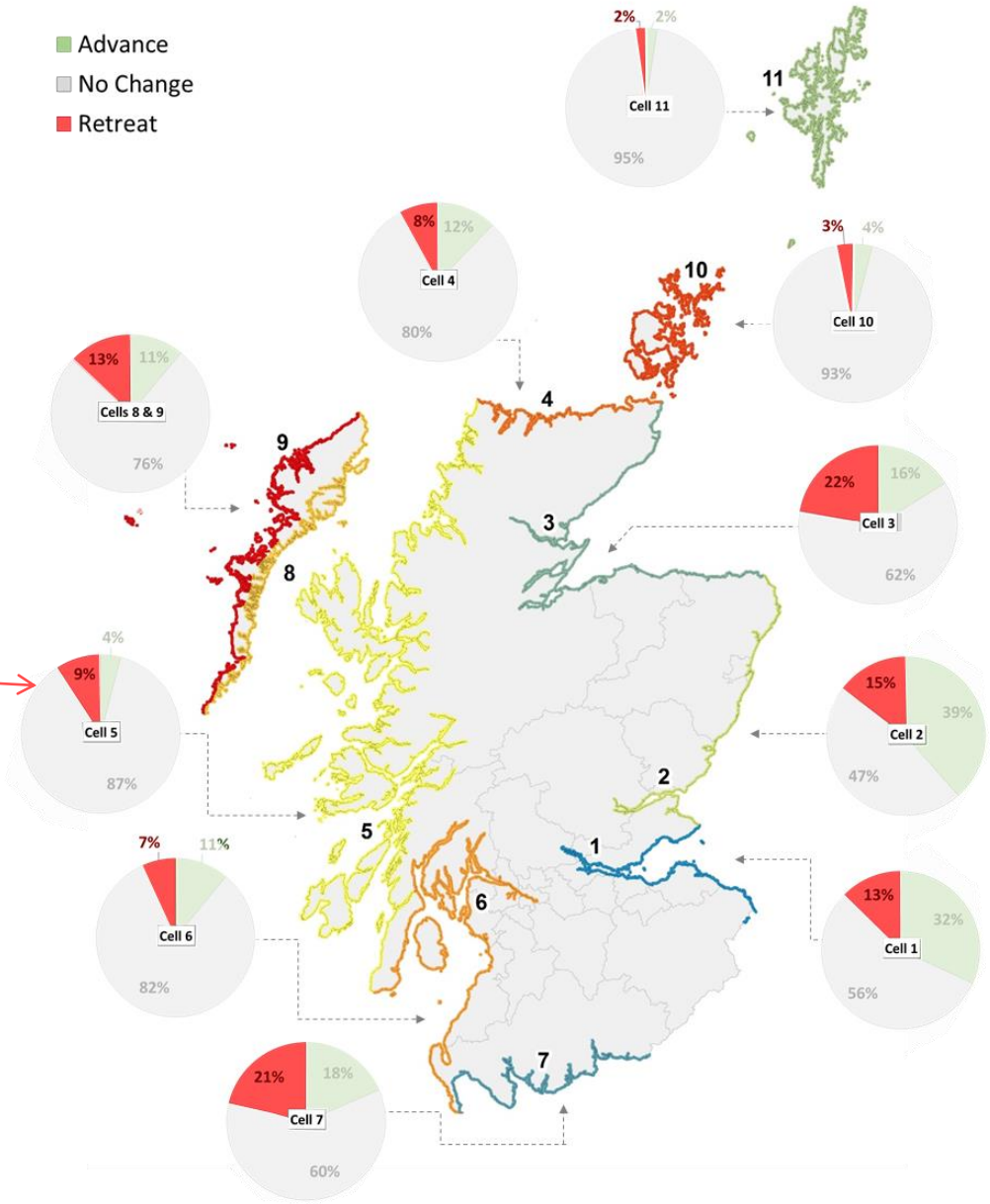
What lies behind recently eroding areas?

If recent erosion rates continues to 2050:
50 buildings
5.2 km of roads
1.6 km of railway
2.4 km of water pipes
… expected to be eroded

But…
Spatially limited analysis (only red bits)
No increase in rate
No change in management
No change due to climate change

Under estimate?

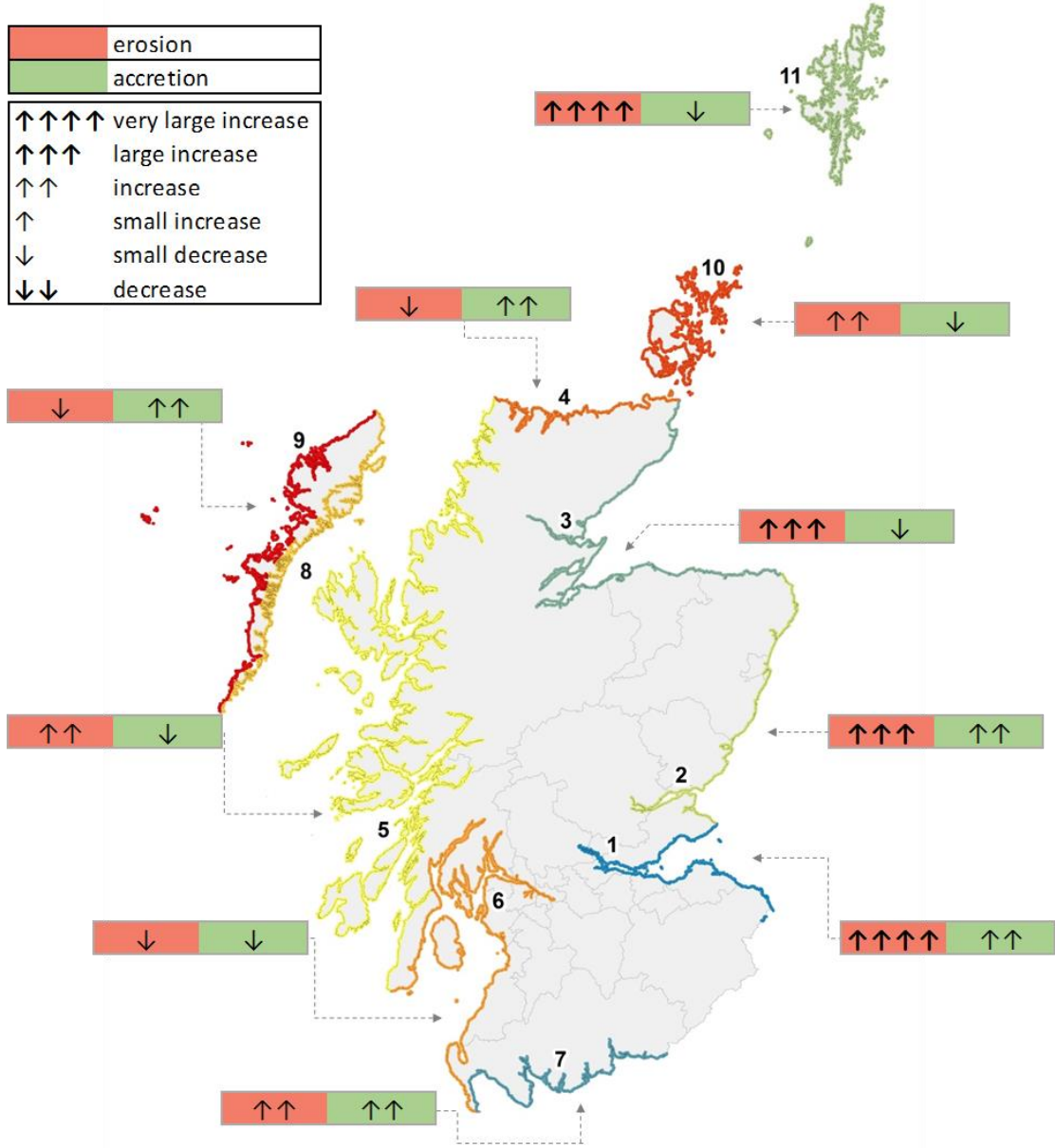
How is the distribution of erosion changing?



Results: regional change with time

More enclosed cells:
Smaller changes in erosion and accretion
(fewer arrows)

More exposed cells:
Greater change in erosion and accretion
(more arrows)



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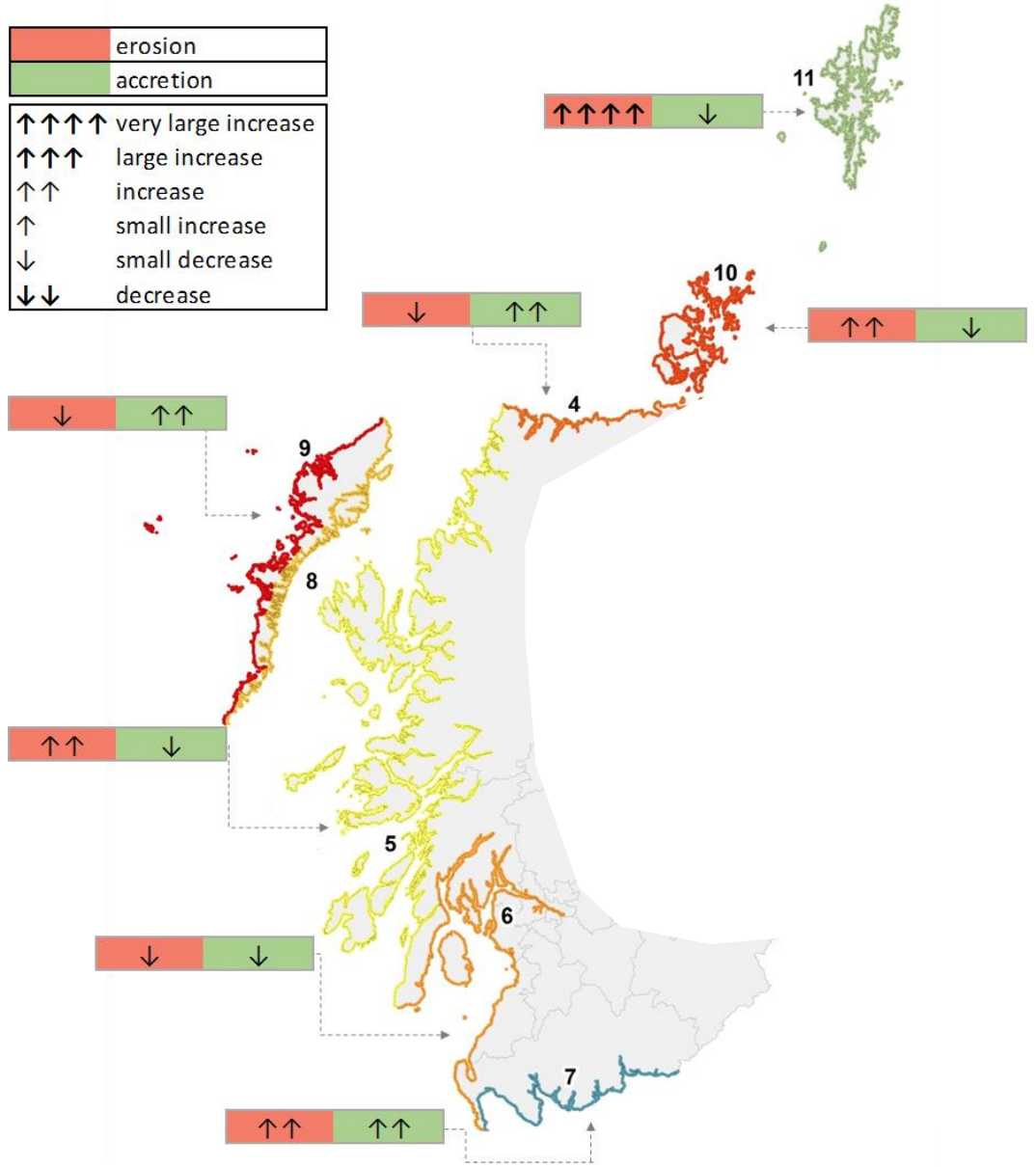

Results: regional change with time

More enclosed cells:
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More exposed cells:
Greater change in erosion and accretion
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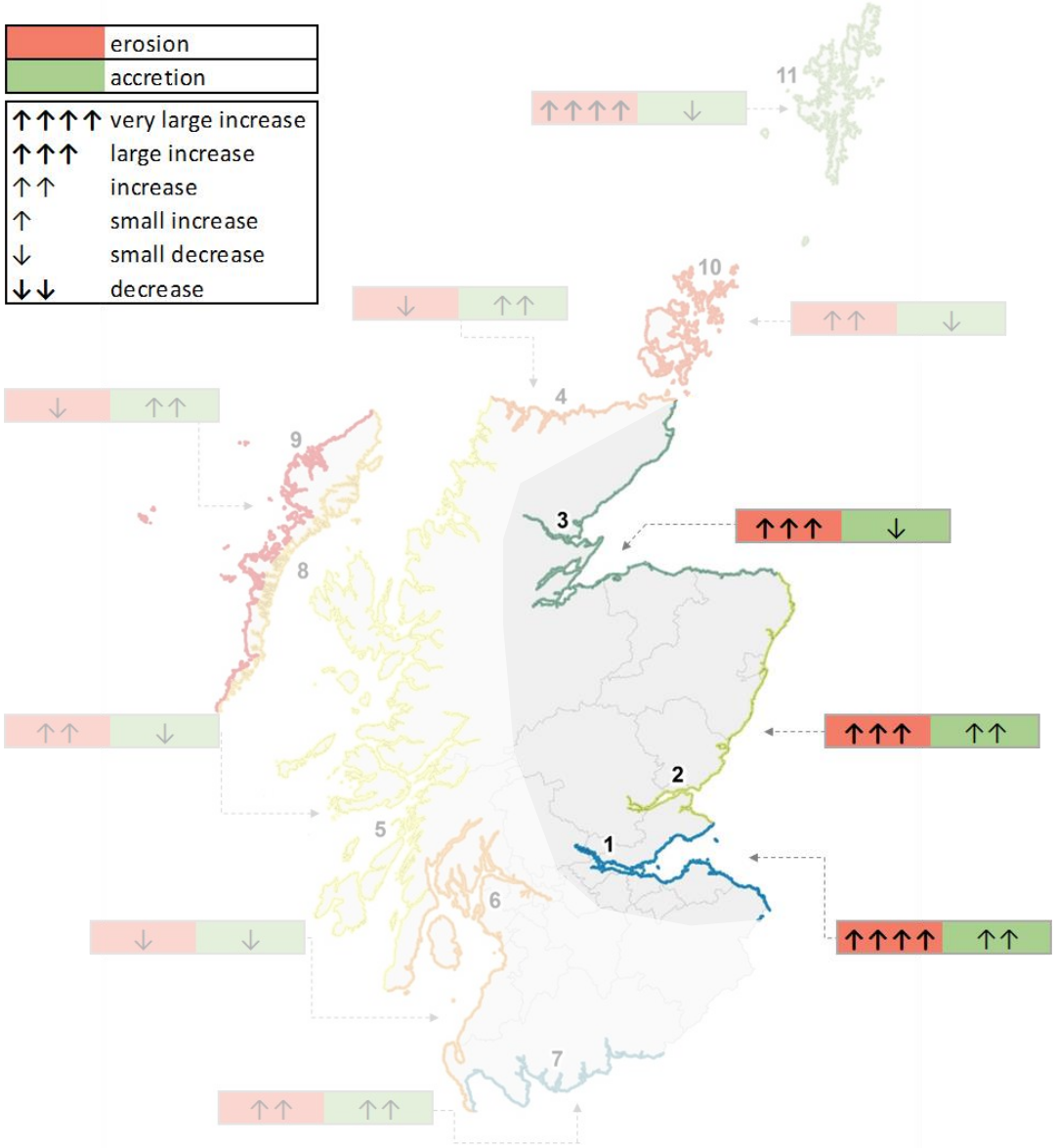
Interpretation:
The greatest changes since the 1970s is seen on exposed cells, with more modest changes within enclosed cells.



Results: Whole Coast Assessment

How many assets within 50m to the coast:

Buffered the coast and intersected the assets.

30,000 buildings
1,500 septic water tanks
1,300 km road
100 km rail

35% are on soft coast
which makes up 19% of total coast

5% of soft coast eroded more than 30m since 1970s.

		Within 50m of MHWS					
			Coastal Type				
Asset / Receptor	**Unit**	**All**	**Hard & Mixed**	**Soft**	**Artificial**	**% in Soft**	**Erodable (UPSM40+)**
Community Services	#	78	48	20	10	26%	45
Non Residential Property		9,045	4,393	2,309	2,343	26%	5,101
Residential Prop		24,449	9,966	7,194	7,289	29%	15,276
Septic Water Tanks		1,656	954	677	25	41%	769
Utilities		312	137	80	95	26%	184
Rail	km	104	27	58	18	56%	61
Roads		1,336	733	497	107	37%	590
Clean Water Network		931	507	304	120	33%	452
Cultural Heritage	ha	1,029	471	438	120	43%	529
Environment		23,430	14,873	8,424	133	36%	8,615
Runway		3	2	0	1	11%	2
Average						35%	

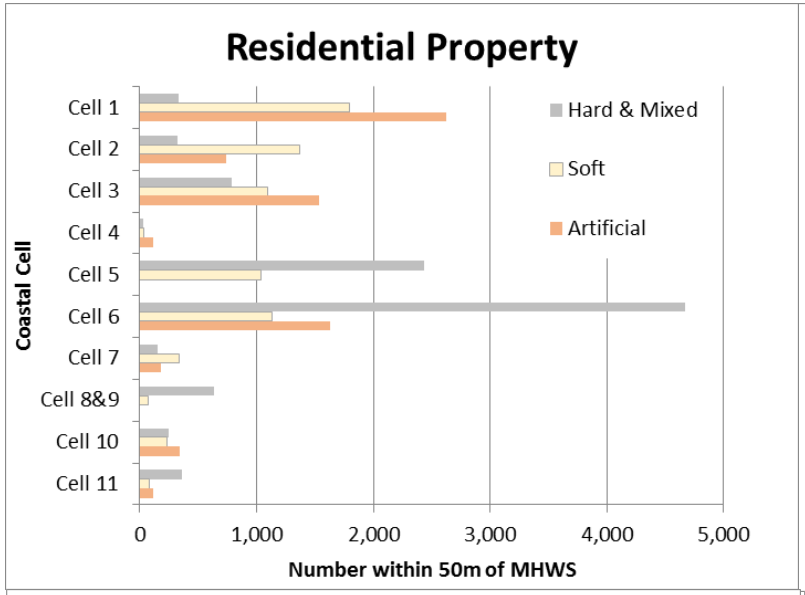
Results: Whole Coast Assessment

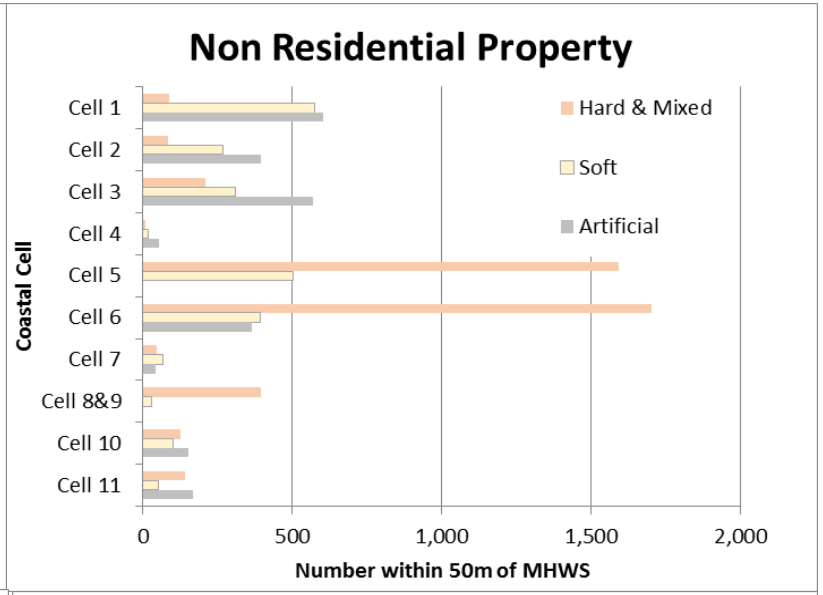
How many assets close to the coast:

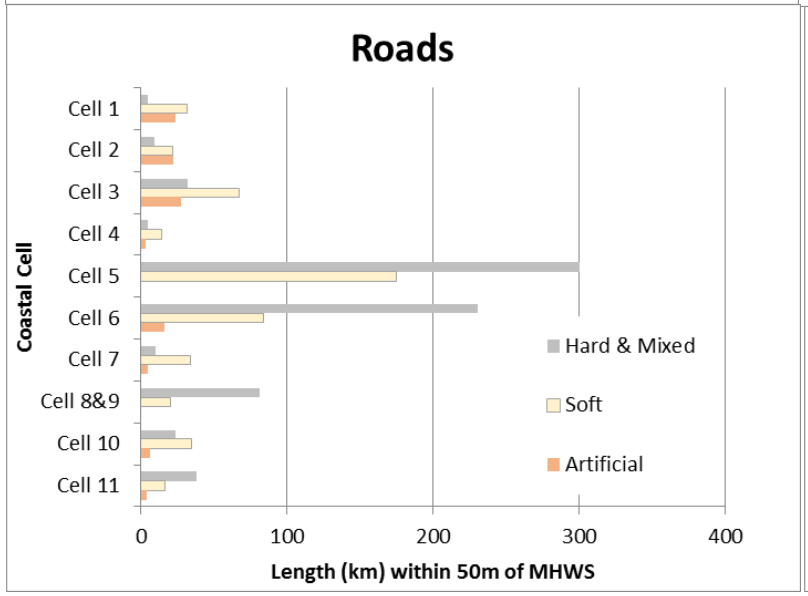
The distribution of assets can be considered

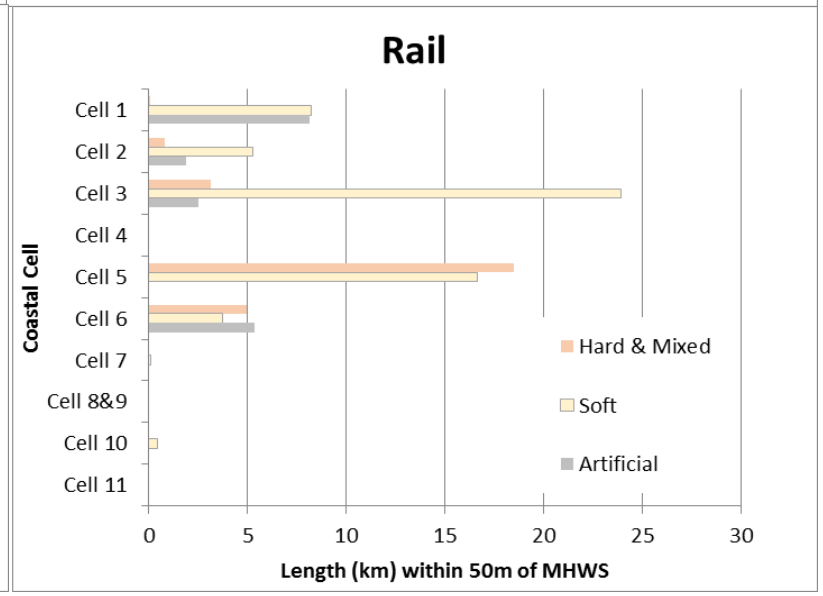
Interpretation:
East coast contains a lot of assets close to the coast

BUT:
No asset type is immune
and all cells have erodible assets









Conclusions from the results:

19% of Scotland's coastline is soft and has the potential to erode / 'erodible'

35% of coastal buildings and assets a located on this erodible soft coast

Since the 1970s:

- 77% of the soft coast has remained stable,
- 11% has accreted seawards and
- 12% has eroded landwards

Natural coastal defences are defending 88% of the soft coast.

Sustainable management of our natural capital is vital to protect essential services and economic growth in Scotland"

"Nature can help us cope with Climate change".

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Sustainable management of our natural capital is vital to protect essential services and economic growth in Scotland"

"Nature can help us cope with Climate change".

But comparing the two time periods:

- 39% increase in extent of erosion
- 22% reduce in extent of accretion

- Average erosion rates have doubled.
- Average accretion rates have also increased.

These observations are consistent climate change.

It is likely that….

"Climate change is effecting coastal erosion … much like coastal flooding"

Conclusions for the future:

Projecting known erosion forward has identified all asset types are at risk.

But given the observed:

- current distribution of erosion,
- changes in extent of erosion,
- increase in rate of erosion…
- climate change impacts (including sea level rise) excluded from this analysis

= more assets are likely to be at risk by 2050 as erosion quickens and expands into new areas.

Those coastal cells at greatest additional risk are:

- inherently more susceptible to erosion (higher % soft coast)
- have the more coastal assets
- have less natural resilience (protection due to geology but also due to defences & dredging)

Conclusions for the future:

Considering the climate change, there is a growing need for coastal erosion and flooding to be considered together. As both are anticipated worsen in the coming decades.

Given the observed changes **a window of opportunity now exists** to plan, mitigate and **adapt in advance** to avoid widespread unnecessary harm and cost. Cross sector and integrated adaptation and mitigation planning is now required.

To hear if and how Scotland can deliver the required adaptation

…. Please see Jim's presentation.

On behalf of

Jim Hansom, James Fitton & the NCCA Steering Committee

Thanks for listening

Questions ?

www.dynamiccoast.com

Our thanks for the support given by our steering committee and partner organisations.

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