



SEFTON COAST PARTNERSHIP NATURE CONSERVATION STRATEGY

BACKGROUND INFORMATION FOR WORKING GROUP: COASTAL PROCESSES

Introduction

In the distant past both human and wild life moved with, and adapted to, changes in the position of the coast. Between the last Ice Age, and medieval times the sea occasionally broke through the coastal dune barrier and flooded low-lying inland areas. Large tracts of sand were periodically stripped by gales from the dune coast and sand penetrated inland across fields and settlements. In more recent times the dunes have been partially stabilised by maintaining their natural vegetation, trees have been planted for shelter and artificial sea defences have been built to protect developed shorelines. The inland lakes and mosslands have been drained and claimed for agricultural production.

The physical nature of the Sefton Coast is therefore always in a state of change. However, in recent centuries the coastline has been, and continues to be, affected by human interference with coastal processes. It is therefore not easy now to separate natural trends from those resulting from past and ongoing activities such as mineral extraction, navigational dredging, construction of sea walls and past dune reinforcement for coastal protection. Nevertheless, current **shoreline management** policies are to allow the coast to evolve 'as naturally as possible' and land managers have adopted policies of minimal intervention.

Physical processes, such as tides, wind, the sorting of particles and long-shore drift maintain a 'dynamic' environment on which is based the vegetation communities of the dunes and saltmarshes and their associated animals and plants. Processes therefore determine 'nature' and also maintain the diversity of habitats: some develop in windswept, mobile, conditions, whereas others require quiet deposition of silts or older dunes. The rise and fall of the water table is another process which determines soil character and vegetation.

In understanding nature it may be useful to consider our ability to manipulate the hierarchy from climate (over which we have little control), through geomorphology, soils, hydrology, vegetation communities to animals (over which we can exert a high level of control).

Current discussions in nature conservation have focused on the scale of ecosystems –the larger a connected area the more nature can be left alone (the term re-wilding has been coined). This approach would be difficult, if not impossible, on the fragmented Sefton Coast –the mobile dune system of the 1920s no longer has the space to function but this emphasises the importance of the large areas that do remain, especially the combined Ainsdale Sand Dunes NNR and Ainsdale Sandhills LNR. This part of the coast is a nationally designated Geological Conservation Review site (a SSSI) for active geomorphological processes –an area of nature conservation generally not well understood.

Sea level and climate change predictions

Global sea levels are changing but, at the regional level, so are land levels relative to sea level. The European continent is still adjusting to the release of the weight of the ice following the most recent glaciation. In simple terms southern Britain is sinking and northern Britain is rising. The Sefton Coast, however, lies on one of the hinge points where very little uplift or subsidence is recorded. In practice this means, that from the perspective of Government policy, that most concern is being given to south-east England.

Taking these balances into account figures recently updated by the UK Climate Impact Programme (UKCIP) show for the north west of England the predicted sea level **1-11 cm higher by 2020** and **3-63 cm higher by 2080**. This wide margin is connected to the various climate scenarios (low emissions and high emissions).

At the local level (Liverpool Bay and estuaries of the Mersey and Ribble) the most important factor may be the availability of coastal sediment. At present there is a net onshore movement of sediment to the Mersey and Ribble estuaries and the development of saltmarsh habitat in the Ribble estuary has managed to keep pace with sea level rises to date. Although sand extraction is still carried out in the Ribble Estuary (on the Horse Bank at Southport) it is difficult to assess the impact given the scale and quantity of mobile sediment in the Ribble Estuary. The immediate conclusion from a rising sea level scenario would be for there to be an eventual increase in erosion along the whole coast.

There is a need to continue to monitor the behaviour of the sands and sediments in the coastal zone at a scale sufficient to inform predictive models. There remains a large volume of sediment in Liverpool Bay in the shallow waters and offshore banks.

Coastal processes which shape the coast

Storms, tides, wind and waves

Local sea levels can be pushed up by 'storm surges' caused by wind and low barometric pressure. When such conditions coincide with high water there can be considerable erosion and structural damage to defences along the coast. Severe storm events can lead to 10-20m of erosion at Formby Point. However, after such events there is often a rapid accumulation of sand at the top of the (new) beach in the following weeks. A process of natural recovery begins –dunes are often referred to as 'elastic sea defences' as they have a capacity for self-repair. Climate change could increase the frequency of storm events, leading to increased erosion. For example, a storm that in 2004 would be expected to occur once every 50 years might by 2080 occur every 3 years.

A storm event on 1 February 2002 was the second highest recorded water level during the period 1991-2003 and the highest since the February 1990 event. A level of 10.686m chart datum was recorded. Recently (end of March 2006) there has been significant erosion at Formby Point (on a 10.4 m tide).

Wave energy affects the Sefton coast in different ways. The narrow foreshore at Crosby can only absorb some wave energy: on high tides waves crash into the sea

defences. In contrast the wide beach at Southport takes most of the energy out of the system –the sea walls rarely come under attack.

Coastal change in Sefton

Accretion of the beaches and marshes from Ainsdale-Marshside

The natural dynamic of the near-shore zone, beaches, estuaries and embryo dunes appears to be functioning well and, in the medium-term (perhaps over next 20 years?), these habitats are well placed to adapt to sea-level rise and predicted increases in storminess. The coastline at Southport, Birkdale and Altcar (to the north of the Alt estuary) continues to accrete, with increasing marsh and dune development and rising beach levels. Whilst this natural development gives rise to concerns at Southport from a tourism and amenity perspectives nature is providing an additional level of coast protection. Set against the global predictions of rising sea levels this is a useful insurance policy.

Erosion at Formby Point

At Formby Point erosion predominates (with sand being moved both southwards and northwards) and the current policy of land managers (English Nature, National Trust, Formby Golf Club and Sefton Council), and Sefton Council as Coast Protection Authority, is to allow the dune crest to 'roll back' in response to erosion thus maintaining a high dune barrier offering continued protection to the community of Formby. Here, as the frontal dunes roll back, there is a greater level of sand mobility than elsewhere on the coast. The area of land allowed for the mobile zone needs to be some 200m deep.

There is a concern about 'habitat squeeze' as fixed dunes become buried by advancing mobile dunes which in places at Formby Point have now reached the edge of the woodlands. Is there an acceptance that frontal woodlands will have to retreat as sand advances? The remains of an earlier thin belt of stunted pine trees which fringed Formby Point can be seen in the soils and erosion near the beach.

Coastal issues-Crosby to Hightown

The situation at Crosby is complicated by the hardened sea defences from the docks to Hall Road. In the 'bay' formed by the sea-walls sand is building up, forming dunes and overtopping the wall. Blown sand has accumulated to form a semi-natural 'perched' foredune. This has developed high conservation value –but raises some concerns in the residential area. Between Hall Road and Hightown the coastline is mainly artificial (rubble was used from the 1940s to the 1960s to tackle coastal erosion) –a future coast defence scheme will seek to enhance the ecological value of the coastal edge.

Shoreline Management Plans

The management of the coastal zone for coastal defence is called 'shoreline management' and is primarily an engineering function guided by DEFRA's Flood Management Division. Shoreline Management must, however, take into consideration the nature conservation values of the site, especially the EU designations of Special Protection Area and Special Area of Conservation.

Shoreline Management Plans highlight a number of issues to be considered when deciding how to implement policy:

- the impact of global warming and sea level rises
- solutions must be sympathetic to the environment
- contribute to the biodiversity targets covered by both national and local Biodiversity Action Plans
- the need to work more with natural processes
- the need to raise the public awareness of the risks associated with development at the coastline
- how best to implement managed realignment

Shoreline management must be forward looking using 50-100 year predictions of potential coastal change, pressures and responses. Experimental work in the 1990s has led to developing national policies for 'management re-alignment' where coastal defences are no longer sustainable or for over-riding conservation reasons. A managed re-alignment project is currently being developed on former re-claimed land on the south shore of the Ribble Estuary.

For the dune coast predictions of coastal change to 2050 have been prepared based on current trends and current advice on responses to sea-level rise. Monitoring is essential to ensure that there is sufficient information to develop medium-term policies and to refine predictions for future change. Government policy will evolve as information on coastal responses to rising sea levels is assessed.

In 1993 Sefton Council adopted a coastal defence strategy based on the recommendations of the Coastal Defence Issues and Strategy Report. In 1999 this strategy was updated to incorporate changes in Government policy through the Liverpool Bay and Ribble Estuary Shoreline Management Plans.

This update of the coastal defence policy reflects further changes in policy and attitude towards coastal defence through increased understanding of coastal processes and a need to disseminate this information.

Beach-dune interaction and the conservation of strandline and embryo dunes.

The beach-dune interface is an important ecological zone; the management practices on beaches can have an impact on the development of dunes and marshes. In the 1960s and 1970s recreation pressures, especially at Ainsdale-on-Sea, did not allow the natural growth of foredunes –as a consequence a 'bay' developed. As beach management policies were introduced in the 1980s and 1990s the foredunes were first 'restored' by the use of sand-trapping fencing but after about ten years it was possible to allow natural dune development.

Strandline and embryo dune communities are not always present –monitoring habitat condition needs to look at the habitat presence over periods of several years. It is often the case that after periods of erosion there is a flush of new strandline vegetation as there is more suitable habitat to be colonised.

Beach cleansing has to be careful not to damage the ecological value of these habitats.

Natural processes

Sand movement

Public perception tends to perceive sand blow as 'bad' and stabilisation as 'good'. This is reinforced by the experience of nuisance sand-blow: in fact much of the early work of the Sefton Coast Management Scheme was concerned with addressing these problems. Residents in Crosby are concerned about the development of dunes in the coastal park area –and there is a need to consider solutions.

Throughout the main dune system there are now few concerns about sand-blow. Ecologists and geomorphologists now recognise mobile sand and bare sand patches as an important and integral part of the dune 'system'. Throughout the twentieth Century there was a general natural trend towards dune stability; recreation pressure and other disturbances did counter this but we are now seeing a much more stable dune system than even 20 years ago. Similar trends have been reported from other dune systems.

Importance of bare sand as a habitat

This has consequences for nature as many of the animals and plants of the dune system are adapted to more open conditions. The habitats on the Sefton Coast with disturbed ground and bare sand have been shown to support the greatest number of plant species.

Bare sand is an important component throughout the dune system –not just in the frontal dunes. Several rare species, such as the Northern Dune Tiger Beetle, are well adapted to the mobile dunes, but many other invertebrates specialise in more inland bare sand habitats.

The recent Vascular Plant Inventory for the Sefton Coast (Smith 2005) lists 1177 plants for the coastal zone. One third of these (463 plants) are associated with disturbed ground, compared to 263 plants associated with slacks, scrapes and ditches and 204 plants associated with fixed dunes.

Whilst there is no single cause for the observed stabilisation of the dunes, some possible reasons might include;

- The very open dune system of the early twentieth Century (as seen on early photographs) is becoming more vegetated with the development of scrub a natural consequence
- The current balance of dune stabilising processes (e.g. soil and vegetation processes) is maybe greater than the natural forces which would re-activate sand movement (drought, wind, grazing etc).
- The increase in nutrient deposition adds to the nutrient 'pool' in the soil favouring the growth of coarse vegetation which out-competes the lower growing dune vegetation.

- The reduction in grazing pressure following the decline of rabbit populations in the 1950s allowed the growth of tall vegetation and scrub.
- Some plants, Sea Buckthorn, for example, 'fix' atmospheric nitrogen adding to the nutrient pool in the soil.

Conserving active processes

Conservation land managers may wish to counter this trend by encouraging more open sand throughout the dune system, especially the natural formation of blowouts which in turn lead to the development of wet slacks. Such an objective would be in keeping with the recognised importance of the Sefton Coast for the conservation of active geomorphological processes.

Conservation of soil types and soil processes

Soils have been one of the over-looked aspects of the Sefton Coast. A number of issues were identified in discussions on the 1999 conservation strategy. These were;

- The lack of a soil data base. A comprehensive sampling programme of dunes, slacks and woodlands was proposed.
- The monitoring of soil processes. Soil processes govern the source, flux and resultant concentration of nutrients and the movement of water.
- Soil erosion. Destruction of mature soils will limit the extent and development of some vegetation communities.
- Nutrient enrichment. Concern about the cumulative impacts of enrichment from a number of sources –atmosphere, garden waste, dog fouling, golf course management etc.
- Conservation value of soils. Three values: a component of coastal geomorphology, as features in their own right and as part of overall biodiversity.

The development of soils is often overlooked as a critical determinant of vegetation communities. With time dune soils increase organic content, increase their water-retaining capacity and become more acidic (from the leaching of carbonates). The re-activation of sand blow can act to disrupt the development of soils by bringing calcium-rich bare sand back to the surface. Rabbits will do this on a small scale. Re-activated dunes in the fixed dune landscape will add to overall habitat and species diversity.

There is need, therefore, to identify areas for the conservation of soil types and processes and other areas where younger soils could be reactivated to conservation earlier stages of soil and vegetation succession.

Monitoring and research

Monitoring is a statutory requirement of shoreline management.

Monitoring of coastal processes and coastal change is an essential task to undertake if we are to understand how our coastal systems work and how they are inter-linked. This allows the identification of the source, pathway and receptors of the coastal processes. By understanding the system we can begin to predict possible future changes and manage the coast to accommodate them.

Ongoing local monitoring includes;

- Annual beach profiles across the whole Sefton foreshore
- Annual beach topographic survey
- Annual visual inspection of coastal defences and shoreline features
- Biannual shore vegetation surveys from Birkdale to Southport
- Biannual coastal change monitoring Hall Road to Hightown
- Monthly monitoring of the dune front position
- Hydrographic profile extensions at 3 year intervals
- Sediment sampling at 3 year intervals
- Vertical air photography typically at 2 year intervals
- Monitoring of salt marshes in the Ribble Estuary (EN)
- Regular recording of tidal levels Seaforth, Alt and Crossens (EA)
- Regular weather monitoring at Crosby and Squires Gate (Met Office)
- Collection of physical / environmental data by Sandwinning licensee
- Monitoring of bird populations, Ribble & Alt Estuaries SPA (EN)

In 2006 a PhD study commenced to look at soil and hydrological issues on the dune coast. Also a PhD being completed this year looking at accretion rates on the saltmarsh, sediment sources and linking to future evolution.

Further details of the main surveys coordinated by Sefton Council are given in the box below.

Annual beach profile survey

Profile lines are a series of survey lines typically perpendicular to the coast, which are monitored to record beach level (height). There are 30 lines spread across the Sefton Coast with data for some profile lines dating back to 1913.

Profile lines provide a snap-shot of the beach profile which can give an indication of the state of the beach. A short steep beach profile often suggests an eroding coast where as a long, shallow beach profile suggests an accreting coast.

Profile lines are currently collected annually.

Annual beach topographic survey

Topographic surveys are a measure of the position of the surface of the beach, this data is captured using a Geographical Positioning System (GPS) that is accurate to within +/-5mm using several satellites to establish an exact position on the earth's surface.

The survey produces a grid of points covering the beach that can be imported into a Geographical Information System (GIS) for analysis and interpretation. By carrying out a series of topographic surveys over time it is possible to identify trends in the evolution of the beach, which when related to other data can inform our understanding of coastal processes and aid our prediction of the future evolution of the coastline.

Topographic surveys are currently collected annually.

Annual visual inspection of coastal defences and shoreline features

The hard and soft coastal defences require regular monitoring assess their ability to maintain defence.

Coastal Defence Inspection Survey is undertaken for two principle reasons, the first to monitor the condition and functionality of Sefton's hard defences, which are in place to provide protection against tidal flooding. The second, to provide an expert assessment of the quality of the soft defences, which includes all beaches, sand dunes and saltmarshes.

The Coastal Defence Inspection Survey is currently undertaken annually.

Biannual shore vegetation surveys from Birkdale to Southport

The 'green beach' has developed rapidly since parking was stopped in 1993. The area now provides a useful coastal defence feature by reducing wave energy impacting on the upper shore and sand dunes.

A biannual survey can pick up changes in development between summer and winter.

The green beach is currently surveyed every six months.

Biannual coastal change monitoring Hall Road, Blundellsands to Hightown

This section of coastline is currently eroding and requires regular monitoring to assess its rate of erosion to inform the Crosby to Formby point strategy study.

Hall Road, Crosby to Hightown survey is currently every six months.

Monthly monitoring of the dune front position

The foredune is surveyed to record the position of the front of the sand dunes in several separate surveys. The first section surveyed runs from Hoggs Hill Lane, Ravenmeols to Shore Road, Ainsdale. The second runs from Shore Road, Ainsdale to Weld Road, Birkdale. The last section of sand dunes are developing in front of the hard sea defences at Crosby. These dunes are providing an additional coastal defence along a small section of the sea wall.

The information gathered allows us to observe seasonal changes and the effects of individual storms. The information is typically expressed as an average rate of accretion or erosion for a particular location, although throughout the year the location of the foot of the sand dune may have moved both in and out.

During Summer 2004 the no parking zone on the section Shore Road, Ainsdale to Weld Road, Birkdale was extended. It is likely that there will be considerable change across this frontage over a short time period as was experience further north towards Weld Road.

Dune front surveys are currently collected monthly. The Crosby beach dunes survey is currently collected every six months.

Hydrographic profile extensions at 3 year intervals

Beach Profile lines are a series of survey lines typically perpendicular to the coast, which are monitored to record beach level (height). Extensions of these are taken to the nearshore subtidal area. There are 30 lines spread across the Sefton Coast.

Changes to the nearshore topography can indicate potential changes to the beach profiles and topograph.

Hydrographic extensions are currently collected every three years.

Sediment Sampling

An understanding of the nature of sediment on the beach is important in informing our understanding of current and future changes to the coast. When linked to information about the nature of sediment elsewhere it is possible to start to develop models of how the sediment may be being transported and from where it has come.

Over the longer term changes in sediment can provide an early indication of developing changes in exposure conditions on the coastline.

Sediment sampling is currently collected every three years.

Vertical Aerial Photography

Vertical aerial photographs are taken looking straight down to the ground, at a right angle, to produce an image that would appear as a map does. Vertical photography can be imported into a Geographical Information System (GIS) and used as a map base. Several datasets can be overlaid and changes can easily be seen. These changes can be digitised and quantified. Certain features and changes are much more easily identified in aerial photography than other types of survey.

The coastal zone is currently surveyed with colour vertical aerial photography every two years by the Liverpool Bay Coastal Group.