

# Adaptation Pathways in Coastal Management

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Decision Making Under Deep  
Uncertainty Workshop



# Overview

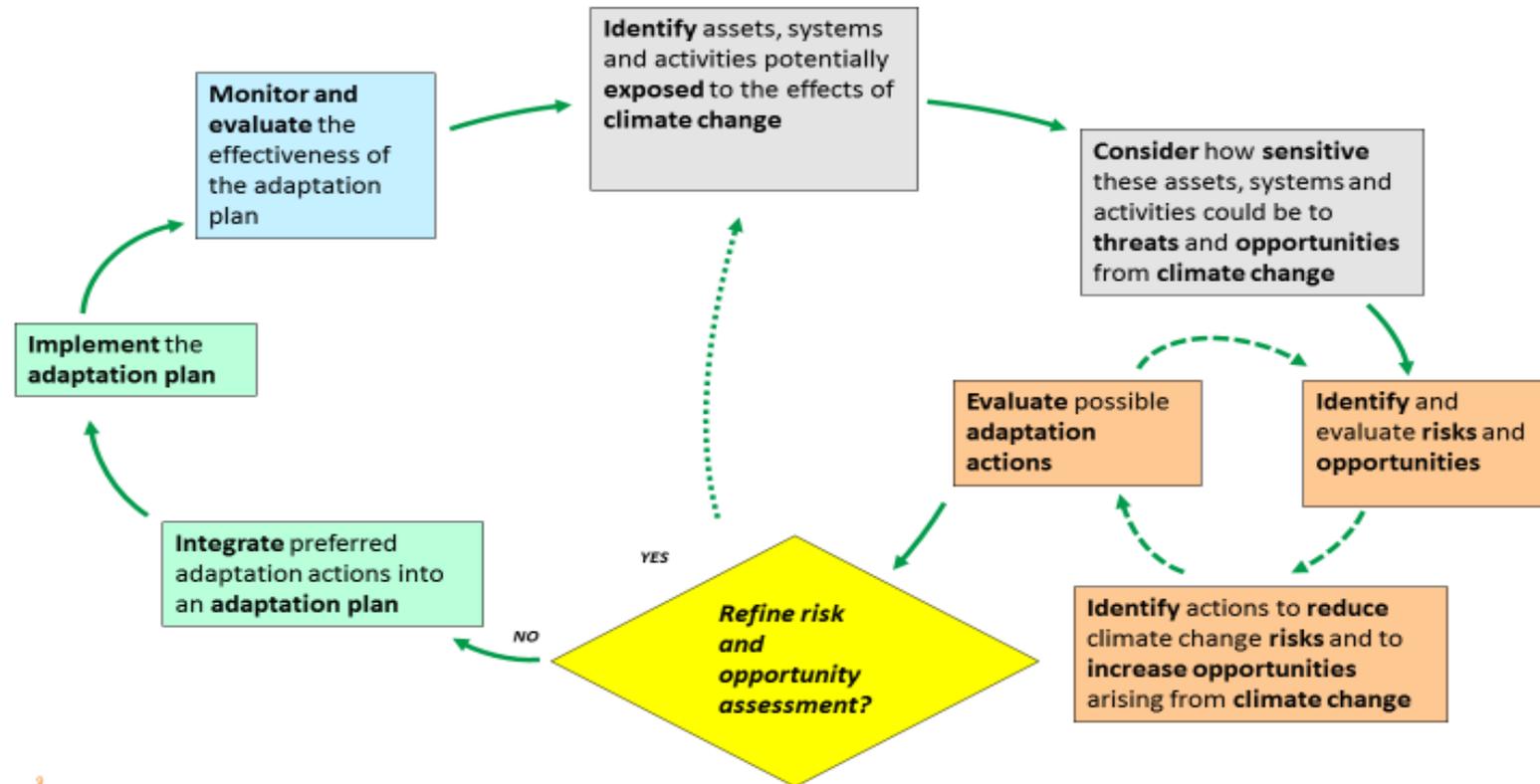
- ❖ **Introductory remarks**
- ❖ **Adaptive planning and management**
- ❖ **Coastal zone adaptation pathway case example**
- ❖ **Insights and observations**

# Adaptive planning - change and uncertainty



- ❖ Adaptive planning is about intervening proactively to ensure key expectations can be met in the face of future change and uncertainty
- ❖ Adaptation Pathways are coherent sequences of planned interventions to maintain the performance of systems over the long term in response to change and uncertainty
- ❖ Interventions are aimed at maintaining or improving the adaptive capacity and resilience of assets and systems in ways that are robust and sustainable

# Adaptive management

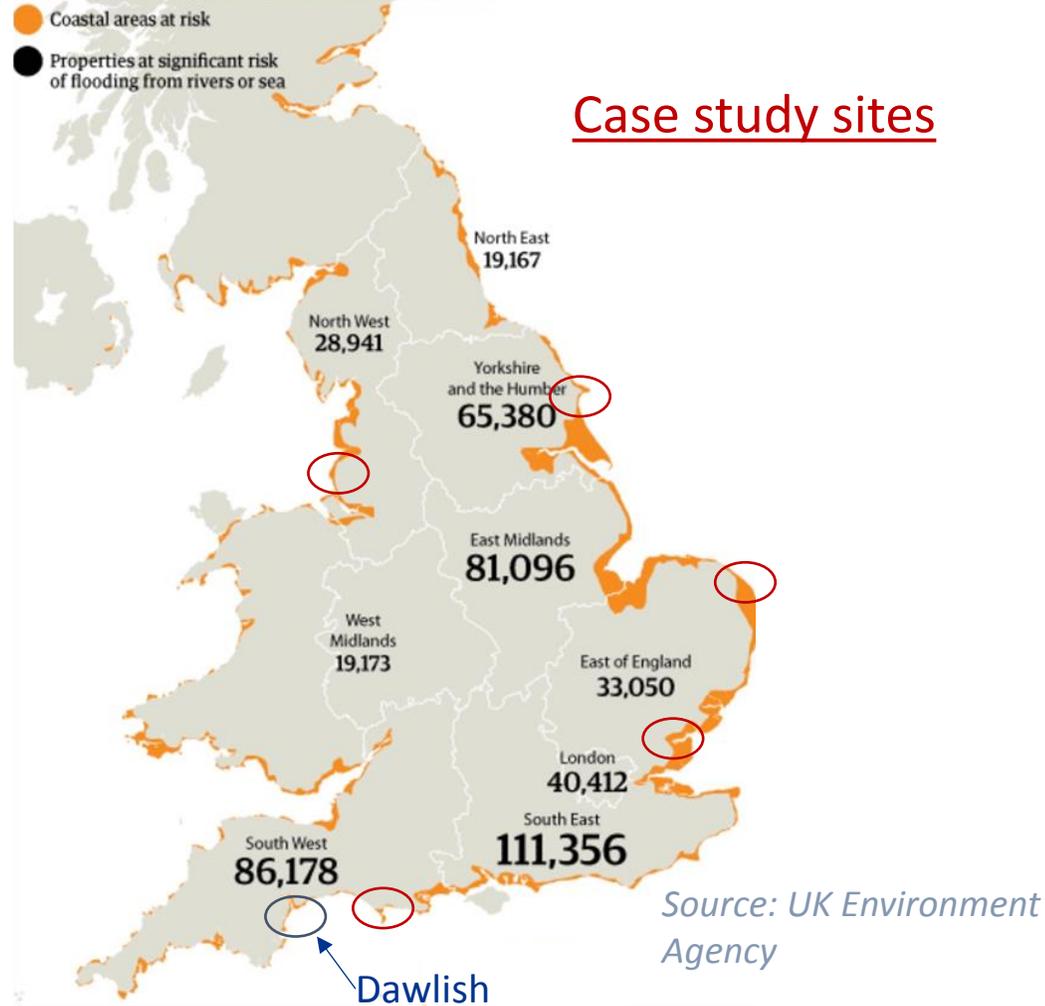


*Adapted from Haasnoot et al., 2013*



# Climate change and coastal communities

Probable scenario: A 2-metre rise in sea levels



Implications of climate change	Coastal zone risks and opportunities <i>(as identified in CCRA Evidence Report)</i>
Sea-level rise	Threat to coastal ecosystems that buffer against flooding and erosion
Flooding and coastal erosion	Threats to communities, infrastructure and areas of amenity value (e.g. beaches)
Extreme water levels	Accelerate coastal erosion
Warmer weather	Increase in the number of visitors to coastal areas

# Dawlish case study



**Coastal erosion**



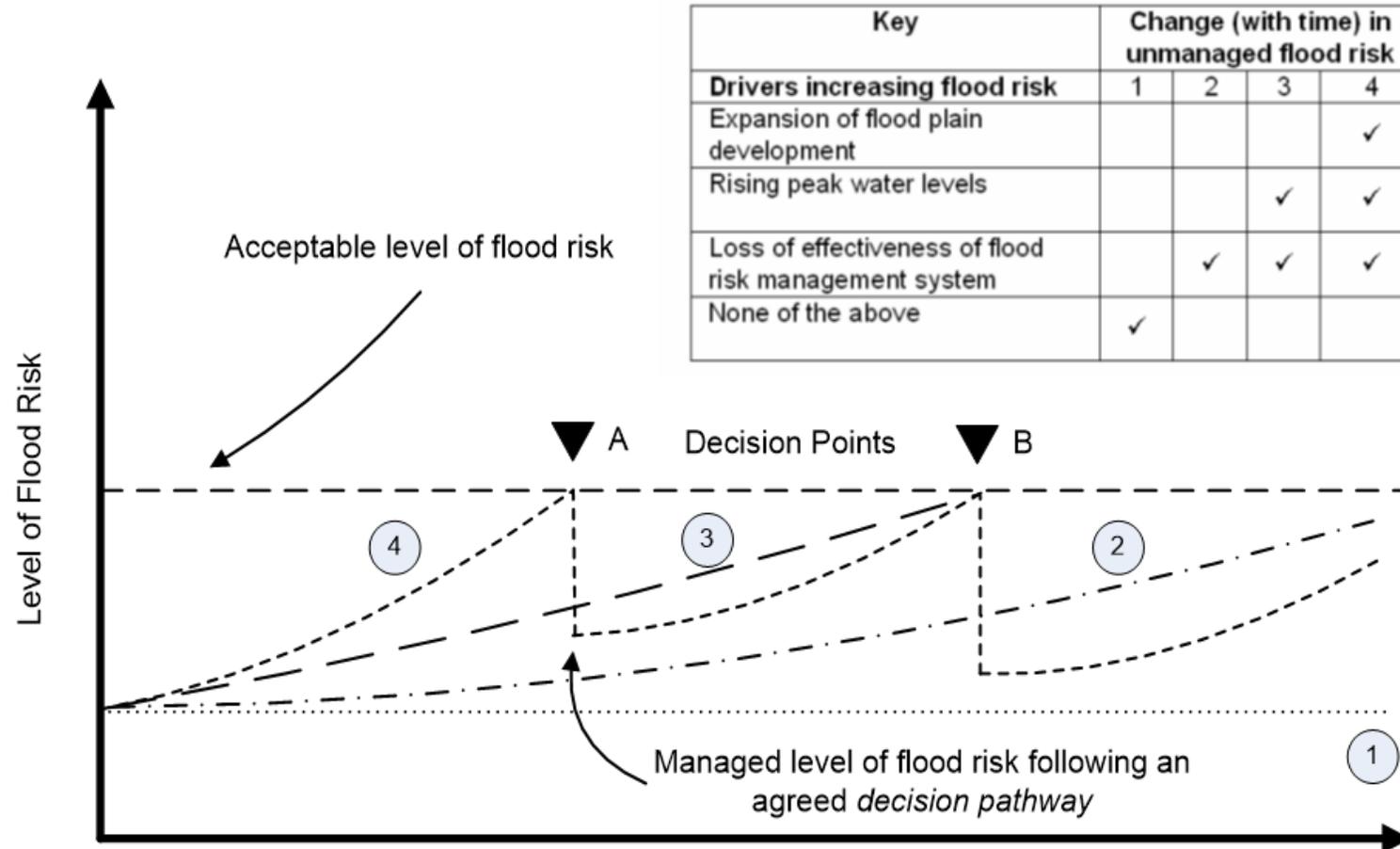
**High sea levels**



**Cliff instability**

- ❖ Understand coastal processes
- ❖ Identify risk thresholds (tipping points)
- ❖ Develop triggers and agree decision-points
- ❖ Build indicative adaptation pathways

# Risk thresholds and decisions

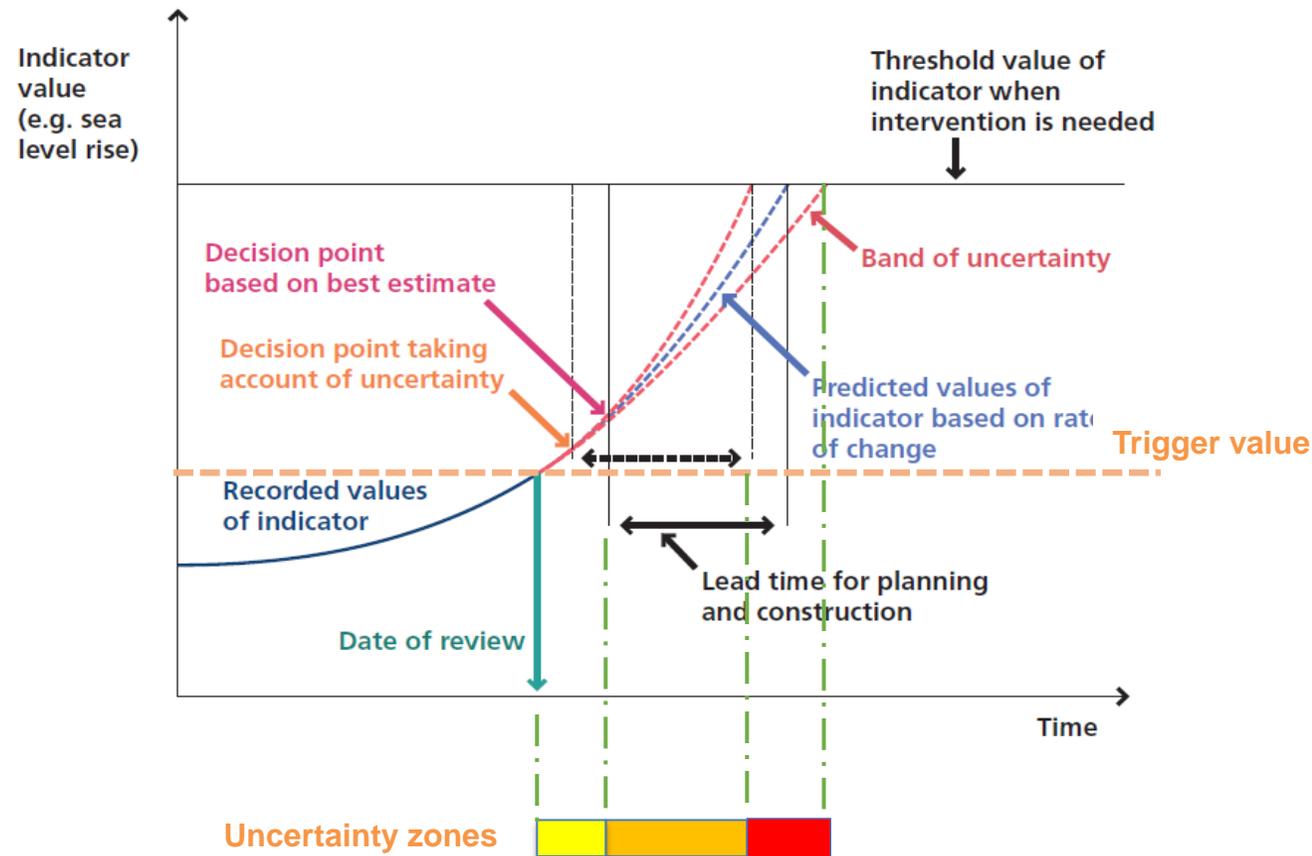


From Donovan, von Lany, et al., 2006

# Uncertainties

- ❖ **estimating future rates of green-house gas (GHG) emissions**
- ❖ **modelling climate responses to emissions levels and deriving projections of future change**
- ❖ **translating projections of future change into physical parameters of interest**
- ❖ **envisaging and assessing what threats and opportunities could result**
- ❖ **the impacts of responses by us and natural systems to climate threats and opportunities – given dynamic interactive systems (of systems)**

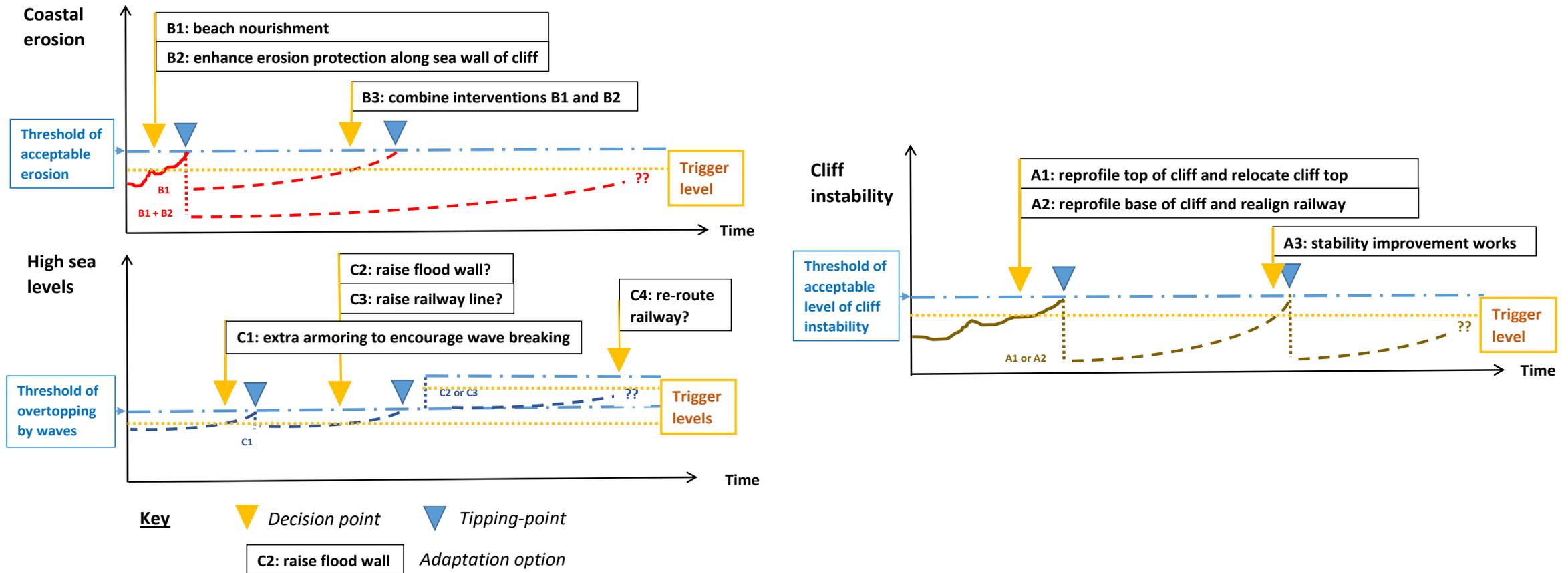
# Triggers and thresholds



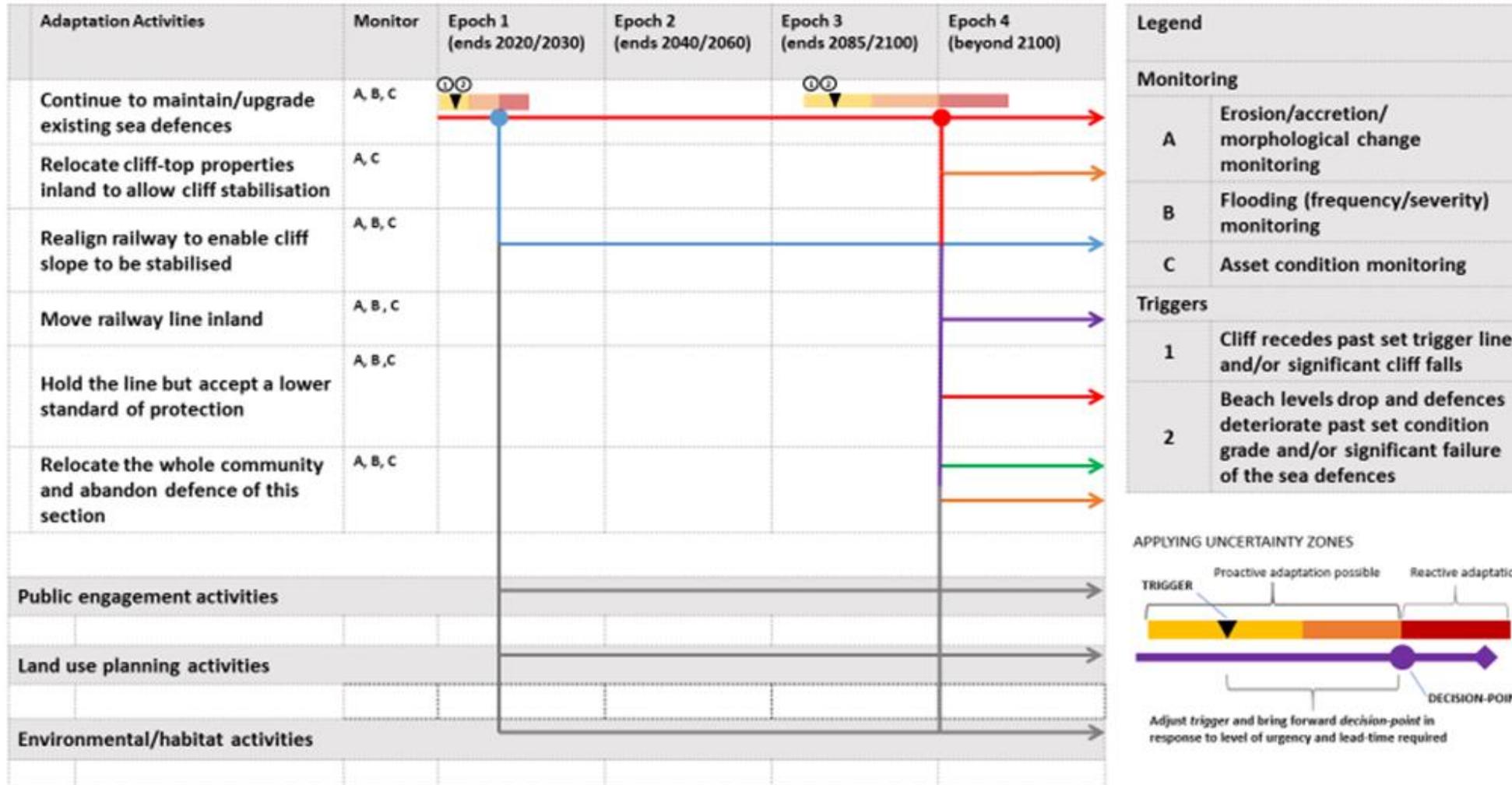
Adapted from Lowe et al, 2009

- ❖ Yellow: indicator value above *trigger* level in 'freeboard' or buffer zone around the *threshold*. Could extreme high-water levels exceed *trigger* level? => **decide!**
- ❖ Orange: level of threat within 'freeboard' or buffer zone. Now possible for extreme event to cross the *threshold*. => **implement adaptation action!**
- ❖ Red: level of threat at the *threshold*. => **ensure adaptation response in place!**

# Multiple threats and thresholds



# Outline adaptation pathways



# Implications of uncertainty

- ❖ An increase in variability in extreme sea conditions could lead to more frequent high water levels (storm surges and waves) which in turn could cause unexpected crossing of flooding and/or erosion risk *thresholds* earlier than anticipated – adaptation actions may need to be brought forward
- ❖ Extreme scenarios (e.g. H++) suggesting sea level could rise to levels much greater than previously anticipated – useful in testing robustness and revealing where incremental adaptation may not be sustainable in the long term
- ❖ New (transformational) strategies such as managed coastal retreat and relocation may be required in certain areas

# Observations and insights

- ❖ Coastal adaptation raises complex and challenging questions around the planning of long-term interventions to manage risks and to deal with uncertainty
- ❖ Adaptation pathways help
  - develop adaptive coastal management strategies, building on existing planning approaches
  - explore issues around risk and uncertainty at coastal locations
  - identify what to monitor
  - inform technical, socio-economic and environmental aspects of adaptation
  - communicate choices between alternative interventions and pathways
- ❖ Challenges in applying adaptation pathways
  - setting *trigger levels* and identifying *thresholds* - particularly where several interactive and dynamic processes are at work
  - incorporating socio-economic and policy factors into risk-based decision-making
  - determining which pathways are the most cost effective and robust over the long term

# Analysis Under Uncertainty for Decision Makers (AU4DM) Network

energy futures lab  
An institute of Imperial College London

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