

Coastal Heritage and Climate Change in England: Assessing Threats and Priorities

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There are now strong grounds for thinking that the rates of coastal processes will increase in the future, and that this speeding up is at least partly due to the impact of climate change on the coastline. The focus of this paper is on England only, primarily the impact of coastal change specifically upon archaeology rather than on the wider historic environment, but acknowledging, though not referencing here, the work of colleagues in Wales, Scotland and Northern Ireland on coastal and marine survey which contributes so much to our understanding of the processes and impacts of coastal change. The paper discusses the different climate change impacts on the coastal and maritime historic environment, including direct physical impacts, indirect impacts that are a consequence of decisions taken now by coastal managers anticipating future climate change, and indirect impacts related to attempts at climate change mitigation.

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Coasts are dynamic, but historic assets are fixed (Figure 1). There is nothing new about that: in England, losses of Roman coastal forts (such as Walton Castle, Suffolk), prehistoric and later trading sites (such as Meols, Wirral) and medieval churches (such as at a number of locations on the East Anglian coast) have been documented since the eighteenth century. Similar losses have been recorded around Britain and Europe and, indeed, at many other locations around the world. This continuing process of resource loss is part of the much longer-term process of relative

sea-level rise that has resulted in submergence of the prehistoric landscapes of the European continental shelf.

However, there are now strong grounds for thinking that the *rates* of coastal processes will increase in the future. The focus of this paper is England only, primarily the impact of coastal change upon specifically archaeology rather than the wider historic environment, and acknowledging but not referencing here the work of colleagues in Wales, Scotland and Northern Ireland whose work on coastal and marine survey contributes so much to our understanding of the processes and impacts of coastal change.

The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) expresses ‘very high confidence’ that humanly induced climate impacts have led to a net warming of global climate since 1750 (IPCC 2007a; 2007b). An increase in the mean rate of global sea-level rise has been recorded already (1.8 mm per year overall in 1961–2003, but 3.1 mm per year in 1993–2003), resulting from thermal expansion of the oceans, combined with an input of glacial meltwater. Models suggest increased frequency of heavy precipitation events, and it is possible that storm intensity will also increase. There could be a mean rise in sea levels globally of



FIGURE 1 The hulk of the sailing barge *Tuesday of Rochester* on the Alde Estuary, Suffolk. The trade carried by small coasting vessels was of enormous economic importance well into the twentieth century. This hulk is just one of very many in English estuaries. How can we manage their inevitable disintegration and loss?

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between 28 and 43 cm by 2100, though this could easily be an underestimate as the effects of ice-sheet flow were excluded from the IPCC models intentionally; and more recent studies suggest that atmospheric CO₂ concentrations are rising more rapidly than previously thought. The final reports from UK Climate Impacts Programme UKCIPo8, to be published later in 2009, will make interesting reading; these will offer the opportunity to compare data at the pan-European scale of climate impacts, particularly in relation to the findings of the only EU-wide study to date, the 'Noah's Ark' Global Climate Change Impact on Built Heritage and Cultural Landscapes project (<http://noahsark.isac.cnr.it/>) (Brimblecombe & Grossi 2006).

Climate change impacts on the coastal and maritime historic environment fall into four main categories:

- direct physical impacts causing accelerated erosion or increased flooding
- indirect impacts that are a consequence of decisions taken now by coastal managers anticipating future climate change (such as 'non-intervention' approaches to coastal defence)
- indirect impacts related to attempts at climate change mitigation (principally expansion of the renewable energy sector)
- northwards expansion of alien fauna.

The physical processes affecting coastal historic assets are varied (Figure 2). Increased cliff erosion due to rising relative sea levels, partly related to loss of beaches, but also to increased rotational failure of unstable cliffs after heavy rain, will affect cliff-top and foreshore sites. Sites stratified within salt marsh sediments will be destroyed by the effects of 'coastal squeeze', which occurs where an area of salt marsh is 'trapped' between a rising sea level and hard defences such as sea walls and erodes progressively. Salt marsh sediments contain numerous well-preserved archaeological sites and structures, and coastal squeeze prevents natural habitats gradually migrating inland as the coast erodes. The loss of these habitats may reduce the protective buffer effect of the salt marsh, accelerating the movement of the coast, but the archaeological deposits would be at similar risk whether squeeze were taking place or not. Breaching of coastal dune and spit barriers will expose sites formerly landwards of these features to flooding and erosion, and, more generally, increases in the severity and frequency of flooding will damage historic buildings and structures. Other climate change scenarios (with high/increasing probabilities) include increases in the severity and frequency of storms, wind throw and accelerating cycles of airborne salt pollution. All of these coastal processes will have impacts on coastal historic features, landscapes, parks and gardens as well as structures.

Mitigation measures, including excavation and recording of sites before their loss, and relocation of buildings, have already been initiated in some places, but in a situation where hundreds of historic assets are threatened by natural processes full mitigation is likely to be financially unrealistic. Heritage groups and agencies will need to prioritize their resources for sites and buildings of special interest. We are talking about archaeological sites, buildings and structures, many protected by existing legislation. We should also include numbers of Registered Historic Gardens that are also affected, where alternative agents of mitigation may need to be developed. Many of these sites are themselves of considerable archaeological value, but we may need to develop new methodologies to achieve 'preservation by record'.



FIGURE 2 Wallasea Island, Essex: managed realignment. The formerly reclaimed area to the left of the sea wall (once maintained as grazing marsh and, later, arable) is now reverting to salt marsh and mudflat following sea wall breaching for realignment.

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In England, Shoreline Management Plans (SMPs), produced by local authority coastal groups and the Environment Agency with guidance from the Department for Environment, Food and Rural Affairs (Defra), set the broad management framework for coasts over timescales of 0–20, 20–50 and 50–100 years (McInnes 2003). The aim is to ‘manage risk [...] to people, and the developed, historic and natural environment’ in a sustainable way (Defra 2006). For each Coastal Policy Unit — a discrete definable length of coast — one of four options is selected:

1. Hold the line
2. Advance the line
3. Managed realignment
4. No active intervention.

The preferred option will depend, among other factors, on risk management, on the value of assets to be protected (from houses to nuclear power stations) relative to costs of defences, and on the requirement to comply with nature conservation legislation and biodiversity obligations. English Heritage has provided guidance for coastal managers (2006), and is commissioning a programme of Rapid Coastal Zone Assessment Surveys (RCZAS) to enhance the coastal National Monuments Record (NMR) and county Historic Environment Records (HER). An expanded

evidence base is essential for informed contributions to SMP review, and long-term asset management (see <http://www.english-heritage.org.uk/server/show/nav.18390> for RCZAS reports). The Environment Agency has also produced internal guidance on coastal defence and the historic environment, aimed at ensuring that decisions that affect the historic environment are informed but are also sustainable. However, the historic environment is only one of many factors to be considered in option selection. It is worth noting that no property has a legal right to flood defence, and that property that is no longer defended as a result of the SMP process does not have a right to compensation. Some options, including allowing natural processes to take place, will adversely affect sites and buildings, and are bound to be selected for some lengths of coast in most, if not all, SMPs. While in many cases it may be possible to develop mitigation strategies for individual monuments, there will inevitably be instances where significant archaeological sites are lost to the sea (Figure 3).

Climate change mitigation, in terms of reducing carbon emissions from power generation, is partly focused on increased use of renewable energy resources. At present, offshore wind farms are providing the most significant contribution. The implications for the coastal historic environment from large-scale offshore arrays



FIGURE 3 Wallasea Island, Essex. Within the realigned area, linear features such as drainage ditches and borrow-dykes (originally dug to provide material for sea wall construction) begin to function as natural creeks and will eventually develop sinuous courses. Signs of human intervention will become less evident over time.

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relate largely to the cable landfalls and associated infrastructure. The UK Department for Business, Enterprise and Regulatory Reform has initiated a feasibility study for a possible tidal power barrage in the Severn Estuary, to report in 2009, and there is potential for tidal energy generation elsewhere. Barrages of this type plainly could have severe impacts on submerged and coastal archaeology. It is therefore essential that environmental impact assessments include desk-based assessment of potential archaeology, combined with geophysical and geotechnical investigation, to define the resource and ensure effective archaeological mitigation.

Rising ocean temperatures are already resulting in expansion northwards of organisms such as *Lyrodus pedicellatus*, a species of shipworm that, unlike the northern species, is active all year, thus constituting a major threat to submerged and intertidal wrecks and other archaeological wooden structures. It has been recorded on sites in Langstone Harbour, Hampshire and on the wreck of the Tudor warship *Mary Rose* when it was recovered from the seabed in 1982. New terrestrial colonists may also be expected. There is already a population of North African scorpions in the eighteenth-century Sheerness dockyard wall, which causes problems during maintenance, for contractors are reluctant to tender for works.



FIGURE 4 Reculver, Kent. The partly ruinous medieval church is on the site of a Roman fort of the *Litus Saxonicum* and an Anglo-Saxon monastery. The towers were only preserved because they act as a day-mark for mariners. The site is now heavily defended with rock-rubble armouring, without which it would erode rapidly, but will it be possible to sustain this through the twenty-first century?

Image © Peter Murphy

Historic assets on the coast are already being affected by climate change and this can only get worse. Protection of some assets — especially those on developed coasts — will be possible, but elsewhere mitigation rather than conservation will be needed (Figure 4). This obviously goes against the grain for heritage conservation bodies. Nevertheless, difficult decisions will have to be made on prioritization and funding allocation, and in the end we will simply have to let some assets go (see Flatman 2009).

Bibliography

- Brimblecombe P & Grossi C M 2006 Climate change critical to cultural heritage, in R Fort, M Alvarez de Buergo, M Gomez-Heras & C Vazquez-Calvo (eds) *Heritage, weathering and conservation*. London: Taylor and Francis, 387–93. Downloadable from http://noahsark.isac.cnr.it/publications/Publication_1.pdf
- Department for Environment, Food and Rural Affairs (Defra) 2006 *Shoreline management plan guidance: aims and requirements* (vol. 1) and *procedures* (vol. 2). London: Defra. Downloadable from <http://www.defra.gov.uk/Environ/Fcd/guidance/smp.htm>
- English Heritage 2006 *Shoreline management plan review and the historic environment: English Heritage guidance*. London: English Heritage. Downloadable from <http://www.helm.org.uk/upload/pdf/Shoreline-Management-Plan-Review.pdf?1242037019>
- Flatman, J 2009 A climate of fear: recent British policy and management of coastal heritage, *Public Archaeology* 8(1), 6–22.
- Intergovernmental Panel on Climate Change (IPCC) 2007a *Climate change 2007: climate change impacts, adaptation and vulnerability. Contribution of Working Group II to the fourth assessment report of the IPCC*. Cambridge: Cambridge University Press. Downloadable from <http://www.ipcc.ch/ipccreports/ar4-wg2.htm>
- Intergovernmental Panel on Climate Change (IPCC) 2007b *Climate change 2007: the physical science basis. Contribution of Working Group I to the fourth assessment report of the IPCC*. Cambridge: Cambridge University Press. Downloadable from <http://www.ipcc.ch/ipccreports/ar4-wg1.htm>
- McInnes, R 2003 *Coastal defence: a non-technical guide*. Ventnor, Isle of Wight: Standing Conference on Problems Associated with the Coastline.

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