

Rising sea levels and the Suffolk coast

Many of us can recall seeing headlines like: "storm surge threatens lives", "homes lost to sea erosion", or "rising sea levels increase flood risk".

If scientists are right about global warming then these headlines are unlikely to remain rare events and may be set to become a good deal commoner.

Suffolk coast - eroding for centuries

Suffolk has one of the most rapidly receding coastlines in England. It has been subjected to sea erosion for centuries - as the Dunwich story demonstrated. We can expect the County's soft muddy cliffs to continue to crumble and its coastal shingle and sand features drift, naturally migrating to create new freshwater lagoons or, more likely, turning present ones into saline estuaries or brackish meres. Consequently the majority of the coastal bird reserves in the County¹ are vulnerable, along with many other sections of the Suffolk coastline, to erosion and inundation by the sea.



Rising sea levels

¹ Moving south to north, these birding areas include Levington Lagoon, Trimley Marshes, the Landguard bird observatory, Orfordness, Havergate Island, Boyton Marsh, North Warren, Minsmere, Dingle Marshes, Walberswick the Hen Reedbeds and Benacre.

Is this rate of erosion going to get any worse? Because of a forecast rise in sea level, the short answer appears to be yes. Almost all of the scientific community consider the chief culprit for this rise to be global warming which is prompting a change in climate that is directly melting the planet's ice caps - hence raising the sea level. These scientists and most national governments regard this is an inexorable process that, even with radical controls on our future greenhouse gas emissions², will continue.

But ranged against the scientists are the climate 'skeptics'. They point to these changes being one phase of longer-term climate trend and thus argue the present situation is just an upward blip in a climate cycle. One that will see the adverse effects pass in time, if not actually be reversed. The evidence of glaciers periodically retreating and expanding throughout the Holocene³ certainly adds support to this argument. Thus, to the 'skeptics', global warming is not seen as a long-term inevitability and the consequent climate change will not lead to permanently higher sea levels. At first sight this skeptics' argument seems to be no less reasonable a stance to adopt than the scientific communities' more pessimistic view.

So who and what are we to believe? Both poles of this debate (i.e. the on-going rise and the episodic rise and fall view) seem plausible. Surely they cannot both be right? To answer this question we need to consider some hard facts, not the unsupported assertions that are commonly bandied about in their stead.

The key drivers

When it comes to the drivers of sea level rise, we can be certain of the guilty parties - there are three principle factors:

- Isostatic subsidence, the land's on-going adjustment to reduced pressure on it following the de-glaciation that ended the last major ice age some 14,000 years ago. To put it crudely, south of Flamborough Head, Britain is tipping downwards at a rate of -0.8mm/year
- Glacial melting of the Arctic and Antarctic ice sheets
- Thermal expansion of the oceans

The table below reveals that the latter two factors above are of much more significance and both of these are driven by climate change. However, in scientific circles, as there is considerable uncertainty over climate change predictions, there is a very broad range of estimates as to the extent of this melt and consequently the resulting sea level expansion figures range widely. For example, Sarah Raper in her sea level rise paper for the Climatic Research Unit at UEA published a table with an extremely wide range in component contributions (viz. low/middle/high estimates), which also revealed a significant disparity between tidal gauge data and other estimates. Altogether a very confusing picture emerges:

Estimated contributions to sea level rise over the last 100 years

² These gases' presence is believed to be the chief trigger for rising temperatures.

³ Our present geological epoch.

Component contributions	Low	Middle	High
Thermal expansion	2	4	7
Glaciers/ice caps	2	3.5	5
Greenland ice sheet	- 4	0	4
Antarctic ice sheet	-14	0	14
Surface water and ground water storage	- 5	0.5	7
Total from above	- 19	8	37
Total based on tide gauges	10	15	20

[Climatic Research Unit, UEA]

Inevitably the predictions for the future are as variable as the estimates in the table above. The 4th Report of the International Panel on Climate Change (IPCC) delivered a range of estimates too. Thus it was optimistically indicated there would be a global sea level rise of 0.18 - 0.38m by 2100, but at the other more pessimistic extreme, a greater rise of 0.26 - 0.59m was also forecast. So, while a rise can definitely be expected, the range of its impact remains wide.

Specifically in the East of England, scientists think this mix of drivers could be responsible for sea level rises from anywhere between 26cm and 82cm by 2100. That half a metre difference would lead to markedly different coastal change impacts. To make matters worse, this rate of sea level change is predicted to increase as the century progresses, thus:

Net sea level rises in mm/year across the region

1990 - 2025	4.0
2025 - 2055	8.5
2055 - 2085	12.0
2085 - 2115	15.0

[Climatic Research Unit, UEA]

So the longer time goes on, the worse this coastal change impact is likely to be.

Further contributory factors

Two more separate factors are regarded as likely to aggravate any sea level rise and increase the likelihood of flooding, even though they are climate related and usually of a local and/or short-lived nature, viz.:

- storm surges
- episodes of extreme wave heights

In addition to these, some interest groups have alleged that offshore aggregate dredging could be another factor exacerbating matters. It is argued that, in some places, removal of this offshore shingle might, indirectly, impact on local inshore sea profiles and so accentuate coastal erosion. But other experts dispute this, as they point out that this extraction is usually undertaken so far offshore as to have only a negligible effect, if any at all.



Finally, although it is difficult to predict its effect, it should be noted that yet other experts believe alluvial accretions of fine sediments into estuaries around the East of England coastline could also offset a proportion of the sea level rise and thus reducing its impact somewhat.

The Shoreline Management Plan

In the face of this ongoing and perhaps accelerating erosion problem the Suffolk Coastal District Council has developed a plan. Working alongside many other agencies (such as the Environment Agency) and associated authorities the Shoreline Management Plan (or SMP for short) has been drawn up for Suffolk and was published in 2010 and was approved by Defra this summer.

Also, while we may appreciate *what* is likely to happen, it is difficult for this Plan to be definitive about *when* these flooding/erosion events will occur. The proposals are presently divided into three progressively lengthier epochs⁴ featuring a variety of local efforts as the Plan pursues its three core protection objectives of:

- People and property
- Conservation assets
- Agricultural/economic interests

But these objectives are being pursued along a coastline where it is not practical (if only because of reduced funding availability) to hold the line everywhere. In other words, inevitably, the Plan means some areas will be safeguarded, whilst others will be left to suffer these natural processes without intervention.

⁴ Epoch 1 2000-2020, Epoch 2 2021 - 2050 & Epoch 3 2051 - 2100

General implications -

There is one further non-specific location issues that we might consider:

- the need for dynamic conservation

This sea level rise problem may mean there is a need to change one aspect of our conservation legislation. By their nature all environmental site designations (SPA, SACs, SSSI's etc.) are presently static. Yet the foregoing has shown that, for many Suffolk coastal sites, the situation will actually be a dynamic one with which a static designation could not cope.

This is not a new problem. The Benacre to Easton Bavents SSSI, Suffolk, included a coastal cliff for geological reasons. A member of the public arranged for thousands of tons of material to be used to protect the cliff, an action that hid the geology and rendered the SSSI unavailable for study. Natural England tried enforcement action but were unable to do so because the SSSI had been notified several years earlier and, by the time of the attempted enforcement, the boundary was an irrelevant line out at sea! Natural England then had to re-notify the SSSI in its modern position to solve the problem. Now called Pakefield – Easton Bavents SSSI, the sea is slowly washing the waste away.

So, as significant change is inevitable for some sites, a process has been developed that allows conservation legislation to 'migrate' these designated areas. This is known as the habitat creation programme. It has been given little publicity, so it was surprising to learn that the Environment Agency is currently in the throes of establishing 1000ha in the East of England with the likelihood of more in the future to compensate for these anticipated losses.



Fortunately the overall the process of habitat change resulting from a rising sea level could be slow and this might, at least in the short-term, present reserves with an opportunity to evolve. However, as was noted above, if the incidence of storm surges is set to increase, they could periodically lead to rapid habitat change, enforcing a highly responsive policy that might prove beyond the means of some reserve's managements.

Towards a conclusion

To close we might observe that arguments about this issue are probably inevitable because, as we have seen, the data is so variable and the whole change process subject to such a wide range of diverse factors.

So, to return to the selection of headlines we opened this article with, this review of the key facts has shown sea rise is inevitable and that such headlines are set to become a commoner feature of our future press. However, as scientists' estimates of sea level rise still vary so much, it is impossible to predict when we'll see such headlines. All we can be sure of is, it is inevitable they will be appearing, that some locations will be featured earlier than others and that our authorities are preparing for sea rise and its many ramifications.

So watch this space or a future Harrier.