All selective areas of coastline to flood in a controlled way and promote the regeneration of natural coastal processes and vegetation.

MANAGING ECOSYSTEM SERVICES

COASTAL & MARINE

IMPLEMENT MANAGED REALIGNMENT

GOODS & SERVICES

Biodiversity	⬌	
Climate Regulation	⬆	
Erosion Control	⬆	
Flood Control	⬆	

These pages represent a review of the available evidence linking management of habitats with the ecosystem services they provide. It is a review of the published peer-reviewed literature and does not include grey literature or expert opinion. There may be significant gaps in the data if no published work within the selection criteria or geographical range exists. These pages do not provide advice, only review the outcome of what has been studied.

Full data are available in electronic form from the Evidence Spreadsheet.

Data are correct to March 2015.

KEY

Quality of Evidence

Good

Medium

Poor

Quantity of Evidence

Number of sources showing direct evidence

Number of sources showing indirect evidence

Magnitude and Direction of Effect

Magnitude	Direction: ⬆	Direction: ⬌	Direction: ⬇
Strong	⬆		⬇
Medium	⬆	⬌	⬇
Low	⬆		⬇

MANAGING ECOSYSTEM SERVICES

COASTAL & MARINE

IMPLEMENT MANAGED REALIGNMENT

Provisioning Services—providing goods that people can use.

Cultural Services—contributing to health, wellbeing and happiness.

Regulating Services—maintaining a healthy, diverse and functioning environment.

CULTURAL

Biodiversity: ***Strong Evidence:-*** A study from the UK found that five years after a re-alignment, bird communities were similar to adjoining natural habitat but that there were some exceptions, such as Oystercatchers and Red Knot [1]. These species may not be using the sites due to the absence of large bivalves such as *Macoma balthica*. The paper suggests that as UK realignment sites are often small, enclosed and poorly drained they may take decades to reach the diversity found in surrounding mudflats and saltmarshes. In a different UK study, it was found that typical estuarine benthic invertebrates quickly recolonized re-aligned areas with the total species richness being almost equal to a control natural site within a year[2]. However, species abundance within the realigned site was almost one tenth that of the control site. The site on the Humber was subject to rapid accretion, favouring salt-marsh communities rather than mud-flat communities with associated invertebrates. A comparison of sites with natural and managed roll-back in Essex found that 13 regenerated marshes had fewer species than their paired control site, three had an equal number, and two had more[3]. Only two sites had the same plant communities as their (natural) control sites. The study found that even after 100 years, plant communities differed in species richness, composition and structure. In Norfolk, a managed re-alignment site was compared with five reference marshes varying in ages from 30 to c.6,000 years old[4]. Five years following inundation, the plant community structure was still different from all references marshes, with low abundance of perennial and later-successional species. This difference was not due to dispersal, as 76% of species from the local pool had colonised the site. The lack of full vegetation cover may be due to a lower soil redox potential. ***Weak Evidence:-*** A study on the intertidal sediments of a managed re-alignment site in Essex found that after six years the previous agricultural soil had been covered by sediment and was rich in saltmarsh plants such *as Salicornia europea*[5]. Overall the benefits to biodiversity depend on whether you compare the re-aligned site with existing salt marsh or agricultural land.

REGULATING

Climate Regulation: ***Strong Evidence:-*** A study of the Blackwater estuary in the UK looked at how managed re-alignment sites might affect carbon storage and greenhouse gasses[6]. Potentially, managed re-alignment sites in the estuary (29.5 km^2 of saltmarsh and 23.7 km^2 of intertidal mudflat) could sequester 5478 t C yr^{-1}. However, greenhouse gas emissions of methane (CH_4) and nitrous oxide (N_2O) would reduce the net benefit by 24% to 4174 t C yr^{-1}. A similar calculation applied to the Humber Estuary suggests that adding 7494 ha of new intertidal area to the estuary would lead to an annual accumulation of 1.2 x 10^5 tonnes of new sediment increasing the carbon sink potential of the estuary by 150%[7]. This figure is offset by greenhouse gas emissions, reducing the potential benefit by over 50%. Creating about 25% of the maximum potential area for managed realignment on the Humber Estuary (26 km^2 of land) would potentially store 40,000 tonnes of sediment per year[8], burying around 800 tonnes of organic carbon. A comparison of agricultural land, natural saltmarsh and management realignment sites in Essex found that soil carbon stock, C/N ratio and below ground biomass in managed realignment sites were more similar to agricultural land than natural saltmarsh[9]. This study suggests that the carbon storage potential of managed realignment sites may take 100 years to reach the full potential of the natural sites at storing 0.92 t C ha^{-1} yr^{-1}. ***Moderate Evidence:-*** A cost-benefit analysis of managed re-alignment for the Blackwater Estuary suggests that over a 50-100 year timescale the value of carbon buried would make the project cost-effective[10].

Erosion Control: ***Strong Evidence:-*** A study of the sediments at a UK managed realignment site found that resistance to erosion below mean high water mark was low, but above it, the creation of gullies which drained water allowed significant increases in bed strength and resistance to erosion[5]. Overall, the site was found to be mostly depositional, and with characteristics likely to reduce erosion and protect the coast. ***Moderate Evidence:-*** There is a net sediment gain under managed realignment, suggesting that deposition is occurring and that erosion is not[6,7,8]. A meta-analysis of seventy five articles on salt marsh properties[11] found that salt marshes have the ability to attenuate wave energy and stabilise shorelines, as measured by accretion, lateral erosion reduction and marsh surface elevation. ***Weak Evidence:-*** Soft cliff retreat is analysed in a number of studies with regard to shoreline defence or managed retreat. Defence construction was analysed on the East Yorkshire coast and in two cases showed significant excess retreat for tens to thousands of meters down-drift from the defences[12]. Another two cases were indicative of excess retreat. The suggestion is that by preventing managed retreat, erosion patterns will not be reduced, they may just move location. A similar result was found at Christchurch Bay UK where protection works increased the levels of down-drift erosion[13]. An analysis of the effect of coastal defence structures around Brighton, UK, has shown that defences put in place by heavy machinery have 4-25x greater surface lowering in their vicinity than along the surface as a whole[14].

Flood Control: ***Moderate Evidence:-*** A meta analysis of 75 published articles found that wave attenuation was reduced over salt marshes but that there were no studies which quantitatively evaluated floodwater attenuation[11].

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