Economics of Wetland Conservation Case Study: Learning from Managed Realignment

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Abstract

The term "coastal squeeze" describes the loss of intertidal wetland habitat, a combined result of a sinking coastline and rising sea levels constraining the extent of intertidal wetland margins as they abut hard flood and sea defenses and infrastructure such as port facilities. This is driving innovation in the management of coastal flooding through such techniques as managed realignment, where land formerly "reclaimed" for agriculture and other uses is allowed to revert to intertidal wetland habitat. As these habitats reform, a range of beneficially and formerly undervalued services such as flood risk regulation, habitat for wildlife including fishery recruitment, nutrient cycling, and characteristic landscapes are

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restored. This chapter draws lessons about value creation by the recreation of these various ecosystem services drawing upon studies of four managed realignment schemes.

Keywords
Blackwater · Wareham · Managed realignment · Flood defense · Coastal defense · Cost benefit analysis · Stakeholders · Ecosystem services · Fisheries · No net loss · Coastal squeeze · Missing markets

Introduction

The term "coastal squeeze" describes the loss of intertidal wetland habitat, a combined result of a sinking coastline and rising sea levels constraining the extent of intertidal wetland margins as they abut hard flood and sea defenses and infrastructure such as port facilities. This is driving innovation in the management of coastal flooding through such techniques as managed realignment, where land formerly "reclaimed" for agriculture and other uses is allowed to revert to intertidal wetland habitat. As these habitats reform, a range of beneficially and formerly undervalued services such as flood risk regulation, habitat for wildlife including fishery recruitment, nutrient cycling, and characteristic landscapes are restored. This chapter draws lessons about value creation by the recreation of these various ecosystem services drawing upon studies of four managed realignment schemes. Dixon et al. (2007) provides a summary of early experiences with managed realign-
38 ment and the steps needed to optimize habitat creation.

Case Study 1: The ComCoast Project

The EU-funded ComCoast project (ComCoast 2007) investigated the multifunctional ecosystem services provided by intertidal habitats in Northern Europe, exploring more defensible and sustainable approaches to coastal flood defenses including "soft" land management approaches rather than hard engineered barriers. The research analyzed cobenefits for the whole coastal community, in the construction of environmentally and economically sound Flood Risk and Coastal Defence solutions covering a range of ecosystem services, such as fish recruitment, carbon sequestration, water quality, and cultural services.

ComCoast was funded under the EU North Sea Interreg IIIb Programme with key partners in the Netherlands, England and Wales, Germany, Belgium, and Denmark. It included three UK-based PhD studentships examining: (1) fish utilization of managed realignment sites, (2) nutrient capture and carbon sequestration on managed realignment sites, and (3) the economic case for a more integrated approach to estuary management, drawing on the results of the other two science-orientated PhD studies. These PhD studies were based in a number managed realignment sites and mature saltmarshes in the Blackwater and Roach & Crouch estuaries in Essex, in the East of England.

The fisheries research strand of ComCoast (Fonseca 2009) highlighted the links between changes to physical habitat and the resulting societal benefits arising from increased fish stocks relevant to both commercial and recreational fishing. Early work summarized by Colclough et al. (2005) had demonstrated a close association of the early life stages of important commercial species such as sea bass (*Dicentrarchus labrax*) with the existence of high marsh, confirming the provisional findings of French authors (such as Laffaille et al. 2001). These observations are important given the requirements of the EU Water Framework and the Marine Strategy Framework Directives. Fonseca et al. (2011) describe highly dynamic and pronounced seasonal use of the habitats under study, also providing detailed evidence of the early feeding of the bass fry in newly created habitats. An attempt was made during the study period to quantify fish utilization.

The fish survey data fed into an economic analysis, though the weight of this evidence was restricted by the size and amount of time available for fish sampling. This may also help explain the relatively small component the conservative fishery quantification represented in the overall valuation (Luisetti 2009). Clearly, multiyear quantitative data sets would have added more analytical power. Furthermore, commercial (and not recreational) value data were only available for sea bass. Other marine fish species with commercial and/or recreational significance were also observed exploiting experimental saltmarshes, but no valuation data were available for these. (This issue of partial valuation of fish recruitment is covered in detail by Vieira da Silva 2012.) More recent studies of juvenile fish on some of the same Essex sites have also demonstrated high site fidelity over the first summer for young of year sea bass and other species (Green et al. 2012).

Conclusions drawn in the economic study of fish recruitment services were thus low, omitting most species and the higher-value recreational services provided by the affected realignment. If additional benefits arising from fish recruitment on intertidal wetlands can be substantiated scientifically, beyond observation (for example by S. Colclough & W.Watts, pers.obs.), there could well be a case for public funding for the construction or rehabilitation of intertidal habitats through funding mechanisms such as the EU Common Fisheries Policy. Quantification of cobenefits such as coastal flood regulation, amenity, and landscape aesthetics may open up other potential cofunding streams and may justify realignment, even where the potential fishery service is not sufficient, in itself, to make the case.

The nutrient and carbon cycling research strand of ComCoast found that carbon (C) and nitrogen (N) contents in natural intertidal sediments were higher than in managed realignment sediments (Adams 2008). However, mature managed realignment sites possessed C and N burial rates at least as great as natural marshes and, if increased sedimentation in these predominantly low-lying intertidal areas is accounted for, mature managed realignment sites far outstrip natural marsh C burial rates.

Both natural and managed realignment intertidal wetlands were also found to be small sources of the greenhouse gases methane and nitrous oxide (each with a stronger climate-forcing effect than carbon dioxide), offsetting to a limited extent the net climate regulation benefits of carbon sequestration. The observed current carbon sequestration rate at the Blackwater estuary managed realignment sites was ~690 tonnes (metric) of CO_2eq year^{-1} (carbon dioxide equivalents per year).

The economics research within ComCoast highlighted some of values of ecosystem services provided by saltmarshes. It deduced a "willingness to pay" among members of the public polled under the ComCoast program for the creation of new saltmarsh in the Blackwater estuary, accounting for the existence of other saltmarshes in the area and the potential substitution of these alternative saltmarshes by the public in the delivery of wetland services, in their valuation of the worth of a new realignment. Saltmarsh was considered important for amenity and recreation as well as for biodiversity both in terms of access to the site (use value) and improved environmental quality (nonuse value). While there was general public support for saltmarsh recreation, people felt uncomfortable having them too close to their houses. This may be linked to nuisance associated with visitors, though other studies suggest that having water closer to their homes is perceived as a greater risk even though, hydrologically, the risk of flooding in actual fact may be decreased by these now closer but larger floodwater storage areas.

Luisetti (2009) synthesized this "willingness to pay" data with physical science-based fisheries and biochemistry data, producing an overall assessment of the value of various realignment options within the Blackwater estuary. This subsequent study, based on the Composite Environmental Benefit variable which includes both use and nonuse value, found that irrespective of the economic discount rate applied in cost-benefit analysis, a substantial scheme of realignment within the Blackwater was justified.

Potential air quality and water pollution control benefits may also arise from habitat recreated under managed realignment explored in the ComCoast study. However, these purification benefits were not reflected in the benefits elicited, due to scientific uncertainty about the magnitude of these effects. The absence of such data is of course symptomatic of the often low public awareness of far-field environmental effects, even though there may well be substantial potential health benefits to be gained from realignment upwind of urban areas.

The ComCoast project extended knowledge about many of the ecosystem services associated with intertidal habitat recreation through managed realignment, highlighting the need to include all ecosystem services into optimal decision-making about sustainable coastal defense strategies.

Case Study 2: Wareham

The first instance where the ecosystem valuation approach was applied to Flood Risk Management within the UK was at Wareham in 2006 (summarized in Defra 2007). Wareham is located close to two adjacent estuaries of the rivers Frome and Piddle where they enter the western end of Poole Harbour, Dorset, an area of international importance for nature conservation. These estuaries were lined by 50-year-old flood banks, providing some protection against flooding for 42 properties and 400 ha of poor quality grazing marsh.

As the flood defenses were nearing end-of-life, various options were considered for their future management. These included “No Intervention” and “Do Minimum,” which would have put people and property at risk as well as adversely affecting existing nature conservation interests, navigation, and rights of way. These issues could have exposed the regulatory authority (the Environment Agency) to litigation. A “Hold the Line” scenario considering rebuilding defenses to maintain the status quo was also found to be economically unsustainable, the expenditure not meeting the Cost Benefit Analysis-based funding criteria of Defra (the relevant UK government department). This left various managed realignment options.

Economic valuation of outcomes for ecosystem services supported the managed realignment approach, setting back smaller-scale flood defenses and allowing the recreation of intertidal habitat. This was supported by local stakeholder dialogue using a simple semiquantitative scoring system to assess the likely magnitude of changes, from significantly positive to significantly negative or unknown, for a range of ecosystem services as a result of these different options. Although the Wareham assessment was equivocal in terms of absolute economic benefits, it indicated a broader balance of costs and benefits associated with a particular managed realignment option and highlighted where further information or research was necessary.

The Wareham study showed that constructive engagement with a wide range of stakeholders is essential to build understanding and support for the results of the process. This was helped considerably by expressing benefits in readily understood ecosystem services terms (amenity areas, protection of farmed land, etc.) evaluated via a simple semiquantitative ecosystem valuation process.

Case Study 3: Alkborough Flats

Everard (2009) led an ex-post ecosystem service analysis of the Alkborough Flats managed realignment on the Humber Estuary. The realignment site includes around 440 hectares of farmed land which was to be periodically inundated on high tides through an engineered breach in the former flood bank. The breach is tightly controlled to protect the adjacent navigation channel that forms an important trading route up the rivers Ouse and Trent. This realignment project was driven by EU Habitats Directive requirements to ensure “no net loss” of habitat, caused both by sea level rise-induced “coastal squeeze” and development elsewhere in the estuary. It is also a flood defense scheme, providing flood storage and thus allowed a delay in the construction of new flood defense structures upstream, yielding a significant benefit through delayed construction costs.

The need to protect the navigation route and create substitute habitat led to suboptimal outcomes from a narrowly flood defense perspective, though the traditional property-saving benefits of the scheme totaled £12.3m over the likely life of the project, which was marginally greater than the aggregate of site acquisition and development costs of £10.2m. Evidently potential flood risk and habitat-related benefits alone would not normally have affected the management of the site by a private owner.

However, the wider lessons from the ecosystem services valuation study reveal a more than doubling of benefit cumulatively from changes in various other ecosystem services, with an approximate aggregate benefit of £23m. This figure excludes some potentially significant values that eluded monetization, including air quality regulation and fish recruitment. These omissions highlight the "missing markets" phenomenon and absent scientific data.

The maximization of marketed outputs prior to realignment to achieve wider public benefits (principally flood risk management and habitat for wildlife) suggests that "provisioning service" values should have fallen after realignment. In fact, Everard (2009) found that the fall in provisioning services related to declining arable production was approximately balanced by gains from rare breed grazing (including sales of meat, wool, breeding stock, and other products). Therefore, it is at least sometimes possible to achieve "win-win" outcomes across ecosystem services when innovative ideas and practices are deployed. This runs contrary to many established assumptions about "win-lose" trade-offs being inevitable when realignment takes place.

Case Study 4: Steart Peninsula

Similar conclusions about positive-sum gains from realignment were drawn in a study of ecosystem service outcomes likely to result from managed realignment of the Steart Peninsular in Somerset, UK (Vieira da Silva 2012; Vieira da Silva et al. 2014). This study demonstrated that "*A conservative, yet considerable, net annual benefit range of £491k to £913k has been deduced*" from combined changes in services.

In agreement with the findings of other ecosystem services case studies, Vieira da Silva (*ibid*.) also notes that many "*. . .research and knowledge gaps exist with respect to several ecosystem services, particularly the supporting services for which market values are clearly elusive. This is of concern as it affects our current ability to quantify and/or value them, and hence to include these important aspects of ecosystem integrity, functioning and resilience into decision-making. . . ...These gaps therefore demonstrate a clear need for further research, both theoretical and through long-term monitoring of these schemes once established.*" Several areas of necessary further research were identified, including the contribution of intertidal habitats to fish recruitment, the net contribution of recruitment to local and national fish stocks, values associated with potential alternative farming systems (shellfish, salicornia, etc.), microclimate effects of coastal wetlands, nutrient burial studies, and the effect of intertidal habitats on micropollutants.

Conclusions

Studies at these four managed realignment sites underline that many of the problems we have with assigning values to wetland systems are not economic, but are a function of absent underlying science as well as societal recognition of these values. Nevertheless, the absence of markets for these often unrecognized services means they are not valued and often, to the extent they are thought about at all, deemed valueless. These four case studies illustrate that these values can be significant and, with the correct policy and/or market instruments, can be exploited for net societal gain.

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