Scotland’s Dynamic Coast – The National Coastal Change Assessment

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www.dynamiccoast.com
Please click ...

Ctrl + L

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?
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)
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
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.
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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](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 Some was out of date, but it has been re-flown.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

• 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

Hard & mixed: St Andrews town

Soft: St Andrews dunes

Artificial: Grangemouth
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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Doubling of erosion & accretion rates

But:
National picture dilutes more significant changes and patterns
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)
Results: regional since 1970s

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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?

<table>
<thead>
<tr>
<th>Assets etc at risk from erosion</th>
<th>Airports</th>
<th>Buildings</th>
<th>Roads</th>
<th>Rail</th>
<th>Fresh Water Network</th>
<th>Septic Water</th>
<th>Cultural Heritage</th>
<th>Natural Heritage</th>
<th>Flood risk</th>
<th>PVA</th>
<th>Examples</th>
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<tbody>
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<td>Southerness (Solway), Prestonpans (Forth), Broughty Ferry (Tay)</td>
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</tbody>
</table>

Key
- no coincidence
x some coincidence
xx 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)
Results: regional change with time

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

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.
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 are 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”.
Conclusions from the results:

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

35% of coastal buildings and assets are 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

But comparing the two time periods:
• 39% increase in extent of erosion
• 22% reduction in extent of accretion

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

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”.

These observations are consistent with 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

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

Steering Committee:
Debi Garft  Scottish Government
Alan Corbett  Scottish Government
Kat Ball  SEPA
Alistair Cargill  SEPA
Mairi Davies  HES
Nicholas Williamson  Fife Council
Tom Dawson  SCAPE
Tracy McCollin  Marine Scotland
Martyn Cox  Scottish Government
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Jannette MacDonald  CREW
Emily Hastings  CREW

Thanks for listening
Questions?

www.dynamiccoast.com