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Dynamics of the macrophyte vegetation of the Mgobezeleni floodplain and estuary, Northern KwaZulu-Natal

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ABSTRACT

This empirical study describes the vegetation responses to natural and artificial perturbations that have affected the Mgobezeleni Estuary and floodplain in recent decades. Typically the floodplain and estuary are affected by the changing morphology of the beach berm and the constancy of groundwater-fed baseflow entering the estuary from the catchment. Over the past several decades there have been two major perturbations to the mangroves. A road-bridge was built across the estuary in the early 1970s that raised the water level in the mangrove area. This killed many of the mangroves before the bridge was demolished and then rebuilt to rectify the situation. The second event occurred in 2007 when extremely high seas flushed saline marine water into the lower portion of the estuarine floodplain. This killed swamp vegetation that was unable to tolerate the saline water. Decaying vegetation was flushed into the main part of the estuary and the ensuing de-oxygenated water flooded the remaining living mangroves killing all except for a handful. There has been a slow and constant expansion of *Ficus trichopoda* dominated swamp forest into the estuarine floodplain, displacing sedge swamp. This study highlights the importance of the hydrological regime and alerts us to the sensitivity of this system to future recruitment of mangroves after an extreme perturbation.

1. Introduction

One of the difficulties when studying estuaries is to understand the extent of natural variability – and then to be able to detect when and how this may be modified by human-induced changes. It is only by having a good knowledge of ecosystem functioning that we can gain insights into this, and then to use this knowledge to avoid unintended human impacts. Not only are estuaries variable, but they evolve over time. In southern Africa most were formed due to scouring that occurred when sea levels were below that of the present day (Orme, 1973). Since the last Glacial Maximum there has been sea level transgression (Ramsay and Cooper, 2002). It was in this period that flooding of the scoured basins and the formation of barrier dunes formed the southern African estuaries as we know them (Orme, 1973; Bird, 1982). As this process of evolution has proceeded, the estuaries have changed from relatively stable deepwater systems with a strong oceanic influence, to highly unstable shallow systems with more of a fluvial influence. The end-point of this trajectory is that the estuaries become floodplains. In most cases it is inorganic sediments that accumulate to fill the estuaries, but in some cases organic sediments and precipitates can be important (Humphries et al., 2010). Generally the pattern of infilling is that the sediments are deposited in the region where rivers enter the estuary basin. The river floodplain therefore progrades into the estuary, and gradually the infilling progresses moves towards the mouth (Barnes, 1980). As this occurs, the interface between the estuary and the floodplain shifts seawards. This interface zone can be narrow or quite expanded depending on the degree of influx of seawater caused by extreme tidal and storm events and changes in sea level. As individual macrophyte plants cannot move once established they are useful indicators of the conditions that have occurred at any particular point in the estuary over the duration of their life. In this study of the Mgobezeleni floodplain and estuary changes caused by known perturbations are described to obtain insights into responses of the vegetation that have occurred in the estuary, the floodplain and the estuary–floodplain interface zone. The results presented here are a component of the Water Research Commission-funded research initiative that aims to gain an understanding of the links between hydrology and ecology in the full Mgobezeleni catchment (Bate et al., 2016).

2. Study site

Mgobezeleni is a small floodplain–estuary system that enters the sea at Sodwana Bay in northern KwaZulu-Natal (Fig. 1). Although it is a relatively little-studied system, in recent decades it has been subjected to several natural and human-caused events that have influenced the

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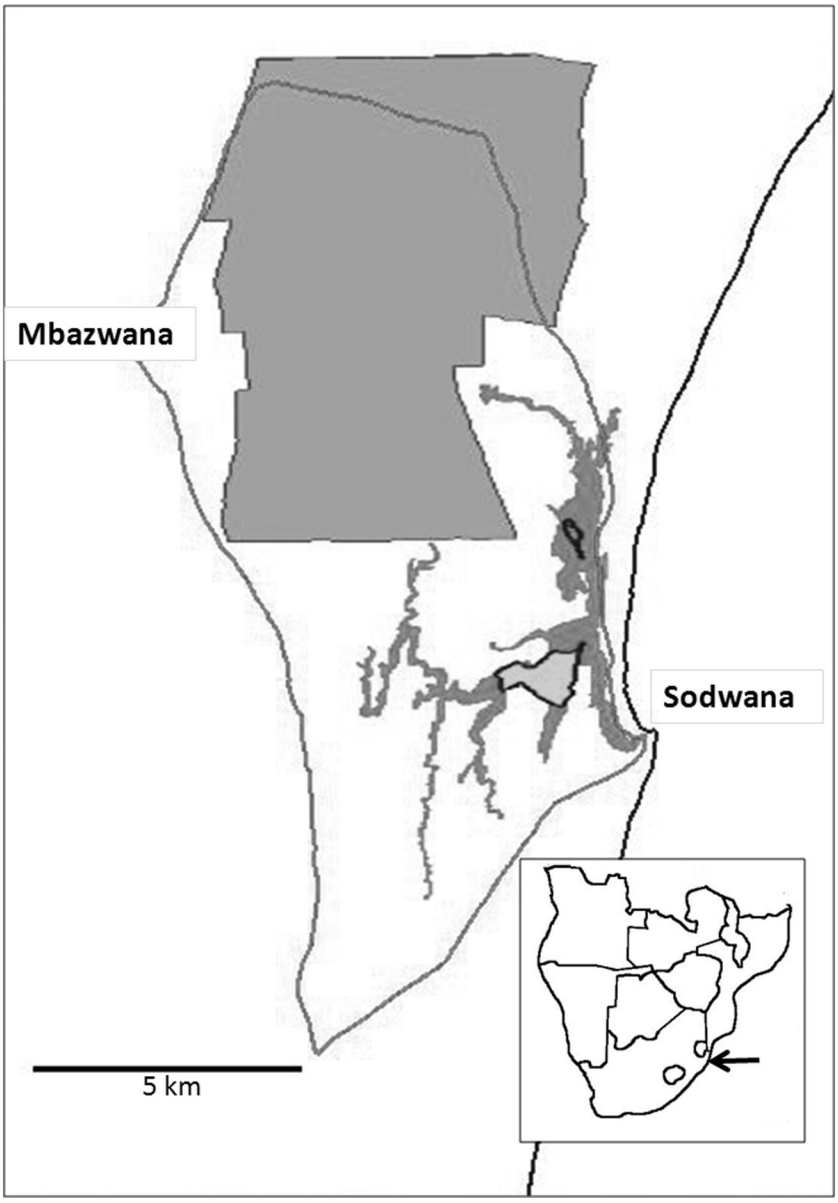

Fig. 1. Location of the Mgobezeleni catchment and estuary. The map shows the locations of Sodwana Bay, the town of Mbazwana, the outline of the catchment area, the commercial forestry plantations (shaded area in the north) and the drainage lines within the catchment which contain wetlands and coastal lakes.

vegetation. The catchment area for the floodplain and the Mgobezeleni Estuary (−27.541° S; 32.678° E) is about 10 km by 15 km. Incised into the catchment landscape are several drainage lines in which wetlands have formed (Fig. 1). These drainage lines lead into two coastal lakes – Lake Mgobezeleni (93 ha) and Lake Shazibe (8 ha). The streams that exit these lakes come together in a confluence at a point 2.7 km upstream of the estuary mouth. It is the portion of the wetlands between the confluence and the estuary that is defined as 'floodplain'. This is subjected to saturation and draining in response to the closure and breaching of the estuary; however it is a freshwater system that is not affected by sea tides or salinity. It is in a basin where tall vegetated coastal dunes separate the coast-parallel floodplain from the sea. The downstream margin of the floodplain merges with the estuary in the region where the wetland makes a right-angle turn to pass through the dunes to link with the sea (Fig. 2).

The upstream boundary of the estuary is considered to be the inland extent of saline water penetration or where there is a detectable tidal signature. This is consistent with Perillo (1995) who defines that the inland limit of an estuary to be either the point where there is the attenuation of tidal rise and fall, or the limit of the penetration of sea salt. From the botanical perspective the floodplain is separate from the estuary as it does not have plants growing in it that can withstand marine salinity. The mouth of the Mgobezeleni Estuary is in the Sodwana Bay which is formed by the Jesser Point rocks. This small sheltered bay is the focal point for the busy Sodwana Bay coastal resort. It is used extensively for the launching of ski-boats as well as for swimming. It is notable that this is the only estuary in the 175 km of coastline between Kosi Bay and the St Lucia mouth. The distance reduces the probability of biotic recruitment from either of these adjacent estuaries.

The study area does not include the freshwater lakes that are regarded as being part of the system which is defined as an estuarine lake by SANBI (2011). This is because there is no detection of any responses of the vegetation in the lakes that are related to salt penetration, marine tides or the backing up of water when the estuary mouth closes (Bate et al., 2016). For a similar reason the freshwater swamp forests and sedge swamp vegetation on the margins of these lakes is not included – although much is below the 5 m contour line which defines the Estuarine Functional Zone (EFZ) (Veldkornet et al., 2015).

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