CELEBRATING 30 years

OF DEMOCRACY IN SOUTH AFRICA

REFLECTING ON THE COLLABORATION BETWEEN THE BOSMONT COMMUNITY & UJ PEETS

Introduction

As South Africa commemorates 30 years of democracy, the nation reflects on a transformative journey that began with the historic 1994 elections. These elections marked the end of decades of institutionalised racial segregation under the apartheid regime and heralded a new era of inclusive governance. Nelson Mandela's ascent to the presidency symbolised hope, unity, and a commitment to reconciliation in a country deeply scarred by racial division. Over the past three decades, South Africa has made significant strides in various sectors, including education, healthcare, and infrastructure, striving to build a more equitable society.

Yet, the path to democracy in South Africa has not been smooth. The nation grapples with economic inequality, political corruption, and social unrest. However, the resilience and activism of its citizens are a testament to their unwavering commitment to democracy. South Africa's 30-year democratic milestone is a time to celebrate progress, critically examine the obstacles, and renew commitments to addressing disparities for a more just and prosperous future.

Johannesburg, also known as the City of Gold, has a rich history intertwined with the discovery of gold in 1886. During the Witwatersrand Gold Rush, Johannesburg, initially a small mining settlement, rapidly transformed into a bustling city. The promise of wealth attracted a diverse population, turning the city into a cultural melting pot. By the early 20th century, Johannesburg had become the economic powerhouse of South Africa, marked by rapid industrialisation and significant urban development. However, this prosperity was overshadowed by the harsh realities of apartheid, which enforced racial segregation and economic disparity.

During the apartheid era, Johannesburg was a focal point of resistance and activism. Neighbourhoods such as Soweto became synonymous with the struggle against apartheid, witnessing pivotal events like the 1976 Soweto Uprising. Despite the oppressive regime, the spirit of resilience and defiance among the city’s inhabitants remained unbroken. The dismantling of apartheid in the early 1990s marked a turning point, ushering in a new democratic era. Johannesburg emerged as a symbol of the new South Africa, embracing its role as a beacon of hope and transformation.

Modern Johannesburg is a vibrant metropolis, reflecting its storied past and dynamic present. The city is a central financial and cultural hub, boasting a skyline with skyscrapers and a landscape rich with museums, theatres, and galleries. Johannesburg's economy remains robust and driven by the finance, manufacturing, and information technology sectors. However, the city faces contemporary challenges, including economic inequality and social tensions. Initiatives aimed at urban renewal and social development are actively transforming Johannesburg, striving to create a more inclusive and sustainable urban environment. The city's blend of historical significance and modern dynamism makes it a fascinating and complex place, emblematic of South Africa's ongoing journey towards progress and reconciliation.

Bosmont, a suburb in the western part of Johannesburg, has a unique history that reflects the broader narrative of South Africa's socio-political landscape. Originally established as a residential area for people classified as "Coloured" under the apartheid regime's racial classification system, Bosmont emerged in the 1950s and 1960s. The Group Areas Act, a cornerstone of apartheid legislation, forcibly relocated many Coloured communities to areas like Bosmont, shaping its demographic and cultural identity. This policy aimed to segregate communities based on race, resulting in a tightly knit community that, despite its forced creation, developed a strong sense of unity and resilience.

Throughout the apartheid era, Bosmont was not just a residential area but also a centre of resistance and activism. Community members actively opposed the oppressive regime, contributing to the broader anti-apartheid struggle. With the advent of democracy in 1994, Bosmont, like many other suburbs, began to transform. The end of racial segregation allowed for greater social and economic mobility, increasing diversity within the suburbs. Today, Bosmont is known for its vibrant community life, with a rich cultural heritage that continues to honour its history while embracing the changes brought about by a democratic South Africa.

Environmental challenges faced by the Bosmont community

The Bosmont community, like many urban areas in Johannesburg, faces numerous environmental challenges that significantly impact the quality of life for its residents. One of the primary concerns is air pollution, exacerbated by the area's proximity to industrial zones, mine tailings and major

highways. Emissions from factories, vehicular traffic, dust from mine tailings and occasional uncontrolled waste burning contribute to poor air quality, posing health risks such as respiratory problems and cardiovascular diseases. The community frequently experiences smog and elevated

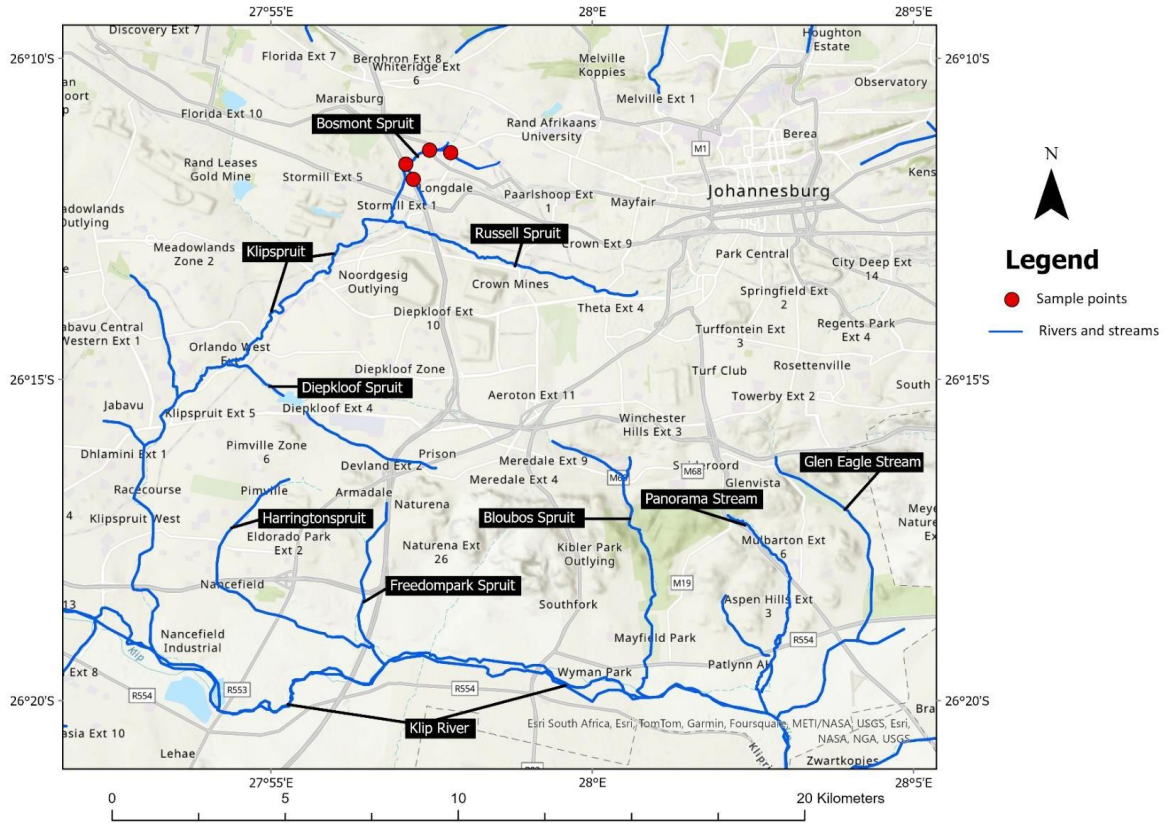

Figure 1: The Bosmont Spruit and sampling points in relation to the Klip River.

levels of particulate matter, necessitating urgent attention to air quality management and pollution control measures.

The streams and rivers that flow through the Bosmont community form a part of the headwaters of the Klip River, which runs into the Vaal River and provides the majority of Johannesburg with drinking water (Figure 1).

This system is of crucial environmental and social importance. Water quality and supply issues also present substantial challenges for Bosmont. Ageing infrastructure, improper waste disposal, illegal dumping, and inadequate maintenance have led to frequent water outages and leaks, sewage spills and riverine degradation, impacting daily life and economic activities. Additionally, pollution from industrial runoff and improper waste disposal contaminates local water sources, posing risks to human health and the environment. Sewage effluents, waste, and mine tailing runoff within a freshwater ecosystem are highly detrimental due to the introduction of various pollutants that disrupt the natural balance of these environments. Sewage effluents often contain high levels of organic matter, pathogens, and nutrients such as nitrogen and phosphorus. When these substances enter freshwater systems, they can lead to eutrophication, a process where excessive nutrients stimulate the overgrowth of algae and aquatic plants. This overgrowth depletes oxygen levels in the water as decomposing plant material consumes oxygen, resulting in hypoxic conditions that can cause fish killings and the loss of other aquatic life.

Waste from industrial and residential sources further exacerbates the problem by introducing toxic chemicals, heavy metals, and non-biodegradable materials into freshwater ecosystems. These pollutants can accumulate in the tissues of aquatic organisms, leading to bioaccumulation and biomagnification, where higher concentrations of toxins are found in top predators. This affects aquatic life and poses serious health risks to humans who consume contaminated fish or use polluted water sources. Additionally, waste materials can physically alter habitats, clogging waterways and smothering the riverbed, which disrupts the habitats of organisms that depend on these environments for survival.

Mine tailing runoff is particularly harmful due to heavy metals and acidic compounds. Tailing and mining operations' byproducts often contain arsenic, lead, mercury, and cadmium. When these toxic elements are introduced into freshwater systems, they can severely affect aquatic life, impairing growth, reproduction, and survival. Acid mine drainage, a common byproduct of mining activities, lowers the pH of water bodies, making the environment inhospitable for many species and leading to the dissolution of harmful metals into the water. The cumulative impact of these pollutants disrupts the entire freshwater ecosystem, leading to a decline in biodiversity, the degradation of water quality, and the loss of ecosystem services such as water purification,

recreation, and fishing. Addressing these issues requires stringent regulation, effective waste management practices, and rehabilitation efforts to restore and protect freshwater ecosystems from further degradation. In the central region of Roodepoort, surface water quality, including that of the Bosmontspruit, has been majorly compromised due to mining activities. The levels of several metals have surpassed the allowable limits. Moreover, the waterway is contaminated with faecal coliforms and ammonium.

Lastly, the community of Bosmont faces challenges related to green spaces and urban development. Rapid urbanisation and industrial expansion have reduced natural habitats and green areas, limited recreational spaces, and contributed to the urban heat island effect. The loss of greenery affects local biodiversity and diminishes the community's resilience to climate change impacts. Initiatives aimed at preserving and expanding green spaces, such as planting trees, creating community gardens, and promoting sustainable urban planning, are vital for enhancing the quality of life and environmental sustainability in Bosmont. Addressing these ecological challenges requires a collaborative effort involving residents, local authorities, and environmental organisations to create a healthier, more sustainable future for the community.

UJ PEETS Intervention

The University of Johannesburg Process, Energy and Environmental Technology Station (UJ PEETS) was established in 2010 under the support of the Technology Innovation Agency via the Department of Science and Innovation to provide access to world-class infrastructure and expertise that would otherwise not be available to stakeholders in the National System of Innovation. The PEETS goal is to enable technological innovation in the green economy, which is aligned with UJ's vision to inspire communities to transform and serve humanity through innovation and the collaborative pursuit of knowledge. Through a collaborative effort, the UJ PEETS team and members from the Bosmont local community investigated their environmental challenges. Four sites were selected for water quality sampling over a year, and several dust monitors were deployed around Bosmont. Samples were taken at four sites for water quality analyses (Figure 2).

Figure 2: The four water quality sampling sites for chemical analyses and Next-Generation Sequencing within Bosmont.

Water

Water quality testing involves evaluating physical, chemical, and biological parameters to determine the health and safety of a water source for various uses. A chemical analysis of a water sample provides detailed information about the composition and quality of the water, identifying the presence and concentration of various chemical substances. This analysis can detect contaminants such as heavy metals (e.g., lead, mercury, arsenic), nutrients (e.g., nitrogen, phosphorus), organic compounds, and inorganic ions (e.g., chloride, sulfate). It can also measure pH, dissolved oxygen, conductivity, and total dissolved solids. These data points help determine whether the water is safe for human consumption, agricultural use, and aquatic life. By identifying specific pollutants, a chemical analysis can pinpoint sources of contamination, such as industrial discharges, agricultural runoff, or sewage effluents, enabling targeted remediation efforts.

Chemical analysis is helpful for several reasons. Firstly, it ensures compliance with environmental regulations and water quality standards, protecting public health and ecosystems. Regular

monitoring can prevent exposure to harmful substances and mitigate health risks associated with contaminated water. Secondly, it provides critical information for managing water resources effectively. Understanding the chemical composition of water allows for better decision-making regarding water treatment processes, pollution control measures, and the management of natural water bodies. Additionally, chemical analysis can track changes in water quality over time, identifying trends and potential environmental impacts from urbanisation, industrial activities, or climate change. This information is essential for developing sustainable water management practices and preserving the integrity of freshwater ecosystems.

From the chemical analysis, the results from the Bosmont Spruit have indicated a high Total Organic Carbon (TOC) level, indicating that much of the oxygen in the water has been depleted, which can lead to oxygen-deficient conditions. Through on-site observations, it is evident that the aquatic life within this stream has been severely impacted and is nearly gone.

Next-generation sequencing (NGS) is a powerful technology that allows scientists to read the DNA of many different organisms at the same time. NGS is like a very detailed book where every tiny creature's genetic information is written. NGS can quickly "read" this book, identifying all the different bacteria, viruses, and other microorganisms present in a sample. This is much faster and more accurate than older methods, which often looked at just one type of organism at a time. When considering water quality, NGS is used to see what kinds of microorganisms are in the water. By collecting a water sample and using NGS, it is possible to create a complete picture of all the microscopic life in that sample. This helps to understand if the water is healthy and safe, or if it contains harmful bacteria or viruses that could make people sick. By knowing exactly what organisms are in the water, scientists can take steps to improve water quality and protect public health. The NGS results from the Bosmont Spruit Sampling Points have picked up harmful microorganisms such as the bacteria *Burkholderia cepacian,* and *Burkholderia pseudomallei*. These bacteria cause pulmonary infections in people with cystic fibrosis and Whitmore’s disease, which can affect both humans and animals, leading to severe symptoms such as pneumonia, septicemia, and abscess formation in various organs.

Air

Dust collectors, also known as particulate or aerosol samplers, capture airborne particles suspended in the atmosphere over time. A dust collector is a valuable method for assessing air pollution, particularly in environments where particulate matter (PM) emissions are a concern. Particulate matter is a mixture of tiny solid particles and liquid droplets found in the air, which can include dust, dirt, soot, and smoke. These particles can vary in size, composition, and origin, ranging from natural sources like soil and pollen to anthropogenic sources such as industrial emissions, vehicle exhaust, and mining activities. The usefulness of dust collectors lies in their ability to quantify the concentration and characteristics of airborne particulates. This data is crucial for understanding ambient air quality and assessing potential health risks posed to nearby communities.

Mining operations can generate significant quantities of dust containing potentially hazardous substances such as heavy metals (e.g., lead, arsenic, mercury) and silica. These particles can be dispersed over considerable distances, affecting air quality in nearby residential areas and agricultural lands. High PM levels can exacerbate respiratory and cardiovascular diseases, making accurate monitoring essential for public health management. By deploying dust collectors and passive samplers near mine tailings and monitoring airborne particulates, researchers and environmental agencies can determine the extent of contamination and assess compliance with air quality regulations. This information helps inform mitigation strategies and protective measures to minimise exposure, safeguard public health, and understand the dispersion patterns and concentration levels of mine tailings dust.

Passive samplers for gases are also crucial tools in monitoring air quality, providing valuable data on the levels of these pollutants in the environment without requiring active air sampling mechanisms. Results from the passive samplers found an increase in ozone levels throughout the monitoring period, with a slight seasonality evident brought about by environmental factors such as rainfall.

Perception study

A perception study was undertaken with the members of the Bosmont community to gain an understanding of views of the water and air quality, river health and environmental degradation in

Bosmont. A survey can provide valuable insights into community attitudes, concerns, and experiences regarding ecological health. Surveys offer a quantitative and qualitative assessment of public perception. They gauge community awareness of environmental issues, including pollution sources, impacts on health, and perceived risks. Understanding these perceptions helps policymakers, environmental agencies, and researchers align their efforts with community priorities and concerns, fostering informed decision-making and effective communication strategies. Surveys on environmental perceptions provide a platform for community engagement and participation in environmental management. By soliciting feedback from residents, stakeholders can gather firsthand information on local environmental conditions and the perceived effectiveness of existing regulations or mitigation measures. This participatory approach enhances transparency and accountability in environmental governance, empowering communities to advocate for ecological improvements and hold authorities accountable for addressing their concerns.

Surveys contribute to identifying disparities in environmental impacts and perceptions across different demographic groups. Socioeconomic factors, geographic location, and cultural backgrounds can influence how individuals perceive and experience ecological issues. Policymakers can identify vulnerable populations disproportionately affected by environmental degradation by analysing survey data disaggregated by demographic variables. This knowledge is crucial for developing targeted interventions and policies that promote environmental justice and equity. Surveys investigating environmental perceptions serve as baseline assessments for monitoring changes over time. They provide a benchmark against which future ecological improvements or deteriorations can be measured. Longitudinal studies using repeated surveys can track shifts in public attitudes, behaviours, and awareness, allowing for adaptive management strategies that respond to evolving environmental challenges and community needs. These surveys are indispensable tools for promoting sustainable development, enhancing public health outcomes, and fostering resilient communities in the face of environmental changes.

The results of the survey undertaken with members from the Bosmont community revealed that 37.7% of the participants interviewed indicated that Household tap waters are safe to drink. While 30.2% indicated that the water is unsafe to drink, 18.9% indicated that they are unsure or do not

know if it is, 9.4% indicated that the water is very safe to drink, and 3.8% indicated that it is very unsafe to drink (Figure 3).

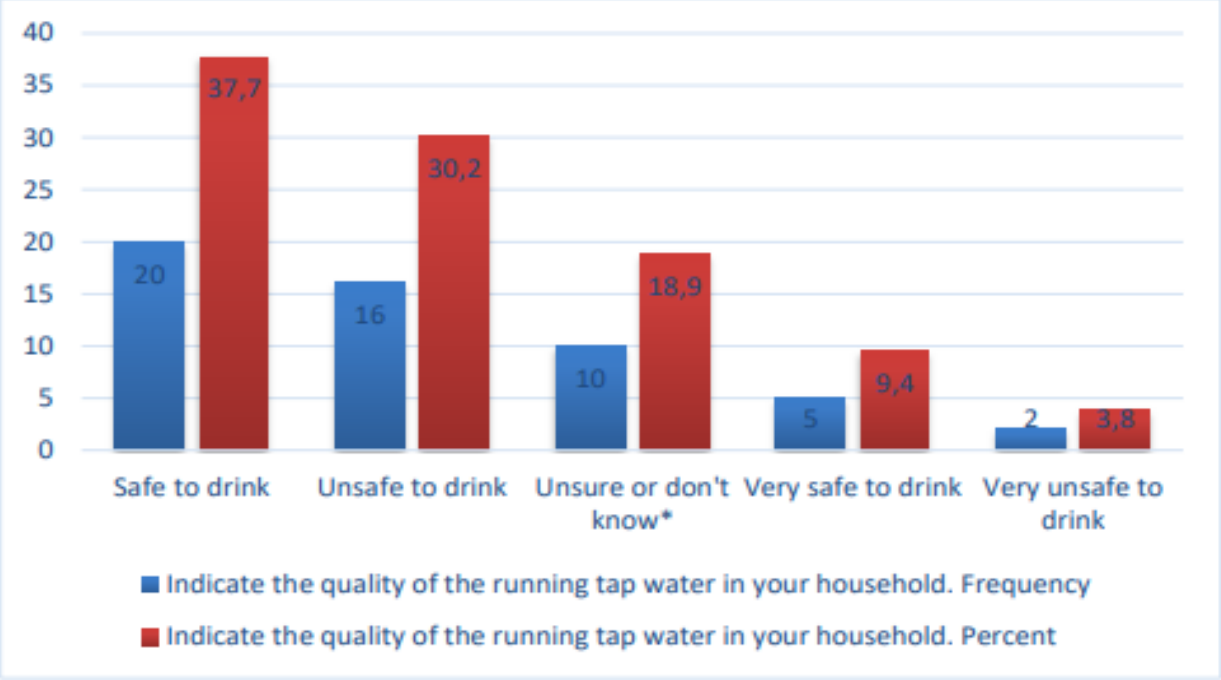

Figure 3:Frequency and percentage of Participants Quality of Tap water in Households in the Bosmont community.

Community Engagement

Public Awareness Campaigns play a crucial role in educating and informing the public about various issues, ranging from health concerns, environmental protection, social injustices, and emergency preparedness. These campaigns use different communication channels, including social media, television, radio, and outdoor advertising, to reach and engage a broad audience. On the 25th of November 2023, the Bosmont community held the Green Fest event, which the UJ PEETS team attended (Figure 4).

Figure 4: UJ PEETS team at the Green Fest held by the Bosmont community.

The objective of this event was to spark a conversation among experts in their fields, ranging from water, rivers, air quality, waste management, and much more, in the environmental portfolio to find solutions to the problems associated with the Bosmont Area. The event served as a platform for empowering skills as guest speakers shared various aspects of knowledge and involvement with CGP, from The Bosmont Wetlands/Spruit project to healing essential oils and the magnificent Moringa tree. The UJ PEETS also shared some of the results related to the water and air quality monitoring gathered as research data on the work done as a collaboration partner in the efforts related to environmental activities. Most importantly, the event was about highlighting the fantastic work done by the team from the Urban Jones Urban Farm and building networks with like-minded individuals and organisations to shift the dial and narrative around Urban farming, Education and awareness, Environmental advocacy, and Active citizenry.

The official takeaways from the event were on essential oils that can enhance your skin, the Moringa tree, and how the distinct parts of the plant can be utilised for various healing effects. The presentations were educational to the attendees on the current state of water and air quality, the potential risks associated with pollution, and the importance of maintaining clean environments.

The attendees were encouraged to participate in improving water and air quality through local initiatives like clean-up and advocacy for better environmental policies.

Since issues related to air and water quality were identified and highlighted in this event, to build on the momentum, it is recommended that the focus in the next event be on solutions related to solving those identified problems. Some potential solutions could be reducing pollution, conserving water resources, or supporting sustainable practices. One of the fantastic things which were witnessed from the event is that it fostered collaboration between community members, local authorities, environmental organisations, and other stakeholders to work together towards improving water and air quality in the area and environmental issues, which helps in the eradicating of vast other problems of the country such as crime, unemployment, and food security. The event also emphasised the importance of advocating for more robust local, regional, or national environmental policies and regulations to ensure the long-term protection of natural resources and public health.

Where to from here?

Solving some of the problems experienced by the Bosmont community won't be easy. However, within UJ PEET's capacity, the next step going forward would be to raise awareness by engaging the graphic design department from the University of Johannesburg to simplify the data collected into visible small boards to alert and inform the local community about the health state of the Bosmont Spuit and ways to prevent pollution. In collaboration with the Community Green Project NPC, a women-led, 100% volunteer-based entity, UJ PEETs can mobilise local volunteers for regular clean-up activities along the riverbanks by engaging schools, colleges, and community groups to participate in these efforts.

The compounds picked up in the chemical water analysis are believed to arise from the industrial effluents of the paint factory in the surrounding area of Bosmont. UJ PEETs can potentially further engage with potential industry companies to see if there are possible solutions or ways they could be helped with dealing with waste by leveraging greener methods. Additionally, going forward, UJ PEETs can also get involved in leveraging low-cost pollution prevention measures along the

Bosmont spruit, such as implementing natural filtration systems like constructed wetlands or vegetated buffer strips to filter pollutants from runoff as they pass through the Bosmont area.

Conclusion

Collaboration between universities and local communities to address environmental problems holds significant value. These partnerships leverage universities' academic expertise and research capabilities to tackle complex environmental challenges affecting nearby communities. Universities often house specialised knowledge in fields such as environmental science, ecology, engineering, and social sciences, which can be applied to understand local environmental issues, assess impacts, and develop innovative solutions. Collaborative research projects and initiatives allow for the co-creation of knowledge, drawing on both academic rigor and community insights to formulate effective strategies for environmental conservation and sustainability.

The partnership between **UJ PEETS** and the **Bosmont community** has fostered capacity building and empowerment, engaging community members in research activities, training programs, and educational outreach initiatives. This collaboration has enhanced local knowledge, and awareness of environmental issues, strengthening the community resilience in the face of environmental challenges and promoting active participation in decision-making processes. Such partnerships contribute to building a sense of ownership and stewardship among community members, encouraging sustainable practices, and fostering long-term environmental stewardship.

Collaborations between universities and local communities in South Africa are instrumental in promoting holistic approaches to environmental management and sustainability. They facilitate the exchange of knowledge, foster mutual learning, and empower communities to address environmental problems effectively. By harnessing collective expertise and engaging diverse stakeholders, these partnerships contribute to building resilient communities and safeguarding South Africa's rich natural heritage for future generations.

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Photo: Kyle van Heyde, 2023.

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