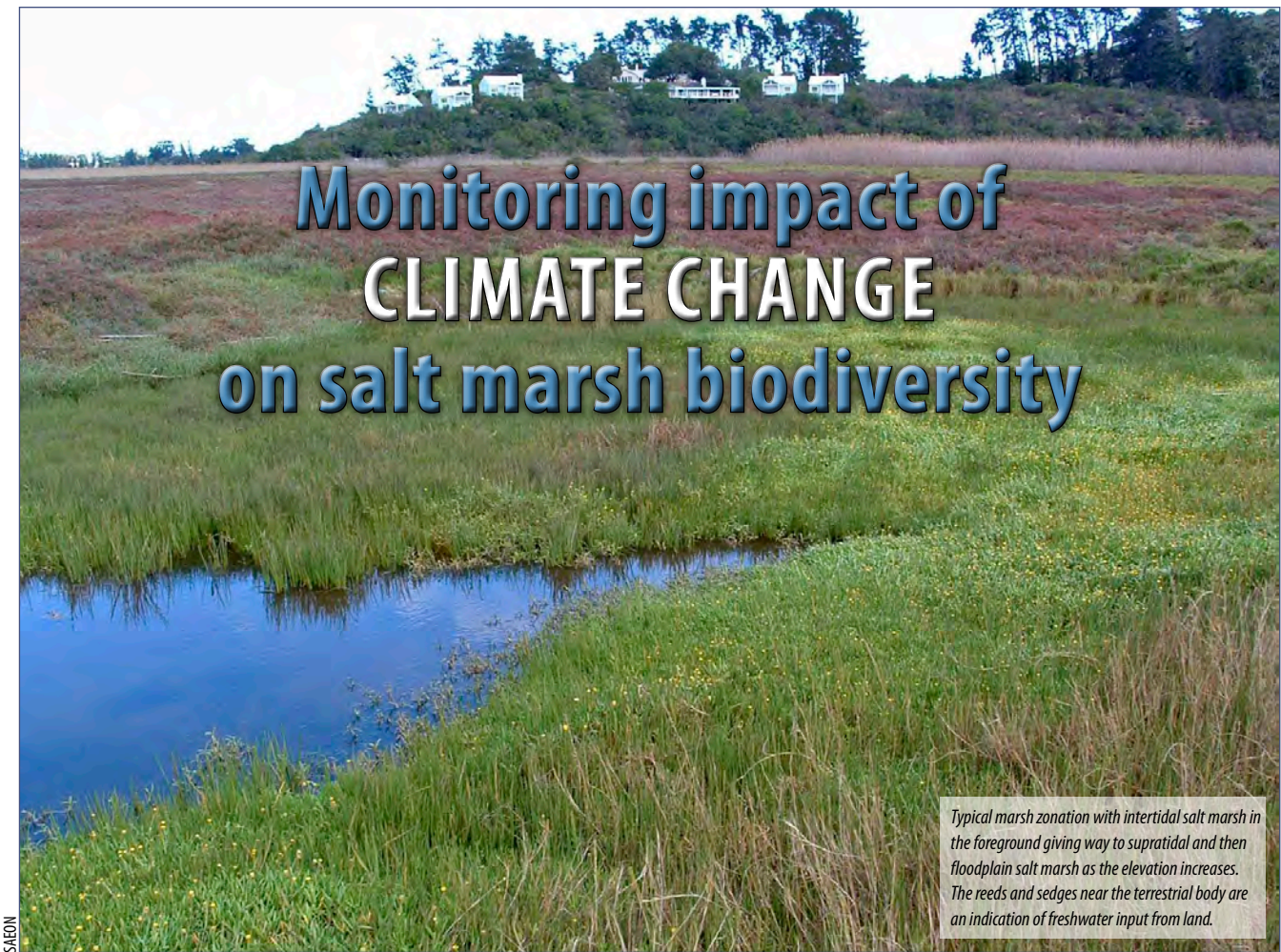




Typical marsh zonation with intertidal salt marsh in the foreground giving way to supratidal and then floodplain salt marsh as the elevation increases. The reeds and sedges near the terrestrial body are an indication of freshwater input from land.

The South African Environmental Observation Network (SAEON) is the principal investigator in a study to investigate the influence of predicted climate change and sea-level change on the diversity, distribution, abundance and community composition of salt marshes in selected estuaries in South Africa. Article by Tommy Bornman and Jadon Schmidt.

South Africa is likely to experience substantial climate change in the next decades, leading to a dramatic decline in biodiversity. The predicted changes in the rate of sea-level rise, as a result of global warming, will have important impacts on the coastal zone, displacing ecosystems, altering geomorphological configurations and their associated sediment dynamics, and

increasing the vulnerability of social infrastructure.

SEA-LEVEL RISE

Coastal wetlands (collectively comprising salt marshes, mangroves, intertidal and supratidal areas) could experience substantial losses as a result of sea-level rise. These economically valuable ecosystems are highly productive and provide a number of important functions, such as flood and storm protection, waste assimilation, nursery areas for fisheries, supply of organic matter to estuarine and marine environments and nature conservation.

Tide gauge measurements from South Africa indicate that sea levels have risen by around 1,2 mm/year over the last three decades, similar to international estimates, although recent observations from satellites

indicate that the global sea levels have been rising by 3,3 to around 0,4 mm/year from 1994 to 2006. The current trend of sea-level rise is expected to accelerate in the future, with recent estimates indicating a 12,3 cm rise by the year 2020, 24,5 cm rise by 2050 and 40,7 cm rise by 2080.

DECLINE IN RIVER RUNOFF

In addition to sea-level rise, it is estimated that runoff from rivers on the west and south coasts would decline by 11% to 84%, while those on the east coast would change by anything from -21% to +10%, making the percentage runoff change in southern Africa among the highest in the world.

The reduction in freshwater reaching the estuary will have a direct impact on the ecological functioning of the salt marsh because each species has a specific freshwater requirement.

A further impact will be the reduction in sediment input from the catchment, reducing the ability of the salt marsh to accrete at the same rate as eustatic sea level rise.

If salt marshes are to survive rising water levels, they must be able to accrete at a rate such that surface elevations gain is sufficient to offset the rate of water level rise. A number of studies have shown that coastal marshes are able to accrete at a rate equal to the historical rate of eustatic sea-level rise (1-2 mm/year).

UNDERSTANDING SHORELINE RESPONSE IS CRITICAL

Marginal and emergent vegetation such as salt marshes and mangroves contribute significantly to estuarine productivity and any negative effects on these communities could thus feed through to estuarine associated fish and fisheries. In the face of a global rise in sea level, understanding the response of the shoreline, the change in productivity of coastal wetlands and its impacts on faunal populations and other coastal ecosystems, to changes in sea level is a critical scientific goal to inform policy makers and managers.

RSET MONITORING

SAEON is attempting to understand the response of the salt marsh by measuring vegetation cover, soil characteristics, vertical accretion, short-term sedimentation, soil vertical elevation changes, shallow subsistence and horizontal shoreline change at nine sites with varying sediment availability and wave energy in the Swartkops, Kromme and Knysna estuaries. The research was originally funded by the Marine Living Resources Fund, however, it is now supported by the Department of Agriculture, Forestry & Fisheries and Oceans and Coasts, Department of Environment Affairs. Precise measurements (within

1 mm) of sediment elevation in the intertidal salt marsh have been made over a period of three years relative to a fixed subsurface datum using a Rod Sediment Elevation Table (RSET).

SET monitoring provides a time series of the integrated effect of surface and below ground processes on sediment elevation. Measuring sediment elevation with a SET involved the installation of a permanent receiver in a concrete casing in the *Spartina maritima* zone.

The SET provides a non-destructive method for making highly accurate and precise measurements of sediment elevation of intertidal and subtidal wetlands over long periods of time relative to a fixed subsurface datum. This technique overcomes many of the limitations of methods currently used to estimate elevation, such as sedimentation pins, and precision surveying.

Repeated measurements (three sets) of elevation were taken at nine points on eight fixed different orientations at each station, i.e. 5 832 measurements in total every six months. The only significant change in sediment elevation at the 27 stations in the three estuaries was recorded at Station 3 in the Knysna Estuary, located in the Ashmead Channel. This seasonal variance could be related to sediment input and scouring from the Bagai tributary.

BASELINE FOR MEASURING CHANGE

SAEON will continue to monitor the sediment elevations at the 27 stations in the three estuaries on an annual basis. It is expected that a few more years of data collection will be necessary to set a baseline against which change could be measured. Vegetation ($n > 20\,000$) and sediment data ($n > 1\,112$) are being analysed at present).

Based on the preliminary data it is hypothesised that the strongest physical variables that determine

vegetation composition and distribution are sediment salinity and elevation. Both variables will be influenced by direct and indirect effects of climate change and sea level rise, and it is further hypothesised that salt marsh community and species distributions and cover abundance will be significantly altered within the next ten years.

Long-term monitoring of the salt marsh sediments in these three estuaries will continue indefinitely to test the following main hypotheses:

1. The Kromme Estuary is starved of fine sediment and a significant portion of the salt marsh will drown with increasing sea levels.
2. The Swartkops Estuary has the largest diversity and area cover and salt marsh habitat that, together with the ample supply of fine and coarse sediment, will ensure the survival of the marsh with rising sea levels.
3. The Knysna Estuary receives sufficient sediment from the catchment, but coastal squeeze will restrict the landward transgressions of salt march, resulting in a significant loss of salt marsh habitat and area with increasing sea levels.

• This article originally appeared in the eNewsletter 1 of 2012 of SAEON, www.saeon.ac.za. □

The levelling arm with the measuring pins.

