

PREPARING FOR THE IMPACTS OF CLIMATE CHANGE

***'A Strategy for
Long Term Planning
and Management of
the Shoreline in the
Context of Climate
Change Predictions'***

**Summary
Report**

Halcrow

About SCOPAC

Established in 1986, the Standing Conference on Problems Associated with the Coastline (SCOPAC) is a Regional Coastal Group of local authorities and other organisations which share an interest in the sustainable management of the shoreline of central southern England. SCOPAC's area of interest extends from Lyme Bay in the west to Shoreham-by-Sea in the east and includes the Isle of Wight and the coastal waters.

SCOPAC's primary aims are to:

- Support the duties and responsibilities of member organisations relating to coastal defence;
- Promote and co-ordinate regional strategic shoreline management objectives;
- Commission, disseminate and apply research;
- Assist operating authorities in the delivery of DEFRA's High Level Targets for Flood and Coastal defence by facilitating the exchange of experiences and best practice and by fulfilling a co-ordinating role; and
- Influence the development of National and European Union policy and programmes.



Background to this Study

The anticipated implications of climate change and sea level rise present a significant challenge to future coastal management. It is expected that there will be increased levels of risk to many coastal assets. Central and local government will have to develop and implement policies that address the increasing risks, whilst also meeting the inevitable financial constraints.

In commissioning the research study, SCOPAC stated that it "believes that the question of climate change impacts is probably the most important issue to be faced by coastal local authorities and communities they represent, alongside other organisations, in the coastal zone". SCOPAC recognised that it is essential to carry out research and investigation work on climate change now, in order that appropriate decision-making can be implemented through the planning and political processes. The study aims to inform those with responsibility for shoreline management, along the central south coast of England, of the likely impacts of climate change, and its implications for future management.

This provides the context for this study commissioned by SCOPAC to assess the impacts of climate change on the central south coast of England. The study has been undertaken by a consortium led by Halcrow Group, in partnership with the Universities of Newcastle-upon-Tyne and Portsmouth, and the UK Meteorological Office (Met Office).

The key aims of the research project were to:

- Derive climate change scenarios for the next 80 years;
- Develop an understanding of the generic impacts of climate change on the coast;
- Determine vulnerability, hazard and risk along the SCOPAC coast;
- Identify requirements for informing coastal planning and management of climate change impacts; and
- Identify future good practice for coastal management.

A two-stage approach has been taken. The first involved identification of future climate scenarios and their likely physical impacts on the coast, and the second involved assessing the implications of these for assets and coastal risk management.

Climate Change

Climate change is a natural phenomenon. However, there is a growing body of evidence that the atmosphere is changing significantly and that human activities, which result in the emission of so-called greenhouse gases, are strongly implicated. The majority of scientific opinion agrees that human influences on global climate are now detectable above and beyond natural changes. This is particularly the case for near surface global mean temperature. Since the industrial revolution man has been changing the composition of the atmosphere, primarily by the burning of fossil fuels. Through the study of historical weather records and future projections with numerical models there is strong evidence to suggest that human influenced climate change is taking place, and may accelerate in the future.

Over the last fifteen years a very considerable amount of work has been published on climate change and its potential impacts, and much research is presently underway. This study has reviewed a wide range of sources and has carried out new analysis of data to derive scenarios of climate change for the central south coast of England up to 2080. This has focused on the potential changes in temperature, rainfall, wind, waves and sea level, as these parameters are most likely to influence coastal change.

Published estimates of future climate change have been reviewed and where possible a best estimate applicable to the SCOPAC coast has been derived. The key expected changes up to 2080 are:

- Rainfall to be greater in winter (up to 23% increase) but less in summer (up to 20% reduction);
- Global temperature predicted to increase up to 4.7°C;
- Extreme sea levels to rise about 84cm for the 1 in 50 year event;
- Wind and locally generated waves to undergo little change, although wind speed and wave heights likely to increase slightly in the west and decrease slightly in the east of the SCOPAC area; and
- Wave direction to change, an example for Lyme Bay, Dorset predicted a 2° shift in mean wave direction and the potential for the longshore drift direction to be reversed.

Summary of Physical Impacts

The assessment of future vulnerability, hazard and risk was based upon an appraisal of possible impacts of climate change on the landforms of the SCOPAC coastline. The following points summarise the main impacts and sensitivities identified:

- Climate change is likely to result in changes to three key forcing agents that could have significant implications for the physical condition of shorelines: (i) rising sea-levels; (ii) changes in wave direction; and (iii) increased rainfall with concentration in winter and a tendency for more extreme events.

- Beaches fronting coastal lowlands are especially sensitive to these impacts. This is the result of three main factors: (i) inherent sensitivity to change of free standing barrier beaches and spits; (ii) limited natural supplies of fresh sediment, often due to the presence of updrift coastal defences; and (iii) stabilisation of many beaches by defences preventing them from naturally migrating landward. Past patterns of flooding of developments built on lowlands behind such beaches are likely to intensify in the future, raising major questions over the sustainability of attempting to 'hold the line' at such locations in the long term.
- Existing trends for erosion of saltmarshes in estuaries are likely to accelerate in the future. This is because: (i) most perimeters are defended or backed by rising land preventing landward migration of marshes and generating problems of "coastal squeeze"; and (ii) fresh sediment supplies may not be sufficient to allow marshes to accrete vertically to keep pace with rising sea-levels. Increased exposure of backing defences through loss of marshes, again raises questions over 'holding the coastal defence line' in the long term.
- Soft rock coastal cliffs are likely to retreat more rapidly in future due to: (i) increased toe erosion resulting from sea-level rise; and (ii) higher winter groundwater levels due to increased effective rainfall. It is thought that cliff recession rates could increase by up to 100%, although there might be a time-lag before the cliff top responds to conditions at the toe. Although this would increase hazards at the cliff top, it has the potential to supply valuable additional sediments to local beaches and estuaries.
- One of the major hazards identified is the potential for reactivation of relic landslides due to increased toe erosion and elevated groundwater levels. Such slopes are identified around Lyme Regis, Dorset, and within the Undercliff and on the north coast, of the Isle of Wight. The exceptionally wet winter of 2000/01 has already resulted in intensification of reactivations at some locations and is an indication of the conditions that might be expected to occur more frequently in the future.
- Wherever decisions are made to 'hold the defence line', it is likely that future climate change will make it technically more difficult and increasingly expensive to achieve this in practice. Key pressures are identified as follows: (i) overtopping due to rising sea-levels; (ii) growing potential for combined tidal and fluvial flooding on tidal rivers; (iii) losses of beaches and marshes in front of defences; (iv) increased wave forces on structures; (v) changing patterns of drift resulting in altered patterns of erosion and deposition; (vi) possible reduction of toe support and an increase in groundwater levels within stabilised cliffs; and (vii) an increased potential for "flash flooding" of low-lying urban areas caused by intense rainfall events.
- Changes in the climate and coastal landforms will inevitably also result in changes to coastal habitats. These are some of the potential impacts: (i) loss of freshwater and brackish habitats as a result of either coastal retreat or increased saline flooding; (ii) loss of terrestrial habitats as a result of erosion; (iii) 'squeeze' of intertidal habitats between rising sea levels and defences; (iv) changes in habitat and species distribution as a result of climatic alterations; and (v) habitat impacts from changing patterns or distribution of agricultural and tourist practices.

Relatively few beneficial impacts of climate change can be identified at the coast. Eroding cliffs should supply additional sediments where they remain free to erode.

Increased tidal prisms of estuaries may assist in tidal flushing and maintenance of navigable channels. Warmer conditions may encourage coastal tourism.

Issues and Recommendations

Research, and a detailed consultation exercise, were undertaken to assess the impacts of these climate-induced changes on the management of risks at the coastline. The following are the key issues and recommendations arising.

Ability to Manage Risks

SCOPAC should seek to influence its own future ability to manage coastal risks. This will involve taking steps to influence the government and, possibly, the EC on what they consider to be the best and most cost effective approaches to managing risks in the future. This will require SCOPAC to adopt a more pro-active lobbying role, which could include producing position statements and policy review papers. This could involve the following:

- Research to identify the legislative and administrative tools that SCOPAC members believe they require for effective management of coastal risks, including studies to determine the feasibility of introducing new management options such as compensation.
- Review of new legislation and policy changes, before their implementation, to ensure they do not have adverse effects on SCOPAC's risk management aims, i.e. be able to demonstrate any potential problems or conflicts.

Planning and Coastal Management

The existing planning and coastal management framework should be used to reduce coastal risks. Key actions could include:

- Strengthening of Local Plan policies against inappropriate development on land at risk from flooding or erosion. This will increase the accommodation space behind the shoreline and enable improved "natural" adjustments of landforms.



- Development of risk appraisal studies in developed areas known to be at risk from either land instability or flooding.
- Implementation of a suite of options to reduce future flood risks, including improvement grants (flood proofing), change of property use (i.e. non-residential), not developing in 'brown field' sites within risk areas, etc.



Coast Defence

The management of coastal defence provision will largely involve consideration of a range of climate change scenarios and impacts within the existing procedures. Key recommendations include:

- Operating authorities must ensure that the long-term policies adopted in Shoreline Management Plans (SMPs) and Strategy Plans are not unduly amended as a result of political pressures.
- Future coastal defences should be designed with a full understanding of coastal processes and longer-term evolution trends, based on DEFRA's Futurecoast project.
- New defences should be designed so they are capable of adapting to changes in future conditions. Probabilistic risk assessments can be used to consider a range of future scenarios and their impacts.

Nature Conservation

Recommended actions are aimed at meeting statutory obligations placed on local authorities, meeting biodiversity targets and seeking to maintain the existing nature conservation resource in the face of climate change.

- SCOPAC should lobby to ensure that the boundaries of protected areas reflect the realities of the dynamic coast. This may include seeking a modification of current legislation to enable the enlargement or de-designation of protected areas to reflect shifts in habitat interest, or the creation of buffer zones to allow for future changes in habitat distribution.
- New protected sites will be needed to replace those that no longer meet their designation criteria. In some cases, land could be set aside and protected in advance of habitat creation.

Data and Education

Whilst it does not ensure effective risk management, increasing the understanding and certainty associated with climate change will allow better informed judgements to be made. This applies to all levels of decision-making from Central Government down to individuals. Key recommendations include the following:

- Strategic monitoring is vital to coastal management. SCOPAC should encourage the adoption, funding and extension of current proposals for a regional monitoring strategy.
- The SMP review process should be used to improve the understanding of climate change and its potential impacts.

Widespread consultation is undertaken during SMP development, and this will provide an ideal platform for 'spreading the word' to all parts of the coastal community.

- SCOPAC could promote research into the combined effects of tidal surges and high precipitation events. Flooding from this combination affects many coastal urban areas in the region. This is currently poorly understood.

Conclusions

Two of the key findings of this study are:

- Climate change will bring about changed patterns and intensities of existing coastal processes and hazards, but new hazards will not be created. Therefore we know what the physical impacts of climate change will be, it is their magnitude which remains uncertain.
- Climate change is just one variable in the future coastal management framework. The changes in society and the political economy that will inevitably occur over the next 80 years will be as significant as climate change in determining coastal risk management. **So regardless of climate SCOPAC must be prepared for future change.**

With regard to future risk management, the key message is one of the need for SCOPAC to be pro-active in recognising the potential for change, climate-induced or other, and ensure that their needs are considered in any changes to the management framework. This will primarily involve research and lobbying of government.

It is argued that the majority of the measures recommended by this study will prove strongly beneficial irrespective of climate change. The key issue is that the threat of climate change should focus attention upon the needs now for forward planning and preparedness rather than awaiting overwhelming evidence of impacts. Many of the options to work with physical systems by creating accommodation space would no longer be feasible should the latter option be pursued.

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