

'With risks of climate change come opportunities to re-explore Edinburgh's coast, and the benefits it can provide for nature and society. We can choose what we want our future to look like, and now is the time to act.'

Larissa Naylor, University of Glasgow, 2017



Initial thoughts on: Re-imagining urban coasts: a socio-geomorphology lens to enhance life in an era of extremes

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State of Science

Stormy geomorphology: geomorphic contributions in an age of climate extremes

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How do we help Stormy Geomorphology concepts like “**geomorphic flux zones**” help shift decision-making?

*“The choices society makes in the present – such as planning, infrastructure and engineering decisions – have a strong bearing on the **physical space left to allow natural landforms to adjust to extreme events** while minimizing social and economic impacts.” Naylor et al. in prep.*

Shifting from coastal management to land-based management of coastal risks

- Coastal climate change risks mean we need to re-frame our relationship with the coast.
- The coast is *dynamic* and is not a fixed line
- In practical terms this means we need to allow the sea/coast to occupy currently developed areas on land.
- Are existing land-based policies aware of these risks? Do they consider the coast?



Why now?



SCIENCE BASIS



INCREASING
DAMAGE



POLICY BASIS



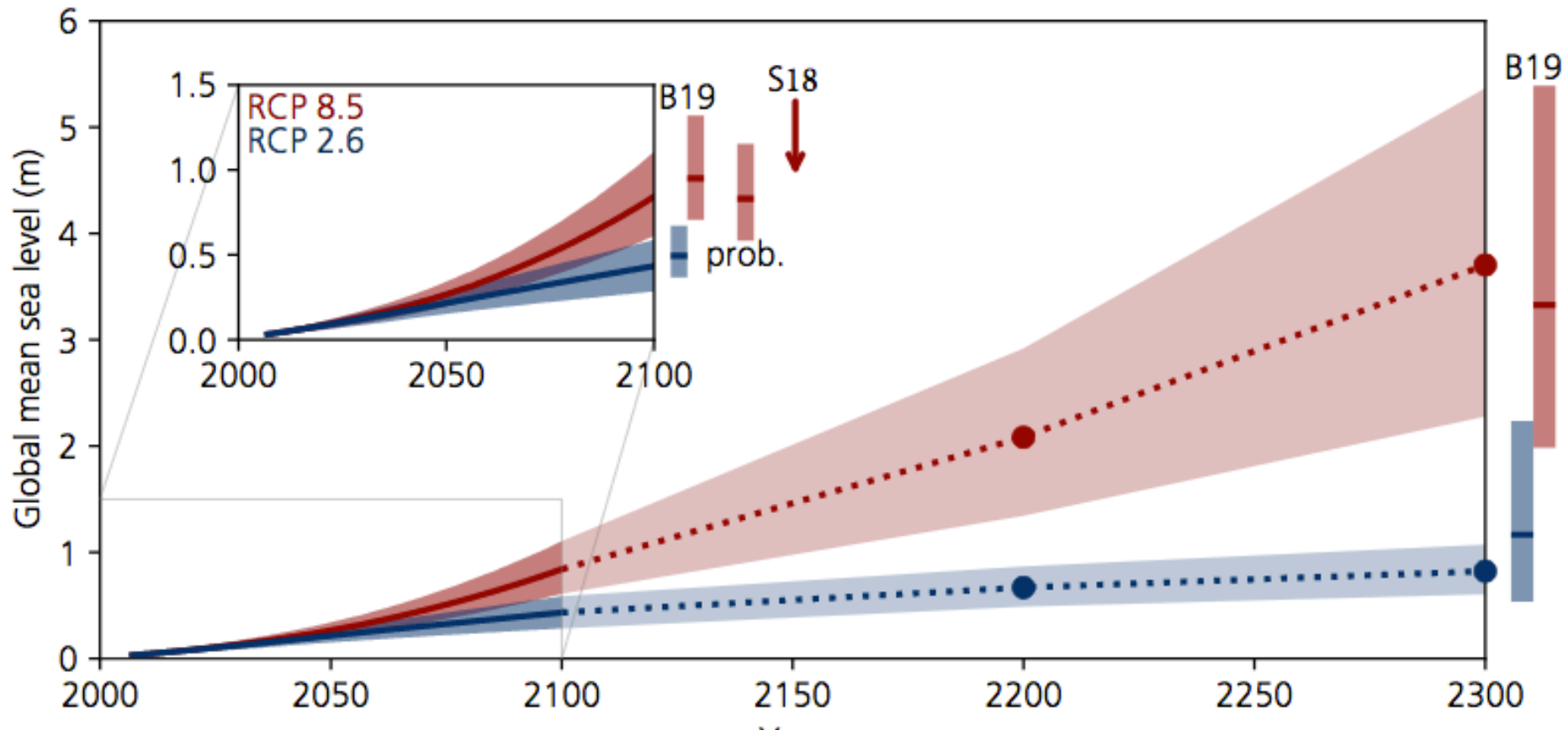
MANAGEMENT
NEED



WINDOW OF
OPPORTUNITY

“This urgent need now creates a new frontier for geomorphology science at the social, political and policy interface.” Naylor et al. in prep.

Why now? Science basis



Source: 2019 IPCC SROCC Report,
https://report.ipcc.ch/srocc/pdf/SROCC_FinalDraft_Chapter4.pdf

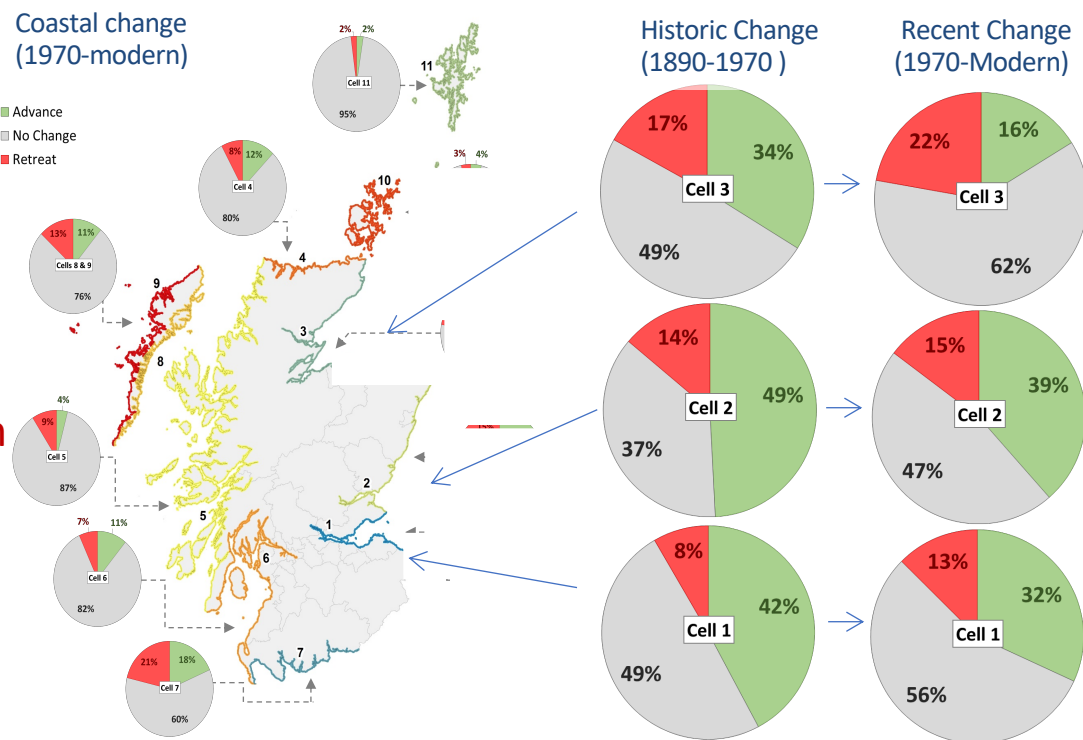
Why Now? Science Basis: Since the 1970s: Coastal change quickening across Scotland

Comparing recent to historic change:

- **22% decrease in advance**
- **39% increase in retreat**
- **2x erosion rate to 1 m per year**
- **Spatial bias**

Consistent with climate change, which is set to quicken in the future.

Natural geomorphic features (beaches, dunes) provide a large buffer – they are key economic asset



Dynamic Coast is an award winning, pan-government research project providing the evidence base on coastal changes to inform sustainable decision making on Scotland's coast

Increasing damages, e.g. Hurricane Imogen destroys new EU funded ferry car park, Ireland



Current responses to storm events

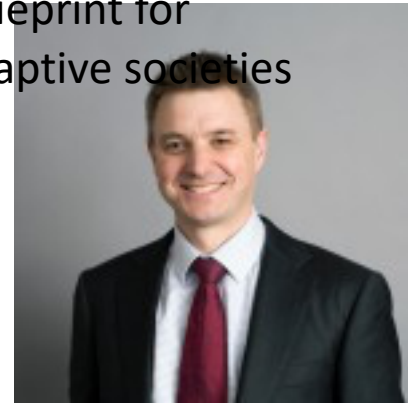
- “Command and Control”
- Focus on “rebuilding” rather than implementing proactive adaptation
- Non-statutory, longer term coastal change plans (i.e. shoreline management plans) are often over-ruled with ‘fixing’ short term disruption
- Can we re-frame storm responses as catalysts for adaptation?



Why now? Climate Change Adaptation Policy Agenda

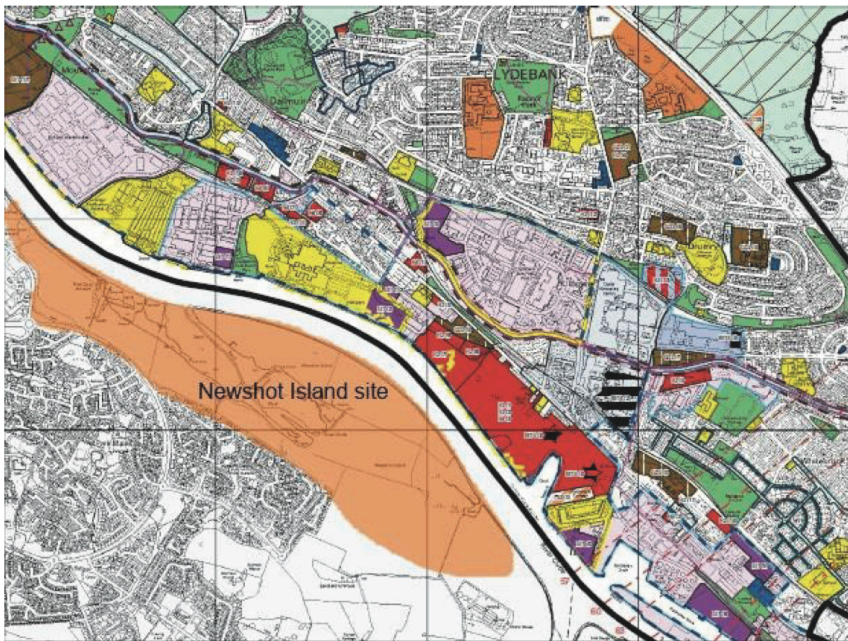
1. **Actions of Low/No Regret**
2. **Not making problems worse** by making L-T decisions now that increase our risk (avoid lock-ins)
3. **Prepare now** for L-T risks and impacts

Daniel Johns's
blueprint for
adaptive societies

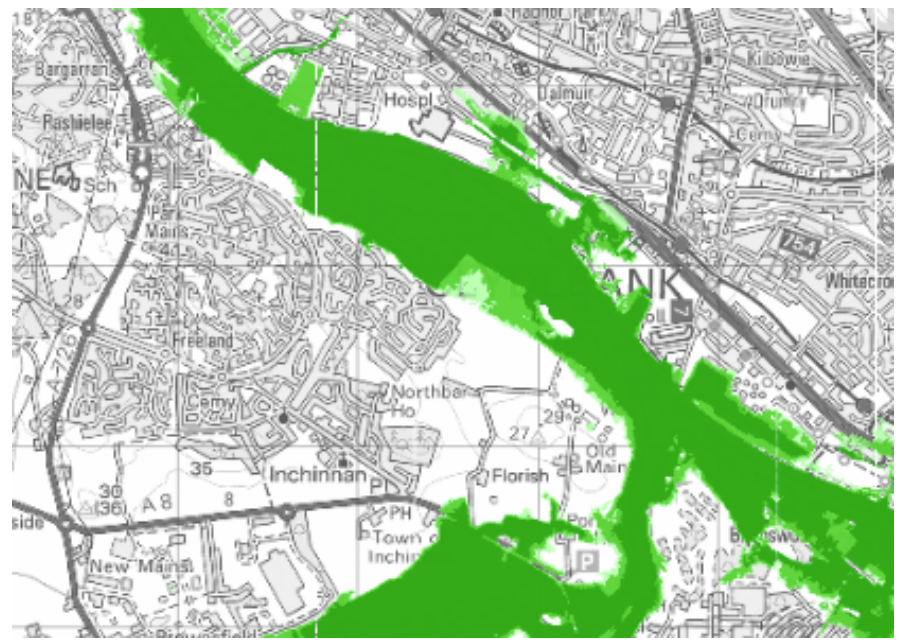


The role of strategic urban planning:

- avoidable lock ins are still happening (the red areas on the left have recently been developed)
- this will increase future risks and costs, and make society less resilient



Recent Development Plan for Clydebank



SEPA coastal flood risk map,
<http://map.sepa.org.uk/floodmap/map.htm>

Why now? Management basis

The “current approach to protecting England’s coastal communities from flooding and erosion not fit for purpose as the climate changes,”
Committee on Climate Change 2018.

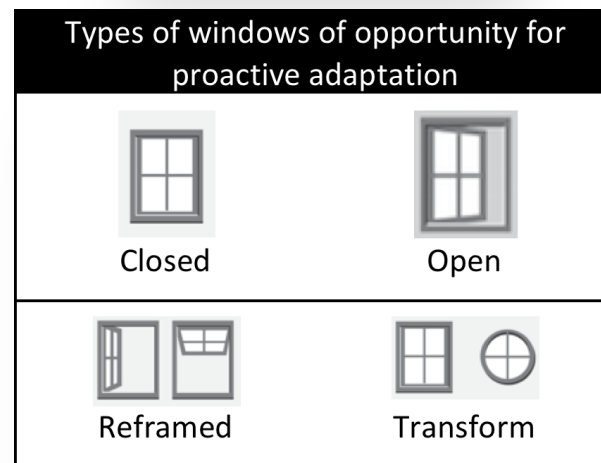
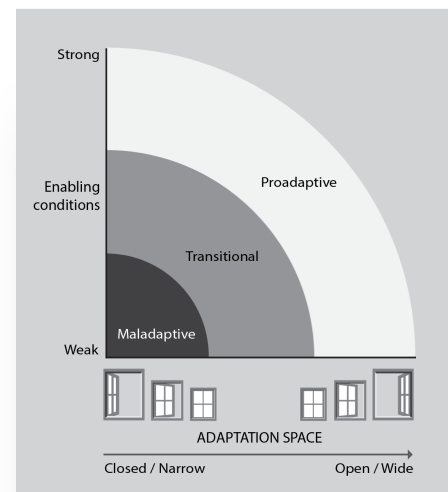
This report makes key
recommendations for science, policy
and engaging with communities to
address these problems.

A window of opportunity for
geomorphology?



(Adaptation) Windows of Opportunity

- Climate change adaptation windows can be defined as: *“a series of individual or collective decisions (cross the full range of sectors influencing the resilience of coastal areas) that can either narrow or enhance our ability to create **physical**, behavioural or political space to better facilitate proactive climate change adaptation.”*
- If we safeguard **physical space for geomorphic systems to function** well now we will increase our adaptation choices



Who do geomorphologists need to work with?



Coastal engineering and process teams



Urban planners



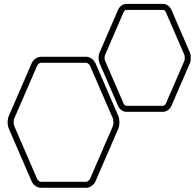
Climate change teams



Housing teams



Landscape and open space teams



Source: Guardian

‘The idea of a less fixed, profoundly dynamic edge seems better suited to the current world and to a more integrative land–sea vision of blue biophilic cities.’ Prof. Beatley, 2017, 99.

Transformative urban change -

- Academic urban planners
- Visualising landscape responses to storms like Hurricane Sandy



What if retreat in urban areas is called “green infrastructure” ?

Post-industrial areas – a physical window of opportunity? What is the role for geomorphology in this space?



Types of windows of opportunity for proactive adaptation



Closed



Open



Reframed



Transform

Brown, Naylor, Quinn. 2017. Making Space for Proactive Adaptation of Rapidly Changing Coasts: A Windows of Opportunity Approach. Sustainability 2017, 9(8), 1408; doi:10.3390/su9081408

Post-industrial areas – physical window of opportunity? Role for biogeomorphology?

c. 1970s regeneration



c. 2005-10 regeneration



Case Study - Edinburgh's Coast

- 34% of the City's boundary
- Not a fixed coast, it has changed through time;
- Much has historically been reclaimed;
- 74% classified as artificial Naturally made up of soft sediment – susceptible to coastal erosion;
- Reclamation and hard engineering means that the natural state of the coast has long been forgotten



Geomorphology meets climate change policy:

Late in the consultation process, this coastal city had no coastal actions. We worked with them and added two:

- Strengthen **scientific evidence** and awareness building of current and future coastal change along Edinburgh's coast ...
- Engage stakeholders to identify how we can adapt our urban footprint to accommodate **a dynamic and changing coast (= geomorphology)** and live with increased coastal flood and erosion risk.



Edinburgh Adapts
Climate Change Adaptation Action Plan

Geomorphology meets strategic planning: 2030 Edinburgh Cityplan Consultation



Source:
<https://www.edinburgh.gov.uk/cityplan2030>

- Coast, shoreline not mentioned
- Erosion, sea level, storm risk not mentioned
- Flood is mentioned, but only in reference to rivers.
- Key risks for a coastal city are not present in the current city plan



For Edinburgh, sea level rise by the end of the century (when compared to 1981- 2000) is very likely to be:

Low emissions: ~ 0.08 m to 0.49 m.

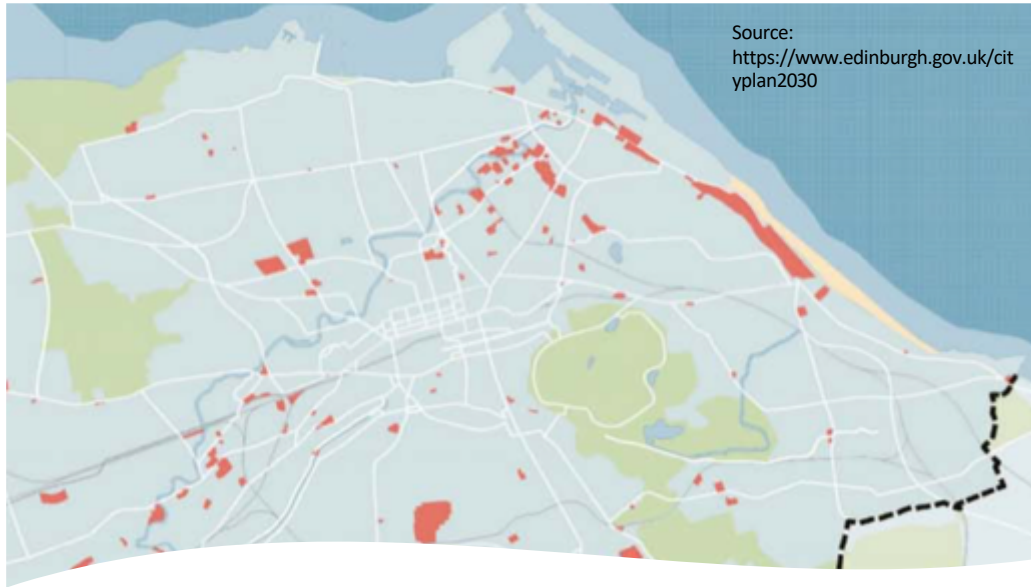
High emissions: ~0.30m - 0.90m.

Geomorphology science – to improve evidence base to support urban planning changes



Fitton, J. M., Hansom, J. D., & Rennie, A. F. [A national coastal erosion susceptibility model for Scotland](#). (2016) Journal Article: [Ocean and Coastal Management](#), 132, pp. 80-89. doi:[10.1016/j.ocecoaman.2016.08.018](#)

Geomorphic work = housing policy consultation response



Current CityPlan: “Protect and restore the water environment to create a clean and natural river corridor restored to good ecological status with sufficient space for extreme flood events,” p45

Our suggested addition: “Protect and restore the coastal environment to create a clean and natural coastal corridor restored to good ecological status with sufficient space for extreme flood and erosion events to improve resilience of property and assets near the coast”

Geomorphology
meets housing &
open space teams
– Edinburgh

Creating an urban park instead of houses?



- Coastal geomorphology and coastal climate change risks becomes part of conversation with housing development team
- Coastal geomorphology as part of urban blue-green infrastructure conversations
- Coastal erosion susceptibility data is being used to support the business case for creating a park as a multi-benefit resilience buffer