



Urban Nature Reserves Waste Challenges from Neighboring Informal Settlements: Western Cape, South Africa

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ABSTRACT

Nature reserves have played a crucial role in biodiversity conservation for decades. Rapid urban sprawl has increased the amount of solid waste created by littering and illegal dumping in metropolitan nature reserves. This paper examines how two nature reserves, Wolfgat Nature Reserve and Witzands Aquifer Nature Reserves, can combine community conservation with waste management. To determine aspects such as the socioeconomic impact of the nature reserves on the surrounding communities, questionnaires with a specific focus on the topic were distributed to the surrounding communities and subsequently administered. Data was collected using semi-structured interviews with key informants from the nature reserve staff and observational methods, and SPSS was used to analyze the data. Consistent with previous research, this study revealed that ignoring local populations frequently results in people disobeying the appropriate regulations in these protected areas and that education does not guarantee conservation support. Despite this, the survey revealed an absence of community participation; conservators were more reactive than proactive. In this study, the level of education, which in some studies is always associated with knowledge, was contradicted; those with post-secondary education knew little about these areas, and the vast majority of participants were unaware of the protected areas just a few kilometers away from their communities.

INTRODUCTION

Rapid population growth in emerging nations, particularly in large cities, is driving a strong demand for space. As a result, residential areas are being constructed close to protected areas, leading to increased human engagement with the natural environment. In the past, humans and nature were considered different entities, resulting in nature being viewed as an infinite supply of raw materials and an infinite dumpsite for garbage. Later, it became apparent that the exclusion strategy had caused conflict between protected zones and the surrounding communities (Simelane et al. 2006). Community-based conservation (CBC) is utilized globally to engage local people in the protection of natural areas and the preservation of nature and its animals. It is also utilized to better develop a connection between community people, the environment, and conservationists. Although tourists and members of the neighboring community are now permitted in select protected areas. Even though protected areas are intended to conserve natural resources and limit

human effects. According to De Witt & Van der Merwe (2015), the fast population growth in protected regions has led to a rise in environmental issues including trash pollution since it degrades the aesthetic quality of the ecosystem, irresponsible rubbish disposal has been one of the most evident forms of deterioration in protected areas for many years (de los Angele Somarriba-Chang 2012). Moreover, inefficient waste management is rapidly affecting crucial environmental and human health factors. According to research by Kadafa et al. (2014) and Przydatek (2019), the rising volume of solid waste is a significant problem for many nations, particularly emerging nations where education and environmental awareness are inadequate. Illegal dumping is a widespread concern for natural protected areas (Jakiel et al. 2019), as is the ignorance or lack of understanding of tourists who continue to trash in these protected areas; protected spaces are thus not an exception.

This research addresses unlawful garbage disposal and investigates community engagement options that

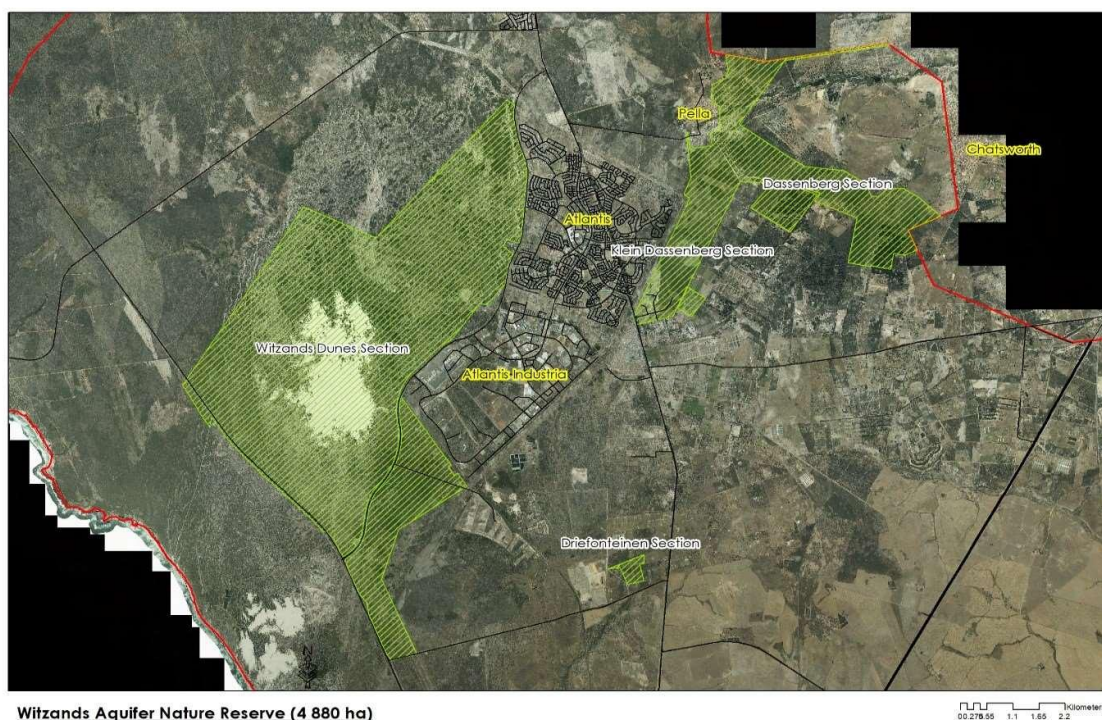
might successfully solve waste issues in protected areas. Communities around nature reserves have a propensity to dispose of rubbish illegally in protected areas, as these locations are frequently perceived as open spaces that harbor criminals due to their dense vegetation (McDonald et al. 2009, City of Cape Town 2019). This is especially prevalent in informal communities, which lack dependable garbage collection services. However, although some dispose of their trash in open fields, high winds and rains force it directly into protected areas, creating waste management issues. Thousands of protected places are currently badly impacted by metropolitan areas, and many more will be in the future (McDonald et al. 2009). According to Prydzatek (2019), countries handle protected areas differently. Nature reserves are declared according to section 23 of the National Environmental Management: Protected Areas Act 57 of 2003 whereby the legislation safeguards and preserves environmentally valuable places (Hatton 2002). Therefore, the National Environmental Management: Trash Act (No. 59 of 2008), which limits the discharge of waste into or onto land, guides and regulates waste management in protected areas. In addition, protected areas were governed by the Environmental Conservation Act of 1989, Section 73, which forbids trash in any manner. Despite these restrictions,

littering is a chronic problem in many urban protected areas; trash from outside the reserve, primarily from surrounding towns, and garbage created by visitors pose a danger to the protected areas' integrity. The expansion of new complexes and the persistent demand for homes in the region further jeopardize conservation initiatives.

MATERIALS AND METHODS

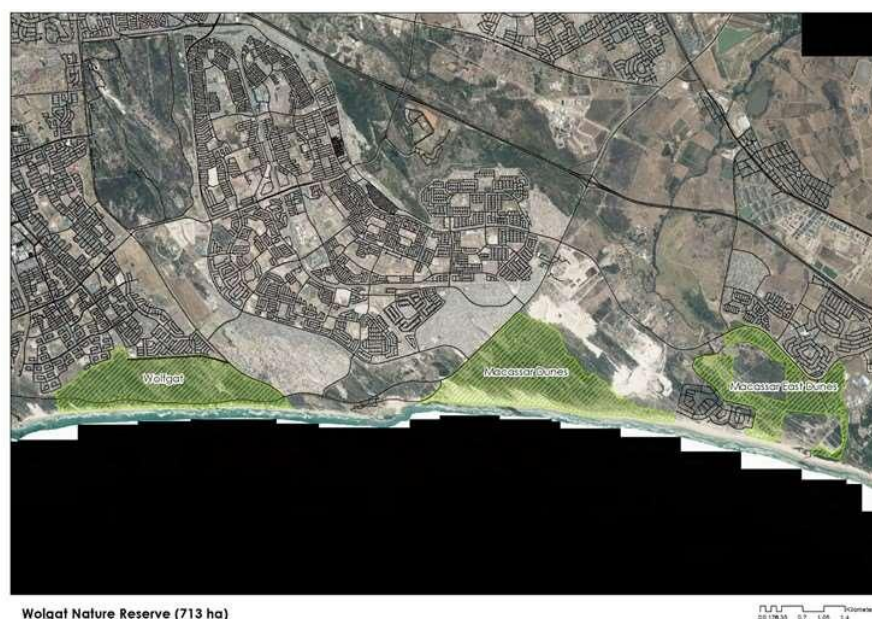
Study Region

Wolfgat Nature Reserve is a coastal nature reserve located in Mitchells Plain and Khayelitsha, between the resorts of Mnandi and Monwabisi (Fig. 1). Wolfgat encompasses 248 hectares and was designated a nature reserve by the City of Cape Town in 1986. It preserves more than 150 plant species and is home to the endangered Strandveld flora of the Cape Flats dune (City of Cape Town (CoCT) 2008). The reserve's proximity to disadvantaged communities makes it susceptible to criminal activities. Khayelitsha, a notoriously high-crime area with a population of 391,749 (Stats SA 2011), and Mitchell's Plain, a large, spreading colored township with a population of 310,485 are home to more than half of Cape Town's jobless (Stats SA 2011). Mitchells Plain is one of fifteen high-priority areas for anti-crime



(Source: Jacques van der Merwe)

Fig. 1: Map of Atlantis Aquifer Nature Reserve and other satellite sites highlighted in green.



(Source: Jacques van der Merwe)

Fig. 2: Wolgat Nature Reserve aerial map.

and anti-drug addiction initiatives (Eksteen 2012, Stats SA 2011).

The 1,750-hectare Atlantis Dune area is included in the Witzands Aquifer Nature Reserve. According to (CoCT 2008), the reserve is home to two distinct types of flora: the severely endangered Cape Flats dune Strandveld, which is the dominating vegetation in the reserve, and the critically endangered Atlantis sand Fynbos. The nature reserve is notable for its non-vegetated movable dunes and rocky outcrops (CoCT 2008), the dunes are commonly used for recreational activities, which increase the number of visitors to the region. The reserve borders residential and industrial areas such as Atlantis, Mamre, and the informal settlement of Witzands and Pella communities. Except for the informal settlement of Witzands, these villages depend largely on the reserve for water, the reserve natural aquifer supplies water that is harvested and purified for human use (Eksteen 2012). The residential neighborhoods are dominated by persons of color and range in income from poor to middle class (Stats SA 2011). Atlantis has a population of 67,491 and an unemployment rate of 37% (CoCT 2006, Stats SA 2011). Mamre has a population of 9,048 people, whereas Pella has just 1,681 individuals. (Stats SA 2011). Fig. 2 shows the aerial map of the Wolgat Nature Reserve.

Sampling Method

Questionnaires, interviews, and observational procedures were used to collect data as part of qualitative and

quantitative research techniques. The questionnaire was sent to villages surrounding the reserve to collect data on garbage generation in the protected regions. There were both open-ended and closed-ended questions on the surveys. A qualitative interview, according to Oakley (1998), is a framework in which practices and standards are not only documented, but also achieved, challenged, and reinforced. This study employed unstructured interviews because they are frequently employed in long-term fieldwork and permit respondents to express themselves in their own way and at their own pace, with few restrictions on their responses. Ethnographers pioneered the use of unstructured interviews with local key informants, as well as the collection of data via observation and field notes, and the involvement of study participants (Gray 2021). To be more precise, an unstructured interview more closely resembles a conversation than an interview and is always assumed to be a “controlled conversation” skewed towards the interviewer’s interests (Gray 2021).

This study included three distinct non-probability sampling strategies, namely purposive, snowball, and convenience sampling. These methods were used to obtain information from all participants (managers, community members, community partners, etc.) (Marshall 1996). The non-probability sampling approach of purposive sampling was employed to interview individuals who were presumed to comprehend the study and have relevant responses (Taherdoost 2016). In this area, the major actors were the

managers and community partners. The convenience sampling approach was implemented in public areas close to the nature reserve, where participants/residents volunteered to take part in the study, and the snowball technique was utilized, in which current study subjects recruited or discovered potential research participants. The reserve managers were interviewed in the form of unstructured interviews regarding awareness and interactions with the neighboring community while the closed-ended questionnaires were used for the residents and reserve partners. In addition, the approach of observational assessment was employed to observe people's behavioral patterns and interactions with the natural environment.

Sampling Size

Using sampling approaches based on probability, the researcher selected a representative sample of the investigated population. To get a probability sample for the investigation, a simple random and stratified sampling method was employed. Stratified sampling requires the researcher to split a population into homogenous subpopulations, or strata, depending on certain criteria (e.g., race, gender, location, etc.). Then, each stratum was sampled using a second form of probability sampling, simple random sampling. The researcher utilized a basic random sampling approach to randomly choose a subset of a population. In this sampling technique, all potential biases were eliminated, and each person in the population had an equal chance of being picked to participate in the research.

These methods were used to obtain information from all participants (managers, community members, community partners, etc.). Used to interview individuals who were considered to comprehend the study and had the relevant responses. In this area, the major actors were the managers and community partners. As of the 2011 Census, Atlantis has 67491 residents (Stats SA 2011). Slovin's formula was used to compute the sample size, where (n) is the sample size, (N) is the known population size and (e) is the margin of error. The definition of the margin of error is "the range of values below and above the sample statistic in a confidence interval". It is computed as, $n = \frac{N}{1 + Ne^2}$ with a 95% confidence interval, therefore the margin of error is 0.05%.

Data Analysis

The researcher read all of the administered surveys and had the interview recordings transcribed to have an overall understanding of the data supplied and the material to be analyzed. Using IBM Statistical Package for the Social Sciences (SPSS) version 26, a program used for editing and analyzing data (Verma 2012) that assures the meaningful and symbolic value of qualitative data, the demographic

information from the questionnaires was analyzed. The significance of the major statements and phrases about the examined phenomena developed into significant statements.

Thematic analysis is defined as the important systematic method for identifying, organizing, and presenting patterns of themes across a data set (Clarke 2015). In essence, thematic analyses are a meaningful method for identifying common themes in a way that enhances the exploration of the key elements that focus on the discussed topic and provide answers to the research questions. Given this context, the present study employed thematic analysis to identify the common concern that emerged from the questionnaire survey which formed part of the unstructured interview with the nature reserves managers.

RESULTS AND DISCUSSION

There were a few parallels and variances among participants from Atlantis and Khayelitsha (Fig. 3). In terms of demographic statistics, minimal distinctions were detected, such as the employment rate, dominating population group, and level of education; nonetheless, it was noted that both places had weak economic growth, and the areas are sprawling with informal settlements and low-cost housing. According to research, the most significant component of an effective society is not income or a high level of education, but rather social capital, which consists of deeply ingrained ties of trust and vision (Pitt & Boule 2010). According to Eksteen (2012) people's relationships with the environment vary with individuals but not only does people's profession influence their perception but also their history and encounters with the environment. Therefore, how people interact with the natural environment is not entirely based on their level of education there are various influencing factors such as where they were raised. Fig. 3 illustrates Atlantis and Khayelitsha communities' level of education. Based on the results for both areas, the majority of people had formal education; however, they had little to no knowledge about nature reserves. Furthermore, other studies contradict Fig. 3 by stating that a positive attitude toward the natural environment tends to increase with respondents' level of education and knowledge about conservation issues (Bajracharya et al. 2007, Brown et al. 2010). However, based on the majority of the results of people with formal education they have never been to a nature reserve before. Therefore, the participant's level of education cannot be used as an indicator of knowledge regarding a specific area.

The findings reveal that both study areas had a majority representative population of people in their youth (35-44) and the communities were dominated by middle-aged

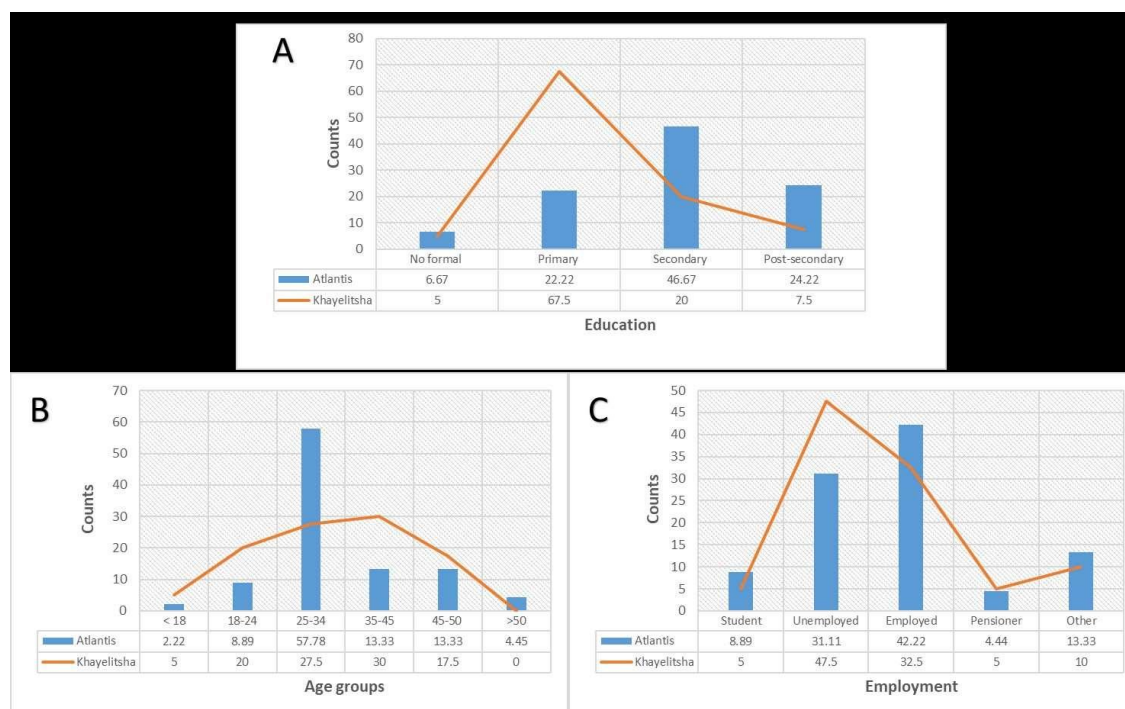


Fig. 3: Summary of the demographics for Atlantis and Khayelitsha.

people (Fig. 3) and fewer teenagers for both sites, few youth representatives (18-24). The age pyramid of Atlantis, on the other hand, contradicts the aforementioned findings, indicating that there are a greater number of young, both males and women, between the ages of 20 and 30 (Census 2011). According to research by Saadat et al. (2022), states that the COVID-19 pandemic has also changed people's lifestyles; caused extensive job losses, and threatened the sustenance of millions of people, as businesses have shut down to control the spread of the virus. This has caused employment losses among populations that have historically been susceptible, such as the less educated, young, and people of color (Wessels et al. 2021). The Atlantis and Khayelitsha neighborhoods are characterized by a low-to-middle-income margin, Atlantis with having a 37% unemployment rate (Stats SA 2011). Although, most people were harmed by job loss owing to Covid-19 the chosen group had a majority of employed people in Atlantis than in Khayelitsha (Fig. 3). According to the literature both areas are still impoverished, with many individuals jobless or underemployed. Stats SA (2021) just released its latest Quarterly Force Labor Survey, which shows that the Western Cape currently has the lowest unemployment rate in the country, at 27.9%.

Through literature and observation by the author, litter is known to have hazardous consequences on biodiversity and humans therefore protected areas such as nature reserves have

strict visitor management measures put in place to minimize the impact of litter and there are frequent patrols and clean ups in these areas. However, illegal dumping and littering have economic repercussions as well as environmental and social ones (Table 1). Conservation problems have arisen, especially in urban nature reserves, Table 1 illustrates the cost of disposing of waste in a landfill, however, the cost does not include the labor, hiring of the special machine (digger loader), and the fuel used to transport the waste. Illegal dumping is a complex issue that affects more than one aspect. Education and environmental information, which is seen as an effective means to raise community awareness may be working for some groups. However, it does not work as a waste management tool to prevent littering. According to Simelane et al. (2006) community involvement and liaising have more impact and can influence change in people's behavior in natural areas.

Fig. 4 is the illustration of the participants' responses when they were questioned about their role in tackling illegal dumping in their communities. 20% of those individuals who were unfamiliar with illegal dumping knew their role in dealing with illegal dumping. 12.50% indicated that their role as community members is to clean the litter, while 25% of the participants advised that it should be disposed of correctly through the use of wheelie bins, 12.50% said it was none of their business and 37.50% were unclear followed

Table 1: Waste removals, delivered to False Bay Coastal Park landfill from July to September 2021.

DATE 2021	FROM	WEIGHT (KG)	COST (R) R1 (\$0,061)
JULY			
05 Jul	Wolfgat Nature Reserve	5240	3360.61
05-Jul	Wolfgat Nature Reserve	11040	7201.2
05-Jul	Wolfgat Nature Reserve	8520	3360.61
06-Jul	Wolfgat Nature Reserve	9000	5760.9
07-Jul	Wolfgat Nature Reserve	9660	6241.2
07-Jul	Wolfgat Nature Reserve	7460	4800.9
08-Jul	Wolfgat Nature Reserve	6980	185.5
08-Jul	Wolfgat Nature Reserve	6480	185.5
08-Jul	Wolfgat Nature Reserve	4380	2880.6
08-Jul	Wolfgat Nature Reserve	9740	6241.2
09-Jul	Wolfgat Nature Reserve	5960	159
15-Jul	Wolfgat Nature Reserve	6980	185.5
15-Jul	Wolfgat Nature Reserve	8660	5601.1
16-Jul	Wolfgat Nature Reserve	7620	4961
16-Jul	Wolfgat Nature Reserve	7000	4480.7
26-Jul	Wolfgat Nature Reserve	7680	4961
27-Jul	Wolfgat Nature Reserve	7640	4961
27-Jul	Wolfgat Nature Reserve	6820	4480.7
27-Jul	Wolfgat Nature Reserve	2240	1440.3
28-Jul	Wolfgat Nature Reserve	2240	1440.3
29-Jul	Wolfgat Nature Reserve	2340	1600.4
21 Days	TOTAL	136 000 Kg	R 407 189,61
AUGUST			
11-Aug	Wolfgat Nature Reserve	480	3600
12-Aug	Wolfgat Nature Reserve	480	3600
20-Aug	Wolfgat Nature Reserve	3140	2080.4
23-Aug	Wolfgat Nature Reserve	2020	1440.3
23-Aug	Wolfgat Nature Reserve	3160	2080.4
23-Aug	Wolfgat Nature Reserve	1400	960.3
25-Aug	Wolfgat Nature Reserve	5760	3840.6
25-Aug	Wolfgat Nature Reserve	7680	212
25-Aug	Wolfgat Nature Reserve	5260	3520.71
30-Aug	Wolfgat Nature Reserve	3300	2240.5
8 Days	TOTAL	32 680 Kg	R 23 575,21

Source: Zandisile Biko

by 12.50% of participants who said it should be reported to the local authorities. Out of the 17.5% that disagreed that illegal dumping impacts the reserve, 57.14% of respondents responded with “I do not know” while 42.87% was equally split amongst those who say it should be cleaned, not their business and those who say the community should prohibit dumping and protect the environment. A maximum of 28%

of those who agreed that illegal dumping affects the reserve indicated that the communities’ role is to report it, 20% stated that people should stop dumping, 16% said clean it, the lowest number of people said the community’s role is deal with littering challenges (4%).

Due to their reduced reliance on natural resources, urbanites are the most disconnected from nature. According

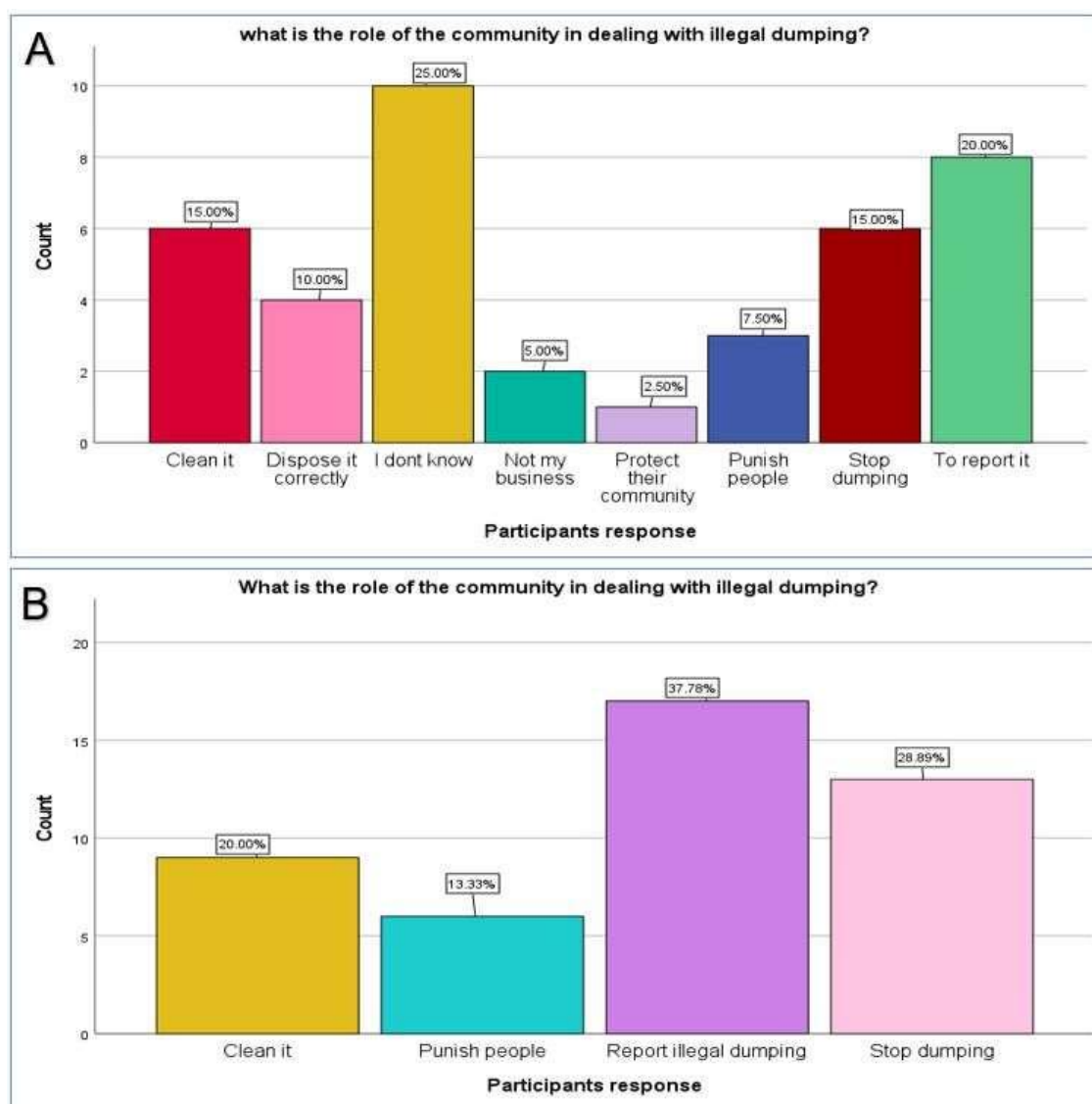


Fig. 4: Response of Atlantis (A) and Khayelitsha (B) residents on how to deal with illegal dumping.

to Eksteen (2012), there has been a steady transition from living in rural, natural regions to living in urban, urbanized regions. Fig. 3 demonstrates that poor people are aware of their impact on the environment but lack the time to care due to a variety of adverse social and economic consequences. In addition, other research confirms the findings, indicating that some individuals are aware of their impact on the environment and wish to act in a way that minimizes the damage they cause (Eksteen 2012, Wells & McShane 2004). As evidenced by the diagram, everyone was aware of their responsibilities regarding illegal dumping. Since laws and regulations do not guarantee compliance and the government cannot enforce them perfectly, it is essential to involve

communities in conservation (Agrawal & Gibson 1999). According to a study by Matsumoto & Takeuchi (2011), illegal dumping is more prevalent in communities with a high unemployment rate. The results of Fig. 4b were interpreted and the relationship observed. The figure demonstrates that, of all the study participants, 71.11% agreed that illegal dumping affects the nature reserve, while 8.88% disagreed and the remaining participants were unsure. About 71.11% of the participants were aware of the impact of litter on the nature reserve, and 21.88% stated that their role in addressing dumping is to clean it up, while 9.38% stated that litterbugs should be punished. 43.75% of respondents indicated that, as members of the community, they should report it, while

25% recommended that people stop dumping. Approximately 20% of respondents indicated that litter has an impact on the nature reserve, with 11.1% indicating that it should be cleaned, 22.22% preferred the community to punish litterers and 22.22% insisted that it should they should report illegal dumping, while the majority of 44.44% indicated that it is the community's responsibility to stop dumping. Communities should not be regarded in isolation from the environment, and according to Agrawal & Gibson (1999), one actor should not be isolated from the other. Environmental protection must be prioritized, and local people must be educated and empowered to monitor their environment and manage their trash at levels that are acceptable to them (Joseph 2006). According to research (Joseph 2006, Przydatek 2019), communities and cultures may fight unlawful dumping by empowering themselves since individuals who engage in illegal dumping operations do so deliberately.

Possible Ways of Dealing with the Illegal Dumping

Rapid urbanization has wreaked havoc on developing countries' ecosystems and will continue to do so unless urgent action is taken (Pitt & Boule 2010). A growing body of evidence suggests that the best hope for protecting our endangered resource is for the majority of humans to become instinctive and passionate conservationists, which can only be accomplished by making people truly aware of our

interdependence with nature by involving communities and making them critical stakeholders. Several studies have found that individuals in these villages have a terrible relationship with their neighboring protected areas (Kaltenborn et al. 2008). Kruger National Park is a good example, as neighboring communities continue to struggle with park authorities. Despite confrontations between local populations and conservators, Andrade & Rhodes (2012) demonstrated that most local communities are still prepared to help biodiversity conservation and management by collaborating with conservators. A large number of studies have also revealed that communities have a limited understanding of the resources occurring within their neighboring protected areas (Andrade & Rhodes 2012, Angwenyi et al. 2021, Western & Henry 1979) because many protected areas followed the traditional and exclusionary approach in which people were denied access to the areas. This is a tendency that has been recognized and implemented widely for many years (Andrade & Rhodes 2012). Furthermore, Simelane et al. (2006) stated that the lack of awareness of natural resources in South Africa is comprehensible because most conservation areas were privately fenced after communities were evicted without sufficient explanations.

Neglecting local communities may result in negative social consequences. As a result, such effects may lead to hostility against conservation efforts, undermining protection

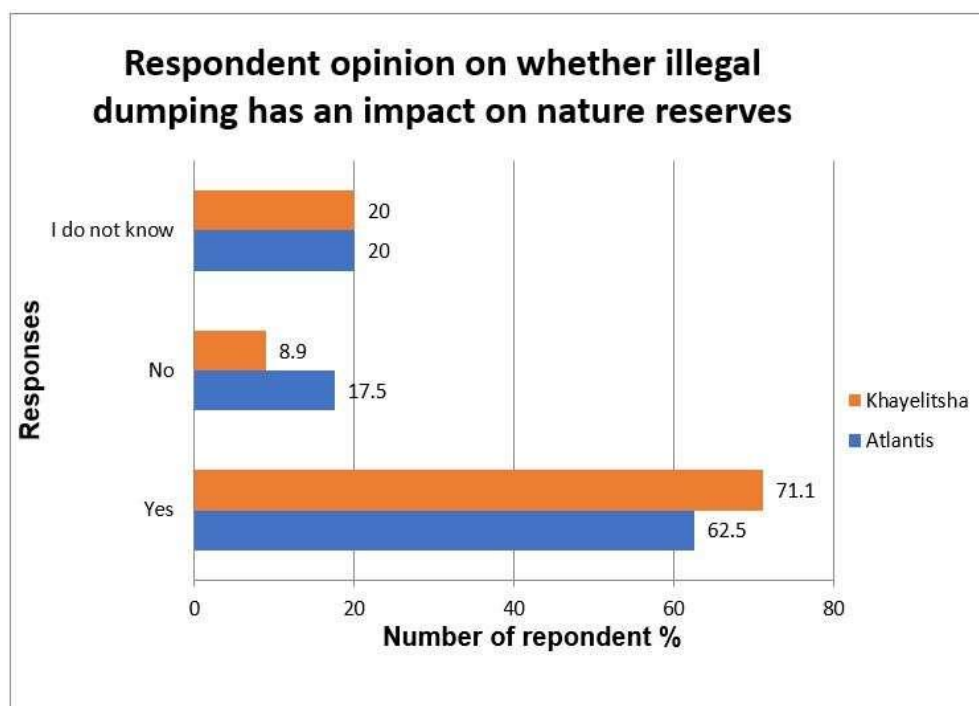


Fig. 5: Participants' response to illegal dumping.

regulations and reducing the use of protected areas for biodiversity. According to Simelane et al. (2006), to maximize local community participation and avoid conflict between conservationists and local communities, a comprehensive understanding of environmental concerns as well as the role of a community in that specific conservation area must be prioritized. On the other hand, a lack of connectivity between local communities and regions of biological importance can jeopardize the future and viability of protected areas such as South Africa's Kruger National Park (Simelane et al. 2006). In other words, conservation area management must always adapt and respond quickly to conservation-related difficulties by using tactics that encourage community support for protected areas. Regardless of the fencing and other strategies in place, illegal dumping continues to be a huge threat to the existence of these areas; therefore, the far most effective strategy is to work with communities and make them the fence of these areas, allowing them to defend these areas from any environmental degradation; it has been demonstrated that local residents can contribute significantly to the reduction of illegal dumping. To combat the environmental issue of illegal dumping and littering, nature reserves must employ a people-centered approach and garner public support by incorporating the public in important decision-making and management plans.

The study found that residents living near the reserve are aware of the effects of illegal dumping on the reserve and are aware of their role as community members (Fig. 5). However, the value of the areas was unknown to the majority of the participants; they indicated that the areas are important for income generation, but only a few respondents valued the areas for their ecological importance. An increasing collection of evidence indicates that no barrier is strong enough to withstand the indifference of an indifferent population (Pitt & Boulle 2010, Wessels et al. 2021). Poorly managed garbage from neighboring residences and unlawful dumping are the principal threats in most protected areas; dumping of waste ranging from household debris, building rubble, tires, and hazardous waste such as asbestos occurs unabated (Wessels et al. 2021).

Fig. 5 shows that, out of all the people that participated in the study in Atlantis, 62,50% agreed that illegal dumping has an impact on the nature reserve while 17,50% disagreed that illegal dumping has an effect and 20% did not have knowledge on the subject matter. According to a study conducted by Wessels et al. (2021), improper waste management in protected areas is frequently ascribed to the actions of residents and insufficient service from the municipality. Illegal dumping is recognized to have significant environmental, health, and economic consequences; there is adequate evidence that excessive

dumping poses a fire hazard risk; and hazardous items can contaminate soil and groundwater and harm plants and wildlife (Carlon et al. 2003). Illegal dumping also harms tourism and can be a financial burden on governments (see Table 1). According to Brandt (2017), unlawful dump sites are difficult to rehabilitate; for example, in 2010, Australian local governments spent \$10 million (approx. R 162, 739, 500) removing and disposing of illegally discarded pollutants (Crofts et al. 2010). In the United States, the costs of illegal dumping site rehabilitation can consume up to 30% of municipal government budgets (Glanville & Chang 2015).

Unstructured Interview Responses from Key Informants

1. City of Cape Town participants on the nature reserve's relationship with the surrounding community:

"The relationship is going well but in terms of the social standards there are challenges here and there" (Reserve Supervisor, Wolfgat Nature Reserve)

"It's a work in progress but there's always changing community leadership; it's a constantly moving relationship" (Functional Operational Manager) "The relationship is not as positive but we still do environmental awareness" (Reserve Supervisor, Witzands Aquifer Nature Reserve)

The above findings indicate that the community's relationship with nature reserves is relatively poor; the majority of those who took part in the study had never visited a nature reserve or been a part of a community-based project. This reveals a shortage of marketing and community participation efforts targeted at raising awareness and fostering relationships. Socioeconomic considerations are critical since a hungry person will be apathetic to the protected territory if his or her immediate needs are not satisfied. Additionally, conservators are aware of this dysfunctional connection, although one interviewee asserts that the tie is developed via education. Indeed, Graham & Ernston (2012) found that cooperation should not just be theoretical, but also practical.

2. The nature reserve's strategies for ensuring sustainable yield, promoting compliance with applicable laws, integrating biodiversity issues with waste management, and promoting sustainable eco-tourism. What are these techniques?

"Due to visitors leaving their litter on the reserve unattended, we have adapted to new policies; some of our reserves are now "Bin Free" reserves and regular patrols are being done to monitor illegal dumping, in terms of promoting eco-tourism we allow harvesting of alien plants (wood species) through permit systems" (Functional Operational Manager).

“We have methods in terms of compliance; we have coordinated with the law enforcement and field rangers to conduct patrols. Jerome September integrates biodiversity concerns with waste management through working with local people such as Sangomas, Khoisan, etc. through education” (Reserve Supervisor, Wolfgat Nature Reserve).

The local communities from both nature reserves have indicated that the municipality provides them with Waste Management Services; however, illegal dumping is still an environmental issue for nature reserves regardless of the methods and laws that have been implemented. Well-known conservation agencies such as SANParks have adopted a proactive strategy to ensure community support, and this includes the establishment of various community development projects. A study by Dube (2018) states that local communities should be one of the important stakeholders in protected area management as they have valuable information to share about the area.

3. What environmental challenges does the nature reserve face, and is the current waste management system effective, according to participants from the City of Cape Town?

“The nature reserve is currently confronted with many challenges, but illegal dumping, particularly near the fence separating the nature reserve from the houses, is a major issue. Yes, we do have a waste management system in place, and so far it has been effective” (Reserve Supervisor, Wolfgat Nature Reserve)

The Witzands Aquifer Nature Reserve is not significantly affected by illegal dumping, but remote sites are. Witzands Aquifer Nature Reserve is a bin-free nature reserve; visitors bring their own bags and leave with their trash; thus far, this has been effective” (Witzands Aquifer Nature Reserve Supervisor)”

According to the conservators’ semi-interviews, illegal dumping and litter brought in from neighboring communities were identified as the primary environmental issues for both nature reserves, despite respondents’ assertions that their reserves’ waste management plans were efficient. The communities surrounding both areas indicated that they had witnessed illegal dumping and were aware of their role as community members. Even though people are aware of the problem and nature reserves are protected by specific laws and regulations, they continue to experience waste problems. According to Joseph (2006), to make real progress in waste management, local communities must be involved, but collaborative approaches have led to attitude shifts without corresponding behavioral cooperation.

4. A compilation of quotations regarding the nature reserve’s strategies for ensuring sustainable yield,

promoting compliance with applicable laws, integrating biodiversity concerns with waste management, and promoting sustainable ecotourism. What are these strategies?

“Due to visitors leaving their trash unattended on the reserve, we have adopted new policies; some of our reserves are now “Bin Free” reserves, and regular patrols are conducted to monitor illegal dumping in the interest of promoting ecotourism. Through permit systems, we permit the harvesting of alien plants (wood species) for tourism” (Functional Operational Manager).

“We have methods for ensuring compliance; we have coordinated patrols with law enforcement and field rangers.” Jerome September integrates concerns about biodiversity with waste management by educating local people such as Sangomas, Khoisan, etc. (Superintendent of the Wolfgat Nature Reserve)

The local communities of both nature reserves have indicated that the municipality provides them with Waste Management Services; despite the methods and laws that have been implemented, illegal dumping remains an environmental concern for nature reserves. Notable conservation organizations, such as SANParks, have adopted a proactive strategy to ensure community support, which includes the establishment of numerous community development projects. Local communities should be one of the key stakeholders in protected area management, according to a study by Dube (2018), because they have valuable information to share about the area.

CONCLUSION

There is growing evidence that higher incomes and education do not necessarily translate to greater environmental awareness. As a result, nature reserves must empower individuals with skills and vision to develop their communities. According to literature, the majority of the world’s population is migrating to urban areas for economic reasons as urbanization increases; however, such migration frequently leads to unlawful land occupation without proper dumping and sanitation facilities, which puts a strain on natural resources and threatens urban conservation spaces. The relationship between conservationists and communities is the starting point for making conservation relevant to local communities, according to the literature. The conservation-community relationship contributes to the long-term security and sustainability of ecosystems that are severely threatened. Through the study, the researcher investigated the relationship between conservationists and communities in greater depth by administering a questionnaire to communities who reside near the reserves and not just community partners. According

to the study, conservationists have a variety of relationships with local communities that range from poor to excellent. As a result of changes in community leaders and socioeconomic conditions, the conservator stated that the relationship is constantly changing. By providing temporary jobs and environmental education programs, significant progress has been made in trying to improve these relationships. The importance of these relationships to people is not to serve biodiversity, but rather to serve some of their social needs. Although the majority of respondents from both sites have never visited a nature reserve or participated in a community conservation project, they have a good understanding of the environmental impact of waste on the nature reserve. Despite their knowledge, communities lacked a sense of ownership and belonging as a result of exclusionary decision-making in conservation-related activities. They were more concerned with issues such as inequality, marginalization, and poverty.

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REFERENCES

- Agrawal, A. and Gibson, C. C. 1999. Enchantment and disenchantment: the role of community in natural resource conservation. *World Development*, 27(4): 629-649.
- Andrade, G. S. and Rhodes, J. R. 2012. Protected areas and local communities: an inevitable partnership toward successful conservation strategies? *Ecology and Society*, 17(4).
- Angwenyi, D., Potgieter, M. and Gambiza, J. 2021. Community perceptions towards nature conservation in the Eastern Cape Province, South Africa. *Nature Conservation*, 43: 41.
- Bajracharya, S. B., Gurung, G. B. and Basnet, K. 2007. Learning from community participation in conservation area management. *Journal of Forest and Livelihood*, 6(2): 54-66.
- Brandt, A. 2017. Illegal dumping as an indicator for community social disorganization and crime. Doctoral dissertation, San José State University.
- Brown, T. J., Ham, S. H. and Hughes, M. 2010. Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism*, 18(7): 879-900.
- Clarke, R. 2015. Beyond landscape designation: innovative funding, delivery and governance and the UK protected area system. *Management of Environmental Quality: An International Journal*, 26(2): 172-194.
- Creswell, J. W. and Tashakkori, A. 2007. Differing perspectives on mixed methods research, 1(4): 303-308.
- Critto, A., Carlon, C. and Marcomini, A. 2003. Characterization of contaminated soil and groundwater surrounding an illegal landfill (S. Giuliano, Venice, Italy) by principal component analysis and kriging. *Environmental Pollution*, 122(2): 235-244.
- Crofts, P., Morris, T., Wells, K. and Powell, A. 2010. Illegal dumping and crime prevention: A case study of Ash Road, Liverpool Council. *Pub. Space: JL and Soc. Just.*, 5(1).
- de los Angeles Somarriba-Chang, M and Gunnarsdotter, Y. 2012. Local community participation in ecotourism and conservation issues in two nature reserves in Nicaragua. *Journal of Sustainable Tourism*, 20(8): 1025-43.
- De Witt, L. and Van der Merwe, P. 2015. Key environmental management factors in protected areas an eco-tourist perspective, 4(2). Available at: <http://www.aarcherinc.com/files/2011/11/environmental-policy.jpg>
- Dube, C.N. 2018. Community participation in the management of South Africa's protected areas. *African Journal of Hospitality, Tourism and Leisure*, 7(2): 1-18.
- Eksteen, L. 2012. Relationships between conservators, community partners, and urban conservation areas: a case study of nature reserves on the Cape Flats. Unpublished Magister Artium thesis, University of the Western Cape, Cape Town.
- Glanville, K. and Chang, H. C. 2015. Remote sensing analysis techniques and sensor requirements to support the mapping of illegal domestic waste disposal sites in Queensland, Australia. *Remote Sensing*, 7(10): 13053-13069.
- Graham, M. and Ernstson, H. 2012. Comanagement at the fringes: examining stakeholder perspectives at Macassar Dunes, Cape Town, South Africa at the intersection of high biodiversity, urban poverty, and inequality. *Ecology and Society*, 17(3).
- Jakiel, M., Bernatek-Jakiel, A., Gajda, A., Filiks, M. and Pufelska, M. 2019. Spatial and temporal distribution of illegal dumping sites in the nature protected area: The Ojców National Park, Poland. *Journal of Environmental Planning and Management*, 62(2): 286-305.
- Kadafa, A. A., Latifah, A. M., Abdullah, H. S. and Sulaiman, W. N. A. 2013. Current Status of Municipal Solid Waste Management Practice in FCT Abuja. *Research Journal of Environmental and Earth Sciences*, 5(6): 295-304.
- Kaltenborn, B. P., Nyahongo, J. W., Kidegesho, J. R. and Haaland, H. 2008. Serengeti National Park and its neighbours—Do they interact? *Journal for Nature Conservation*, 16(2): 96-108.
- Marshall, M. N. 1996. Sampling for qualitative research. *Family Practice*, 13(6): 522-526.
- Matsumoto, S. and Takeuchi, K. 2011. The effect of community characteristics on the frequency of illegal dumping. *Environmental Economics and Policy Studies*, 13(3): 177-193.
- Oakley, A. 1998. Gender, methodology and people's ways of knowing: Some problems with feminism and the paradigm debate in social science. *Sociology*, 32(4): 707-731.
- Pitt, B. and Bouille, T. 2010. Thinking and Practice of Urban Nature Conservators.
- Przydatek, G. 2019. Waste Management in Selected National Parks—A Review. *Journal of Ecological Engineering*, 20(4): 14-22.
- Sadat al Sajib, S. M., Islam, S. Z. and Sohad, M. K. N. 2022. Rohingya influx and socio-environmental crisis in southeastern Bangladesh. *The International Journal of Community and Social Development*, 4(1): 89-103.
- Simelane, T. S., Kerley, G. I. H. and Knight, M. H. 2006. Reflections on the relationships between communities and conservation areas of South Africa: The case of five South African national parks. *Koedoe*, 49(2): 85-102.
- Statistics South Africa (StatsSA). 2011. Census Data. <http://www.resource.capetown.gov.za/documentcentre>. [20 November 2021]
- Taherdoost, H. 2016. Sampling methods in research methodology; how to choose a sampling technique for research. How to choose a sampling technique for research (April 10, 2016), (IJARM), 5.
- The City of Cape Town. 2008. Nature Reserves: A network of amazing biodiversity. <https://www.capetown.gov.za/environment> [18 November 2021]
- Verma, J. P. 2012. Data analysis in management with SPSS software. New Delhi: Springer Science and Business Media.



- Wells, M. P. and McShane, T. O. 2004. Integrating protected area management with local needs and aspirations. *AMBIO: A Journal of the Human Environment*, 33(8): 513-519.
- Wessels, N., Sitas, N., Esler, K. J. and O'Farrell, P. 2021. Understanding community perceptions of a natural open space system for urban conservation and stewardship in a metropolitan city in Africa. *Environmental Conservation*, 1-11.
- Western, D. and Henry, W. 1979. Economics and conservation in third

world national parks. *BioScience*, 29(7): 414-418.

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