



# VIII CLGE Conference of the European Surveyor “BLUE SURVEYING”

## Scotland's Dynamic Coast

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Principal Consultant, Ordnance Survey



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Introduction



Context



Methods



Results



Implications



Next steps

# Introduction

The Scottish Government's Dynamic Coast project was funded by CREW, NatureScot and St Andrews Links Trust, with the research conducted by the University of Glasgow.

Dynamic Coast aims to:

- Improve the evidence on coastal change in Scotland;
- Improve awareness of the impacts of coastal change in Scotland;
- Support decision-makers to ensure Scotland's coast and assets can flexibly adapt to our future climate.



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HISTORIC ENVIRONMENT SCOTLAND ÀRAINNEACHD EACHDRAIDHEIL ALBA



# Context

Pre 2015	Poor awareness
2015	DC1 starts
2017	DC1 published
2018	DC2 starts
2021	DC2 published
2050	+ 0.44m sea level
2100	+ 1.16m sea level (IPCC RCP 8.5 95%)

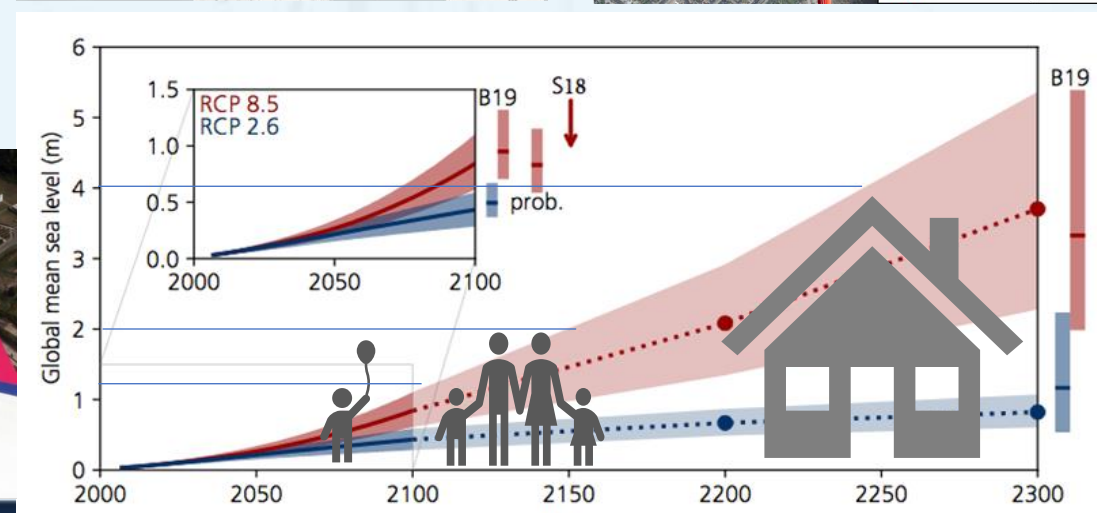
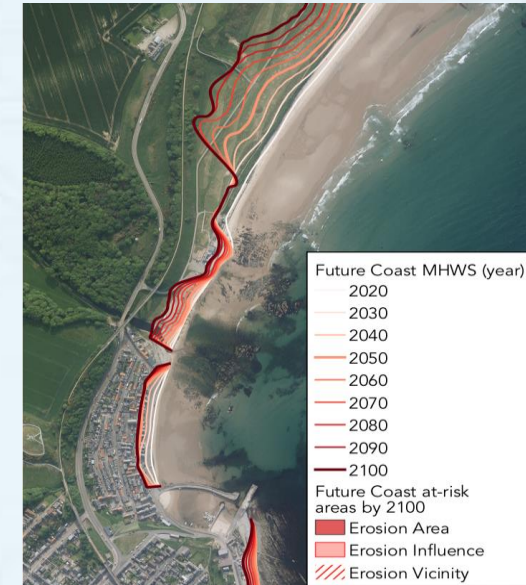
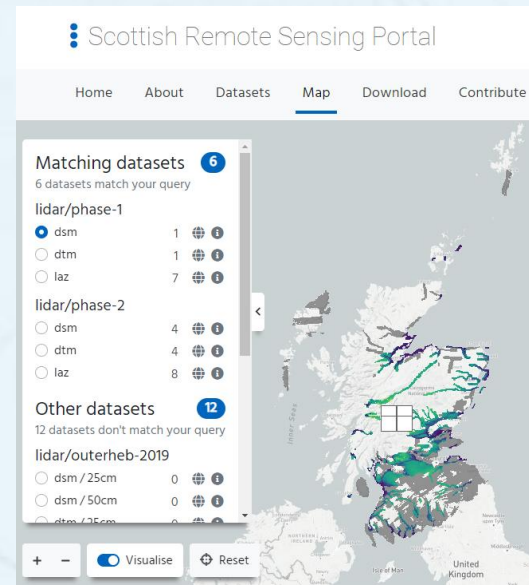


- Prior to 2015, Scotland's coastal erosion problem was devolved to local authorities & landowners, relying on inaccurate legacy data, with **limited national awareness of future implications.**
- Over the last 7 years Dynamic Coast has driven huge improvements in Science and Governance... **'Laggards to leaders.'**
- Like many countries, our risk appraisal shows that past approaches aren't enough: **'In a changing world, business as usual will fail'**
- Dynamic Coast is a game-changer, delivering a step-change in awareness but **improvements, delivery and action are now required to realise the benefits.**



# Methods

- +6,000km new & updated coastal tide lines (OS & SG-Lidar),
- New modelling to account for future relative sea level rise,
- High, Med & Low Emissions projections & implications,
- Erosion enhanced flooding,
- Improved change detection,
- Super site exemplars,
- Social disadvantage &
- Novel satellite monitoring.



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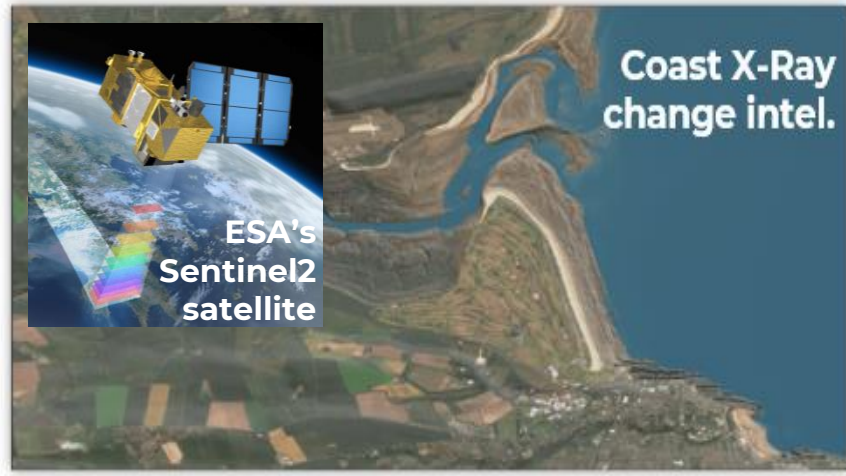
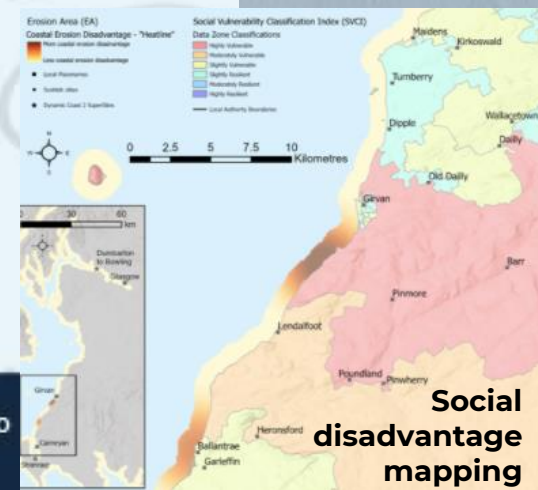
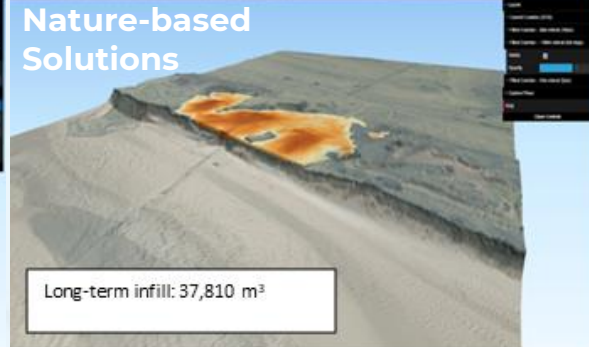
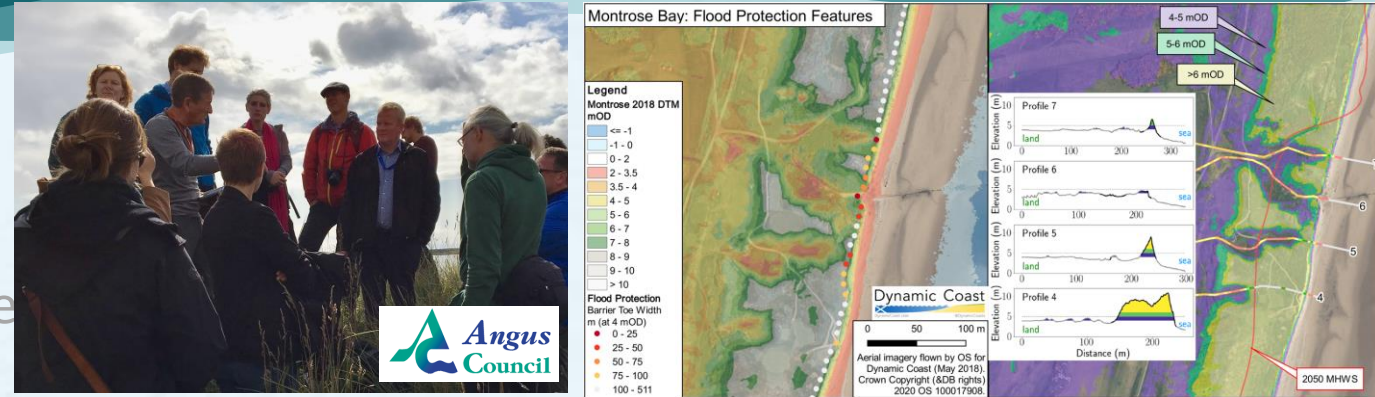
Automatic veg edge detection on satellite & aerial imagery

Veg edge at St Cyrus (Montrose) mapped with GPS device

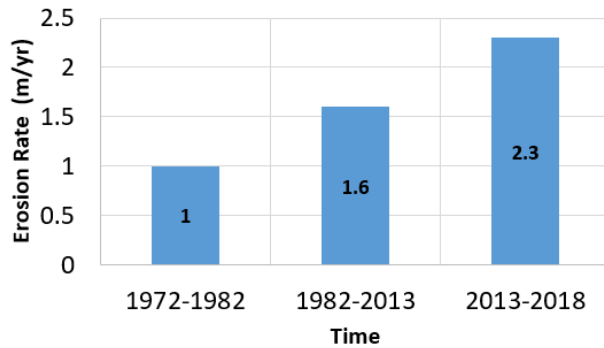


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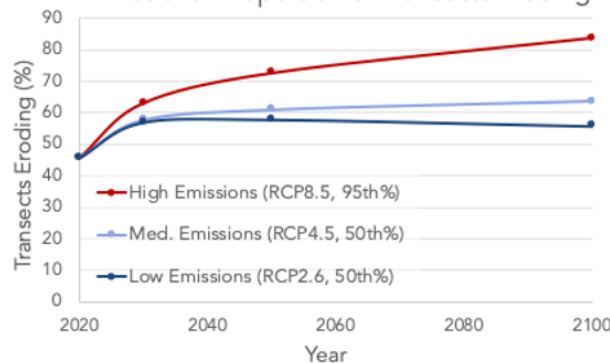


Montrose Erosion Rate

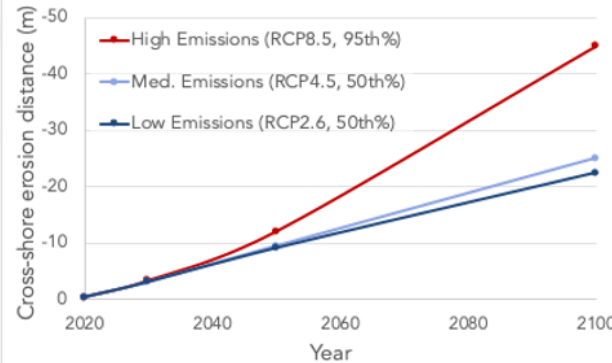


- Erosion affects more open erodible coast than historically and since 2017 (DC1 38% → DC2 46%)
- Rate & extent of erosion increases for both for Low & High Emissions futures (locked in due to past & current emissions)
- £20bn assets within 50m of coast (£14.5bn behind natural defences, £5bn behind artificial)
- £1.2bn at risk by 2050 (partial estimate 'do nothing management' & High Emissions (AKA current track))
- Low Emissions saves ca. £400m by 2050 (partial estimate: 'do nothing management' & Low Emissions)
- Coastal erosion social disadvantage is uneven, now estimated for the first time (more detailed assessment now needed)

National Proportion of Transects Eroding



National Mean Eroded Distance







### Layer List

- MHWS 1890s ...
- Future MHWS for High Emissions Scenario ...
  - 2020
  - 2030
  - 2040
  - 2050
  - 2060
  - 2070
  - 2080
  - 2090
  - 2100
- Transects for High Emissions Scenario ...
- Future Erosion 2050 High Emissions Scenario ...
- Future Erosion 2100 High Emissions Scenario ...
  - ErodedArea
  - Influence
  - Vicinity
- Artificial Coastal Defences ...





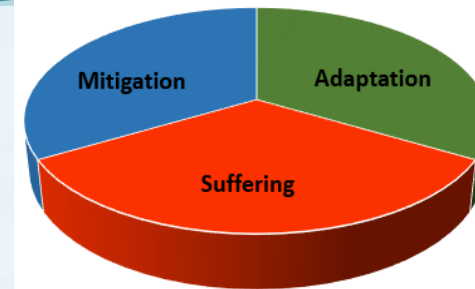
Layer List

- Coastal Cells (sub cells) ...
- Dynamic Coast results {click here to view} ...
- Flood levels and High Emission Scenario SLR ...
- MHWs Modern ...
- MHWs 1970s ...
- MHWs 1890s ...
- Future MHWs for High Emissions Scenario ...
  - 2020
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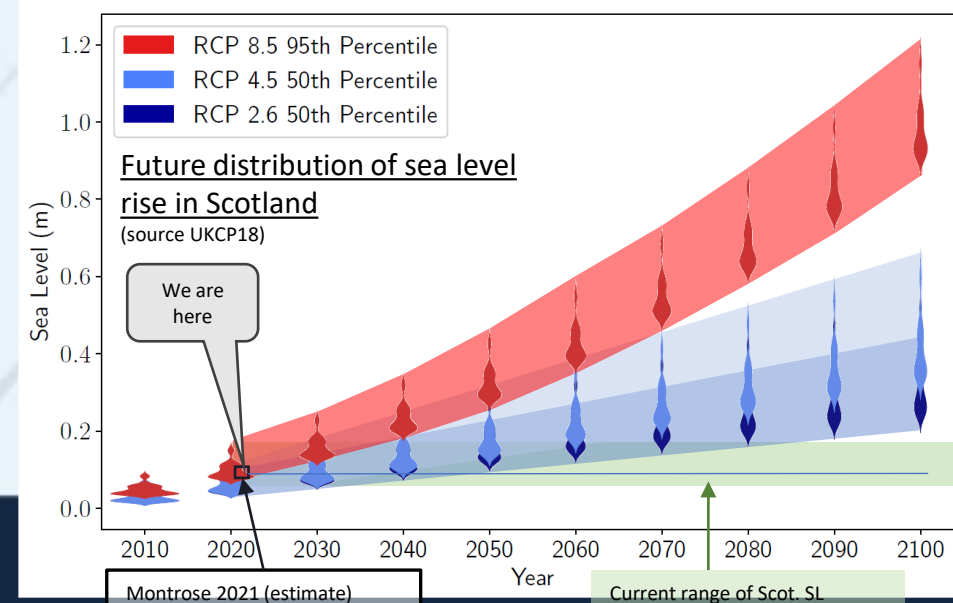
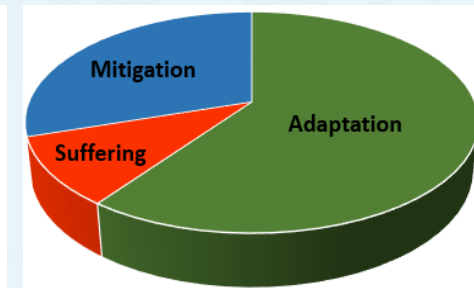
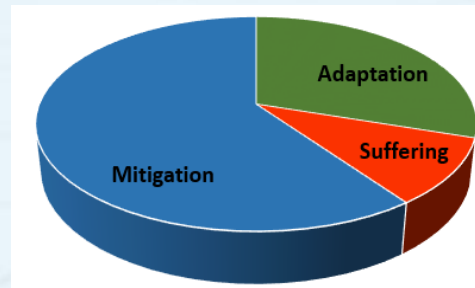
# Implications

- Achieving NetZero will save assets, management & repair costs, livelihoods and possibly lives. It is an act of self-interest.
  - **But on its own it is not enough. Why?**
  - Because the substantial time lag between now to NetZero & beyond we will see sea level rise and coastal erosion impacting more of our coast, whatever the climate emissions scenario.
  - Scottish sea level rise anticipated under
    - High Emissions up to:
      - 0.25-0.46m by 2050; 0.86-1.21m by 2100
    - Low Emissions up to:
      - 0.11-0.31m by 2050; 0.20-0.55m by 2100.
- +25cm SL will increase flood frequency from 1:10yr to 1:1yr



John Holdren, Obama's science advisor (2007):

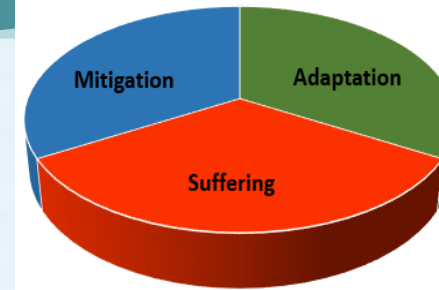
"We basically have three choices: mitigation, adaptation and suffering. We're going to do some of each. The question is what the mix is going to be. The more mitigation we do, the less adaptation will be required and the less suffering there will be."



# Implications

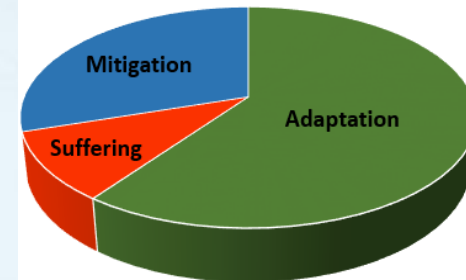
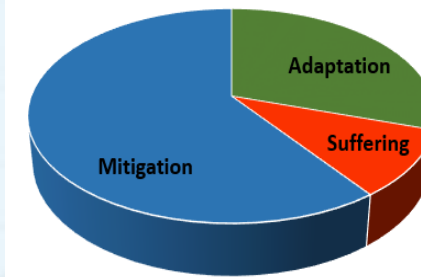
- **Irrespective of (and in addition to) future GHG reductions, new approaches are needed:**

- National coastal monitoring programme,
- Adaptive Shoreline Management Plans,
- Joined-up and funded short-term resilience and long-term adaptation actions,
- Recognise scale of challenge to ensure the planning system can secure coastal adaptation space to allow the shore, and the assets behind, to move inland,
- Consider social disadvantage to ensure Just Transition,
- Avoid development lock-ins, and
- Invest in both natural & artificial defences.



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"We basically have three choices: mitigation, adaptation and suffering. We're going to do some of each. The question is what the mix is going to be. The more mitigation we do, the less adaptation will be required and the less suffering there will be."



Our beloved coastal towns will flood more frequently.



# Next steps

- Increase awareness & support the use of **Dynamic Coast** (Working with Scottish Government, local authorities, public sector, business, communities and public)
- Maintain & improve evidence base (Scotland is the only home nation without a funded coastal monitoring program)
- Promote adaptive Shoreline Management Plans (aSMPs) (Guidance now underway, with roll-out based on DC2)
- Coordinate & deliver aSMPs collaboratively & flexibly via resilience and adaptation actions (Improvements to adaptation planning, collaboration & funding all needed)
- We need to be "Sea Level Wise"



Dynamic Coast awareness workshops to key agencies and partners



## Our funders:



Scottish Government  
Riaghaltas na h-Alba  
gov.scot



**NatureScot**  
Scotland's Nature Agency  
Buidheann Nàdair na h-Alba



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supporting climate change resilience



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ORKNEY  
ISLANDS COUNCIL



Ordnance Survey



Crown Estate  
Scotland  
Oighreachd a' Chrùin Alba



SCAPE  
Scottish Coastal Archaeology and the Problem of Erosion

## DC research team:

Prof Jim Hansom

Dr Martin Hurst

Freya Muir

Prof Larissa Naylor

Dr Ria Dunkley

Dr James Fitton

Craig McDonnell



## DC team

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(CREW)

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(SEPA)

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(Historic Envi. Scotland)

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(Angus Council)

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(St Andrews Links Trust)

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(Adaptation Scotland)

Duncan Moss

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