occupy a large portion of the coastal plain. The mudflats dry during the dry season and are eroded by the wind as dust storms sweep the coastal plain. Loss of soil from wind transport may increase the depth of the basin, letting in even more salt water.

What is driving saltwater intrusion and morphological change?

Saltwater intrusion appears to be linked to climatic and oceanographic processes such as Wet season floods, stronger than average monsoonal activity, storm surges, higher than average sea level conditions and very high tides. When these events coincide, they can change the morphology of the coastal region, and result in an increase in saltwater intrusion.

Can it be managed?

It appears that saltwater intrusion is a natural process related to big climatic and oceanographic conditions and the natural physiography of the area. It may not be practicable to prevent salinisation of freshwater wetlands along some parts of the coastal plain.

Further studies could be done into management options, such as the construction of barrages, which could replicate the buffering of natural barrages such as existed in the basin near Point Farewell prior to 1973.

Research may focus on why climatic and oceanographic processes undermine some barrages, and whether barrages could be constructed in a way that would increase their effectiveness.

Based on research undertaken by Kristy Winn as part of a BSc honours project.

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The Environmental Research Institute of the Supervising Scientist carries out scientific research for the protection of people and the environment in places that are highly valued by the Australian community.

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Supervising Scientist notes

SALTWATER INTRUSION – A NATURAL PROCESS

What is saltwater intrusion?

Saltwater intrusion is a major coastal management problem confronting the conservation of freshwater wetlands, flora and fauna all over the world.

Over the last 50 years, tidal creeks in the Alligator Rivers Region in Northern Australia have rapidly extended inland to low-lying freshwater wetlands, turning them saline. This process, called saltwater intrusion, is natural and leads to significant ecological and morphological changes to coastal freshwater environments.

Why is it a problem?

Saltwater intrusion leads to the loss of freshwater vegetation and the spread of saline mudflats into previously vegetated areas. This can lead to the destruction of crocodile breeding grounds and magpie geese habitat and can impact on the ability of the local Aboriginal people to hunt and gather food. Saltwater intrusion also affects the high conservation values of coastal freshwater wetlands, as it reduces the diversity of flora and fauna.

Point Farewell - a case study in Kakadu

In 1995, an Aboriginal traditional owner noticed the disappearance of magpie geese (*Anseranus semipalmata*) from wetlands at Point Farewell in Kakadu National Park. As magpie geese and eggs are a traditional food for the local Aboriginal people there was concern about the extent of the change and the loss of a valuable resource. It was likely that the disappearance of the geese was related to the dieback of freshwater wetland vegetation

Dead stands of paperbark trees (Melaleuca) often indicate saltwater intrusion

(paperbark trees) caused by an influx of seawater via a tidal creek.

An attempt was made to stop the tidal creek encroaching on the freshwater habitat by constructing a barrage across the creek, however this eroded and was outflanked by the tidal creek. ***eriss*** was asked to examine the area and focused on a salt-affected freshwater wetland about 12 km south-east from Point Farewell. The wetland is fed by freshwater springs, and in the past served as a valuable source of freshwater for Aboriginal people during the dry season.

Photogrammetric interpretation was used to compare aerial photos of the area from 1950 onwards, looking for connections between the changes in morphology of the basin and the climatic and oceanographic history of the region. Aerial and on-the-ground studies were also carried out to assess the current state of the area.

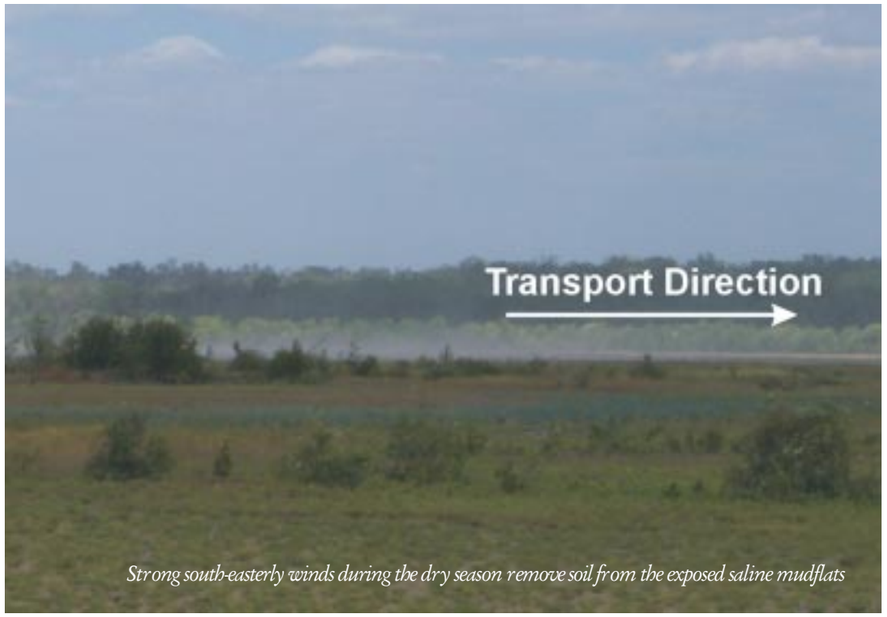
A view through time

In 1950, the area was almost free of saltwater intrusion. The freshwater basin, a string of billabongs vegetated with forests of paperbark trees, was protected from the incoming saltwater tide by old beach ridges, vegetation, and a build-up of alluvium deposited by the freshwater stream during the wet season. Sedges and grasses covered the coastal plain, and the salty tidal creek extended just 1 km inland.

From 1973 to 1975, above average wet season rainfall and floods were recorded. Increased flooding appears to have cut through the barrier formed by the alluvium, allowing tide water to move further into the freshwater basin, a process compounded by above average sea levels.

From 1975 to 1984, the tidal creek network rapidly extended inland. Low-frequency and low-intensity cyclones and above average water levels provided good conditions for inland channel extension, and the wet season floods during this time were weak and did not prevent tidal water from entering the freshwater wetland.

Left: During the dry season the unvegetated saline mudflat cracks deeply and the soil/sediment is removed by strong winds



Strong south-easterly winds during the dry season remove soil from the exposed saline mudflats

By 1997, bare saline mudflats on this part of the coastal plain had increased almost 10 times, more than half the paperbark forest had been lost, and the tidal creek had extended 4 km inland.

The freshwater basin today

Today, evidence of saltwater intrusion can be seen in the morphology of the area. The main mangrove-lined, tidal creek extends inland from the coast to the freshwater basin. Tidal splays are left on the coastal plain where tidal flooding, scour and deposition of sediment have taken place during high tides. There are localised areas of erosion within areas of paperbark forest dieback, and bare saline mudflats

Below: Study area at Point Farewell. The left image shows the extent of the tidal creek in 1950 and the right image shows the tidal creek in 1997. By 1997 the tidal creek had penetrated 4km inland from its opening at the estuarine funnel of the East Alligator River.