Environment Agency

Evidence

Vulnerability of estuaries to sea level rise

Project summary SC080016/S1

The Environment Agency have developed a screening tool which will allow planners and policy makers to rapidly identify the estuaries within England and Wales that are most vulnerable to future change if there are changes in sea level or other climate related factors, like storminess or river flow.

Estuaries are constantly changing through both natural evolution and human intervention. These changes are also influenced by the impact of global climate change (particularly sea level rise), altered river flow patterns and increased storminess.

In the future we are likely to experience changes in sea level and storminess around the coast of England and Wales, probably at rates not experienced during the last ten thousand years. Over the last hundred years sea levels in England and Wales have risen between 10 and 20 cm, but the Intergovernmental Panel on Climate Change have forecasted rises of 13 to 76 cm for the next century.

These changes in sea level may have a significant impact on the shape and size (i.e. the morphology) of some estuaries in England and Wales. The Environment Agency needs to understand what changes are likely to occur because it is required to maintain 'good status' in estuaries and the habitats found within them. This is to ensure that we comply with the European Union's Water Framework Directive and the Habitats Directive.

This two stage Environment Agency report investigates how estuarine morphologies and the associated habitats will adapt to global climate change.

Understanding the shape of estuaries and the processes that create them is essential for understanding how they may change in the future. There are many external processes that affect the shape of estuaries, including: tidal range and elevation; storminess; vertical current structure; sediment type; salinity and mixing; river discharge and geology.

In the Stage 1 report we outline how estuaries respond to these factors and describe the scientific development behind a screening tool to identify estuaries that are most vulnerable to future change as a result of changes in sea level and other climate variables, such as storminess and river flow.

This tool will allow us to make sure our resources are used where they will have most impact, in estuaries and habitats that are at greatest risk. The tool will also help us understand how interventions such as dredging or breakwater construction will affect the estuaries.

The Stage 2 report contains information on how to use the screening tool, as well as a discussion of the assumptions that were made. The tool is based on four measures or 'indices' of vulnerability that describe important estuary characteristics and how they are likely to be affected by global climate change. These are mass flow, vertical mixing, energetics and salinity intrusion.

The resulting tool combines theory and observational data to provide an idea of the likely morphological and environmental changes over the next century across the diverse range of estuaries in England and Wales. It indicates that deep narrow estuaries are likely to be far more resilient to global climate change than shallower, coastal estuaries.

Changes in river flows would not influence mass flow or energetics, but would affect vertical mixing and salinity intrusion. Increases in river flow would only have significant impacts on vertical mixing in the shallower estuaries, but could lead to significant decreases in saline intrusion in any estuary, which would be substantially enhanced in shallow waters. At times of decreased river flow the reverse effect would be seen on saline intrusion, increasing the ratio of saline intrusion to estuarine length. These changes in saline intrusion and vertical mixing have potentially significant impacts on the sensitive habitats found in estuaries.

Further work is required to link these impacts on dynamics, saline intrusion, sediment patterns and morphological adjustments to associated impacts on estuarine habitats and ecology.

This summary relates to information from project SC080016, reported in detail in the following output(s):

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