CoastAdapt

Case Study

Impact of sea-level rise on coastal natural values in Tasmania

Summary

Inundation by rising sea levels and increased storm surge is likely to have a significant adverse impact on the habitats and associated biodiversity along Australia's coastline. The impacts of projected sea level rise on beach-nesting shorebirds, native coastal vegetation and coastal plant species were assessed across all land tenure in Tasmania in a pilot study using GIS-based rules and risk assessment methods. From this, 118 coastal areas were identified and mapped as the highest priorities for conservation management.

Broad options for the conservation of beach-nesting shorebirds, coastal native vegetation and plant species in priority locations were developed as practical adaptation responses. Three response types were identified: refugia sites, retreat pathway sites (threat avoidance areas) and squeezed-out sites (with a high sea-level rise threat). For refugia, it is recommended that land managers minimise activities that may cause disturbance or present threats to natural values. For retreat pathways, facilitating protection of retreat pathways is important through minimising new developments or infrastructure, and by minimising disturbance and physical threats. For areas that are to be inundated or squeezed out, it may be important to consider alternative management options including translocation and monitoring of the location to assess impacts.

A relatively short list of high risk values (beach-nesting shorebirds and coastal-obligate plant species locations) was identified, with a small proportion of the Tasmanian coast zoned into three management response categories, allowing for efficient and effective allocation of management effort and resources for dealing with these sites. This is the first time such an approach has been undertaken in Australia and the results clearly demonstrate that it is possible to effectively prioritise sites for biodiversity conservation management to mitigate the expected impacts of sea-level rise on coastal natural heritage.

Overview

Sea-level rise is expected to impact coastal biodiversity in various ways, however information about the types of anticipated impacts on vulnerable natural values is currently lacking for much of Australia's coastline. We categorised the-sea level rise-related impact types expected to occur along sandy Tasmanian beaches where beach-nesting shorebirds, coastal-obligate plant species and coastal native vegetation are present.

We demonstrated that it is possible to effectively prioritise sites for biodiversity conservation management to mitigate the adverse impacts of sea-level rise on coastal natural heritage values. A relatively short list of high risk natural coastal

values was identified, with a small proportion of the Tasmanian coast zoned into three management response categories (squeezed-out, retreat and refugia). This allowed for efficient and effective allocation of management effort and resources for dealing with these sites. Our approach also identified species that, although not currently formally listed as vulnerable or endangered, may be threatened by a very high likelihood of coastal inundation.

Background and context

Tasmania is the southern island state of Australia, lying in temperate latitudes exposed to the 'Roaring 40s'. It has approximately 5,400 km of coastline with the highest ratio of coastline per unit area of land of any state in Australia. This case study assessed the impacts on the whole of the Tasmanian coast where inundation by rising sea levels and increased storm surges is likely to have a significant impact on coastal habitats and species.

There have been recent advances in the development of information and data relating to projected sea-level rise and coastal geomorphology, along with excellent contemporary biodiversity data. With these, Tasmania was well-positioned to assess the vulnerability (sensitivity + exposure to threats) of natural coastal values to sea-level rise in order to determine and to establish priorities where conservation management effort should be focused in order to maximise conservation success.

However, it still remains a complex task to undertake vulnerability assessment and prioritising management amongst coastal sites and natural values, in part due to the extensive and convoluted Tasmanian coastline. Understanding the impacts of sea-level rise on Tasmania's natural diversity is crucial, given the State's high biological and geomorphological richness and diversity, and the presence of many nationally and internationally significant natural values. The current Tasmanian effort is seen as a pilot for a similar approach in mainland states.

Description of climate risk(s) and impact(s) addressed

Inundation by rising sea levels and increased storm surge is likely to have a significant impact on habitats and species along Tasmania's coastline. Additional adverse impacts on coastal vegetation and species are expected to result from additional salt intrusion into freshwater systems, and an increase in storm surge and salt spray, which result in additional biological and ecological pressures. Changes in coastal geomorphology can have profound impacts on the availability of different habitats along the coast.

The impact of sea-level rise on plant species is not well studied in Tasmania, other than studies of the adaptive capacity of saltmarshes to retreat. These studies suggest that coastal saltmarsh vegetation may have the capacity to retreat landward, given sufficient room and suitable conditions (Figure 1).

Globally-averaged sea level rose by 21 cm in the last century in Tasmania, and for many locations a 50 cm sea-level rise would result in the present 1-in-100-year storm surge event becoming an annual or more frequent event by 2100. Over 25% of the Tasmania coastline is at risk from inundation and erosion, sand dune mobility, rock falls and slumping as a result of sea-level rise and storm surge associated with climate change. The coast has been identified as an important at-risk habitat for four species of resident coastal-nesting shorebirds (Figures 2 and 3) and two species of small terns, coastal vegetation, and coastal obligate species.

Figure 1: Round-leaved Pigface (Disphyma australe) in flower in saltmarsh at Lauderdale. Source: ©Peter Tonelli – TasNature.

Figure 2: Adult pied oystercatcher and large chick feeding in a sandy beach. Rising sea levels threaten this species' nesting, feeding and roosting habitats. Source: © Eric Woehler, BirdLife Tasmania.

Figure 3: Hooded Plover nest with two day-old chicks and egg. Source: © Eric Woehler, BirdLife Tasmania.

Previous risk assessment work includes inundation modelling that shows how sea-level rise is projected to affect Tasmania's coastline by 2100, and coastal geomorphical mapping (Smartline), which describes the vulnerability of Tasmanian and mainland coasts to sea-level rise. The range of Tasmanian coastal landforms in combination with likely processes of degradation allowed various key factors to be identified, and applied to a detailed line map of the state's coastal landforms. Our case study only looked at the impacts of sea-level rise - the additional, significant, potential impact of climate change on coastal ecosystems was not assessed.

Our risk-assessment approach identified priority places for species that allowed for a range of site-specific options that could be translated into real conservation management at the site level. We compared the results of a traditional risk assessment approach with our prioritisation approach and found the latter to be an improved approach as it considered all species regardless of listed status. Our approach identified species that, although not currently formally listed as vulnerable or endangered, may be threatened by a very high likelihood of coastal inundation.

Three plant species were prioritised by our current approach that were not identified in the top five high-risk species through the traditional risk assessment that only considered listed species. These three species have a very high to extreme likelihood of inundation, with 72% to 100% of their currently-known distributions projected to be inundated.

Identification and/ or implementation of adaptation actions

A key achievement was to develop a set of maps that are useful to public land managers such as the Tasmania Parks and Wildlife Service, for conservation planning purposes (Figure 4). The maps will inform land management, including reserve selection, local government planning, infrastructure placement (sensitive, appropriate or strategic), and other land management practices in coastal areas.

Management options for the priority locations identified have been developed, which are applicable under any land tenure. Locations are prioritised to assist planners and land managers to respond efficiently to projected sea-level rise impacts on coastal vegetation and/or shorebirds. This will ensure that highly vulnerable locations are managed to remove as many other threats as possible and remove, where possible, any barriers to adaptation to higher sea levels.

One important outcome was the strong multi-partner collaboration that developed. This work was a collaboration between the Department of Primary Industries, Parks, Water and Environment, the University of Tasmania, Natural Resource Management South and BirdLife Tasmania, who all worked closely together to explore how the Tasmanian coastal environment and its biodiversity could be prioritised for conservation management effort in the face of current and future sea-level rise impacts. Invaluable to the success of the project was the social component of this collaboration, which included strong stakeholder engagement and commitment, along with networking and the ownership of a transparent and agreed approach.

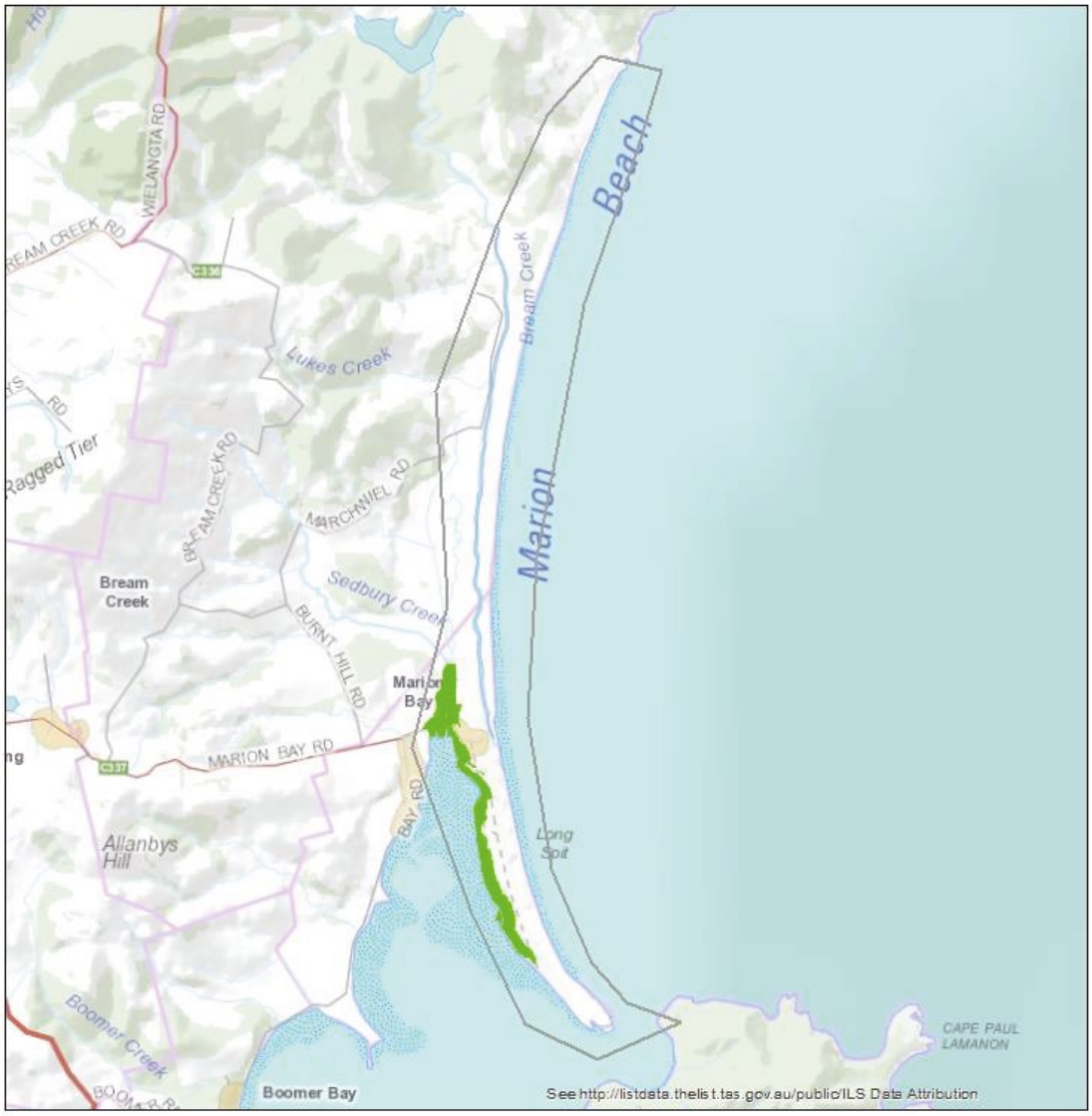
It was this multi-disciplinary partnership, embracing government and non-government bodies, researchers, planners, policy makers and the community, that allowed the project to be successful. Collaborations by their nature involve more time, but the greater investment required (in terms of time and effort) was easily recouped by having the many stakeholders actively contributing in the project and concurring on the outcomes. This high level of transparency and involvement ensured widespread acceptance of the prioritisation for coastal areas.

Outcomes and next steps

Management actions are needed to minimise the risk of loss of Australia's coastal biodiversity from sea-level rise. Our prioritization has identified the beaches that require further on-site investigation for the site-specific management or adaptation required at the landscape scale.

Future steps will look at the significance of sites based on the species that are at priority locations, and the adaptive capacity of the species present. Whilst generalised adaptation principles have been developed, specific management actions are needed for those sites to minimise the risk of loss of Tasmania's coastal biodiversity from sea-level rise. Further work is also needed to understand the impacts of sea-level rise on Tasmanian coastal freshwater and brackish water-bodies.

To enable interpretation of this analysis by land managers, a report summarising the priority beaches arising from this work, and recommended conservation management work, has been compiled and will shortly be made available to planners.



Native Vegetation

Retreat or Refuge site

Squeezed-out site

Priority beach for shorebirds

Shorebird Retreat Pathway - Threat Management with pathway protection

At-risk vegetation communities: Coastal grass and herbfield, Succulent saline herbland, Saline grassland, Eucalyptus viminalis- Eucalyptus globuluscoastal forest and woodland

At-risk shorebirds: Hooded Plover, Pied Oystercatcher, Sooty Oystercatcher, Red-capped Plover, Fairy Tern, Little Tern

Figure 4: Map showing results for Marion Bay, southeast Tasmania. The beach supports six species of breeding shorebirds and four vegetation communities, all identified as being at risk from sea-level rise. Source: © Map produced by DPIPWE, Tasmanian Government. Base map provided by Land Tasmania.

Conclusions, recommendations and lessons learned

During the course of the research, new sea-level rise modelling and natural values datasets became available so we re-ran the models with these new data to obtain the most contemporary outcomes. This resulted in considerable delays to the original schedule, but did not significantly change the results between the two data sets. Our advice to other regions is to go with the best data you have at the time when the need exists, rather than waiting for the elusive data on the horizon!

Our approach for this project could be applied to other regions around Australia as long as they have good geo-referenced locational data on natural coastal values. A key achievement of this project was the development and use of an approach that appears to be one of the most advanced in Australia, yet is relatively simple to apply with a standard GIS. This is the first time such an integrated approach has been undertaken in Australia, and is one of very few worldwide.

Previous efforts to conserve coastal values have been undertaken for relatively small areas and/or fewer coastal values. This initial effort is the first holistic approach to identifying priorities for the conservation of coastal values in Australia at the landscape scale and for such a broad spectrum of natural values.

Further reading

Smartline maps from the OzCoasts website: http://www.ozcoasts.gov.au/coastal/smartline.jsp (accessed 29 May 2017).

The Birdlife Tasmania website: http://www.birdlife.org.au/locations/birdlife-tasmania (accessed 29 May 2017).

This Case Study was prepared by Eric Woehler from BirdLife Tasmania. Please cite as: Woehler, E., 2016: Impact of sea-level rise on coastal natural values in Tasmania. Case Study for CoastAdapt, National Climate Change Adaptation Research Facility, Gold Coast.

CoastAdapt

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