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# Dynamic Coast

## Scotland's National Coastal Change Assessment

Alistair Rennie, Jim Hansom & James Fitton



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# Dynamic Coast

## National Coastal Change Assessment

### Special thanks to our funder:



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Scottish Natural Heritage  
Dualchas Nàdair na h-Alba  
All of nature for all of Scotland  
Nàdar air fad airson Alba air fad



University  
of Glasgow

Dynamic Coast has shown:

*Climate change is very likely affecting  
Scotland's coastline.*

**National trends:** ↑ erosion, ↓ accretion  
erosion rates doubling

**Regional trends:** differing patterns

*Compared with the projected near future rates,  
recent changes to driving processes are modest.*

***‘Business as usual’ plans will fail.***

**Dynamic Coast launch, 4 Aug 17**



James Fitton, GIS

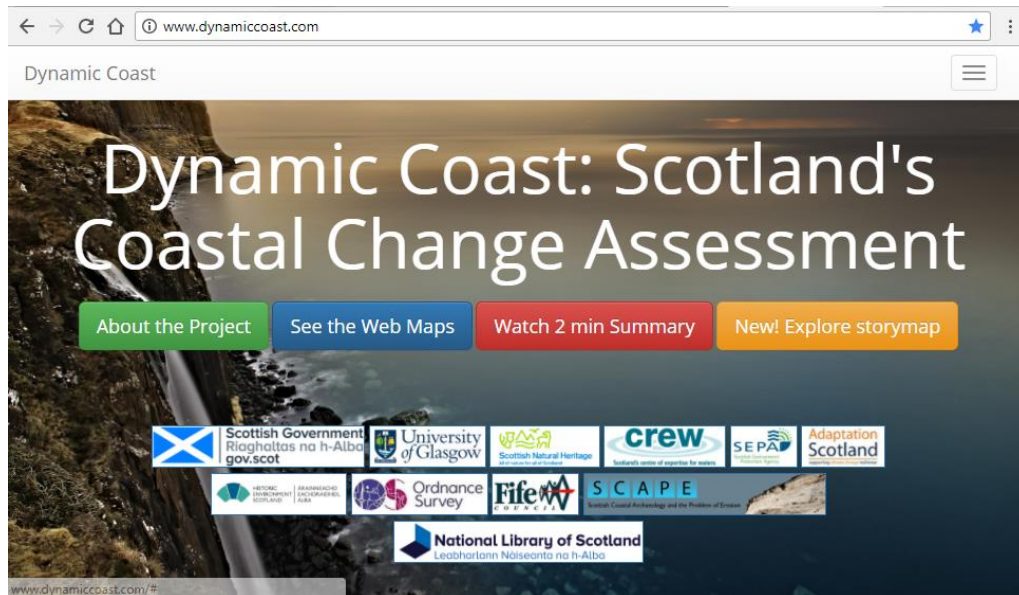
Jim Hansom, PI Science

Roseanna Cunningham, Cab Sec

Alistair Rennie, Project manager

Evidence is available via [DynamicCoast.com](http://DynamicCoast.com) and should be used to support public sector statutory advice. Inclusion of CC is expected in all sectors.

- Maps
- Reports
- Videos
- Presentations
- Blogs & articles
- Storymap



Website has had over 3k hits in 6 months since launch

## Method:

- Over 1m data points to analyse the changes in MHWS on all of Scotland's soft coast, between 1890, 1970 & modern.
- Projected **recent** rate landward to 2050, and intersected this with all coastal asset database (NFRA).

Results available via webmaps on [www.DynamicCoast.com](http://www.DynamicCoast.com)

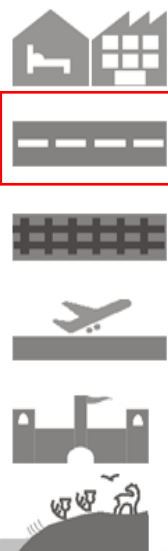
## Whole Coast Assessment Results

*e.g. 156km of roads lie within 10m of MHWS, 53km on soft*

Asset / Receptor	Unit	Within 10m of MHWS					Within 50m of MHWS				
		All	Coastal Type				All	Coastal Type			
			Hard & Mixed	Soft	Artificial	Erodable (UPSM40+)		Hard & Mixed	Soft	Artificial	Erodable (UPSM40+)
Community Services	#	1	1	0	0	0	78	48	20	10	45
Non Residential Property		463	197	103	163	245	9,045	4,393	2,309	2,343	5,101
Residential Prop		458	107	109	242	332	24,449	9,966	7,194	7,289	15,276
Septic Water Tanks		367	219	139	9	181	1,656	954	677	25	769
Utilities		25	10	7	8	14	312	137	80	95	184
Rail		15	2	9	3	9	104	27	58	18	61
Roads	km	156	87	53	16	68	1,336	733	497	107	590
Clean Water Network		87	50	22	16	41	931	507	304	120	452
Cultural Heritage	ha	135	63	55	17	74	1,029	471	438	120	529
Environment		4,204	2,575	1,586	43	1,790	23,430	14,873	8,424	133	8,615
Runway		0	0	0	0	0	3	2	0	1	2

## Method:

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2. Projected **recent** rate landward to 2050, and intersected this with all coastal asset database (NFRA).



Total number of assets within 50m of MHWS

Anticipated (2050) recent rate	Anticipated (2050*) double rate	All	Hard & Mixed	Soft	% in soft coast	Artificial	
52	150	33,494	14,359	9,503	27%	9,632	Buildings
5	10	1,336	733	497	37%	107	Roads (km)
2	2	104	27	58	56%	18	Rail (km)
1	4	3	2	0	11%	1	Runways (ha)
26	27	1,029	471	438	43%	120	Cultural (ha)
447	670	23,430	14,873	8,424	36%	133	Natural (ha)

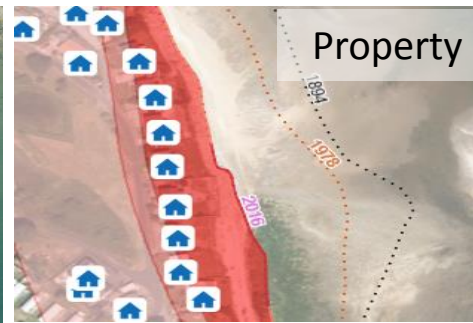
19% of the Scottish coast is soft or 'erodible' (3,802 km).

Between  $\frac{1}{2}$  and  $\frac{1}{3}$  of all coastal buildings, roads, rail and water network lie in these erodible sections.

A large proportion of our coastal assets are at risk from erosion and erosion-exacerbated flooding.

£13bn protected by natural defences, whilst £5bn by sea walls.

Nature is protecting more valuable assets than we are.





## NCCA Results

### Generally:

75% soft coast dynamic stability

25% directional changes

### Before the 1970s:

(normalised for time period)

8% extent of erosion

14% extent of accretion

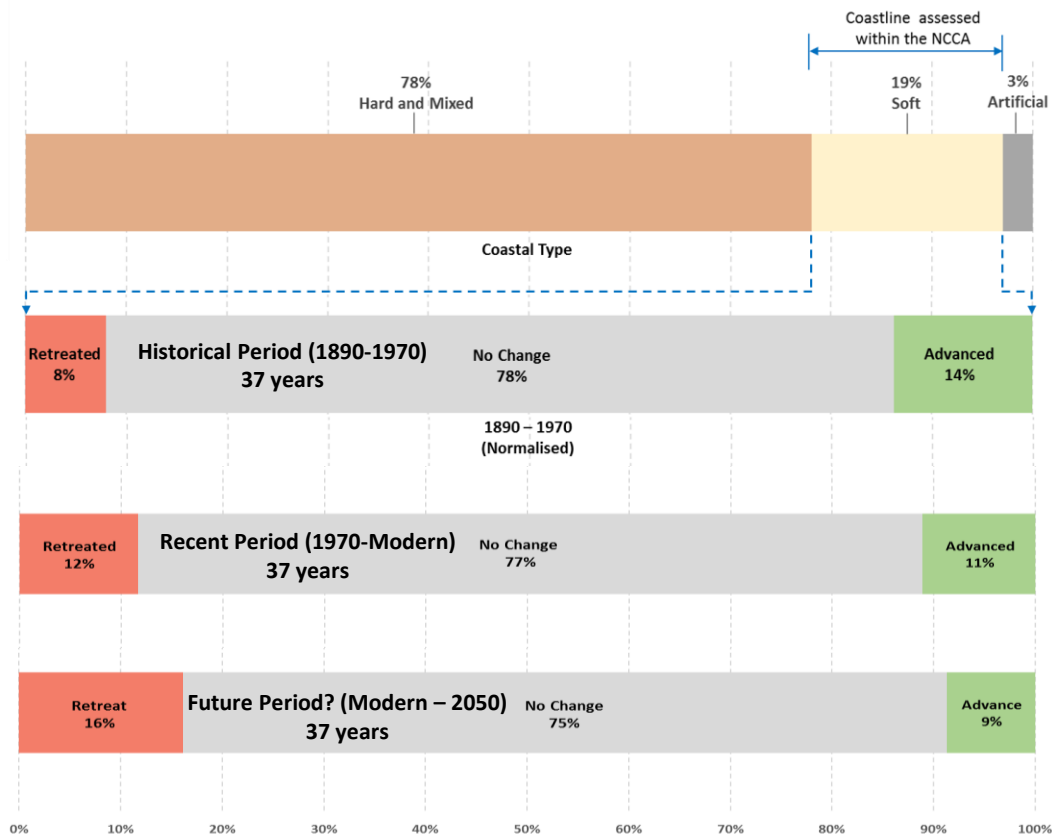
### Since the 1970s:

39% ↑ in extent of erosion

22% ↓ in extent of accretion

+ Doubling of erosion rates to 1m/yr

National picture dilutes more significant changes and regional patterns.



Climate change is a likely driver: (sea level, increasing wave impact & exacerbating storms; added to human factors)



## Regional results show geographic bias.

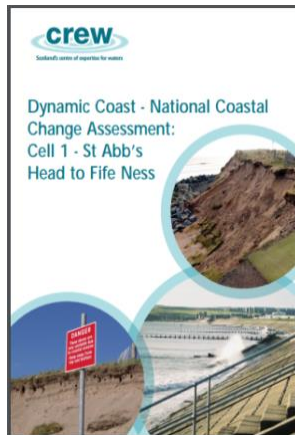
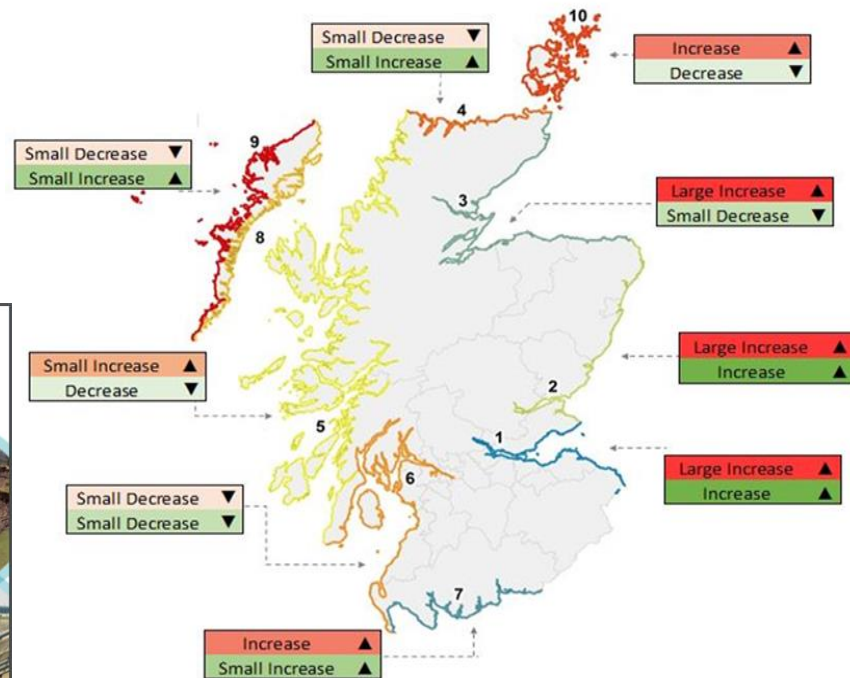
### East coast:

- is more susceptible to erosion,
- has seen greatest increase in erosion
- has a large % of assets.

### North, West & South coast:

- less susceptible,
- less change from baseline
- has a lower % of assets.

Key			
Large Increase	< 100%	Large Increase	> 100%
Increase	> 100%	Small Increase	> 50%
Small Increase	> 50%	Small Decrease	< 50%
Small Decrease	< 50%	Decrease	< 100%



What's at risk if this trend continues to 2050? next 32 years

- at least 50 residential and non-residential buildings,
  - 1.6 km of railtrack,
  - 5.2 km of roadway,
  - 2.4 km of clean water network
  - as well as significant areas of runways, cultural and natural heritage sites
- ... all expected to be affected by coastal erosion.

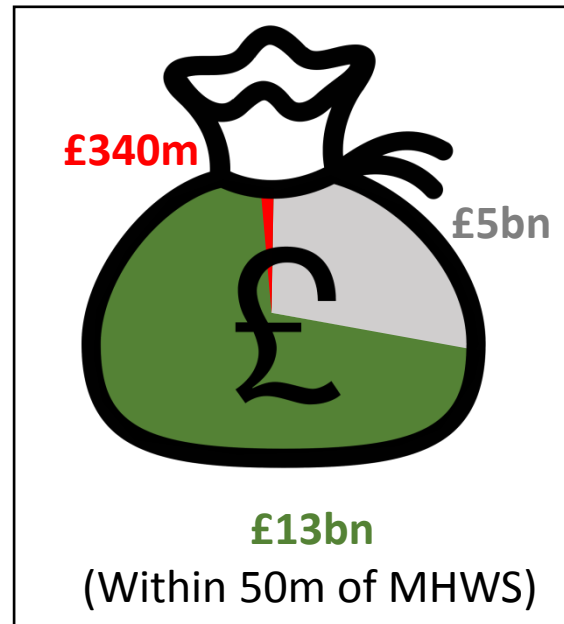
These span all Coastal Cells, all Local Authorities and all asset types.

Of the **£13bn** of coastal assets protected by natural defences, **£340m** are at risk in the next 30 years if recent erosion continues.

.. alongside the **£5bn** behind coastal defences.

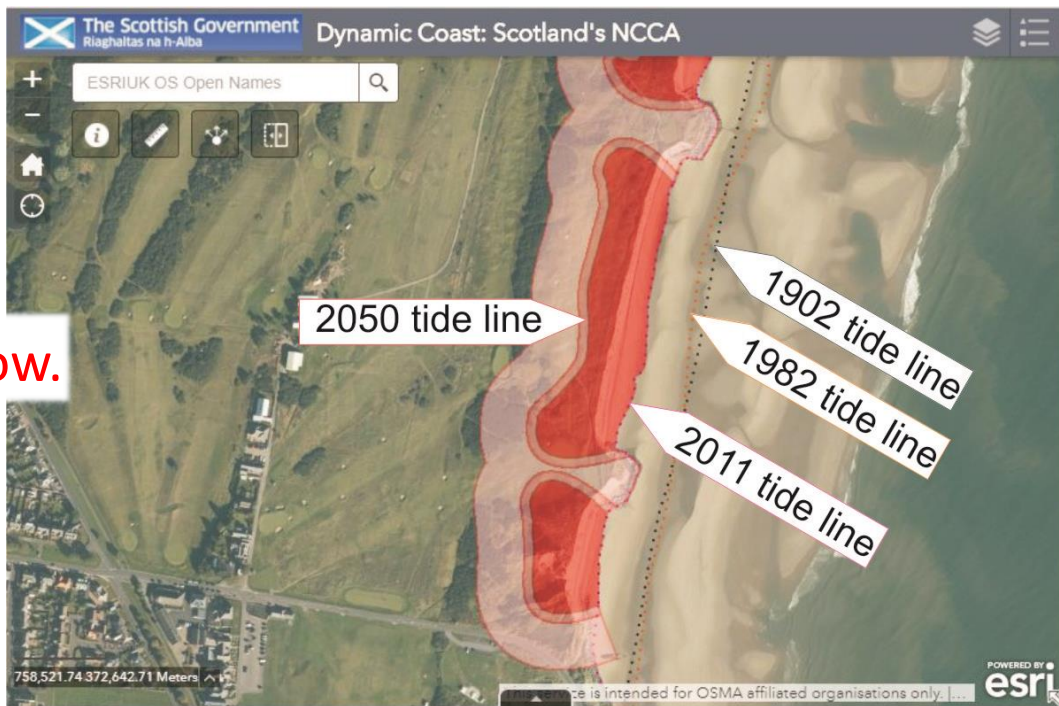
Scotland's society and assets are not immune from erosion.

This is not just about golf courses!



Results show an increase in extent and rate of erosion, so anticipated losses are underestimated. We've used recent rates not future rates nor values.

So Dynamic Coast displays  
the minimum likely impacts.  
Business, communities and  
statutory advisors should plan now.



Sea level rise estimates are being uplifted by 20-30% (Met Office)

.... See UKCP18 (this session)

Accelerating erosion rates  
need to be part of routine planning.  
E.g. Fife SMP2 or  
Newquay Neighborhood Plan

Considered further in next phase of  
Dynamic Coast research.



Gerd Masselink  
@gmasselink

Following

How to curb coastal cliff-top development?  
The Newquay Neighbourhood Plan  
([newquayplan.org](https://newquayplan.org)) has articulated some very  
useful policy advice based on Coastal Change  
Management Area plan  
([newquayplan.org/consultation-m ...](https://newquayplan.org/consultation-m...)). Red  
line is anticipated 100-yr erosion line plus 10-  
m buffer.



Anticipated SLR will have significant impact on flood frequency.

M.E.S. Leith +0.3 m  
of sea level by 2090 =  
1:100 yr event → 1:8 yr.

In Scotland we now have a Window of Opportunity, and the Policies in place, to choose to adapt, mitigate or defend according to the local, regional and national contexts.

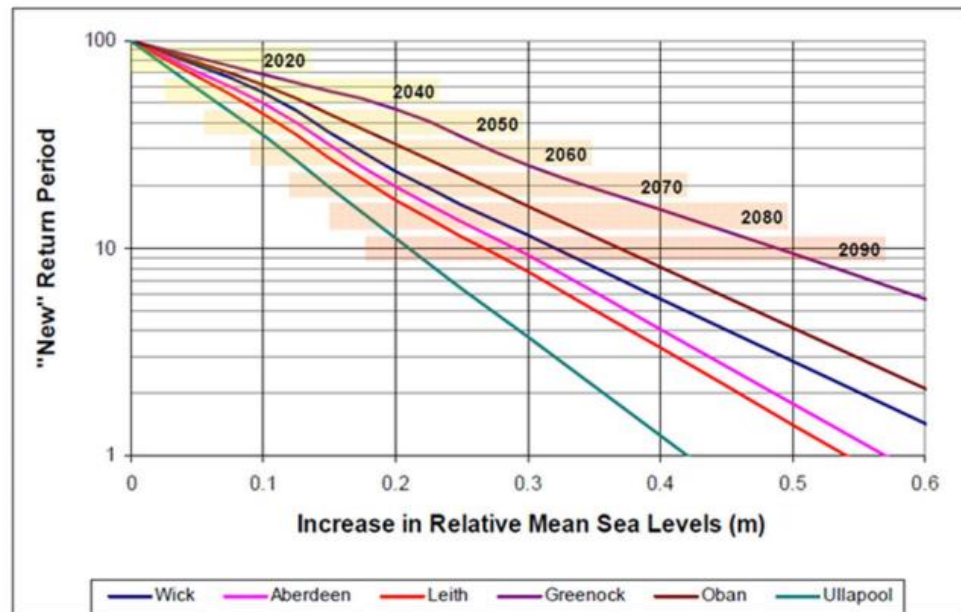


Figure 4.6: Reduction in flood return period given increases in mean sea level (Defra (2012) UKCCRA for Scotland – Technical Report. Fig3.5 p43, based on the central estimate of the Medium Emissions Scenario, locations are approximate)



**Dynamic Coast 2** is about to start, using 3-D modelling to:

- Appraise resilience of soft natural defences,
- ID the breach-points for erosion enhanced flooding (this is how cc will impact people),
- consider impact of acceleration in future erosion extents and rates.





**2<sup>nd</sup> phase** will also:

- Encourage adaptation (super sites)



**AdaptNorthHeritage**

@AdaptNHeritage

Follow

Climate change could damage one fifth of Scotland's coast. @ScotGov is now extending [DynamicCoast.com](https://dynamiccoast.com), a project monitoring soft coasts near @HistEnvScot #HistoricPlaces at #StAndrews and #SkaraBrae. Check out the project's online #GIS #mapping tool [news.gov.scot/news/forecasti ...](https://news.gov.scot/news/forecasti...)



## 2<sup>nd</sup> phase will also:

- Encourage adaptation (super sites)
- Incorporate latest smart phone GPS+tech to ID coastal change.. vegetation edge etc
- Use UAV drones for coastal position updates at key sites
- Produce a coastal erosion disadvantage mapping



## And a final word...

“Dynamic Coast gives Scotland it’s most advanced nationally consistent and locally informed understanding of the causes and consequences of coastal change that it has ever had so we have to use it and build on it now.”

Environment Secretary Roseanna Cunningham

(August 2018)





More info: [www.DynamicCoast.com](http://www.DynamicCoast.com)

Dynamic Coast phase 2 ... continues!

Funder:



Proj. Manager:



Research team:



# Flood Risk Management Conference 2018

Importance of the Dynamic Coast project was underlined in the Key Note speech by Roseanna Cunningham

Environment Secretary

(January 2018)





For more info... [www.DynamicCoast.com](http://www.DynamicCoast.com)

Dynamic Coast is a Scottish Government Project,  
funded by CREW, managed by SNH, with a  
research team from the University of Glasgow