MCCIP Marine Climate Change Impacts Partnership

Topic

Coastal Habitats

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Executive summary

On the south coast of the UK, there is historical evidence of the loss of intertidal areas due to a combination of factors. These include land reclamation and changes in area from sediment deficits, plant 'die-back' and glacial **isostatic** adjustment. Significant losses are likely to continue without climate change but loss rates are likely to be exacerbated by accelerated sea level rise (Nicholls *et al*., 1999).

Inter-tidal habitats are dynamic and can respond to sea level rise by **accreting** vertically with the accumulation of sediments and migrating inland. Migration may, however, be impeded by the presence of fixed defence structures. In England, flood defences have removed most opportunities for landward migration (Nicholls and Wilson, 2001) and it is estimated that at least 40 – 100 ha a^{-1} of saltmarsh is being lost (Environment Agency, 1999). Many marshes exhibit accretionary deficits; where accretion is less than relative sea level rise reversion of vegetated surfaces to unvegetated mudflats may occur.

These factors put pressure on the ability of local agencies to achieve the requirements of statutory regulations such as the EC Habitats Directives. More long-term and flexible approach is needed, including the consideration of less geographically determined boundaries and additional planning approaches such as land-banking or habitat compensation.

Full review

Current

Coastal wetlands are vulnerable to inundation and erosion and could experience substantial losses with future long-term (20-50yrs) sea level rise (Hoozemans *et a*l., 1993; Bijlsma *et al*., 1996, McFadden *et al*., 2007). Wetland areas are already declining with around 1% of the global coastal wetland stock lost each year (Hoozemans *et al*., 1993). Significant losses are likely to continue without climate change, both from land subsidence or glacial **isostatic** adjustment and anthropogenic impacts, but they will be exacerbated by sea level rise (Nicholls *et al.,* 1999) and by changes in wave climate (Pethick, 1992; Burd, 1992). Many coastal habitats are designated as special areas of conservation under the EC Habitats and Species Directive, including: saltmarshes and mudflats, maritime cliffs, sand dunes, vegetated shingle, coastal grazing marsh and saline lagoons.

The EC Habitats and Species Directive require member states to designate areas of importance for particular habitats and species as Special Areas of Conservation. Together with Special Protection Areas designated under the Conservation of Birds Directive, these areas form a Europe wide network known as 'Natura 2000'. These set out measures to maintain at, or restore, to a 'favourable conservation status' these designated sites and requires appropriate steps to avoid destruction or deterioration of habitats. Member states have a duty to ensure compensatory measures are taken to preserve the Natura 2000 network where sites are adversely affected.

Holman *et al.* (2005a and b), in common with the BRANCH project, showed that the response of biodiversity to climate change are species-, habitat- and region-specific, but much of the biodiversity in these regions will depend on planned adaptation in other sectors.

Future

Stratigraphic studies have shown the formation of saltmarshes to be linked to changes in the position of mean sea level; oscillations in sea level (both rise and fall) are known to have triggered marsh expansion phases where sediment supply conditions have been favourable. Morphological response is both by vertical accretion and by changes in lateral extent and position. Where sediment supply has been restricted by coastal management (e.g. levee construction preventing natural bank breaching and overwash into inter-channel bays) marshes have shown 'accretionary deficits' and an inability of marsh surfaces to keep up with sea level rise. Furthermore, landward migration under sea level rise has often been impeded by the presence of defence structures. In England, flood defences have removed most opportunities for natural landward migration (Nicholls and Wilson, 2001) and it is estimated that 100ha of saltmarsh is lost due to coastal squeeze every year (Environment Agency, 1999). French (1997) predicted losses for coastal habitats between 1992 and 2010 with predicted losses between 2% -11% for different habitats.

Habitat	*Present Area (ha) (1992)*	*Predicted loss (ha) (1992-2010)*
Sand dunes	11,897	240 (2%)
Saltmarsh	32,462	2,750 (8.5%)
Intertidal flats	233,361	10,000 (4.3%)
Shingle landforms	12,376	200 (1.6%)
Saline lagoons	1,215	120 (9.9%)
Soft cliffs	256 km	10 km (3.9%)
Cliff grassland	1,895	150 (7.9%)
Coastal heath	462	50 (10.8%)

Table 1: Predicted losses for coastal habitats between 1992 and 2010 *(reproduced from French,* 1997*)*.

A review of the published literature reveals that there is no reliable consensus of a national rate of saltmarsh loss in the UK well supported by empirical evidence. The figures described either have no identifiable basis (e.g. the many studies (UKBAP, 1999; Atkinson *et al*., 2004; Nottage and Robertson, 2005; Badley and Allcorn, 2006) that quote a figure of loss of ~ 100 ha a^{-1}), or are based on local examples (primarily SE England) and extrapolated to a national level. Where the basis of calculation is known, rates of loss are typically 40 ha a^{-1} (Greater Thames only; Cooper *et al*., 2001) to 60 ha a^{-1} (Hughes and Paramor, 2004). Not surprisingly, these better constrained estimates show considerable inter-decadal fluctuations in loss rates (Cooper *et al.,* 2001).

When flood defences are removed for economic or saltmarsh re-creation purposes, there can be conflict between habitats. Most grazing marshes on the South coast of the UK were created originally by the enclosure of former saltmarshes. Although a few still grade naturally into saltmarsh to seaward, most are now isolated behind flood defences. Designated coastal grazing marsh has been recognised as an especially vulnerable habitat due to moves toward managed realignment of flood defences behind areas of grazing marsh and 'sustainable flood defence' (Nicholls and Wilson, 2001), particularly on the south-east coast between The Wash and Portland Bill (Lee, 1998: Lee, 2001). Grazing marshes are also found in association with another designated habitat, saline lagoons.

Within the Branch project (an INTEREGG funded project on spatial planning and biodiversity), case studies were undertaken on the coasts of France and the UK to investigate the impacts of sea level rise on coastal habitats (Gardiner *et al*., 2007). It was found that with long term sea level rise there will be difficulties in meeting the requirements of the EC Habitats Directive within individual designated sites. The most significant issues relate to intertidal saltmarsh and mudflat areas, which are predicted to decline with medium (5-20yrs) to long-term (20-50yrs) sea-level rise. Compensation for these losses in some localities could be achieved through the creation of replacement habitat by the managed realignment of sea defences, often in conjunction with artificial sediment supply to raise intertidal surfaces to levels conducive to vegetation establishment. However, historic land use decisions will restrict this approach in many areas where major developments have been sited in the floodplain. In particular, managed realignment will lead to a decline in coastal grazing marsh, also a designated habitat under the Directive. However, at wider scales potential exists to compensate for lost coastal grazing marsh with fluvial grazing marsh in adjoining river catchments. Spatial planning offers the potential for future land-banking of these areas, but its implementation may require a reinterpretation of the application of the Habitats Directive. In some locations, dredged spoil could be used in the future to increase inter-tidal elevations and encourage saltmarsh development. However the design rules for such activities are still in the early stages of development (e.g. Widdows *et al.*, 2006).

The effect of sea level rise on other coastal habitats is likely to vary according to geographical position, time and management strategy. For habitats such as sand dunes and shingle, development of landward areas often restricts the natural roll back mechanism and where neighbouring coast is defended sediment starvation can occur, leading to submergence with medium to long term sea level rise. However, with the increased frequency in storms that is anticipated with sea level rise, the formation of new ridges of sand or shingle may act as a nuclei for dune growth (Pye & French, 1993). Alternatively a succession of storms may trigger increased erosion and landward recession of the systems (Lee, 1998). It is estimated that in total 129 ha of sand dunes could be lost over the next 50 years and 130 ha of vegetated shingle (Lee, 1998). Natural cliffs are mainly threatened by conflicts with infrastructure and developments, with the construction of coastal defences. The added issue in areas of high cliff recession, such as the Isle of Wight, is that the habitat will migrate beyond its designated boundaries in the long term and so ceases to require compensation for damage. This illustrates the need for a more flexible approach to the conservation of dynamic coastal habitats.

Current and near-future land use decisions have the potential to influence coastal response for a similar period into the future. Flexibility is therefore essential if future restrictions are to be avoided. Application of the EC Habitats Directive in a more responsive and dynamic manner, based on maintaining stocks of coastal habitats in broad areas, with less emphasis on geographically-defined protected areas, may be a more appropriate model to follow in a changing world.

Confidence assessments

‘What is already happening’ - medium.

Saltmarsh loss recorded anecdotally but detailed, repeat surveys of marsh area to a common methodology lacking.

‘What could happen in the future’ – low to medium (many unknowns e.g. regional variations in sea level rise; changes in wave climate; plant responses to global environmental change; changes in sediment supply; coastal management strategies)

Knowledge gaps

- Impacts of beneficial use of dredged material and sediment recharge to intertidal areas.
- Creation of fluvial grazing marsh as a replacement for coastal grazing marsh; are they comparable from a nature conservation point of view?
- Uncertainties involving coastal **geomorphology** (wave climates, sediment and **accretion** rates) with future climate change.
- Ongoing long-term monitoring and data collection – physical and biological.

Commercial impacts

Intertidal areas are highly productive and provide a number of important functions including flood protection and wave dissipation, waste assimilation, nursery areas for fisheries and nature conservation. It has been observed that 200m of saltmarsh surface can reduce significant **wave heights** by as much as 63% (Moller *et al*., 2001), reducing the need for costly sea defences, however with the loss of saltmarshes and intertidal areas sea walls may have to be upgraded to prevent areas flooding. Tidal saltmarshes have been identified as areas of high productivity providing a source of organic matter and nutrients for fish and a variety of invertebrates (Mitch & Gosselink, 1986; Lefeuvre & Dame 1994), as well as being important nursery grounds for commercial fish stocks such as sea bass, (Laffaille *et al.* 2001).

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