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4.5 WETLANDS

Dr Heidi van Deventer (CSIR and UP)

INTRODUCTION

The diversity of coastal rivers and inland wetlands provide essential ecosystem services to sustain life and ensure resilience against climate change. When these ecosystems are in good ecological condition and well-connected, they serve as ecological infrastructure offering a range of services, such as water provision (particularly during droughts), flow regulation, infiltration of rainfall to groundwater aquifers and sediment budget for the coast. However, when degraded, the impacts of climate change exacerbate the negative impacts of existing pressures.

A diversity of river and inland wetlands occur within KZN, with 76 rivers covering a length of 2 313 km along the KZN coast. The areal extent of inland wetlands totals 84 526 ha within the coastal zone (National Wetland Map version 5; Van Deventer *et al.* 2020). About half of the rivers are perennial in nature, flowing throughout the year, while the others are seasonal. These systems supply nutrient-rich waters to the fluvial-dependent marine ecosystem (Figure 4.8; Sink *et al*. 2019), and sediments which sustains beaches (Harris *et al*. 2019).

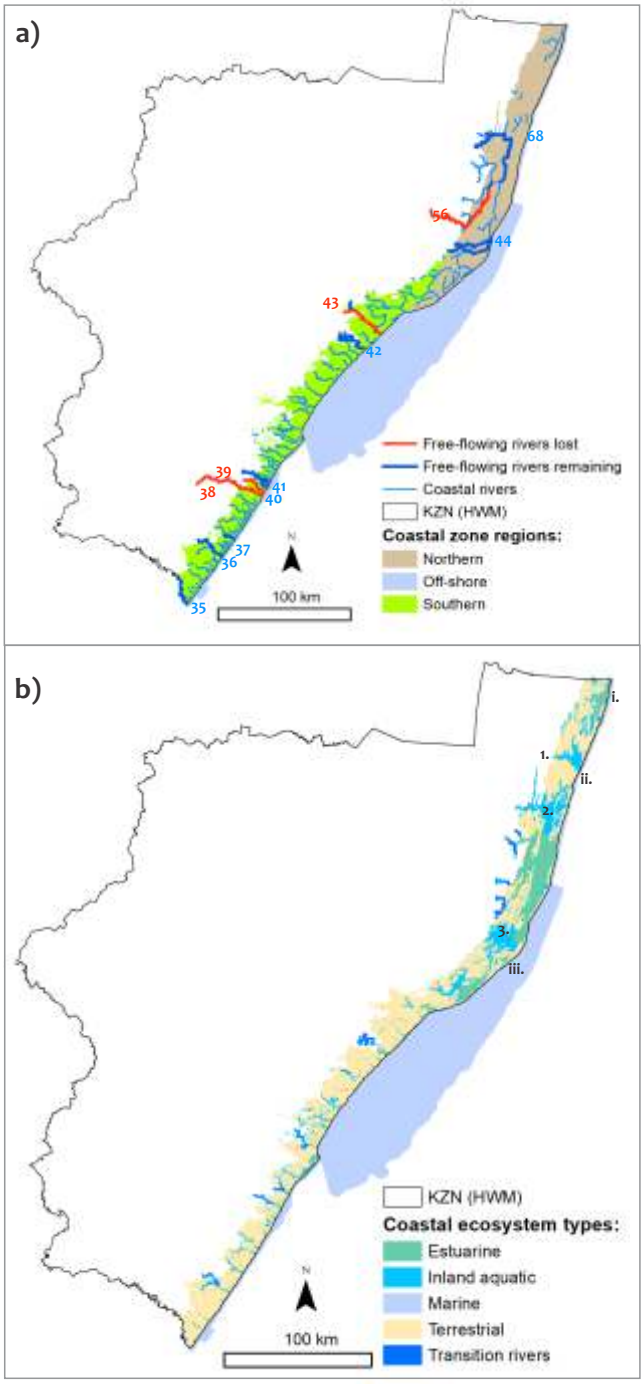

Figure 4.8: The diversity of inland aquatic (river and inland wetland) ecosystems of the KZN coast.

A rich diversity of inland wetlands is found along the KZN coast, with two distinct regions being recognised. The southern region, along 304 km of the southern coast, covering a total areal extent of 546 208 ha, is home to 27% of coastal wetlands and 88% of KZN rivers. The northern region, which is generally referred to as the *Maputaland Coastal Plain (MCP)*, extends along the northern 273 km of the coast and covers an areal extent of 516 426 ha (Figure 4.8a). The MCP is dominated by large, extensive floodplains feeding into estuaries. Inter-dune depressional wetlands intercept rainfall and cause it to percolate slowly through the sandy soils to more extensive wetland systems throughout the year. The MCP hosts 73% of the total areal extent of coastal KZN wetlands (Figure 4.8b), while aquatic systems (rivers, inland wetlands and estuaries) are laterally connected through shallow groundwater aquifers, estimated to be 1-3 m below the surface (Kelbe *et al.* 2016).
It is important to note, that due to KZN's subtropical climate, there is a higher prevalence of riverine and coastal swamp forests than the rest of the country. Swamp forests form a natural ecotone across the estuarine and inland wetland ecosystems (Figure 4.9 and Section 4.2). Additionally, KZN is home to the largest peatland of South Africa and the oldest in the world. Peatlands in general offer exceptionally high ecosystem services and their climate change resilience functions are critical for the region.

DRIVERS

- **Water abstraction:** Increasing demands for freshwater both for increasing population and agricultural activities.
- **Water pollution:** Increasing nutrient addition from Wastewater Treatment Plants not functioning properly.
- **Loss of habitat:** Habitat transformation and fragmentation due to coastal development and landcover change.
- **Climate change:** Climate change can potentially drive changes. However, there is uncertainty as to whether the MCP is getting wetter or drier (Snaddon *et al*. 2019, Van Niekerk *et al*. 2019).
- **Dune mining:** Mining at Richards Bay has had a detrimental effect on water flow.
- **Farming practices:** Subsistence farming in the freshwater swamp forests have been changing to commercial operations. The use of foreign crops is not suited for these wetland areas.

PRESSURES

Several pressures have contributed to the deterioration and losses of rivers and inland wetlands, and their associated freshwater species. Habitat transformation to agricultural food production has the most extensive impact on the surface cover of inland wetlands. Dune mining is expected to have a detrimental impact on the hydrological regime of surface and groundwater resources (Section 8.7). To date, no study has been published to elucidate the impact on rivers, wetlands and water quality during mining operations or after rehabilitation of dunes. At a smaller scale, sand mining in KZN coastal rivers is a pressure, with an estimated 50% of the coastal river systems impacted (Section 8.8; McKelvey and MacKay 2019/2020). These operations result in habitat transformation, loss of riparian and in-stream habitat, an increase in erosion and sediment load. They also result in a reduction in the infiltration of rainfall into the groundwater aquifer, which is critical for water provision during the dry season and particularly droughts. Slash and burn operations within the swamp forest of the MCP occurs with the draining of the substrate peat. This practice is often done for subsistence farming of the indigenous taro (*Colocasia esculenta*), locally

known as *amadumbes*. These practices have increased in extent and intensity; the extent of swamp forest being cleared has drastically escalated and agriculture activities are more commercial. Foreign and more tropical crops, such as bananas, cassava and rice are being cultivated for sale. Drained peatland is prone to erosion and emissions of greenhouse gases since the organic material is no longer sequestered through inundation. Under persistent drought periods or poor land use management these peatlands can collapse.

***Nymphaea nouchali* var. *caerulea*, an aquatic plant found in KZN wetlands**
Photo: Fiona MacKay

STATE

Historic perspective

Wetlands, including inland wetlands and estuaries, are considered the most threatened ecosystems globally and in South Africa (Van Deventer *et al*. 2019, Van Niekerk *et al*. 2019). It is estimated that >85% of their extent has been lost to date, while the rate of current losses exceeds those of forests (IPBES 2019). Most of the river and inland wetland ecosystem types assessed at a national scale in the *National Biodiversity Assessment of 2018* (Van Deventer *et al*. 2019, Van Niekerk *et al.* 2019), are predominantly threatened and poorly protected. By the 1980s, 57% of the lower iMfolozi River catchment was transformed to sugarcane (Begg 1988), reducing the ecosystem service of this floodplain to buffer the area against intense storms.

Current state

Most rivers exiting the KZN coast (64%) originate within the coastal zone and are dominated by coastal climatic influences and the surrounding land uses in these catchments. The others (36%) are larger rivers, where the ecological condition is influenced by pressures outside the coastal zone. In terms of the *National Freshwater Ecosystems Priority Areas (NFEPA)*, 12 of the coastal rivers are assigned a free-flowing status (Nel *et al.* 2011), serving as examples of rivers in a good condition, sustaining ecological processes from source to sea. Five of the 12 were identified as priority rivers, called "*Flagship Rivers*", namely, uMthavuna (35), uMzimkhulu (36), uThukela (42), iMfolozi/uMsunduze (44) and Mkuze (68) (numbers in brackets: ID of the river in Figure 4.8a).

The drought of 2015/16 had a major impact on the wetlands of the MCP. An increasing trend in the number of wetlands with predominantly peat substrate (peatlands) have been burning within the past five years, compared to the decade pre-2015 (Grundling *et al.* 2021). Vasi Pan is, however, one of the exceptions, where 233 ha, or 67% of the whole wetland extent has burnt twice in the past 20 years due to the lowering of the water table, primarily by forest plantations. Such a draw-down can remove available surface water from an area as far as 2 km around the perimeter of the plantations (Bate *et al.* 2016).

A loss of natural and near-natural rivers due to loss of flow, water pollution and habitat transformation is a national concern (Nel and Driver 2015). The Ecological Condition Index of

mainstem rivers showed an alarming loss of 49% of its total extent in a natural ecological condition since 1999. Only 12% of the extent of mainstem rivers on the KZN coast now remain in a natural ecological condition. River flow from source to estuaries has been reduced by at least 20% because of water abstraction, inter-basin transfers and trapping in upstream dams. Similarly, the sediment budget to the coast has also reduced by at least 20%, negatively impacting the coastal ecological processes and tourism (Section 4.1). The deterioration of the ecological condition of the coastal rivers, and loss of connectivity because of building dams, have also resulted in four of the 12 free-flowing rivers of the KZN coast losing their status (Van Deventer *et al.* 2019). Critical intervention is required to curb these concerning trends. Should rivers be left to decline at the rate of the current loss indicated by the Ecological Condition Index, the KZN coast is likely to lose their natural mainstem rivers by 2024.

Surveys conducted in the past three years showed that rivers are a major pathway for solid waste pollution (Naidoo *et al.* 2015, Verster and Bouwman 2020). The DFFE has a Source to Sea Initiative in five rivers of the eThekwini Municipality (uMngeni, uMlaza, uMbilo, uMhlatuzana and aManzimnyama) to trap the solid waste washing out through rivers to the beach and sea (DEA and WRC 2018). Minimising illegal and informal dumping and the urgent restoration of our Waste Water Treatmtent Works will contribute to the reduction of this emergent pressure.

IMPACT

Loss of habitats of rare and endangered species increase their risk of extinction. Urban, agricultural and mining development have also resulted in a decline in habitat for the Pickersgill's Reed Frog (*Hyperolius pickersgilli*), which is endemic to the coastal reed-bed wetlands of the KZN coast (Tarrant and Armstrong 2013). In 2016, the species was listed as Critically Endangered, but through ongoing survey efforts, the number of known sites increased from 8 to 38. Funding by the former DEA - Natural Resource Management, through the Working for Water programme, saw the removal of invasive species covering an area of approximately 1 000 ha, the replanting of indigenous wetland species, and a captive breeding program with the Johannesburg Zoo and Ezemvelo. These interventions resulted in the successful down listing of the status of this frog to Endangered (IUCN 2016).

South Africa's largest freshwater lake (one of only eight), Lake Sibaya, is found on the northern coastal plains of KZN (Figure 4.1, Section 4.4). Lake Sibaya extends to 8 361 ha and has an average depth of 13 m and maximum depth of 41 m (Miller 1998).

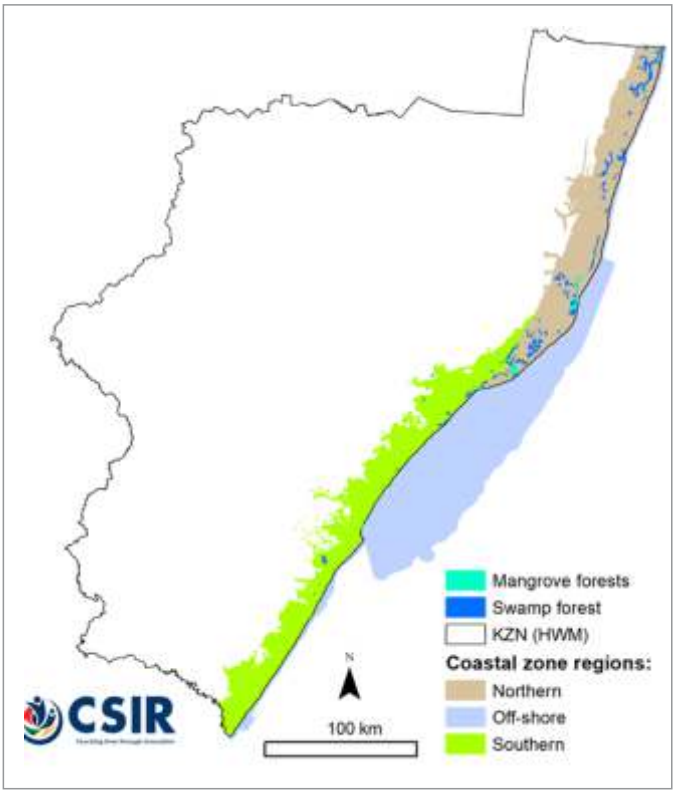

Figure 4.9: Estuarine and freshwater swamp forests of the KZN coastal zone.

Peatlands of the KZN Coast

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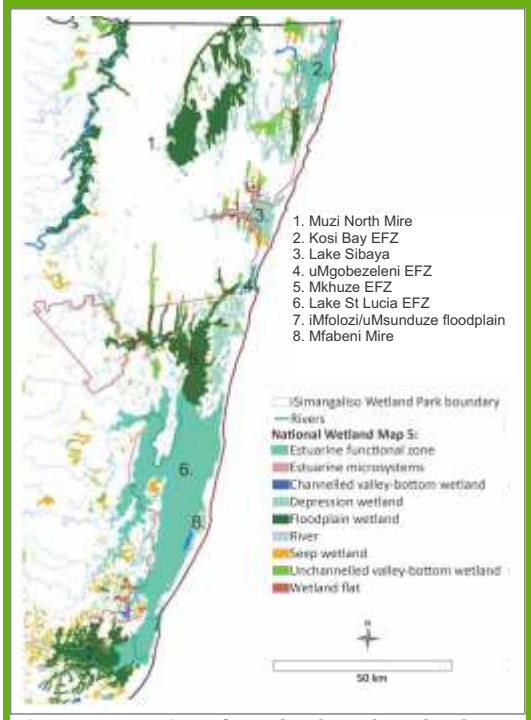

Figure A: Location of peatlands and wetlands.

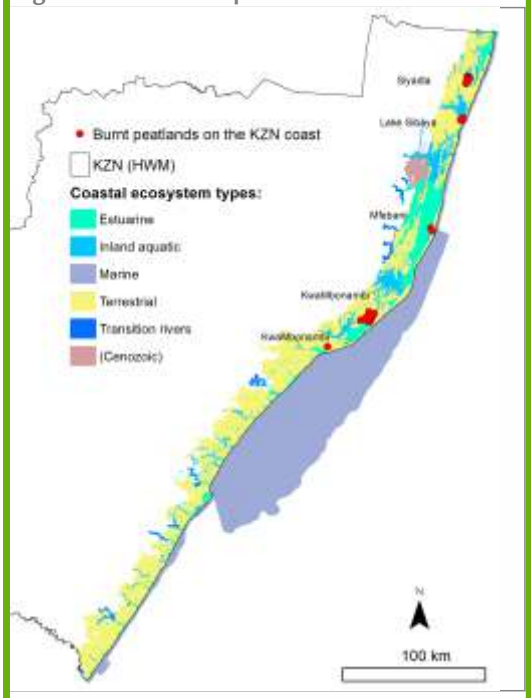

Figure B: Peatland fires recorded.

Peatlands are wetlands which have a naturally high percentage (>30% dry mass) organic substrate (Joosten and Clarke 2002). The KZN coast presents some of the most unique and high-valued peatlands, with the MCP hosting the highest density of peatlands in South Africa (Thamm *et al.* 1996, Grundling *et al.* 1998). These peatlands started to form as early as 47 000 years before present, spanning the Late Pleistocene and Holocene periods (Thamm *et al.* 1996, Grundling *et al.* 2013, Baker *et al.* 2017). The world's oldest known peatland, the Mfabeni Mire (Figure A, 8) is 47 000 years old and is still accumulating peat (Grundling *et al.* 2013, Elshehawi *et al.* 2019).

The MCP peatlands are associated with inland wetlands, rivers and estuaries, and provide a high number of ecosystem services. These peatlands have the highest estimated carbon sequestration values for South Africa (estimated at almost 19 million t) and have recorded the highest rates of carbon accumulation 37 542 t/yr (Grundling *et al.* 2017) and are valued at R 8.8 billion (in 2017). The iSimangaliso Wetland Park alone is estimated to store 7 160 000 t of carbon (Grundling *et al.* 2000), being an asset to the country.

The Mkuze Floodplain (Figure A, 5) is the largest peatland in South Africa with 83% of its areal extent (8 800 ha) containing peat (Grundling *et al.* 1998, 2000). The carbon in this is estimated to contain 25% of the carbon deposited in South Africa's peatlands. However, the smaller Mfabeni Peatland (Figure A, 8; 1 462 ha) has a higher storage capacity of 1 768 t C/ha than the Mkuze (589 t C/ha). This is because it formed earlier than the Mkuze (Grundling *et al.* 2000, 2013).

The wetlands of the MCP are laterally connected through the groundwater that is on average 1-3 m below the surface (Kelbe *et al.* 2016). Rainfall infiltration connects inland wetlands, rivers and estuarine systems to one another. These resultant interconnected systems are difficult to define protection zones for. Eucalyptus plantations pose the biggest threat to peatlands, with deep rooting zones up to 28 m below surface and high evapotranspiration rates (Dye 1996, Bates *et al.* 2016), resulting in a large loss of available water and lowering of the groundwater table for a distance beyond 2 km around these plantations. Of concern is that forestry increased by 4 557.7 ha [45.6 km^2] between 1990 and 2013/4 (Janse van Rensburg 2019). The lowering of the water table caused by these plantations resulted in a peat fire of 233 ha or 76% of the extent of Vasi Pan in 1996 (Grundling and Blackmore 1998) and more recently in 2014. After the recent drought of 2015/16, six of the 20 peat fires recorded in the country to date occurred in the MCP region (Figure B, Grundling *et al.* 2021). The peat fires at KwaMbonambi, Lake Sibaya, Mfabeni, Siyadla, Vasi Pan and Vasi Pan North on the MCP have contributed an estimated amount of 437 581 t CO_2 emissions (Grundling *et al.* 2021).

Considering the uncertainty of climate change, which is expected to increase evapotranspiration rates and intensify droughts, the likelihood of permanent collapse of our peatlands are high and imminent. The complete eradication of forest plantations within MCP where it intercepts rainwater recharge or tap into the groundwater table is considered a top priority for the protection of our ecological infrastructure and peatlands.

RESPONSE

Even though 37% of the extent of the MCP falls within National Protected Areas (NPAs) or Ramsar sites, pressures outside these reserves continue to degrade rivers and inland wetlands within these protected areas. This is evident by the increasing burning of peatlands, decline of the extent and intactness of the swamp forests and deterioration of the ecological condition of rivers. Only 2.2% of the southern region falls within NPAs while this region has the highest rate of land transformation in the country (Skowno *et al.* 2019) and it is likely that large amounts of wetlands in this coastal region have been completely lost. Cooperative governance is therefore key to manage and rehabilitate the landscape inside as well as outside of reserves, to ensure sustainability of our freshwater resources, our most valuable national capital asset.

Using a buffer policy of 500 m around wetlands when screening any development applications is insufficient for the MCP because wetlands are interconnected through the groundwater. Further groundwater studies are therefore required to better map the groundwater compartments and determine more accurate water budgets before the Reserve Determination and Resource Quality Objectives, and further water licenses can be issued.

Data Requirements

- An improved inventory of rivers and wetlands - to improve spatial representation and other attributes.
- The ecological condition of rivers - derived from the River Eco-status Monitoring Programme (REMP) for this report.
- Department of Water and Sanitation (DWS) - REMP and the National Eutrophication Monitoring Programme (NEMP).
- Percentage of effluent and flow needs to be mapped over the months.