
SUSTAINABLE MANAGEMENT OF SOUTH AFRICA'S WETLANDS

2024



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INTRODUCTION

It is globally accepted that ecosystems, as natural features in the landscape, provide environmental, social and economic benefits to associated communities. The value of ecosystems in providing these ecosystem services is becoming increasingly evident. There is a growing recognition of the importance of the services delivered by freshwater ecosystems to human well-being. Ecosystem services are quantifiable benefits

people receive from ecosystems.

Wetlands are highly productive ecosystems. Due to their ecological complexity, wetlands provide a variety of goods and services of value to society. These services can be described as services of nature, directly enjoyed, consumed, or used to yield human well-being. Wetlands are recognised as one of the richest and most productive ecosystems

on earth. Associated with wetlands are a wide range of specially adapted plant species giving food and shelter to a variety of animal life. There is a drive conserve and restore wetlands as far as possible.

Wetlands in South Africa are protected by Law (Water Act of South Africa (Act 36 of 1998). There are different types of wetland, but generally it can be described as "land which is transitional between terrestrial and aquatic ecosystems, where the water table is usually at

or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances support or would support vegetation typically adapted to life in (water or) saturated soil."

This booklet describes some of the latest research reports and guides on wetland assessment and management as funded by the Water Research Commission.



Wetland management and assessment



Hydropedological assessment guidelines: Theory and application in a South African wetland management context

WRC report no. TT 925/23

Clear and comprehensive guidelines on how to conduct hydropedological studies within the context of wetland management have been lacking. Literature on hydropedological theory is dispersed across various journal papers and book chapters, lacking a cohesive methodological structure. The primary objective of this report is therefore to amalgamate and streamline previous guidelines into a comprehensive document, offering both theoretical and practical guidance on conducting hydropedological assessments, with a central focus on wetland management. The guidelines are organised into two main sections. Section A provides a theoretical foundation encompassing hydrological processes, soil property interpretation, and hydropedology of hillslopes. This section can serve as training material for scholars seeking to acquaint themselves with the theory of hydropedology. Section B offers practical guidance for conducting hydropedological surveys for wetland assessments and interpreting the results. It is intended to guide consultants on when, and how hydropedological assessments should be conducted, and by whom, within the context of wetland management.

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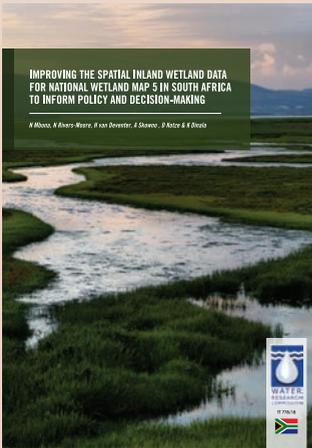


Development of management and rehabilitation protocols for peatlands in South Africa: Case studies of peat fires

WRC report no. TT 907/23

Peat fire occurrence is increasing across South Africa. Peat fires result in a loss of sequestered carbon to the atmosphere as organic carbon stores are combusted, thereby contributing to anthropogenic climate change. Furthermore, peat fires pose risks to respiratory health due to substantial fumes and are a safety hazard to people and animals. These risks are amplified by the prolonged subsurface nature of these fires. There are gaps in knowledge relating to peatlands in South Africa, including their full extent and location, their carbon storage, the occurrence of peat fires, and restoring functionality to burnt peatland systems. The overarching aim of this research study was to develop management and rehabilitation protocols for South African peatlands affected by peat fires from the determined peat loss in selected case studies..

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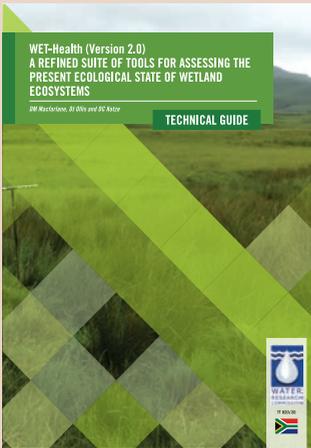


Improving the spatial inland wetland data for National Wetland Map 5 in South Africa to inform policy and decision-making

WRC report no. TT 778/19

Inventories provide information needed to prioritise the most important wetlands systematically and allocate limited resources accordingly. The National Wetland Inventory (NWI), housed within the South African National Biodiversity Institute (SANBI), is the current repository of national spatial information regarding wetlands in South Africa. The NWI generates the National Wetland Map (NWM), which is the primary wetland layer used in national planning projects such as the National Freshwater Ecosystem Priority Areas (NFEPA) and the 2011 National Biodiversity Assessment (NBA). The NFEPA project created a wetlands layer that was adopted by SANBI as NWM4. Based on the available data at the time of preparation of NWM4, the 2011 NBA published by SANBI identified wetlands as the most threatened ecosystem type in South Africa, with 48% of wetland ecosystem types classified as critically endangered, 12% as endangered and 5% as vulnerable. This project set out to assess the accuracy of the current NWM and improve the quality of spatial data on wetland extent and investigate the impacts of scale and regional environmental patterns on predictor variables informing probabilistic models of wetland occurrence, type and condition.

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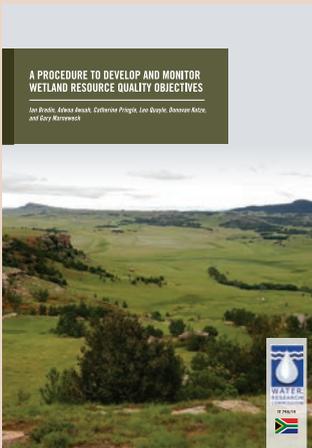


***WET-Health (Version 2.0)
– A refined suite of tools
for assessing the present
ecological state of wetland
ecosystems***

WRC report no. TT 820/20

WET-Health Version 2 consists of a series of three tools developed to assess the Present Ecological State (PES) or “ecological health” of wetland ecosystems of different hydrogeomorphic types at three different levels of detail/ resolution. These tools build on previous assessment methods, including WET-Health Version 1 and Wetland-IHI, in response to the need that was identified to develop a refined and more robust suite of tools for the assessment of the PES of wetland ecosystems in South Africa. The suite of tools was developed through extensive engagement with key stakeholders to clarify user requirements for different types of wetlands and levels of PES assessment, and the tools have been tested across a variety of wetland hydrogeomorphic types and landuse contexts. Thus, WET-Health Version 2 has achieved the main project aim of integrating the existing Wetland PES assessment tools into a single suite of tools which are in line with user requirements and which address the shortcomings of the previous methods.

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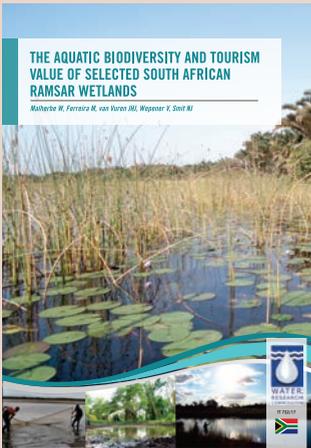


A procedure to develop and monitor wetland resource quality objectives

WRC report no. TT 795/19

There is a clear challenge with respect to the link between development and sustainable wetland management. The challenge is to maintain and reinstate the functions of South Africa’s wetlands in order to ensure that the per capita ecosystem service levels provided by wetlands keep pace with a developing population and its growing demands on the resource base. This can only be achieved by giving effect to the National Water Act (No. 36 of 1998) in co-operation with other relevant authorities and stakeholders. The report provides an overview of the procedure to develop and monitor wetland Resource Quality Objectives (RQOs) in part one, and then a step-by-step technical guideline to implementing the steps of the procedure in part two. The approach focuses on determining primarily qualitative, or at best semi-quantitative, RQOs for priority wetland resources throughout Water Management Areas. The procedure is based on the need to balance practicality with sourcing wetland data at a suitable confidence level for the purposes of setting wetland RQOs. The aim of the procedure is to provide a recommended standardized procedure for determining RQOs for wetlands. It should guide authorities of key departments, catchment managers, classification and RQOs consultants, and specifically wetland specialists through the recommended procedure to develop and monitor RQOs for wetlands.

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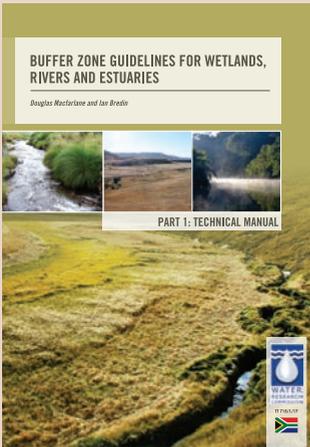


The aquatic biodiversity and tourism value of selected South African Ramsar wetlands

WRC report no. TT 732/17

The Ramsar Convention for Wetlands of International Importance came into force in South Africa on 21 December 1975. The first two designated Ramsar sites in South Africa were De Hoop Vlei and Barberspan Bird Sanctuary. Since then, South Africa has steadily increased the number of designated sites and currently it stands at 23 sites. Even though wetlands are accepted these days as being vitally important as water resources and as ecological infrastructure, many of South Africa's Ramsar wetlands have been neglected in terms of research on their structure, function, importance and the services that they provide. Furthermore, many of these vitally important wetlands have little to no information on the biotic communities present within the aquatic ecosystem. To start to address this lack of aquatic biodiversity information for Ramsar wetlands in South Africa, this research project was initiated. The broad aim was to collate any existing aquatic biodiversity information available on selected Ramsar wetlands in South Africa and to fill in selected gaps within this research. The knowledge gaps will take many years to address but this is a good starting point to further our knowledge of the Ramsar wetlands and determine what research is needed.

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Buffer zone guidelines for wetlands, rivers and estuaries

WRC report no. TT 715/1/17 (Technical Manual) and TT 715/2/17 (Practical Guide)

These reports stems from the work undertaken in a project titled 'Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. (Macfarlane et al., 2014). This project provided an opportunity to test the preliminary guideline at a series of national training and development workshops, and to update and finalise the report and supporting Buffer Zone Tools. A key outcome from the workshops was a clear need for a Technical Manual and a separate Practical Guide to help guide users through the process of determining an appropriate buffer zone. The Technical Manual details the technical aspects of the eight-step assessment procedure and acts as the primary reference point for anyone wishing to determine an appropriate buffer zone around a river, wetland or estuary. The Practical Guide includes relevant information to assist users when selecting appropriate options for each of the criteria that needs to be considered when populating the accompanying site-based Buffer Zone Tools.

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Other reports

Quantifying the extent and rate of changes in wetland types of the Maputaland Coastal Plain with remote sensing

The aim of this research project was to quantify the rate of change of different wetland types on the Maputaland Coastal Plain using remote sensing. In addition, a subcomponent of the work also aimed to understand the social context of these changes, through enabling stakeholder engagement and communication through sharing the remote sensing product output with these stakeholders.

Report no. 3133/1/24

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Advancing water and income security in the unique Maputaland Coastal Plain: A strategic decision support tool to explore land use impacts under a changing climate

The development of a system-wide resource economics model with appropriately scaled and integrated climatological, land cover and hydrological components of the region as a decision support tool to explore the net effects of plausible future trajectories for quaternary catchment W70A with Lake Sibaya's groundwater catchment as the primary response variable.

Report no. 3132/1/24

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WET-EcoServices (Version 2) – A technique for rapidly assessing ecosystem services supplied by wetlands and riparian areas

Individual wetland/riparian areas differ according to their characteristics, contexts and the particular suite of ecosystem services which they supply to society. Thus, there is a need to assess and compare wetland/riparian areas in terms of ecosystem services delivery. Recognizing this need, a rapid assessment technique, termed WET-EcoServices (Version 1) was developed 10 years ago to help non-specialists assess the ecosystem services that individual wetlands supply. The technique has been revised through a Water Research Commission project to produce WET-EcoServices Version 2.

WRC report no. 2737/1/21

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Multi-platform remote-sensing tools for peat fire detection and monitoring

Peat degradation occurs when the water table drops. The peat then dries out, forms cracks and becomes oxidised due to its exposure to air. Peat degradation results in the release of CO₂ into the atmosphere, which contributes to climate change. This is the ideal condition for subsurface peat fires to occur. Peat fires can burn and smoulder for a long period of time, causing health

risks to communities, their livestock and wildlife. Subsurface peat fires are difficult to detect with remotely sensed sensors and are characterised by lower temperatures than surface fires. Therefore, this project aimed to develop a national multi-platform remote-sensing data system for a peat fire detection monitoring framework that integrates information from various remotely sensed and ground-sensed sources.

WRC report no. 2836/1/20

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WET-REHABEVALUATE Version 2: An integrated monitoring and evaluation framework to assess wetland rehabilitation in South Africa

WET-RehabEvaluate was developed as a framework to guide the application of monitoring and evaluation (M&E) during wetland rehabilitation projects, but further experience and recent research have identified several potential improvements required for evaluating wetland rehabilitation efforts. In an attempt to capture these improvements, this Water Research Commission (WRC) research project sought to compile a framework that is a user-friendly guide for implementing M&E for wetland rehabilitation in South Africa.

WRC report no. 2344/1/19

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Ecosystem process and function of temporary wetlands: Baseline data for climate change predictions

This project was designed to attempt to address gaps in knowledge such that it feeds into current water quality models that are designed to predict changes associated with global climate change by making them more robust. Especially as they pertain to temperature effects on lower trophic levels, specifically algal communities and its consequences for higher trophic levels. It also proposed to further address knowledge gaps in the ecological functioning of ephemeral wetlands in the Nelson Mandela Bay Municipality (NMBM) and responses to anthropogenic pressures.

WRC report no. 2348/1/19

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Developing wetland distribution and transfer functions from land type data as a basis for the critical evaluation of wetland delineation guidelines by inclusion of soil water flow dynamics in catchment areas (3 volumes)

The project has grouped the final project deliverables into three volumes. Volume 1 considers the whole project and summarises the results of the project deliverables. Volume 2 presents a methodology for characterising the hydrological hillslopes which make up the wetland catchment, using both Land Type data and field-collected data, in order to support wetland assessment and the avoidance or minimisation of disturbance impact affecting the hydrological condition of wetlands. Volume 3 comprises guidelines for regional wetland soil contextualisation

in support of wetland delineation as a series of discussion documents which draw on the Land Type information to present the case for regional differences in wetland soils and wetland soil indicators.

WRC report no. 2461/1/18 – 2461/3/18

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South African peatlands: Ecohydrological characteristics and socio-economic value

Although peatlands are not common in South Africa where less than 10% of the wetlands are peatlands, some peatlands are unique. The Mfabeni Mire, for example, is 45 000 years old and is one of the oldest active peat-accumulating wetlands in the world. The aim of this study was to evaluate the characteristics of peatlands and related processes and their contribution to South African wetland ecosystem services.

WRC report no. 2346/1/17

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Exploring landscape green innovations to improve aquatic ecosystem services for the benefit of urban and peri-urban communities: A case study of the Khayelitsha Wetlands

This research focuses on the Khayelitsha wetlands system and the ecosystem services it provides to the surrounding communities in a context of socio-economic and spatial disparities in relation to upstream users of the Kuils River. The research explores the characteristics of Kuils River catchment as one cannot speak about the Khayelitsha wetlands without understanding where the water that gives it life comes from.

WRC report no. 2507/1/17

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Modelling of wetland processes impacting water resources at a catchment scale

A critical review of the different hydrological flow models used in integrated water resource management in South Africa is needed in order to understand the various models and how wetlands are incorporated into the models. Moving forward, a selection of these models will then need to be tested in case studies in order to assess the accuracy in modelling wetlands within a catchment. This project aimed to contribute to water resources management through, among others, improved hydrological understanding of wetlands.

WRC report no. 2191/1/16

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The design of a National Wetland Monitoring Programme – Implementation manual

This document is the Implementation Manual (IM) for the South African National Wetland Monitoring Programme. It details the structures, processes and methods to be followed when instituting the programme and thus provides an outline of what is currently envisaged with regard to systematic monitoring of wetlands in the country. The procedures, indicators and indices described here need to be widely tested and refined during the early stages of implementation of the monitoring programme.

WRC report no. 2269/2/16

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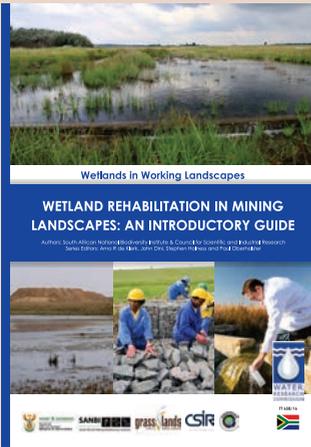
Ephemeral wetlands of the Nelson Mandela Bay Metropolitan Area: Classification, biodiversity and management implications

The research presented in this report was designed to utilise the tools that have been developed nationally and apply them to wetlands in the Nelson Mandela Bay Metropolitan (NMB) area. In arid and semi-arid regions of the country, such as the NMB, the climatic conditions tend to favour a greater number of ephemeral or temporary wetlands. These ephemeral systems often include endemic species of fauna and flora that are adapted to wet and dry periods. Consequently, these systems potentially have a relatively high biodiversity compared to other more permanent systems.

WRC report no. 2181/1/15

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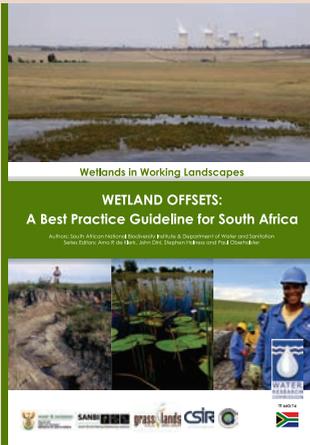


Wetland rehabilitation in mining landscapes: An introductory guide

WRC report no. TT 658/16

The current state of wetland ecosystems in South Africa is such that impacts on remaining wetlands have cumulative, and sometimes significant consequences. There are indications that the cumulative loss or deterioration of services derived from wetlands is undermining the ability of the affected landscapes to deliver these functions, which in turn has social, economic and ecological implications. This is of direct relevance to the mining sector. Impacts on wetlands should be avoided and minimised whenever possible. Where wetland impacts or degradation do take place, wetland rehabilitation should form part of the mitigation of these impacts. Wetland rehabilitation can be successful if it is well planned and implemented. This guide provides practical, user-friendly guidance to specialists, mining houses and regulators on appropriate wetland rehabilitation strategies, planning, methods and implementation. The guide builds on existing guidelines and experience in wetland rehabilitation to consolidate guidance that is specific to wetland rehabilitation in mining landscapes. It is structured to provide users with the core principles that should inform planning and decision-making at different phases of wetland rehabilitation, namely planning, implementation, and monitoring and long-term management phases. The introductory guide should help to ensure that wetland rehabilitation activities leave a meaningful and lasting legacy that helps to address and, to some extent, compensate for some of the negative impacts that mining activities have on water resources.

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Wetland offsets: A best practice guideline for South Africa

Report No. TT 660/16

This guideline serves as a practical tool to aid in the consistent application of wetland offsets in South Africa. The guideline is primarily aimed at wetland offsets required as part of water use authorisation processes (e.g. in application for a water use licence under the National Water Act) where compensatory actions are required to achieve water resource management and biodiversity conservation objectives. The guideline is equally relevant for use in environmental impact assessment processes. Wetland offsets are enduring measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse impacts on wetlands. They are implemented to address any anticipated significant residual impacts arising from development projects after appropriate avoidance, minimisation and rehabilitation measures have been taken into account. The goals of wetland offsets are to achieve 'No Net Loss' and preferably a net gain with respect to the full spectrum of functions and values provided by wetlands. The guideline has been developed in response to the growing need for practical guidance on wetland offsets, which are increasingly being prescribed through regulatory processes in response to ongoing loss and degradation of wetland resources. It has been specifically designed for application where significant, large-scale residual wetland impacts are encountered (e.g. large-scale infrastructure projects and opencast mining). The document nevertheless provides an equally useful framework to inform wetland offset design and implementation in other contexts where there are smaller, but still significant, residual impacts and a wetland offset is still required.

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Other reports

A review of depressional wetlands (pans) in South Africa, including a water quality classification system

In South Africa, wetlands are divided into six classes: marine, estuarine riverine, lacustrine, palustrine and endorheic systems. A pan is commonly classified as an endorheic wetland system. Most of the pans in South Africa are situated in the arid north-western regions in areas with a mean annual rainfall of 500 mm or less. They are characterised by saline deposits and are usually ephemeral. The noticeable exception to this are the pans located in the eastern part of the country, which is characterised by a dense cluster of pans centred on Lake Chrissie. This area is known as the Mpumalanga Lakes District.

WRC report no. 2230/1/16

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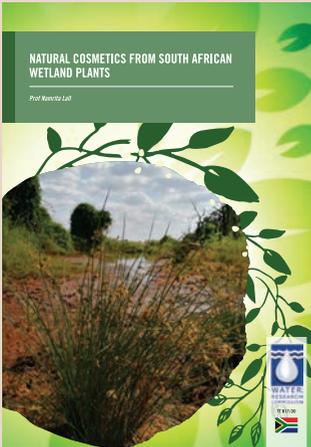
Assessment of the ecological integrity of the Zaalklapspruit wetland in Mpumalanga (South Africa) before and after rehabilitation: The Grootsspruit Case Study

The primary objective of the research was to provide the coal sector with an understanding of how its impacts on wetlands can be limited and mitigated, as well as what can be practically executed. The research study aimed to address various gaps in the current body of knowledge as expressed by various mining companies and science, and environmental organisations. Not only will this help the decision-making support system of the coal sector, but it can also be utilised by other sectors in the country. This research component examined the extent to which rehabilitation of a degraded wetland that was receiving pollution derived from coal-mining improved the wetland's ability to reduce the levels of these particular pollutants in the water flowing through it.

WRC report no. 2230/2/16

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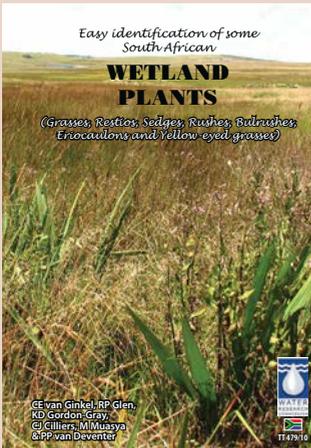


Natural cosmetics from South African wetland plants

WRC report no. TT 817/20

Aquatic plants are found in ecosystems all over the world, ranging from swamps and rivers to wetlands and ocean shores. Aquatic plants can produce phytochemicals, protecting them from environmental stresses. These phytochemicals have been used in drug development to treat human diseases for centuries. However, minimal research has been undertaken to explore the potential of indigenous South African aquatic plants and their phytochemicals for the treatment of various diseases. This project aimed to investigate the potential of indigenous South African aquatic plants that are traditionally used as well as some previously unknown ones, for the treatment of: acne, skin hyperpigmentation, wrinkles, periodontal diseases, tuberculosis, and cancer. Furthermore, the project aimed to develop novel alternative treatments from aquatic plants which accumulate lead and which can be commercialised, benefiting the South African economy and indigenous knowledge holders.

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**Easy identification of some
South African wetland plants**

WRC report no. TT 479/11

In 2010 a list of wetland plants in Southern Africa was completed, but before the publication of this guide, there was no field guide available for the layman or student on the wetland plants of South Africa. The number of plants associated with wetlands in South Africa is such that all could not be published in one book. This led to this field guide, that primarily includes obligate wetland plants as outlined in the caption of this book, with special focus on all grass-like plants. The plant families included are all monocotyledons and include the *Cyperaceae* (sedges), *Eriocaulaceae* (ericaulons), *Juncaceae* (rushes), *Poaceae* (grasses), *Prioniaceae* (palmiet), *Restionaceae* (restios), *Typhaceae* (bulrushes) and the *Xiridaceae* (yellow-eyed grasses). South Africa is known to be a water scarce country. The continuous supply and protection of our water resources is essential for the country. Wetlands are important in the protection, processing and regulation of runoff. A wetland acts as a great sponge, holds back flood waters and releases it during the drier periods. Wetlands, therefore, reduce flood damage and soil erosion. Wetlands are also ground water recharge sites, and it has the ability to remove pollutants from the water. In general wetlands are protectors of the environment, providing breeding grounds and support a wide variety of species, which are totally reliant on wetlands for their survival. These include biota from all trophic levels. Photographing these plants, the authors stood in wonder at the variety of minute insects and other small animals that live on these plants, and which are probably essential in the pollen and seed dispersal of these plants. Many of the wetland plant species are used for food, craft manufacturing, medicinal purposes, building material and as fuel.

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Other reports

Palmiet wetland sustainability: A hydrological and geomorphological perspective on system functioning

Palmiet is endemic to the nutrient-poor Table Mountain Group (TMG) sandstones and the Natal Group sandstones. Palmiet wetlands in the Eastern and Western Cape are particularly threatened wetlands. This situation has potentially serious consequences for water security in many towns in their catchments, including cities such as Port Elizabeth. This study aimed to reduce uncertainty around palmiet systems by improving the understanding of the hydrological and geomorphological functioning of these wetlands.

WRC report no. 2548/1/18

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Investigation of the viability of selected indigenous wetland plants to support entrepreneurship and job creation in South Africa

Typha is an indigenous wetland plant that occurs across the country. It acts as a pioneer species in degraded wetlands, which means that fairly dense populations of Typha occurs in various degraded wetland systems across the country. Typha is therefore an abundant and fast growing plant species, which plays an important role in the rehabilitation of degraded wetlands, especially where nutrient pollution occurs. The Working for Wetlands Programme has identified certain wetlands where this indigenous species has become an environmental problem, due to it out-competing other species. This business case therefore has the added benefit of generating a revenue stream from a species which is effectively a weed in some wetlands.

WRC report no. KV 348/15

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