Knowledge of and concern about global biodiversity loss vs local biodiversity loss in the Maputaland-Pondoland-Albany Hotspot (MPA)

By

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A dissertation in partial fulfilment of the requirements for the Master of Science in Environmental Science at Rhodes University, Makhanda.

Supervisor: Professor Charlie Shackleton

February 2022

Abstract

Biodiversity forms the basis of the ecosystem services that society depends on. However, humanity has caused an increase in the extinction rates up to 100 times higher than that of evolutionary background levels. Recent studies found that biodiversity conservation becomes successful when it is grounded in local support. Support for conservation of biodiversity depends on peoples' knowledge of biodiversity, their attitudes and awareness of the number of species that are present and that are threatened with extinction. However, some studies have shown that the public has little knowledge about the concept of biodiversity and have poor biodiversity identification skills. There is growing concern that people know and are more concerned about global biodiversity loss than what is happening around them locally. The notion that people know and are more concerned about global biodiversity loss rather than local, has not been deeply studied. Most studies have been in developed countries, with limited studies in developing countries and countries that have high diversity such as South Africa. Having accurate knowledge about biodiversity and the environment is said to be the key predictor of intention to change behaviour in relation to biodiversity. Therefore, the purpose of this study was to understand the knowledge and concern (if any) people have of biodiversity at global and local scales. More so, it set out to determine how familiar people are with the term biodiversity, what they consider as forces leading to biodiversity decline, the level of concern that they have for biodiversity loss and if knowledge and concern is influenced by demographic profiles.

To achieve this aim, a total of 220 random interviews were conducted in three towns within the Maputaland-Pondoland-Albany Hotspot in South Africa. The results show that respondents are familiar with the term biodiversity. There was a strong relationship between having heard of the term and the ability to define it with 55 % of the respondents aware of it and able to define it. Respondents had moderate knowledge general knowledge related to biodiversity. Gender, education and childhood background did play a role in the knowledge of biodiversity. Women had more knowledge about biodiversity than men, highly educated respondents knew more and the youth knew more than older respondents. The results of this study found that there were no respondents who could not name any local species from South Africa. However, things changed at global level with 32 % of the participants unable to name species at global level. Endangered species are still relatively unknown, as the majority of respondents could not

name any at district (84 %) or at global level (61 %). Charismatic species were known the most by respondents as 52 % mentioned them at national level and 59 % at global level.

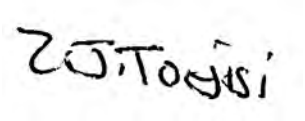
This study also assessed if there is concern for biodiversity loss. The results showed that there is concern for biodiversity with 71 % of the respondents in support for conservation and 60 % of the respondents willing to donate towards conservation. This study found that reasons for conservation related to the level of products consumed directly from the environment. Those that supported conservation for use values consumed more products from the environment than those who were in support for non-use values. Furtherly, this study found that women were more concerned about biodiversity loss than men. Highly educated respondents were more concerned and the youth was not. Furtherly, this study found that knowledge about biodiversity loss corelated with concern. For example, women had more knowledge and were more concerned about biodiversity loss.

Overall, this study has shown that there is some knowledge and concern that people have about biodiversity and its loss. This can assist the relevant policy makers and researchers to know where intervention is needed to increase the knowledge that people have of biodiversity loss and which aspects of biodiversity people are most concerned about. This is so that new policies and conservation measures can include what is appealing to the local people so that support for conservation can be built and accepted by local people.

Keywords: biodiversity loss, concern for biodiversity, conservation, global, knowledge, local, species

Declaration

I, Zanele Jacqueline Toyisi, hereby declare that the work presented in this thesis was carried out in the Department of Environmental Science, Rhodes University, under supervision of Professor Charlie Shackleton. The components of the thesis comprise original work by the author and have not been submitted to any other university.



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February 2022

Dedication

I dedicate this thesis to my parents, your unconditional love, teachings and prayers have landed me here.

Acknowledgements

I would like to thank first and foremost, God for his unconditional and ever merciful love. My sisters and all of my family for the continuous support. I would like to thank my partner for all the support you have given me. To Tshepiso Seboko, you are Godsent, thank you so much for never getting tired of helping me. To my colleagues inside and outside of Rhodes, I thank you for the roles that you have played during this time, I am eternally grateful.

Most importantly I would like to thank my supervisor Professor Charlie Shackleton. Thank you so much for your guidance, support, your cherished input and most importantly your patience, I could not have asked for a better supervisor. To the research participants, thank you for participating in this study. There would be no study without you. I would like to acknowledge the National Research Foundation for funding me. Lastly, I would like to acknowledge myself. I would like to take this moment to acknowledge how I fell down more than a 1 000 times during these past two years and still I managed to get up. Through all the times I got sick because of the pressure, I finished this thesis and I am proud.

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CHAPTER 1: General Introduction

Introduction

1.1.Biodiversity loss

Biodiversity forms the basis of the ecosystem services that society depends on such as the food, flood regulations, medicines, etc (Ezeomedo and Igbokwe, 2013). However, humanity has caused an increase in the extinction rates up to 100 times higher than that of evolutionary background rates due to a variety of actions that result in biodiversity loss (Brooks *et al*., 2006). In the period of 1984-2004 alone, the International Union for Conservation of Nature (IUCN) recorded 27 extinctions with half of them occurring on continents (i.e. excluding islands) (Pereira *et al*., 2012). Of the 27 extinct species, 12 of them were flowering plants, six bird species and eight amphibians. Habitat loss and invasive species are thought to have played a significant role in these extinctions (Pereira *et al*., 2012).

Loss of species has impacts on the function, resilience, and productivity of ecosystems. Over 32 000 species are threatened with extinction (IUCN, 2020). This includes 41 % of amphibians, 26 % of mammals, 34 % of conifers, 30 % of sharks and rays, 28 % of selected crustaceans and 14 % of birds (IUCN, 2020). There is likely to be many more than what has been stated in the IUCN's Red List because there are still many gaps. Overall, there is a significant decline and loss in species number and abundance globally. The same applies to aquatic environments (Knapp *et al*., 2017). A quarter of shark species are considered endangered, vulnerable, or critically endangered by the IUCN (O'Bryhim, 2015). In Africa, more than 21 % of freshwater species are threatened with extinction (UNEP-WCMC, 2016). Additionally, coral reefs in the Indian ocean experienced massive bleaching with over 50 % mortality in some regions of Africa (Mohammed, 2020). Climate change is causing strains in biodiversity as a result Sintayehu (2018) stated that the Ethopian wolf (*Canis Simensis*) which is endemic is struggling to adapt to the shrinking availability of water and longer dry periods caused by climate change in Africa. Furtherly, the Living Planet Report of 2020 states that 65 % of fish, reptile, amphibian and the mammal's population size has declined in Africa (McVey *et al*., 2020).

Different species perform many kinds of functions in an ecosystem (Kumar and Verma, 2017). Species capture and store energy, they produce and decompose organic materials as well as help to cycle nutrients and regulate the climate (Kumar and Verma, 2017). Biodiversity loss is not only seen in species richness and diversity but also ecosystem diversity. Forest cover

globally, continues to decline. More than 35-40 % of the worlds forest have been lost (Pereira *et al*., 2012). This is driven by a continual increase in the need for land for agriculture, urbanization and timber extraction. Wetland cover declined by 30 % between 1970-2015 (OCED, 2019). In Africa, the area under wetlands and mangroves decrease by 1% annually (UNEP-WCMC, 2016).

Ecosystems such as wetlands help with flood regulation, water purification and are habitats for a variety of species. All these functions are vital for ecosystem functioning and human wellbeing (Kumar and Verma, 2017). Diversity in plant communities can also protect the system against temporal variability in response to external fluctuations in the environment (Kardol *et* al., 2018). Therefore, the loss of biodiversity results in the disruption of ecosystem functioning, making ecosystems more vulnerable to disturbances and provide a reduced supply of ecosystem services to people.

South Africa is known to be one of the most biologically diverse countries in the world because of its high rate of endemism, species diversity and diverse ecosystems (Convention on Biological Diversity, 2011). However, much biodiversity in the country is endangered, with 82 % of the river ecosystems threatened, 10 % of the birds and frogs threatened, as well as 20 % of its mammals (Convention on Biological Diversity, 2011). Further, 13 % of plants in the country are threatened (Convention on Biological Diversity, 2021). Plant species totalling to 1 850 of the Cape floral Kingdom in the country are threatened with extinction (Convention on Biological Diversity, 2021). Taxonomic groups that are freshwater dependent such as fish, crabs and dragonflies are more threatened in South Africa than in the rest of the southern African region (Environment, 2012). About two-thirds of 59 endemic freshwater species are threatened in the country (SANBI, 2019). Further, 9 % of the terrestrial ecosystems are critically endangered, because of the loss of natural habitats (Nel and Driver, 2012). Wetlands are said to be the most threatened ecosystem in the country (Nel and Driver, 2012; Van Deventer *et al*., 2021). The reason for this is the construction of dams, urban development, pollution and cultivation which leads to the degradation of wetlands (Fang *et al*., 2019; Nel and Driver 2012). Furtherly, 88 % of wetland area is threatened (SANBI, 2019). Additionally, 99 % of estuaries are also threatened in the country (SANBI, 2019). South Africa, like other countries in the world, is facing high rates of biodiversity loss caused by a variety of drivers, mostly in common with those experienced elsewhere.

1.2.Drivers of biodiversity loss

Recent assessments have shown that there is a continuing decline in species populations and the connectivity of habitats, resulting in increased extinctions and declines in the benefits people get from biodiversity (IPBES, 2019;SANBI, 2019;Rands *et al*., 2010). Yet, pressures on biodiversity continue to increase (IPBES, 2019; SANBI, 2019;Rands *et al*., 2010), as explained below.

1.2.1. Direct exploitation

Humans can cause biodiversity loss through direct use. The use of some species is high and unsustainable (Gaston and Spicer, 2012). For example, the consumption of hunted wildlife is estimated to about 67-165 tonnes per annum in the Brazilian Amazon and demand seems to be increasing (Gaston and Spicer, 2012). The majority of industrial fisheries are overexploited and modern fishing techniques harm wetlands and estuaries (Rawat and Agarwal, 2015). Overexploitation of a particular species leads to reductions in population size which makes it vulnerable to local extinction (Kumar and Mina, 2018). In Pakistan, the Balochistan rivers that have high levels of endemic aquatic fauna and flora are threatened by overfishing in those rivers (Baig and Al-Subaiee, 2009). The aquatic species of Pakistan are not the only ones threatened, but also large mammals are threatened due to illegal hunting for trade, sport and meat (Baig and Al-Subaiee, 2009). This shows that direct exploitation that is not sustainable, can be a threat to biodiversity. South Africa is facing overexploitation of resources, mostly because of trade. Harvesting of plants at unsustainable levels can result in them being threatened (Nel and Driver, 2012). For example, several cycad species in South Africa are threatened with extinction because they are traded as traditional medicine (Nel and Driver, 2012). Cycads are in so much demand that people remove them from protected areas as well (Nel and Driver, 2012).

1.2.2. Habitat alteration and destruction

When habitats are changed dramatically, their capacity to support some species declines, leading to a potential or real loss of biodiversity (Gaston and Spicer, 2012; Kumar and Minar, 2018; Rawat and Agarwal, 2015). Most habitat destruction is caused by the clearing of natural habitats for agriculture, urbanization, and mining (Gebretsadik, 2016). For example, the depletion of the mangrove forests in the Niger delta. These forests are home to a variety of terrestrial and aquatic biodiversity and play a vital role in ecosystem stabilization; but because of the growing human population they are being converted due to the rapid urbanization, agriculture and industrialization that is taking place in the area (Mmon and Arokoyu, 2010).

Agriculture is associated with loss of indigenous plant abundance and this indirectly leads to declines in or the loss of bird and mammal species (Nyingi *et al*., 2018). The extent of tropical forests and the abundance of wild bird species they harbour is declining because of the conversion of habitats (Pereira *et al*., 2012). In China, at least 200 plant species have become extinct since the 1950s due to habitat loss (Liu *et al*., 2019). In the marine realm, the annual loss of habitats has resulted in seagrass beds in Europe, North America and Australia to disappear at an annual net rate of 110 km^2 since 1980 and a loss of a total 29 % since their initial recording in 1879 (Knapp *et al*., 2017).

In addition to habitat loss, habitat fragmentation prevents migration of species which results in the reduced population size and viability (Nyingi *et al*., 2018). More so, habitat fragmentation is said to be one of the most important threats to biodiversity (Gebretsadik, 2016). This may be because fragmentation threatens seed dispersal and movement of wildlife. The disturbances caused by humans are evident in almost every biome, as such forests have decreased by 29 %, savanna/grasslands by 49 % and tundra by 14 % (Gaston and Spicer, 2012). About 22 % of natural habitats in South Africa have been lost since the arrival of European settlers (Skowno *et al*., 2021). Loss has been greatest for the Fynbos, mesic Grassland and Indian Ocean Coastal Belt biomes and rates of loss are as a result of expansion of croplands, mining, plantation forestry and human settlement (Skowno *et al*., 2021). Rates of loss have increased across all biomes between 2014-2018 (Skowno *et al*., 2021). The conversion of land for mining, agriculture and urban areas has resulted in major biodiversity loss (Jewitt *et al*., 2015; Ntshane and Gambiza, 2016). Mining results in the removal of vegetation which results in habitat loss but it also increases the amount of siltation and pollutants in rivers (Ntshane and Gambiza, 2016).

1.2.3. Introduced species

Humans have intentionally or unintentionally introduced species into areas where they did not naturally occur (Gaston and Spicer, 2012). Some of these species cause changes in the ecosystem if they become invasive (Rawat and Agarwal, 2015). Common characteristics are that they grow rapidly, have high dispersal ability and they have the ability to survive in different environmental conditions (Kumar and Mina, 2018). These characteristics enable them to compete with native species for limited resources and alter the habitats (Gaston and Spicer, 2012; Kumar and Mina, 2018; Rawat and Agarwal, 2015). For example, *Chromolaena odorata* (Siam weed) has taken over wilderness areas and farmlands and has affected plant communities and has disrupted forest succession in areas that it invades (Nyingi *et al*., 2018). Invasive alien

species (IAS) pose threats to biodiversity and ecosystem services and therefore affecting the delivery of ecosystem goods and services (Shackleton *et al*., 2007). Invasive alien species are the third biggest threat to European threatened, species with 354 threatened species being affected by IAS in 2015 (IUCN, 2017). Alien species contribute to recent plant and vertebrate extinctions (Blackburn *et al*., 2019). Invasive alien species (IAS) are also a significant problem in South Africa. There are about 1 422 (all taxa) alien species in South Africa (Van Wilgen *et al*., 2020). Brown Trout (*Salmo trutta*) is an example of an IAS that is causing a decline in biodiversity (Van Wilgen *et al*., 2020). Brown Trout are a threat to indigenous aquatic fauna as they eat indigenous fish species or compete with them causing displacement (Cambray, 2003). Another example of an IAS that is causing a decline in biodiversity is Black Wattle (*Acacia mearnsii*), as it competes with indigenous vegetation, takes up a lot of water and therefore threatening change in native habitats (Moyo *et al*., 2009). Thus, IAS have implications for biodiversity and can cause change in the natural environment in that they compete for natural resources resulting in loss of local biodiversity (IPBES, 2022).

1.2.4. Pollution

Organic and inorganic pollutants are considered an important driver of biodiversity loss in many ecosystems (Rawat and Agarwal, 2015). Water pollution happens as a result of harmful substances entering water bodies, causing negative effects in the ecosystem and the health of the biota in the ecosystems (Gebretsadik, 2016). For example, in the Indus River, the *Delphinus* (dolphin) is threatened by extinction due to the toxic pollutants (Baig and Al-Subaiee, 2009). Pollution can also happen in the air and soil. Soil pollution is through substances and pesticides mostly used in agriculture, causing harm to the environment (SANBI, 2019). Soil pollution can increase soil salinity, making it harmful for plants (Knapp *et al*., 2017). Furthermore, the toxins can leach into the ground water. Air pollution happens through chemicals emitted from various activities such as car and industrial emissions. Air pollution can result in acid rain which destroys trees. It can also result in these toxins being introduced into the water, causing eutrophication or be introduced to the soil (IPBES, 2019). In the marine systems, excess nitrogen and phosphorous boost phytoplankton production and can shift the system into a eutrophic state, forcing changes in food web structure and species composition (Knapp *et al*., 2017). Pesticide contamination in freshwater bodies reduces biodiversity in streams and later affects coastal ecosystems such as coral reefs and life across trophic levels (Knapp *et al*., 2017). For example, a decline in coral cover caused a decline in fish biodiversity in marine reserves in Tamane Puli Conservation Area, Kimbe Bay and Papua New Guinea (Jones *et al*., 2004;

Eddy *et al*., 2021). Plastic pollution is of high concern as more plastics are being used and disposed. Plastics have negative effects in biota including gut impaction and entanglement (Nyingi *et al*., 2018). Mining requires high consumption of water and the water polluted by mines gets released into rivers causing contamination (Hadzi *et al*., 2018; Ntshane and Gambiza, 2016). Mining activities in South Africa have been found to alter and degrade both aquatic and terrestrial habitats, causing a decrease in the abundance of indigenous species (Ntshane and Gambiza, 2016). Agricultural activities typically require the use of pesticides and high consumption of water (Dudley and Alexander, 2017; Ntshane and Gambiza, 2016). The effects of agriculture on biodiversity include eutrophication which is a result of fertilisers that go into water bodies resulting in algal blooms that reduce oxygen which results in reduced diversity of aquatic organisms (Ntshane and Gambiza, 2016; Withers *et al*., 2014).

1.2.5. Climatic change

There are increasing levels of carbon dioxide and methane in the atmosphere, resulting in global warming (Rawat and Agarwal, 2015). Changes in climate, such as some regions being warmer, has impacted biodiversity and ecosystems, by affecting species distributions, migration events and the frequency of pest and disease outbreaks (Rawat and Agarwal, 2015; Rands *et al*., 2010). Climate change has caused irreversible losses in ocean marine ecosystems as well as freshwater and terrestrial ecosystems (IPCC, 2022). Climate change is predicted to increase rates of species extinction (Nyingi *et al*., 2018), because some species will not be able to adapt to the changes in climatic conditions. It is estimated that over 50 % of mammals and bird species in Africa will be lost while 5 000 African plant species will also be lost (Nyingi *et al*., 2018). The effects of climate change has already been felt, as evidenced by shifts in migration, breeding and population declines and shifts in species distribution (OCED, 2019). For example, using the Community Temperature Index, birds (United Kingdom), alpine herbs (Switzerland) and butterflies (Sweden) were moving their range limits poleward at a rate of 0.61 km/year and bird and butterflies in Europe at 2.1 and 6.3 km/year (Pereira *et al*., 2012). Knapp *et al*. (2017) reported that when temperatures move beyond the physiological limits of a certain organism, the individual performance will suffer, and the population will decline once the tolerated temperature extremes are surpassed. More so, climate change will cause a rise in sea level, sea temperatures and water acidity (IPCC, 2022; Nyingi *et al*., 2018). This means that climate change will cause changes in the freshwater, coastal and marine ecosystems, effecting on the biota dependent on them.

1.2.6. Extinction cascades

Extinction cascades are when the extinction of one species may lead to the extinction of others (Sanders *et al*., 2018). This happens when one species provides important resources for others, such as predators or specialist dispersal agents (Gaston and Spicer, 2012). Complex interactions, such as the change in the composition of fauna and flora can be a result of the changes in the abundance of key species (Sanders *et al., 2018*; Gaston and Spicer, 2012). For example, when sea otters were removed by Russian fur traders, it resulted in a population increase of sea urchins that overgrazed kelp (Chapin *et al*., 2000).

1.2.7. Interaction between drivers

The drivers of biodiversity loss often do not act in isolation but integrate as co-occurring stressors (Mantyka-Pringle, 2012). Mantyka-Pringle *et al*. (2012) found that climate change negatively interact with habitat fragmentation and loss and combine to contribute to the degradation of biodiversity at habitat, species and genetic levels. Mantyka-Pringle *et al*. (2015) noted that fragmentation and habitat loss can hinder the movement of species and their ability to cope with climate change, further the responses of populations to extreme climatic events such as fire are affected by habitat quality. Mantyka-Pringle *et al*. (2012) found that in United States overharvesting, habitat fragmentation and environmental warming resulted in rotifer zooplankton populations declining up to 50 times faster because of the three combined threats acting together.

Climate change and invasive alien species can also interact, leading to loss of biodiversity. Shrestha and Shrestha (2019:1605) noted that climate change "facilitates dispersal, introduction and naturalization of alien species as well as reduces the resilience of local ecosystems to alien species". This means that climate change will likely increase the threat of invasive species. Louppe *et al*. (2020) found in the Balkan area (Europe), the small Indian mongoose is likely to expand over the years because of its high tolerance of very high temperatures that are expected to raise further by 2050. Furtherly, climate change can interact with pollution to cause more loss. The increased precipitation and runoff caused by climate change can bring more toxins and nutrients into coastal zones which can change the biogeochemical processes of that area (Lu *et al*., 2018).

1.3.Strategies to reduce biodiversity loss

1.3.1. International conventions

International treaties and agreements have been put into place in the attempt of strengthening the participation and commitments internationally to conserve biodiversity (Kumar and Mina, 2018; Rawat and Agrawal, 2015; Kim, 2013). There are many treaties and agreements but this section highlights a few key ones.

The Convention on Biological diversity: the convention was opened for signature on the 5th of June 1992. Its main objectives are i) conservation of biodiversity, ii) sustainable use of biodiversity and iii) the fair and equitable sharing of benefits from the use of genetic resources (Convention on Biological Diversity, 2011). About 196 countries are party to the convention, including South Africa. There are current negotiations for the next global biodiversity framework which will improve the Aichi Targets and are set to be finalized at the end of 2022 (Convention on Biological Diversity, 2021).

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora is meant to protect endangered animals and plants by making sure that international trade in specimens of wild animals and plants does not threaten the survival of species in the wild (Cities, 2019). It has been signed by 183 countries, including South Africa.

RAMSAR Convention on Wetlands: The convention recognizes that wetland ecosystems are important for biological diversity and for human wellbeing (Ramsar, 2014). As such it provides a framework for national action for the wise use of wetlands and their resources (Ramsar, 2014). There are 170 countries that are signatories, including South Africa.

1.3.2. Local and regional scale strategies

Protected areas

Combating biodiversity loss has been going on for decades. A primary strategy is conservation through protected areas (PAs). Globally, 14.6 % of land is under protected areas and in each country this can vary between 1 % to around 50 % of land (Ritchie and Roser, 2021). About 16 % of global forests fall within legally established protected areas and 11.5 % of marine territorial waters were protected by 2017 (Ritchie and Roser, 2021). The 2020 Strategic Plan for Biodiversity calls for the expansion of protected areas globally to cover 17 % of terrestrial areas and 10 % of marine areas by the year 2020 (Ward *et al*., 2020). However, some protected areas are criticised to be insufficient to slow down biodiversity loss (Godet and Devictor,

2018). This may be because the human population rate is increasing and with its increase, resource consumption is increasing. This leads to the point that to combat biodiversity loss, there is a need for strategies that include people in the management process. Protected areas have been criticised as often excluding neighbouring communities and by doing so, the tool has contributed to growing animosity towards conservation (Gavin *et al*., 2018). For example, in the Digya National Park in Ghana, there has been conflict because of the local community being excluded in the management processes of the park (Ayivor *et al*., 2013). The community around the park go into the park to collect non-timber forest products and they are apprehended as a result. The Park has had issues with poachers and have made arrests and evictions which has caused more conflict with the neighbouring community (Ayivor *et al*., 2013). However, it should be noted that not all protected areas exclude local communities around them. Due to the limitations of some PAs, new solutions to biodiversity loss have been proposed including biocultural approaches, community-based conservation programmes and citizen science that have people for support and action towards biodiversity loss as their fundamental core.

Biocultural approaches

Biocultural approaches "emphasize that conservation will be most effective when the process matches the social-ecological context" (Gavin *et al*., 2018:5). This means that this conservation tool recognises that multiple stakeholders will have different worldviews and objectives and there is a need to take account of the different worldviews for conservation to be effective in the long term. Biocultural conservation embraces the different stakeholders' knowledge and needs, creating partnerships and social learning among stakeholders (Gavin *et al*., 2018). The biocultural approach takes a similar approach to co-management. An example of a biocultural approach to conservation is in the Gwaii Haanas National Park, Haida Heritage Site and the National Marine Conservation Area Reserve in Canada. Management follows the Haida concept of respect for all living things while it also meets the Haidas' needs (Gavin *et al*., 2018). The Haida Nation and the government share responsibilities and both traditional knowledge and western knowledge is used for decision making and planning (Stephenson *et al*., 2014). The watchmen were established by the Haida Nation and it was incorporated into management for monitoring biodiversity and caretaking the protected area (Stephenson *et al*., 2014).

Community-based conservation programmes

Community-based conservation programmes are similar to biocultural approaches to conservation by seeking to meet people's needs while conserving biodiversity. Community-based conservation gives local communities the chance to maintain biodiversity while increasing their socioeconomic status and support economic development (Campos-Silva *et* al., 2018; Galvin *et al*., 2018). Some community-based conservation programmes have had positive outcomes when it comes to decreasing the loss of biodiversity. For example, the western Brazilian Amazon community-based conservation programme targeted the conservation of the Giant South American Turtle, Six-tubercled River Turtle and the Yellow-spotted River Turtle (Campos-Silva *et al*., 2018). The turtles were targeted because of the long-term declines that were caused by overexploitation (Campos-Silva *et al*., 2018). The guarding of beaches resulted in population increase of the turtles, and the sociocultural identity that comes with the turtle species (Campos- Silva *et al*., 2018). The programme ensured reproductive success of the turtles and there was an increase in nesting success as well a decrease in illegal activity from poachers (Campos-Silva *et al*., 2018). There was also an increase in abundance of other vertebrates and invertebrates in the area (Campos-Silva *et al*., 2018).

Generally, community-based conservation programmes allow for conservation of biodiversity by communities that live directly with nature. In Africa, cases of community-based conservation programmes were reviewed in 12 countries (Galvin *et al*., 2018). Ecological outcomes were positive, showing a stabilization of species numbers. Social outcomes were mostly positive, but with some negative outcomes related to unequal distribution of benefits and reduced social capital (Galvin *et al*., 2018). Many of the motivations for community-based conservation programmes are now found in biodiversity stewardship initiatives (Cockburn *et al*., 2019; Rawat, 2017).

Citizen science

Citizen science is a movement that allows the public to participate in scientific research through monitoring, make scientific discoveries and do experiments across different disciplines (Theobald *et al*., 2015). Citizen science has been recommended as a means for scientists to address data limitations and thereby better inform conservation actions (Burgess *et al*., 2016). This means that citizen science can be of use for getting data needed at local scales that scientists could previously not collect. Tracking biodiversity loss at all scales requires data

collection from fine scales to continental scales and this is almost an impossible task for scientists and resource managers to perform alone (Theobald *et al*., 2015). However, with citizen science this can be achieved, because citizen science has projects that gather local data that reaches all scales (Burgess *et* al., 2016; Theobald *et al*., 2015).

However, citizen science is criticised for sometimes having low quality data (Burgess *et al*., 2016). There is often an absence in standardization and verification methods which makes it hard to trust the data collected (Burgess *et al*., 2016). Despite criticism, it has been recognized that non-professionals can produce high quality data as NGOs have proven to produce reliable data (Burgess *et al*., 2016). An example of a citizen project that produced reliable data is eBird. This project tracks bird distribution, abundance and habitat use (eBird, 2020). It has over 100 million bird sightings and is one of the largest biodiversity related projects in the world (eBird, 2020). Citizen science projects are continuously growing as the involvement of the public is seen as a precursor to support and action of biodiversity and its loss. The main outcome for people involved in citizen science projects was knowledge gain, changes in attitudes and actions as well as new skills (Peter *et al*., 2019). The solutions to biodiversity loss include the knowledge from citizens as the key component to effective biodiversity loss combat.

Multifunctional landscapes

Multifunctional landscapes are characterized by diversified land use and complex landscape structures to cover many, often competing interests of different stakeholder groups (Rallings *et al*., 2019). It assumes that the more diversified goods lead to economic, environmental and social benefits while sustaining natural resources for future generations (Rallings *et al*., 2019). Agroforestry is an example of multifunctional land use that includes integration of forestry production systems and agriculture on the same piece of land (Mukul and Saha, 2017). It has also been promoted for the conservation of biodiversity with the support for rural livelihoods (Mukul and Saha, 2017). Multifunctional agroforestry was found suitable for the conservation of biodiversity in and around the Lawachara forest of Bangaladesh with a higher diversity in betel leaf afroforestry (Mukul and Saha, 2017). The smallholder landowners of the area retain native forest trees to support them for the betel leaf vine (Mukul and Saha, 2017).

Land sharing and land sparing

Similar to multifunctional land use, land sharing and land sparing are two approaches that are being used to connect urban development with conservation of biodiversity (Ibanez-Alamo *et al*., 2020; Loss and Wehrden, 2018). Land sharing consists of areas with low-density built areas

interspersed with green spaces such as small parks and gardens but lacking large forest areas (Jokimaki *et al*., 2020). Land sparing consists of areas with high-density areas with large-sized continuous green areas set-aside (Jokimaki *et al*., 2020). In European countries, Jokimaki *et al*. (2020) found that land that is shared partly helps to support animals and that the abundance of birds in the places that practiced land sharing was high. Similarly with land sparing areas, land sparing benefitted urban biodiversity but more than land sharing among different taxa including plants, birds and ground nesters (Jokimaki *et al*., 2020). In contrast, the land sharing model found higher species richness in bird assemblages in Granada in South Spain (Ibanez-Alamo *et al*., 2020). Similar results were seen in Tokyo with butterflies and in Cambridge (UK) trees (Ibanez-Alamo *et al*., 2020). This suggests that land sharing and land sparing methods help to conserve biodiversity.

1.4.Local knowledge and attitudes about biodiversity and biodiversity loss

1.4.1. Knowledge about biodiversity and biodiversity loss

Toni and Lucaroni (2017) stated that recent studies found that biodiversity conservation is more successful when it is grounded in local support. Support for conservation of biodiversity partially depends on peoples' knowledge of biodiversity, their attitudes and awareness of the species that are present and that are threatened (Lindemann-Matthis and Bose, 2008). However, some studies have shown that the public generally has limited knowledge about the concept of biodiversity and have poor biodiversity identification skills (Lindemann-Matthis, 2008; Kaltenborn *et al*., 2016). For example, in Switzerland, people between the ages of eight and 18 were questioned about species in their environment, only five to six plant and animal species were mentioned and unspecified taxonomic groups such as birds, grasses and trees were mentioned (Lindemann-Matthis, 2008). Residents in the suburb of a regional city in south-eastern Australia had low levels of biodiversity knowledge (Black *et al*., 2017). In Utah (USA) most of the residents were uncertain about what the term biodiversity meant (Shah and Parsons, 2018).

Although the people of Utah were uncertain about what the term biodiversity meant, they knew it related to ecological issues to some extent (Shah and Parsons, 2018). In contrast, Hooykaas *et al*. (2019) revealed that the lay people in a Dutch community had intermediate knowledge about the species in their environment, with mammals receiving a higher score than other taxa. French citizens gave different definitions of flora and fauna species as well as local diversity (Leve *et al*., 2019). This shows that people have different definitions of biodiversity and what

it means to them and that such knowledge and definitions may not be the same as that of the scientific community. Moreover, different knowledge and definitions of biodiversity are influenced by peoples' attitudes and behaviours (Prevot *et al*., 2018), and exposure to and experiences of biodiversity.

1.4.2. Factors affecting levels of knowledge and attitudes

Attitudes are formed by an individuals' and communities' experiences and perceptions of things (Vodouhe *et al*., 2010). Attitudes can be regarded as a variable that affects behaviour and motivation (Vodouhe *et al*., 2010). There are various factors that influence people's level of knowledge and attitudes towards biodiversity and its loss (Nisiforou and Charalambides, 2012). These can be individual (age, gender, education, income, upbringing, etc.), contextual (urban or rural setting, access to green spaces, biodiversity region, etc.) or experiential (contact with and experience of nature and particular species).

Gkargkavouzi *et al*. (2019) investigated the attitudes towards marine biodiversity in a Greek coastal port city and showed that women have more positive attitudes and concern over biodiversity than men. Haensch *et al*. (2020) also found that women had more positive attitudes towards marine parks than men. In contrast, Nisiforou and Charalambides (2012) revealed that men showed higher levels of knowledge of biodiversity than women in Cyprus. Black *et al*. (2017) found that there is no difference between the two.

With respect to age and knowledge of biodiversity, the results are equivicle. Haensch *et al*. (2020) found that in South Australia people that were older than 35 years were more likely to have positive attitudes towards biodiversity than younger age groups. Hooykaas *et al*. (2019) found that in Netherlands, knowledge about species increased with age. However, Prevot *et al*. (2018) found in Paris (France) that knowledge about biodiversity decreased with the age of the respondents. Despite this finding, the study did declare that there is a possibility that their sampling method could have favoured students in ecology and conservation. Results from Lindemann-Matthies and Bose (2008) also showed that in Zurich (Switzerland) with the increase in age, the probability decreased that a respondent knew what biodiversity is. Gkargavouzi *et al*. (2019) and Black *et al*. (2017) found that knowledge and attitudes towards biodiversity was not corelated to age of the respondents.

Education is a core element that influences attitudes. Haensch *et al*. (2020) found that there is a link between higher education and higher environmental awareness and engagement. Abass *et al*. (2019) found that a respondent's formal education had a highly positive influence in their

perceived benefits and knowledge about biodiversity in Ghana. Similarly, Vodouhe *et al*. (2010) found that people who had higher levels of education tended to support biodiversity conservation measures that the park management imposed. More so, people who did not favour biodiversity conservation in the park, had lower levels of formal education (Vodouhe *et al*., 2010). However, Gkargkavouzi *et al*. (2019) found no correlation between level of education and knowledge and attitudes towards biodiversity in Greece.

Connectiveness to nature and therefore attitudes towards nature is higher for people who grow up in rural contexts than people who grow up in urban ones (Prevot *et al*., 2018). This is because people who live in the urban areas have less exposure to green spaces and nature and children in the urban areas have limited opportunities to go outside to play. Colleony *et al*. (2019) described this as the extinction of experience of nature. This means that people are losing their experiences of nature, resulting in them not caring about what is happening to biodiversity as they do not have any connectiveness to nature (Colleony *et al*., 2019). People who are in rural areas live directly with nature and this may influence their knowledge and attitudes towards biodiversity. The Dutch residents living in a village on the boarder of Drents Friese National Park felt closely connected and had positive attitudes towards the conservation of biodiversity (Buijs *et al*., 2008). One respondent went further to say that "I think we can't live without nature" (Buijis *et al*., 2008:73). However, results from Vodouhe *et al*. (2010) provided contrasting results as the people of Fulani did not have positive attitudes about a national park in their area. This is because they were banned from grazing in the park, which inhibited their traditional pastoralist livelihoods. Similarly, people who are connected to nature through direct use are likely to have more positive attitudes and more knowledge than people who do not. For example, the coastal residents felt more attached to the marine environment than those that lived inland because of the cultural use of the marine environment (Gkargkavouzi *et al*., 2019).

Attitudes and knowledge about biodiversity and its loss are also influenced by context. Coldwell and Evans (2017) contrasted the effects of visiting countryside and greenspaces on biodiversity knowledge and conservation support across England. Knowledge about biodiversity was highly associated with countryside visits and not urban greenspaces. The people who had more contact with the natural landscapes in their region in Canada showed more affection for natural landscapes than those who did not (Nisiforou and Charalambides, 2012). More so, biodiversity knowledge was not associated with urbanization and city size had no influence as well (Coldwell and Evans, 2017). This means that people who lived in urban areas are likely to have lower levels of biodiversity knowledge. People from urban areas that

did not visit coastal areas or engage in coastal activities showed less positive attitudes to marine conservation than people who did (Gkargkavouzi *et al*., 2019).

Some urban areas have greenspaces for people to visit and experience nature. People go to greenspaces for different reasons, walking their pets, entertainment, relaxation and religious reasons. Abass *et al*. (2019) found that 59 % of respondents in Ghana stated that they visit greenspaces. However, Abass *et al*. (2019) and Colleony *et al*. (2019) found that visiting outdoor places frequently does not mean that people know about biodiversity and have high positive attitudes about it and its loss. This means that when people go to greenspaces, it does not mean while they are there they are actively interacting with nature. People in urban areas that are members of projects that include biodiversity tend to have positive attitudes and knowledge about biodiversity. For example, Prevot *et al*. (2018) and Buijs *et al*. (2008) found that people involved in citizen science projects had significantly positive attitudes towards biodiversity than people who did not.

1.5.Think globally, act locally

There is growing concern that people know and are more concerned about global biodiversity loss than what is happening locally. Knowledge about biodiversity can also be influenced by media (Hunter and Brehm, 2003; Hooykaas *et al*., 2019). Arguably, people are influenced by media depicting threats to rare and endangered, charismatic species instead of those at the local level (Hunter and Brehm, 2003; Hooykaas *et al*., 2019). This means that people may rely on what the media tells them about biodiversity rather than personal experience and knowledge. In a more nuanced analysis, Di Minin *et al*. (2013) showed that preference for charismatic megafauna in parks was higher amongst wealthy and less experienced visitors than more experienced or less wealthy ones. The general public tends to know more about the charismatic megafauna (for instance tigers, polar bears and elephants), exotic (such as feral pig) and domesticated species (goat, cat, dogs, etc.) than local fauna and flora (Hooykaas *et al*., 2019; Hunter and Brehm, 2003; Shah and Parson, 2018).

Belaire *et al*. (2015) investigated urban residents' perceptions of birds in their immediate neighbourhood in Cook Country (USA), and showed that people did not know about bird diversity in their neighbourhood, and generally underestimated it (Belaire *et al*., 2015). Similarly, Nisiforou and Charalambides (2012) found that students in Cyprus had more knowledge about global biodiversity loss than knowledge about local biodiversity loss. Hunter and Brehm (2003) found that more than half of the respondents in Utah considered biodiversity

loss as a global issue rather than a local one. Further, they believed loss happened in exotic ecological systems and to exotic species (Hunter and Brehm 2003). Those that regarded biodiversity loss to be a local issue, described it to happen to game populations. This means that people that do consider biodiversity loss as a local issue, they still focus on charismatic fauna. Nevertheless, the notion that people know and are more concerned about global biodiversity loss rather than local, has not been deeply studied, especially in developing countries.

1.6.Problem statement

There is a growing interest in the knowledge that people have about biodiversity and environmental issues. It is argued that developing more detailed understanding of the publics' environmental knowledge and perspectives will allow for better identification of effective means of environmental communication, education and conservation (Hunter and Rinner, 2004). More so, it has been said that the support that people have for conservation will depend on their knowledge about biodiversity (Lindemann-Matthies and Bose, 2008).

However, most studies about biodiversity knowledge are from developed countries (Gkargkavouzi *et al*, 2019; Hooykaas *et al*., 2019; Lindemann-Matthis, 2008; Shah and Parsons, 2018; Toni and Lucaoni, 2017). A few studies have been done in developing countries, such as Argentina (Nates *et al*., 2010). Knowledge of biodiversity and what kind of knowledge that people have of it, has not been deeply studied in developing countries and countries with high biodiversity such as South Africa.

1.7.Aims and objectives

This study sought to understand the knowledge and concern (if any) people have of biodiversity at global and local scales. Therefore, the objectives of the study were to:

1. Determine how familiar people are with the term biodiversity and what they understand by it.
2. Contrast the knowledge that people have of global and local species.
3. Understand what the public considers as forces leading to biodiversity decline and what agency they have to influence it.
4. Determine the level of concern, if any, about biodiversity loss.
5. Investigate if knowledge about biodiversity and its loss is influenced by demographic profile.

1.8.Structure of this thesis

This thesis is divided into five chapters. The present chapter outlines the rates of biodiversity loss along with the drivers and solutions to biodiversity loss. It further reviews literature on local knowledge and attitudes about biodiversity and its loss as well as literature about peoples' knowledge about local and global biodiversity loss.

Chapter 2 provides the description of the study area as well as the methodology and how data was collected to address the objectives.

Chapter 3 addresses the first, second, third and fifth objectives of the research. It presents the results as well discusses the results relating to the knowledge that people have about biodiversity loss and knowledge of this loss at local and global scales.

Chapter 4 addresses the fourth objective of the research through presenting the results and discussion relating to the participants' concern about biodiversity loss.

Chapter 5 brings together the results chapters with its key findings, recommendations, limitations of the study and conclusions.

Each of the research chapters (3 and 4) have their own introduction, results, discussion and a conclusion. In order to avoid repetition, the methods will not be included in chapters 3 and 4 as they are included in chapter 2. All of the references are provided at the end of the thesis.

CHAPTER 2: Study sites and research methods

In this chapter the study sites and research methodology that were used to execute the research are described. Data collection took place during December and January 2020 in the Eastern Cape and KwaZulu-Natal in South Africa. The chapter is divided into four sections namely study sites, research design, ethical considerations and data analysis.

2.1. General background and geographical settings

This study was conducted in the Maputaland-Pondoland Albany Hotspot (MPA) located along the east coast of Southern Africa (Figure 1). The hotspot extends to the southern parts of Mozambique and Mpumalanga in the north, through ESwatini and Kwazulu-Natal to the Eastern Cape province in the south (Steenkamp *et al*., 2004). The hotspot covers 274 316 km^2 (Steenkamp *et al*., 2004; Swanepoel, 2016). The MPA is named after its three centres of endemism, namely i) Maputaland, found in the north of the hotspot and extends from South Africa into Mozambique and ESwatini (Swanepoel, 2016). ii) Pondoland, this area is made up of the southern parts of Kwazulu-Natal and into the Eastern Cape province (Swanepoel, 2016; Steenkamp *et al*., 2004). iii) Albany is the third centre of endemism located in the Eastern Cape. The MPA is densely populated with over 20 million people and is characterized by rural villages and informal townships and urban development, particularly along the coastline (Steenkamp *et al*., 2004).

The growing human population of the MPA has caused large shifts in land cover from native vegetation to urban areas and agriculture (Baily *et al*., 2016). The MPA is an important region of ecotourism and is home to half of Eswatini's and Mozambique's population (Baily *et al*., 2016).The study was conducted in two of the provinces of South Africa, namely the Eastern Cape (EC) and KwaZulu-Natal (KZN). The Kwazulu-Natal province has a total area of 92 000 km^2 that is part of the MPA and it forms the central component of the hotspot (Di Minin *et al*., 2013). The population size of KZN in 2011 was 10.3 million while the population size of the Eastern Cape was 6.6 million (City population, 2011). These two provinces remain the poorest provinces in South Africa with a poverty percentage of 67.3 % for Eastern Cape and 60.7 % for KZN (Statistics South Africa, 2011). Females are in the majority in both provinces (Statistics South Africa, 2011).

2.2. Climate, vegetation and biodiversity

The MPA is one of the 35 hotspots in the world and one of three in Southern Africa. The MPA is the second richest floristic region in Africa after the Cape floristic region (Steenkamp *et al*., 2004). It has eight of South Africa's biomes and has 27 of the 68 vegetation types that occur in South Africa, Swaziland and Lesotho (Steenkamp *et al*., 2004). It is also home to 8 100 plant species from 243 families and has up to 1 900 endemic species (Perera *et al*., 2011). The MPA is an important centre of endemism with 87 endemic reptile and amphibian species, 33 % of southern Africa's restricted range of bird species and 11 endangered mammals (Bailey *et al*., 2016). Of the 73 indigenous species of freshwater fishes, 20 are endemic to the MPA (Steenkamp *et al*., 2004). The seascape and marine areas of the hotspot are equally diverse as the terrestrial habitats of the MPA (Swanepoel, 2016).

The topography of the MPA ranges from "ancient sand dunes and low-lying plains in the north to a series of rugged terraces deeply incised by the river valleys in the central and southern parts" (Di Minin *et al*., 2013:3). The climate of the area ranges from "subtropical/tropical in the low-lying northern areas, to more temperate with frost in winter on higher ground away from the coast" (Di Minin *et al*., 2013:3; Steenkamp *et al*., 2004:220). The MPA is the amalgamation of three centres of endemism and includes eight of the biomes of South Africa (Table 2.1). The annual rainfall in the Maputaland area varies from 400 mm to more than 1 200 mm which is received in summer (Wyk and Smith, 2001). The Pondoland area receives summer rainfall of approximately 1 000 mm, but with some areas exceeding 1 200 mm (Wyk and Smith, 2001). In contrast, the Albany area receives a bimodal rainfall pattern where maximum rainfall is received in spring and autumn (Wyk and Smith, 2001). Here the mean annual rainfall decreases from the coastal area to inland from 800 mm to 250 mm (Wyk and Smith, 2001).

Table 2.1: Summary of vegetation and rainfall of the Maputaland-Pondoland-Albany Hotspot (source: Wyk and Smith, 2001; Swanepoel, 2016)

Region	**Main vegetation types**
Maputaland	grassland, savanna, estuaries, threatened dune forests, thicket, and swamp vegetation
Pondoland	grassland, forest patches and estuaries
Albany	subtropical thicket, forest, savanna, Nama-karoo, fynbos and grassland

2.3. Study towns

In order to span the MPA, data collection was conducted in three areas; one in the south (Port Elizabeth), the middle (East London) and the north east (Margate) (Figure 1). Two of the towns are located in the Eastern Cape where the dominant language is IsiXhosa, followed by Afrikaans. Margate is located in KZN where the dominant language is IsiZulu. The population growth is relatively low for Port Elizabeth although it has the largest population compared to Margate and East London (Table 2.2).

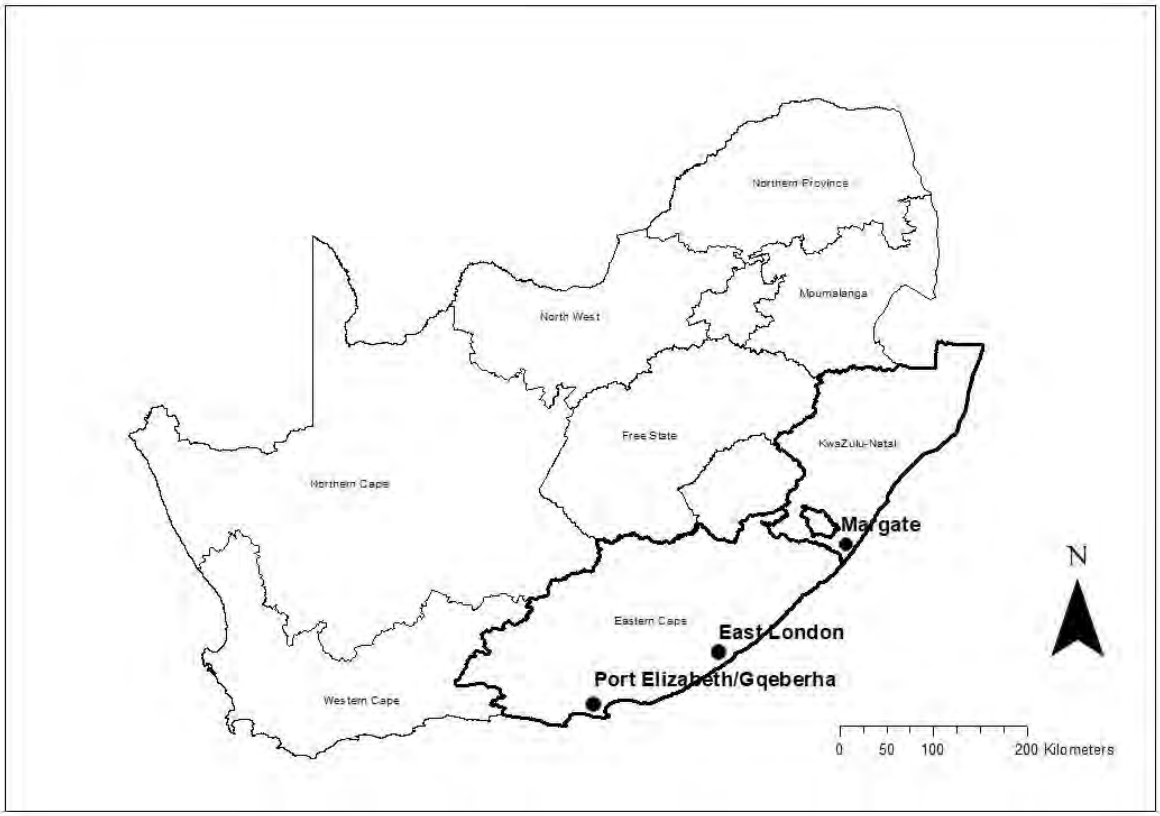


Figure 1: The location of the study towns within the Eastern Cape and KwaZulu-Natal provinces of South Africa

Table 2.2: Characteristics of study towns (source: City Populations 2011)

Town	**Size (km^2)**	**Dominant languages**	**Local municipality**	**Population size 2011**	**Population growth since 2001**
Margate	29.2	IsiZulu, IsiXhosa, English	Ray Nkonyeni	26 786	4.8%
East London /KuGompo	172	IsiXhosa, Afrikaans, English	Buffalo City Metropolitan	295 644	2.4%
Port Elizabeth /Gqeberha	341	IsiXhosa, Afrikaans, English	Nelson Mandela Bay Metropolitan	876 436	1.2%

The climate of the three study towns is warm and temperate (Table 2.3) (Climatedata, 2020). Margate had a lower unemployment rate (30.4 %) than the other two towns (Table 2.4). Similarly, Margate had the smallest household size (2.4). East London had the highest number of people who have primary education out of the three towns while Margate had the highest number of people who have tertiary education.

Table 2.3: Summary of vegetation, mean annual rainfall and temperature (source: Climatedata, 2020; SANBI, 2020)

Town	**Biome**	**Mean annual rainfall (mm)**	**Average temperature (^oC)**
Margate	Indian Ocean Coastal Belt	907	19.7
East London /KuGompo	Indian Ocean Coastal Belt	822	18.2
Port Elizabeth /Gqeberha	Thicket, Grassland, Nama Karoo, Fynbos and Forest	561	17.4

Table 2.4: Socio-economic characteristics of study towns (Source: Cogta, 2020; Municipalities, 2020; StatsSA, 2020).

Towns	Unemployment rate (%)	Average household size	Education attainment (%)		
			No or primary schooling	Secondary	Higher
Margate	30.4	2.4	7.8	66.4	25.7
East London/ KuGompo	35.1	2.9	13.6	66.7	19.6
Port Elizabeth/ Gqeberha	37.6	2.9	10.9	67	23

2.4. Methodology

2.4.1. Research design

The primary research tool was respondent surveys. Data were collected from different areas within each town. The study was conducted in a way to include the different types of neighbourhoods in each towns (affluent, township, and central business district (CBD) areas). An image of each town on Google Earth Pro was brought up. Polygons were used to identify the three areas (affluent, township and CBD) to allow for stratified sampling. Points were dropped randomly within the polygons. The closest street to that point was then visited. Interviews were conducted at every third household in the selected street in each neighbourhood, with the first house selected randomly. If nobody was available or unwilling to participate in the study, the next available household was visited. A total of 225 face-to-face interviews were conducted with respondent age ranging from 18 to 65 years.

The questionnaire consisted of open and closed-ended questions to allow collection of a range of data. Open-ended questions were included to avoid putting ideas about a certain subject into a participants' mind and to allow them to express their views (Thondhlana and Hlatshwayo, 2018). Interviews were approximately 30 minutes long and they were conducted either in IsiXhosa or in English depending on the preference of the respondent. The researcher made it possible for the interviews to be conducted in both languages because of IsiXhosa being the home language of the researcher. The interviews were conducted solely by the researcher and all participants gave consent to be interviewed.

2.4.1.1. Questionnaire

The questionnaire (appendix 1) was designed to get five types of information: (1) definition of and familiarity with the term biodiversity; (2) knowledge of species and forces leading to biodiversity loss; (3) knowledge of biodiversity in general and its loss; (4) concern about biodiversity and its loss; and (5) respondent characteristics.

Definition and familiarity of the term

To determine whether people were familiar with the term biodiversity, respondents were asked if they had heard of the term and to provide their understanding of the term. They were further asked to pick a sentence out of four options that they considered to define biodiversity for them. Additionally, they were asked to pick a source that they heard the term from.

Knowledge of local and global species of biodiversity and forces leading to loss

To test the knowledge that respondents have about biodiversity, I asked respondents to name any species that they know of at different scales (local, national, global). Respondents were also asked questions related to endangered species. A picture with 12 animal species representing endangered species with a combination of both local and global species was presented to them. Additionally, the picture had six mega-fauna charismatic species and six non-charismatic species, each varying from endangered to critically endangered according to the Red List. Respondents were asked to identify each species. More so, respondents were asked to rate their ability to name both tree names and bird names when they travel around their immediate neighbourhood. To examine the knowledge that people have about the forces of biodiversity loss, respondents were given a list of forces to select from with an option to add more if they wished.

Knowledge of biodiversity and its loss

Looking at the knowledge that people have about biodiversity and its loss in general, respondents were asked to rate their level of knowledge around different topics of biodiversity with options ranging from ‘good’ to ‘never heard about it’. Additionally, they were asked to reply with ‘true’ or ‘false’ regarding various statements about biodiversity.

Concern about biodiversity and its loss

In this study, environmental concern is regarded as a proxy for concern about biodiversity. Environmental concern has been defined as an “attitude towards facts, one’s own behaviour, or others’ behaviour with consequences for the environment” (Fransson and Garling,

1996:372). In simpler terms, environmental concern is the feelings or attitudes that people have regarding the environment and different green issues (Zinmer *et al*., 1994). The interview had questions that asked respondents about change seen in nature, products directly consumed, conservation of biodiversity and reasons for it. It further asked them about their thoughts on the seriousness of biodiversity loss and willingness to donate to counter biodiversity loss. Finally, I asked them about the level of agreement with statements about biodiversity, and further asked them if they considered themselves part of biodiversity and if they were affected by biodiversity loss.

Respondent characteristics

Incorporated in the questionnaire, I collected personal information about the respondents to see if there were associations between knowledge of and concern about biodiversity and respondent demographic factors. The gender, age and education of the respondents were recorded. Respondents were further asked if they grew up in a rural or urban area to further investigate if knowledge and concern is influenced by childhood background.

2.4.2. Ethical considerations

The research adhered to the ethical guidelines from Rhodes University Ethics Policy and it was approved by the Ethics Committee of the university (Ref no: 2020-2765-4822). Certain actions included:

- An informed consent form was given to each respondent, which explained the aim and objectives of the study.
- Participant confidentiality and anonymity was assured.
- Respondents were guaranteed that their participation was voluntary and they could end the interview at any time if they felt uncomfortable or could choose to skip questions that were uncomfortable.
- Information provided would be handled by the researcher only and not shared with third parties.

2.4.3. Data analysis

Data were captured into an MS Excel spreadsheet and all statistical analysis were conducted using version 13 of Statistica. Descriptive statistics were used to describe and summarise quantitative data. To analyse the qualitative data, relevant responses were classified according

to themes that emerged. After classification they were categorized and nominal answers were assigned numerical scores before analysis. Chi-square tests were used to determine whether there is a relationship between two categorical variables within the sample (Franke *et al*., 2012). For example, the study tested if awareness of biodiversity was associated with gender. Possible relationships were further assessed using Principal Component Analysis (PCA). For example, relationships between willingness to donate, conservation of biodiversity, changes noticed from the environment and products consumed directly from the environment with the different respondent sociodemographic factors were assessed. T-tests and Anova were used to see how significant the differences were between demographic groups regarding the knowledge that they have about different aspects of biodiversity loss. For example, respondents were asked to state true or false for different statements around the topic of biodiversity. The respondent was given a mark out of 10 for correct answers given and t-tests were conducted between various demographic groups. Ordinal data which included rating of level of knowledge for example, agreement with statement were presented in tabular formats. Results of the study were displayed using tables, graphs and charts to reflect important trends and responses.

CHAPTER 3: Knowledge of biodiversity and its loss in the Maputaland-Pondoland-Albany hotspot, South Africa

3.1. Introduction

In the year 2002, the governments of the world adopted a global commitment to address biodiversity loss through the Convention on Biological Diversity (CBD). They made a commitment to achieve a significant reduction in the current rate of biodiversity loss by 2010 (Butchart *et al*., 2016). However, despite commitment, biodiversity is declining globally (IPBES, 2019).Human activities are causing a loss of biodiversity leading to ecosystem degradation and high rates of species extinction. Biodiversity loss affects all components of ecosystems and in return affects the benefits that humans get from them (Diaz *et al*., 2006). Humans benefit from the diversity of organisms that provide food, medicine energy, etc. and so a loss of biodiversity results in the wellbeing of humans being compromised (Diaz *et al*., 2006; Diaz et al., 2019).

The loss of biodiversity and the efforts to halt it are among the most important issues in conservation science and politics (Buijs *et al*., 2008). Many of the approaches to halt the loss of biodiversity have been focussed on the disconnection between science, decision-making and sustainable management (Carmen *et al*., 2015). Conservation approaches often lead to mismatches with the needs of the users because decision-makers and policy-makers do not include the knowledge and the needs of users and hence promoting resistance in compliance to laws or policies promoting biodiversity conservation (Carmen *et al*., 2015).

The lack of support of conservation at local scales in many areas has been linked to the lack of knowledge that the general public has about biodiversity and that the public might not have enough information to value the benefits of conservation of biodiversity (Buijs *et al*., 2008; Hunter and Brehm, 2003). In order to bring about strategies that are accepted by the general public, a new approach includes bringing together the different knowledge types, including the knowledge of the public, policy-makers and researchers to come up with an inclusive approach to limit biodiversity loss (Carmen *et al*., 2015). Lindemann-Matthies and Bose (2008) argue that general support for biodiversity conservation depends on people being knowledgable about biodiversity, species roles and the seriousness of extinction. Hunter and Rinner (2004) argue that having a detailed understanding of local stakeholders' knowledge towards species conservation is necessary for conservation activists, land managers and policy-makers to devise appropriate and effective measures for biodiversity protection. Celis-Diez *et al*. (2017:9) argue

that “ecological education is essential to stem current dramatic biodiversity loss”. They further argue that biodiversity knowledge is an important driver for people to be concerned about global change and environment problems.

Public surveys about biodiversity have found varying levels of knowledge. DeChano (2006) found that respondents from Chile were less knowledgeable than those from United States, England and Switzerland. Clusa *et al*. (2018), in their study in the North Iberian rivers, found that people had knowledge about local native species and that age and gender did not play a role in the knowledge of river species. Gkargkavouzi *et al*. (2019) found that high levels of knowledge serve as a motivation for conservation activities, while a lack of knowledge leads to people overlooking conservation activities. This means that those with awareness of and knowledge about biodiversity are more likely to support conservation than those with low knowledge. As seen by these examples, studies about knowledge of biodiversity are most common in developed countries with comparatively fewer in developing countries like South Africa.

In this chapter I investigate the level and type of knowledge that people in the Maputaland-Pondoland-Albany Hotspot (South Africa) have of biodiversity. This was accomplished through answering four objectives, namely to:

1. Determine how familiar people are with the term biodiversity and what they understand by it.
2. Determine the relative levels of knowledge people have about global as opposed to local species.
3. Determine what the public consider as forces leading to biodiversity decline and what agency they have to influence them.
4. Investigate if knowledge about biodiversity and its loss is influenced by demographic profile.

3.2. Methods

The methods of data collection are provided in Chapter 2.

3.3. Results

3.3.1. Profile of respondents

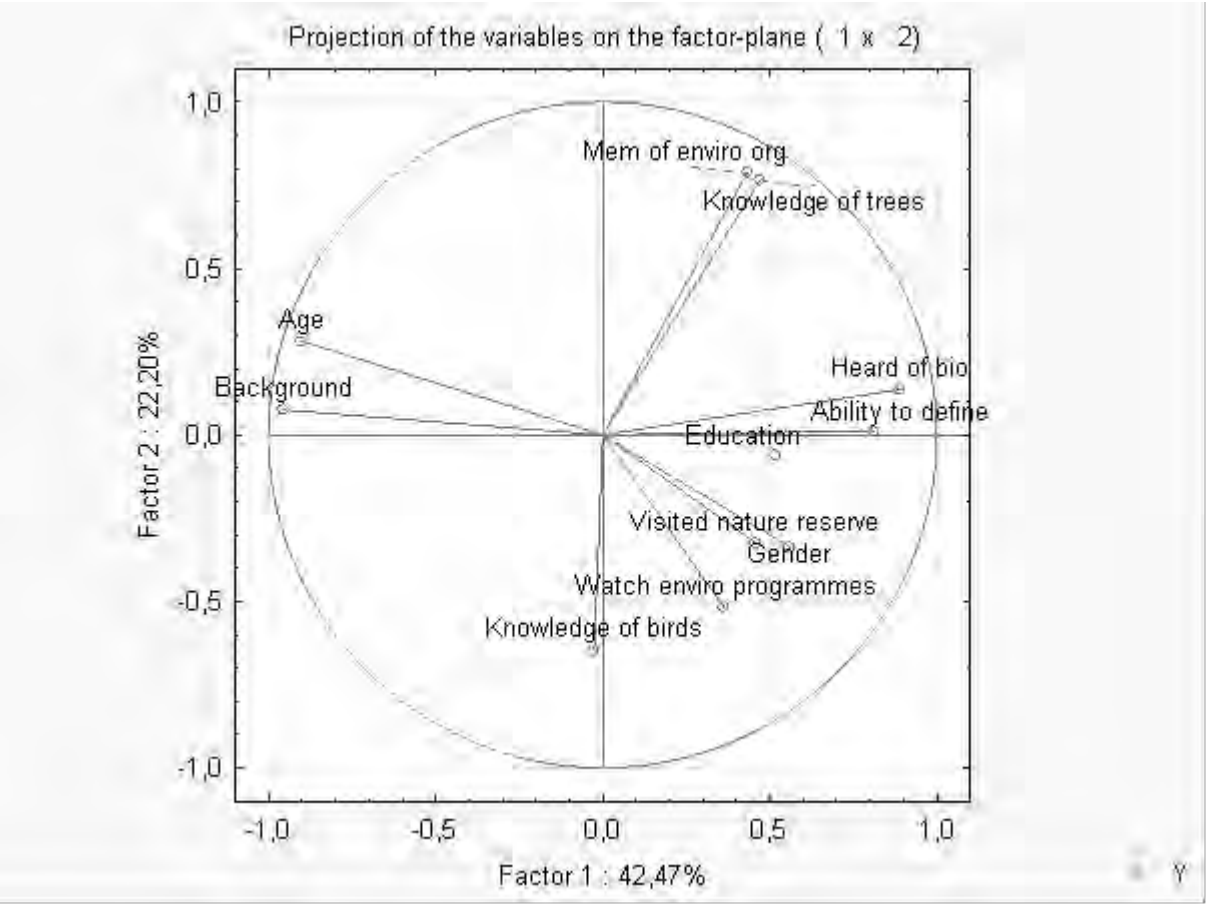
Of the 220 respondents 52 % were males. The ages of the respondents ranged between 18 to 65 years old with an average of 36.6 ± 12.31. The majority of respondents were between 25-59 years old (Table 3.1). Fifty-eight percent of respondents grew up in urban areas whilst 42 % had a rural background. More than half of the respondents (59 %) had tertiary level education, and 41 % had secondary education. Thus, the majority of the respondents were literate.

Table 3.1: Demographic profile of respondents.

Demographic variables		**Percentage**
Gender	Female	48
	Male	52
Ages (years)	Youth (18-24)	20
	Adults (25-59)	75
	Seniors (60+)	5
Background	Rural	42
	Urban	58
Education	Secondary education (Grade 8 to 12)	41
	Tertiary (Higher Certificate +)	59

3.3.2 Familiarity with the term biodiversity and sources of information

The principal component analysis (PCA) accounted for 65 % of the variance in the first two axes, indicated that there was a strong relationship between having heard of the term biodiversity and the ability to define it. Both were positively related to education level (Figure 2). However, being able to define it and heard about the term had a negative association to age and background. This means that younger people did better in defining the term and more of them have heard about it. Rural background respondents had a greater ability to define and were more likely to have heard about the term. There was no relationship to membership of an environmental organization and gender or watching environmental television programmes.



*Age- Age of the respondents (youth, adults, seniors) *Background- childhood background of the respondents (rural, urban) *Education- level of education that respondents have (secondary, tertiary) *Gender- the gender that respondents identify with (male, female)

Figure 2: Principal component analysis (PCA) showing association of biodiversity attributes and the demographic attributes

The majority of respondents (71 %) stated that they had heard of the term biodiversity, 4 % had not and 25 % were unsure. When further asked to define the term, 57 % of the respondents could define what the term meant. The respondents provided various views and had similar ideas about what the term meant. One respondent said: “Living together of different species on mother earth without harming each other” (aged 21, unemployed professional). Another defined it as: “It is where species, no matter how small, have an important role to play on earth” (aged 25, teacher). Others provided a simpler definition for the term. A respondent defined biodiversity as: “Everything on earth” (aged 29, gardener). Similarly, another defined it as: “everything on our planet” (aged 35, librian). One respondent simply defined it as: “the web of life” (aged 60, retired). The relation between heard of the term and being able to define the term was highly significant (X^2= 91.26; 0<0.05). About 55 % of the respondents were able to

define the term and have heard about it before (Table 3.2). This means that respondents that have heard of the term were more likely to be able to define biodiversity as also shown by the PCA (Figure 3). Respondents who had not heard about it were less likely to be able to define it (19 %).

Table 3.2: Percentage of respondents being able to define biodiversity

Defined	**Heard about it**	
	Yes	No
Yes	55	2
No	18	19

Irrespective of their own definitions offered, the respondents were asked to choose one of four definitions they thought best defined biodiversity (Table 3.3). The majority of respondents (51 %) chose the definition "all animals, nature and humans that live on Earth" and only 3 % choose the definition "diversity of landscapes and number of different beings in a given area". The same patterns were seen irrespective of respondent demographics. For example, 52 % of rural and 50 % of urban childhood respondents picked "all animals, nature and humans that live on Earth", (X^2= 2.7; $p>0.05$). There were significant differences (X^2= 8.8; $p<0.05$) in the definition chosen by gender, with more men (57 %) choosing the first definition than women. With respect to age, there were no significant differences between adults and seniors (X^2= 6.1; $p>0.05$) in the definition chosen, as well as between youth and seniors (X^2= 1.2; $p>0.05$). However, there were significant differences between the youth and adults (X^2= 16.0; $p<0.05$), where adults (56 %) had more respondents choosing the first definition than the youth (40 %). Considering education, there were significant differences amongst the groups (X^2= 17.9; $p<0.05$). The first definition had the majority of respondents for secondary (57 %) selective 47 % of tertiary respondents.

Table 3.3: Percentage of respondents choosing definition of biodiversity from options

Definition	**Percentage (%)**
All animals, nature and humans that live on Earth	51
Diversity of plants and animals	25
A mix of several species which manage to live together	21
Diversity of landscapes and number of different beings in a given area	3

Most respondents indicated that television (68 %) was their primary source of information about biodiversity, followed by school (10 %). Radio and academic journals were mentioned as the third source with both being mentioned by 5 % of the participants. Daily newspapers and others accounted for 3 % each. Respondents that had never heard about the term from the sources mentioned were 3 % and those that were not sure accounted for 3 % as well. Across the demographic groups, the main source of information about biodiversity was from television. Tertiary education had the highest percentage of people hearing about biodiversity from journals (7%).

3.3.3 Knowledge of species at different scales

I asked respondents to name any five animals or plants from different scales (local, national and global) (Table 3.4). There were no respondents who could not name species at national level and 55 % of respondents were able to name five species. About 32 % of the respondents could not name global species and about 23 % of respondents could name at least three species from the local level. There were significant differences (X^2= 156.9; $p<0.05$) in the ability to name species between local and national with more people being able to name more species at national level. There were also significant differences in the ability to name species between local and global (X^2= 29.0; $p<0.05$) as well as national to global (X^2= 227.3; $p<0.05$). Across demographics, the majority of respondents could name five species at national level. Slightly more women (37 %) than men (31 %) could not name species at global level. Most urban (61 %) childhood respondents could not name any species at global level, whereas most rural (25 %) childhood respondents could name at least three. The same patterns were seen when education was considered with most of the tertiary (45 %) educated respondents being able to name at least three species and most of the secondary (37 %) educated not being able to name species at global level.

Table 3.4: Number (%) of species respondents can name at different scales.

Scale	**Number of species**					
	0	**1**	**2**	**3**	**4**	**5**
Local	20	16	11	23	22	8
National	-	-	1	11	33	55
Global	32	11	10	22	9	15

South Africa has designated five species as national emblems (tree, flower, fish, bird, animal) and respondents were asked if they could name them (Figure 3). Overall, the majority of respondents could not name the national biodiversity symbols. The most known were the national flower and animal (28 % each). Only 15 % could name the national tree, yet only 2 % of the respondents could not mention any.

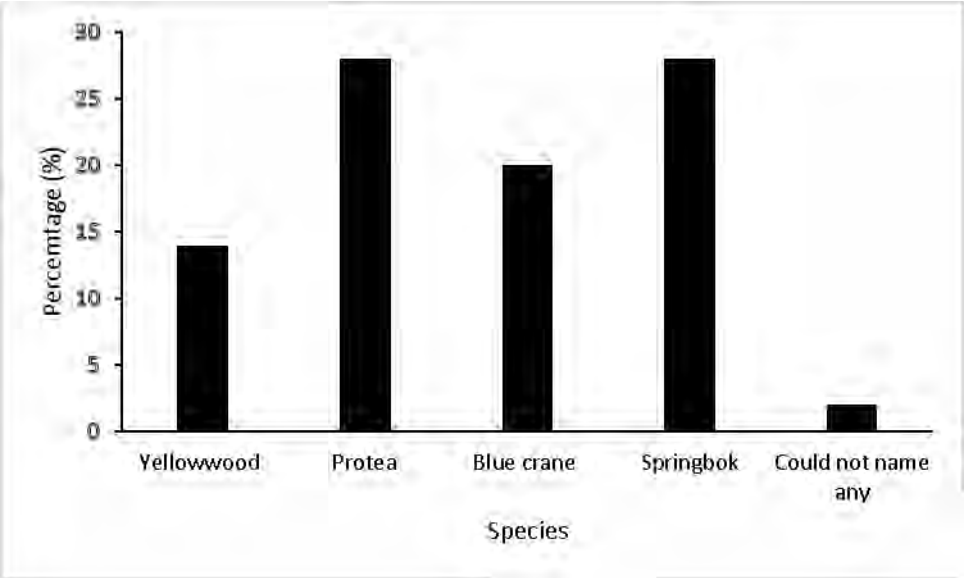


Figure 3: Proportion of respondents who could name each of the national biodiversity emblems of South Africa

Identifying species that are endangered based on imagery showed that respondents could identify species and thus are knowledgeable (Table 3.5). All of the respondents were able to identify a rhino (100 %), whilst a tiger was identified correctly by 97 % of the respondents and a polar bear by 88 %. Out of all the respondents, 99 % correctly identified a lion. The rest of the species in the imagery were identified by some respondents but rarely correctly. For example, a cape parrot was identified as a bird (94 %). A majority of the respondents were able to identify these species: stitchbird (70 %), yellow-breasted pipet (68 %), green sea turtle (88 %), Table Mountain ghost frog (90 %), helmethead gecko (82 %). More respondents were able to name charismatic species from national level (white rhino and lion) than at global level (polar bear, tiger, African elephant).

Table 3.5: Percentage of respondents correctly identifying species from presented images

Scale	Endangered species	Correctly ID the species (%)	ID the species (%)	Could not (%)
Global	African elephant	99	-	1
National	White rhino	100	-	-
Global	Tiger	97	-	3
Global	Polar bear	88	-	12
Global	Green sea turtle	-	88	12
National	Lion	99	-	1
Global	Stitchbird	2	70	28
National	Yellow-breasted pipet	2	68	30
National	Table Mountain ghost frog	-	90	10
Global	Helmethead gecko	-	82	18
National	Riverine rabbit	1	95	4
National	Cape parrot	-	94	6

Respondents were asked to rate the percentage of bird and tree names they know when travelling in their immediate neighbourhood (Table 3.6). Generally, the respondents had low tree (40 %) and bird (39 %) name knowledge. Only 3 % of respondents rated their knowledge of trees as high and 1 % for bird. Irrespective of respondent demographics, the majority of all the demographic groups showed low levels of knowledge of local tree and bird names. However, men had significantly (X^2= 11.8; $p<0.05$) more respondents with moderate knowledge of trees and birds then women. Amongst education, secondary educated respondents had mostly moderate knowledge of tree (X^2=11.0; $p<0.05$) and bird names (X^2=13.2; $p<0.05$) than tertiary educated respondents. Considering childhood background, rural had considerably more respondents with moderate knowledge than urban upbringing. Age seemed to play a role in knowledge of tree names as senior respondents had significantly higher knowledge of tree names than adults (X^2= 10.2; $p<0.05$) and the youth (X^2= 45.2; $p<0.05$). However, there were no significant differences in the knowledge of bird names between adults and seniors (X^2= 9.2; $p>0.05$). There were significant differences in the knowledge of bird names between the youth and adults (X^2= 17.5; $p<0.05$) with the youth knowing more names than adults. Similarly with seniors, there were significant differences (X^2= 41.9; $P<0.05$)

between them and the youth with knowledge of birds with seniors having more moderate knowledge of birds than the youth.

Table 3.6: Respondent's choosing the percentage of tree and bird species they know when travelling around their neighbourhood

Category	**Trees**	**Birds**	**Trees**									**Birds**								
			Gender		**Childhood**		**Age**			**Education**		**Gender**		**Childhood**		**Age**			**Education**	
Percentage			**F**	**M**	**R**	**U**	**Y**	**A**	**S**	**T**	**Sec**	**F**	**M**	**R**	**U**	**Y**	**A**	**S**	**T**	**Sec**
0- <1 %	38	39	42	35	28	45	50	36	27	38	38	45	37	29	47	48	38	27	38	40
5-10 %	40	39	43	37	43	39	41	40	36	46	33	42	33	38	37	45	37	36	46	31
11-50 %	17	2	10	24	24	12	2	21	27	16	24	12	27	31	14	7	23	36	16	26
>50 %	3	1	3	4	3	3	5	2	9	1	4	-	2	1	1	-	1	-	-	2
Unsure	2	1	2	1	1	2	2	1	-	-	1	1	1	1	1	-	1	-	-	-
Chi-square results			X^2=11.78; p<0.05		X^2=19.33; p<0.05		Y vs A (X^2= 28.15; p<0.05) Y vs S (X^2= 45.21 p<0.05) A vs S (X^2= 10.22; p<0.05)			X^2=11.03; p<0.05		X^2=14.51; p<0.05		X^2=27.56; p<0.05		Y vs A (X^2= 17.49; p<0.05) Y vs S (X^2= 41.94 p<0.05) A vs S (X^2= 9.20; p>0.05)			X^2=13.20; p<0.05	

*F- Females *M- Males *R- Rural *U- Urban *Y- Youth *A- Adults *S- Seniors *T- Tertiary *Sec- Secondary

As presented in Table 3.7, participants were asked to freely name any endangered species at different scales. The majority of respondents could not name any endangered species at local level (84 %) or at global (61 %). In contrast, the majority of respondents could mention endangered species that are from South Africa (56 %). More females could name more endangered species at all levels than men. Similarly, more youth could name endangered species than the other age groups. Those with tertiary education were more likely to be able to mention endangered species at all levels than secondary educated respondents.

The conservation status of the species listed as endangered by the respondents was checked against the IUCN Red List of Threatened Species. Of the species mentioned by respondents, more than half of the species were truly endangered. Eighty-five percent of the listed species at local level were truly endangered, 84 % for those listed nationally were endangered and 86 % species listed for global level were truly endangered according to the IUCN Red List of Threatened Species.

Table 3.7: Percentage of respondents who are able to freely name any endangered species within different scales

	Percentage of could list	**Gender**		**Childhood**		**Age**			**Education**	
		F	**M**	**R**	**U**	**Y**	**A**	**S**	**T**	**Sec**
Local	16	20	11	20	13	26	13	-	18	13
National	56	62	53	59	58	74	52	55	65	52
Global	38	42	36	41	41	56	35	27	46	30

*F- Females *M- Males *R- Rural *U- Urban *Y- Youth *A- Adults

*S- Seniors *T- Tertiary *Sec- Secondary

From the species named in Table 3.5, the responses were further grouped into two categories to show if respondents favoured charismatic species over non-charismatic species (Table 3.8). Of all the scales, non-charismatic species were mentioned the most at local level (96 %). Only 4 % of respondents mentioned charismatic species within their answers at local level. Corresponding values for charismatic species were 52 % at national level and 59 % at global level. Considering patterns with age, the youth named more charismatic species than adults but seniors even more. Similarly for education, more tertiary educated participants named more charismatic species than secondary educated. Women named more charismatic species than men.

Table 3.8: Respondents who named charismatic species from different scales

	Percentage of charismatic species	Gender		Childhood		Age			Education	
		F	M	R	U	Y	A	S	T	Sec
Local	4	5	2	2	4	6	5	-	7	3
National	52	58	49	47	48	45	14	47	60	47
Global	59	68	52	48	48	48	35	70	55	51

*F- Females *M- Males *R- Rural *U- Urban *Y- Youth *A- Adults

*S- Seniors *T- Tertiary *Sec- Secondary

Figure 4 show the drivers of biodiversity loss at various scales. About 28 % of the respondents agreed that pollution is one of the forces that lead to biodiversity loss at the local level. Twenty-eight percent of respondents felt that pollution was still the most significant force at national level. Climate change both at local (24 %) and at national level (23 %) was the second highest force that people chose after pollution, followed by habitat loss and invasive species. Climate change was regarded as the leading driver of biodiversity loss at global level (25 %), followed by pollution (22 %). In contrast to the local and national level, where habitat loss was the third listed driver, at global level, invasive species was the third (15 %). Most of the tertiary educated respondents chose pollution as the most significant driver. Climate change was the main driver mentioned by the youth at all levels. For demographic groups gender, childhood background, secondary education, adults and seniors, they all choose pollution at as the main source at local and national level and picked climate change as the main source at global level.

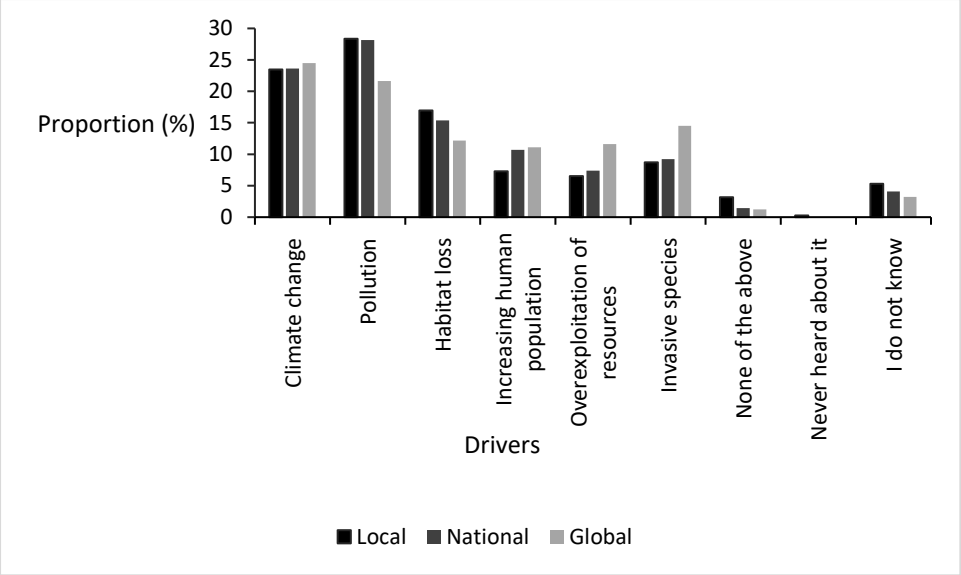


Figure 4: Respondent identification of major drivers of biodiversity loss at different scales

3.3.4 Knowledge about biodiversity

Table 3.9 summarises respondents' self-rating level of knowledge on a variety of different topics related to biodiversity and biodiversity loss. Respondents rated their knowledge of pollution to be "fairly good" (45 %). Knowledge about the topic conservation of natural areas (34 %), climate change (38 %), biodiversity loss (46 %) and ecosystem services (38 %) were also rated "fairly good". The two topics where respondents felt that their knowledge was "little or no knowledge" were about invasive species and the red list. Irrespective of respondent demographics, all groups had little or no knowledge of alien invasives and the red list and had moderate knowledge for all other topics. This actively illustrates that people have little or no knowledge about these two topics.

Table 3.9: Percentage of respondents rating the level of knowledge of a variety of topics of biodiversity

Topic	Good	Fairly good	Fairly poor	Little or no knowledge
Ecosystem services	23	38	23	16
Invasive species	3	8	35	54
Climate change	27	38	26	9
Pollution	33	45	14	8
Red List	1	5	19	75
Conservation of natural areas	9	34	32	25
Biodiversity loss	19	46	22	13

Tables 3.10 to 3.13 summarizes the percentage of respondents rating the level of knowledge of a variety of topics of biodiversity by the different demographic groups. There were no significant differences in the knowledge that women and men have about the different topics of biodiversity as they all showed moderate knowledge (Table 3.10). However, for climate change (X^2= 11.6; p<0.05), pollution (X^2= 8.4; p<0.05) and conservation of natural areas (X^2= 11.4; p<0.05) women claimed to have more knowledge than men. With respect to childhood background, there were no significant differences in the knowledge that these two groups said they have except for knowledge for invasive species (X^2= 10.1; p<0.05), pollution (X^2= 10.9; p<0.05) and conservation of natural areas (X^2= 12.7; p<0.05). Those with a rural background had more knowledge of the topics mentioned than urban respondents (Table 3.11).

More respondents with tertiary education rated their knowledge as moderate than secondary, except for the topic of biodiversity loss (X^2= 5.8; p:>0.05) and ecosystem services (X^2= 2.7; p>0.05) where there were no significant differences (Table 3.12). There were no significant differences in the level of knowledge that adults and seniors had for biodiversity loss, red list and ecosystem services, however they showed significant differences for the others (Table 3.13). The adults claimed to have significantly (X^2= 32.8; p:<0.05) more knowledge of invasive species than seniors (Table 3.14). The same was seen for climate change, (X^2=9.7; p<0.05). Seniors had significantly more knowledge of pollution (X^2= 64.4; p:<0.05) and conservation of natural areas (X^2= 53.7; p:<0.05) than adults. More youth rated their knowledge level as moderate for the various topics than adults, except for pollution (X^2= 6.9; p:>0.05) and invasive species (X^2= 5.7; p:>0.05) where they showed no significant differences. More youth had high knowledge of invasive species (X^2= 16.1; p:<0.05) and conservation of natural areas (X^2= 10.1;

p:<0.05) than seniors. Seniors, on the other hand, had significantly more knowledge of pollution (X^2= 134.5; p:<0.05), climate change (X^2= 18.6; p:<0.05) and biodiversity loss (X^2= 7.9; p:<0.05) than the youth. In other topics, the two groups had no significant differences in their levels of knowledge.

Table 3.10: Percentage of respondents rating the level of knowledge of a variety of topics of biodiversity according to gender

Topic	Male				Female				Chi-square results
	Good	Fairly good	Fairly poor	Little or no knowledge	Good	Fairly good	Fairly poor	Little or no knowledge	
Ecosystem services	25	36	20	18	21	43	22	14	X^2=4.09; p>0.05
Invasive species	2	7	33	58	5	10	35	50	X^2=3.93; p>0.05
Climate change	28	33	27	11	27	46	23	5	X^2= 11.6; p<0.05
Pollution	33	46	11	9	33	46	25	7	X^2= 8.4; p<0.05
Red List	2	4	20	74	1	7	19	14	X^2= 2.33; p>0.05
Conservation of natural areas	9	30	31	31	10	38	34	18	X^2= 11.43; p<0.05
Biodiversity loss	16	48	24	12	23	45	20	12	X^2= 3.13; p>0.05

Table 3.11: Percentage of respondents rating the level of knowledge of a variety of topics of biodiversity according to childhood background

Topic	Rural				Urban				Chi-square results
	Good	Fairly good	Fairly poor	Little or no knowledge	Good	Fairly good	Fairly poor	Little or no knowledge	
Ecosystem services	24	37	23	15	21	39	20	19	X^2= 1.82; p>0.05
Invasive species	5	11	27	57	2	7	38	54	X^2= 10.13; p<0.05
Climate change	26	35	28	10	27	41	24	8	X^2= 2.08; p>0.05
Pollution	43	44	4	8	32	43	13	11	X^2= 10.85; p<0.05
Red List	3	6	14	76	-	5	21	73	X^2= 2.65; p>0.05
Conservation of natural areas	6	40	28	25	13	26	35	25	X^2= 12.70; p<0.05
Biodiversity loss	17	54	16	13	20	41	24	14	X^2= 7.31; p>0.05

Table 3.12: Percentage of respondents rating the level of knowledge of a variety of topics of biodiversity according to education

Topic	Tertiary				Secondary				Chi-square results
	Good	Fairly good	Fairly poor	Little or no knowledge	Good	Fairly good	Fairly poor	Little or no knowledge	
Ecosystem services	22	37	29	13	24	33	25	18	X^2= 2.68; p>0.05
Invasive species	7	14	39	40	-	4	25	75	X^2= 47.06; p<0.05
Climate change	30	46	20	4	21	32	44	13	X^2= 79.30; p<0.05
Pollution	36	50	10	4	30	44	15	11	X^2= 8.13; p<0.05
Red List	2	9	25	64	1	-	11	89	X^2= 25.84; p<0.05
Conservation of natural areas	12	37	37	14	10	25	31	35	X^2= 19.2; p<0.05
Biodiversity loss	21	46	23	10	15	50	19	16	X^2= 5.81; p>0.05

Table 3.13: Percentage of respondents rating their level of knowledge of a variety of topics of biodiversity according to age

Topic	**Youth**				**Adults**				**Seniors**			
	G	**FG**	**FP**	**L or N**	**G**	**FG**	**FP**	**L or N**	**G**	**FG**	**FP**	**L or N**
Ecosystem services	21	42	30	9	23	37	21	19	27	36	36	-
Chi-square result	Y vs A: X^2 =9.20; p<0.05				Y vs S: X^2 = 3.33; p>0.05				A vs S: X^2 = 6.87; p>0.05			
Invasive species	5	12	37	49	3	9	30	59	-	-	64	36
Chi-square result	Y vs A: X^2 =5.66; p>0.05				Y vs S: X^2 = 16.08; p<0.05				A vs S: X^2 = 32.75; p<0.05			
Climate change	40	35	23	4	22	41	27	10	27	36	18	18
Chi-square result	Y vs A: X^2 =19.79; p<0.05				Y vs S: X^2 = 18.56; p<0.05				A vs S: X^2 = 9.67; p<0.05			
Pollution	42	44	12	4	31	47	13	9	9	73	18	-
Chi-square result	Y vs A: X^2 =6.94; p>0.05				Y vs S: X^2 = 134.5; p<0.05				A vs S: X^2 = 64.42; p<0.05			
Red List	2	9	21	70	1	2	20	77	-	-	18	82
Chi-square result	Y vs A: X^2 =26.18; p<0.05				Y vs S: X^2 = 2.25; p>0.05				A vs S: X^2 = 0.52; p>0.05			
Conservation of natural areas	16	42	33	11	8	29	33	30	9	36	45	9
Chi-square result	Y vs A: X^2 =25.86; p<0.05				Y vs S: X^2 = 10.08; p<0.05				A vs S: X^2 = 53.67;p<0.05			
Biodiversity loss	26	49	14	14	17	45	23	15	18	64	18	-
Chi-square result	Y vs A: X^2 =8.70; p<0.05				Y vs S: X^2 = 7.96; p<0.05				A vs S: X^2 = 7.08; p>0.05			

*G- Good *FG- Fairly Good *FP- Fairly Poor *L or N- Little or no knowledge *Y- Youth *A-Adults

*S- Seniors

Participants were asked to answer true or false for statements around the topic biodiversity (Table 3.14). Generally, respondents showed moderate levels of knowledge as they scored an average of 6.0±2.54 (out of 10).

Table 3.14: Respondents reply true or false to statements about biodiversity

Statement	True	False	Unsure	Correct answer
1. The fynbos region of the western cape is one of the most florally biodiverse in the world.	67	5	28	True
2. Polar bears are more endangered than African wild dogs.	60	16	24	False
3.By world standards, SA does not have much biodiversity.	16	69	15	False
4.There is not anything I can do to slow down or prevent biodiversity loss.	16	69	15	False
5. The karoo is one of the most biodiverse arid regions of the world.	42	31	27	True
6. The coastal region of KZN is a known hotspot of biodiversity.	49	19	32	True
7. Approximately 30% of all commercial medicines are developed from wild species.	81	5	14	True
8. There are less than 300 bird species in South Africa.	22	62	16	False
9. Biodiversity provides us with food and energy.	84	3	13	True
10. People who say that pollution is harming our marine species are lying.	19	68	13	False

Tables 3.15 to 3.18 show the respondents replies to the true or false statements about biodiversity according to their demographics. Respondents across the different demographics acknowledged that there is something that they can do to slow down or prevent biodiversity loss. Additionally, they recognized that it is biodiversity that provides them with food and energy and that 30 % of commercial medicines are developed from wild species. Of the respondents who provided a definite answer, most showed moderate knowledge of biodiversity. Females scored 6.6 ± 2.21 which was not significantly higher ($t= 0.96$; $p>0.05$) than the mean score of male respondents (5.5 ± 2.74). Rural childhood had a mean score of 6.1 ± 2.85 which was not significantly lower ($t= -0.09$; $p>0.05$) than urban childhood who scored 6.2 ± 2.08. Tertiary educated respondents had a mean score of 6.0 ± 2.45, which is not significantly lower ($t= -0.32$; $p>0.05$) than secondary educated respondents that had scored 7.1 ± 1.62. The youth scored a mean of 7.1± 1.63 which was significantly higher ($F= 3.4$; $p<0.05$) than adults who scored 5.85 ± 2.56 and seniors who had a score of 5.81 ± 2.56.

Table 3.15: Percentage respondents reply to true or false statements about biodiversity according to gender

Statement	Male			Female			Correct answer
	True	False	Unsure	True	False	Unsure	
1. The fynbos region of the western cape is one of the most florally biodiverse in the world.	58	4	38	75	6	19	True
2. Polar bears are more endangered than African wild dogs.	56	12	32	65	19	16	False
3.By world standards, SA does not have much biodiversity.	16	64	20	15	75	10	False
4.There is not anything I can do to slow down or prevent biodiversity loss.	18	61	21	14	76	9	False
5. The karoo is one of the most biodiverse arid regions of the world.	39	24	38	44	77	16	True
6. The coastal region of KZN is a known hotspot of biodiversity.	40	19	40	51	17	31	True
7. Approximately 30% of all commercial medicines are developed from wild species.	75	5	20	85	4	11	True
8. There are less than 300 bird species in South Africa.	24	56	20	20	70	10	False
9. Biodiversity provides us with food and energy.	80	4	17	90	1	10	True
10. People who say that pollution is harming our marine species are lying.	18	65	17	21	71	8	False

Table 3.16: Percentage respondents reply to true or false statements about biodiversity according to childhood background

Statement	Rural			Urban			Correct answer
	True	False	Unsure	True	False	Unsure	
1. The fynbos region of the western cape is one of the most florally biodiverse in the world.	61	7	32	72	4	24	True
2. Polar bears are more endangered than African wild dogs.	58	13	29	62	19	19	False
3.By world standards, SA does not have much biodiversity.	19	61	20	14	76	9	False
4.There is not anything I can do to slow down or prevent biodiversity loss.	13	66	21	20	71	9	False
5. The karoo is one of the most biodiverse arid regions of the world.	36	29	35	47	31	21	True
6. The coastal region of KZN is a known hotspot of biodiversity.	46	17	37	46	19	35	True
7. Approximately 30% of all commercial medicines are developed from wild species.	80	3	17	83	7	9	True
8. There are less than 300 bird species in South Africa.	21	58	21	22	68	10	False
9. Biodiversity provides us with food and energy.	84	0	16	87	4	9	True
10. People who say that pollution is harming our marine species are lying.	18	63	19	20	75	6	False

Table 3.17: Percentage respondents reply to true or false statements about biodiversity according to education

Statement	Tertiary			Secondary			Correct answer
	True	False	Unsure	True	False	Unsure	
1. The fynbos region of the western cape is one of the most florally biodiverse in the world.	75	6	19	60	5	36	True
2. Polar bears are more endangered than African wild dogs.	65	20	16	54	15	31	False
3.By world standards, SA does not have much biodiversity.	18	74	8	17	64	19	False
4.There is not anything I can do to slow down or prevent biodiversity loss.	14	78	8	24	58	18	False
5. The karoo is one of the most biodiverse arid regions of the world.	49	31	20	33	33	33	True
6. The coastal region of KZN is a known hotspot of biodiversity.	50	23	27	45	13	42	True
7. Approximately 30% of all commercial medicines are developed from wild species.	86	6	8	82	5	13	True
8. There are less than 300 bird species in South Africa.	25	65	11	21	64	14	False
9. Biodiversity provides us with food and energy.	89	6	6	85	-	15	True
10. People who say that pollution is harming our marine species are lying.	20	72	7	19	68	13	False

Table 3.18: Percentage respondents reply to true or false statements about biodiversity according to age

Statement	Youth			Adults			Seniors			Correct answer
	True	False	Unsure	True	False	Unsure	True	False	Unsure	
1. The fynbos region of the western cape is one of the most florally biodiverse in the world.	86	5	9	62	6	32	64	-	36	True
2. Polar bears are more endangered than African wild dogs.	67	23	9	59	15	26	36	18	45	False
3.By world standards, SA does not have much biodiversity.	12	86	2	21	62	17	18	64	18	False
4.There is not anything I can do to slow down or prevent biodiversity loss.	12	86	2	20	63	17	-	82	18	False
5. The karoo is one of the most biodiverse arid regions of the world.	44	40	16	43	28	29	18	36	45	True
6. The coastal region of KZN is a known hotspot of biodiversity.	58	12	30	47	18	36	18	36	45	True
7. Approximately 30% of all commercial medicines are developed from wild species.	86	9	5	81	4	15	91	-	9	True
8. There are less than 300 bird species in South Africa.	21	70	9	22	61	17	18	73	9	False
9. Biodiversity provides us with food and energy.	86	5	9	84	2	13	82	9	9	True
10. People who say that pollution is harming our marine species are lying.	16	81	2	20	67	13	18	64	18	False

3.4. Discussion

3.4.1. Ability to define

The study aimed to know the level of knowledge people have of biodiversity. It asked people what they understood biodiversity as and tested their sources of knowledge as well as their knowledge about the different components of biodiversity loss such as asking them about endangered species. The majority of respondents had heard about the term biodiversity and the majority of them could define what the term meant (55 %). Similarly, Leve *et al*. (2019) found that 96 % of the respondents in France could define the term biodiversity. Parallel to the findings of Fischer *et al*. (2007) and Buijs *et al*. (2008), respondents have a working knowledge about biodiversity regardless of their knowledge about scientific definitions and practical terminology. More so, Bakhtiari *et al*. (2014) found that the majority (80 %) of the people in Scania (Sweden) had heard about the term biodiversity and were able to define it. This is contradictory to Hunter and Brehm (2003) who found that people in Utah (USA) could not provide a clear definition of what biodiversity is. When asked to choose the definition that best described the term, most of the respondents choose the definition "all animals, nature and humans that live on Earth". Respondents chose a definition that was simplistic and most inclusive of all dimensions of biodiversity.

3.4.2. Source of information

Most of the respondents indicated television to be their primary source of information regarding biodiversity. These findings are in line with Erika *et al*. (2021) who found that television and media influenced the knowledge that was gathered about biodiversity in Brazil. This contradicts the findings of Lindemann-Matthies and Bose (2008), who found the people in Switzerland indicated that their main source of knowledge was daily newspapers. With this study, daily newspapers were the least chosen source of information. This indicates that people are moving away from reading newspapers but instead are focusing on digital platforms people as discussed by McLenan and Shackleton (2019). This means that in order to raise awareness of biodiversity loss or to put in new conservation policies, policy makers and researchers need to use television and other digital platforms rather than newspapers to get the targeted. Similar to Lindemann-Matthies and Bose (2008), the sources of information were not differentiated by gender. More so, sources were not influenced by childhood background or education. Contrary to Lindemann-Matthies and Bose (2008) the sources of information were not influenced by age in this study. However, as expected, the people who chose academic journals to be one of their

sources of information were tertiary educated people. This may be because people at college and university level use journals as a significant source of learning about various topics.

3.4.3. Species literacy

This study recognizes that biodiversity is present at ecosystem, species and genetic scales, however this study focuses on species diversity primarily. I concentrated on the knowledge that people have with regard to species and their loss. This study found that the respondents of this study had moderate levels of species literacy. More than half of the species were identified within a general group but not by their correct name. Most of the species were recognised and identified by respondents by their common species name. For example, a Cape parrot was mostly identified as a bird as respondents were not sure of the species name. This is similar to the findings of Nates *et al*. (2010), who found that in Argentina, species were named at species level. More so, this study found that the species that were most identified the were mammals. This is in line with the findings of Hooykaas *et al*. (2019) who found that Dutch residents had higher levels of knowledge and identification of mammals compared to other groups. This information will be useful in creating awareness of species as government and other relevant stakeholders will be able to raise awareness about mammals that are threatened to catch their interest and to raise awareness about other species groups who are threatened other than mammals.

When it came to naming animals and plants from different scales, all of the respondents could name plants or animals from South Africa, and most could not name any species outside of South Africa and those that could, the highest number was three species. This contradicts with the findings of Nates *et al*. (2010) that people know about local species more because this study found that people know about national species more. Another factor that could be a reason that people know more about national animals and plants is because 52 % of the respondents in this study had visited a game reserve within the last five years and they would have received information about the different animals and plants by the park rangers. These results show that game reserves could possibly be in partnership with the government to raise awareness of biodiversity which can reach a wide range of locals that visit these game reserves.

3.4.4. Local vs global charismatic and non-charismatic species knowledge

When respondents named animals and plants, the majority of them named charismatic species the most at national and at global level. This is in line with Hooykaas *et al*. (2019) and Shah and Parsons (2018) who found that people tend to know more about charismatic species of

biodiversity. However, when respondents were asked to name specific species group in their area, respondents showed low levels of knowledge. Respondents were asked to name tree and bird names in their own area of living. Most respondents had low levels of knowledge for both tree names and bird names. These findings support Blaire *et al*. (2015) who found that respondents in Cook Country (USA), do not know about bird biodiversity in their neighbourhood. And also Black *et al*. (2017), who noted that there was a lack of knowledge amongst residents in Australia to correctly identify the different native birds in their neighbourhood. The results of this study imply that people may know some species in general but when it comes to specific groups such as bird and tree species, their knowledge is low, which could mean that even at local level, people may be knowledgeable about mammals compared to birds or trees. This further helps government and other stakeholders to know the focus areas for creating biodiversity awareness.

Furtherly these results show that knowledge of species diversity at local and global level is low but higher at national level. These results are important for strategies to combat biodiversity loss because now policymakers and managers are able to come up with strategies that will be suited for the different stages seeing where knowledge needs to be raised and what people know of. There was a significant association between childhood background and knowledge of tree and bird names, with rural backgrounded respondents knowing more bird and tree names than urban backgrounded respondents. This parallels Pitman *et al*. (2016) who found that in rural and small town residents were more eco-literate than those who stay in big towns. This means that those who have a rural background grew up being taught in the rural areas about the natural environment. This is in contradiction to Hooykaas *et al*. (2019) who found that in Puerto Rico, people living in rural areas were less knowledgeable about birds than people who live in urban areas.

Knowledge of tree and bird names were high for seniors. These findings suggests that with age, knowledge increases as in line with Hooykaas *et al*. (2019) who suggested the same. As well as Tikka *et al*. (2000) who suggested that seniors in Finland were more knowledgeable about the environment. Women know more tree and bird names then men. These findings are different to studies by Mkonyi *et al*. (2017) and Tikka *et al*. (2000), where they found that men had more knowledge of species than women. However, this could be because men are more interested in hunting than women and hence would be able to name wildlife species more, as also found by Hunter and Rinner (2004). Additionally, more females were knowledgeable because of education as more females (56 %) had tertiary education than males (44 %).

Respondent education showed a significant association with bird names and tree names. Tertiary educated respondents had more knowledge of tree names and bird names. These findings are also in line with Randler (2010) and Abass *et al*. (2019) who suggested that those that are more educated are more knowledgeable about species especially when in urban settings.

3.4.5. Knowledge on endangered species

Human influence on the environment has led to a loss of biodiversity with high rates of species extinction, and many more species are threatened. The IUCN Red List of Threatened species has been keeping a record of threatened species, with the aim of making people aware of species that are threatened with extinction. Despite these efforts and more, this study revealed that most people do not know about endangered species, with the majority unable to name any endangered species at both local and global species. This is in line with Hunter and Brehm (2003) who found that people had low levels of knowledge about endangered species in Utah (USA). Erika *et al*. (2021) also found that people were unable to name endangered species in Brazil. This could mean that people do not relate biodiversity loss to specific species or it may be that people do not know about the IUCN Red List of Threatened species and what it is intended to do as 75% of the respondents had little or no knowledge about it.

3.4.6. Drivers of biodiversity loss

Respondents were aware of the drivers of biodiversity loss. Pollution was regarded as the leading driver at local and at national levels, and climate change was stated to be the leading driver at global level. This is in line with Shah and Parsons (2019) who found that respondents regarded pollution to be the biggest threat to biodiversity, followed by climate change. Hunter and Brehm (2003) found that respondents feel that the reason for biodiversity loss is human activities. This study also found similar results that pollution is regarded as a human activity that is the number one drive leading to biodiversity loss. The reason for people to choose pollution at local and national level as the leading driver could be because people do not relate to climate change as they do to pollution because they see pollution happening around their areas. This means that policy makers and researchers can use this knowledge to make people aware of the way different forces interact leading to loss. Policy makers can also use this knowledge to come up with strategies to combat biodiversity loss by using the drivers they consider as leading forces and integrating them in different projects in order for them to relate to what needs to be done.

3.4.7. Knowledge of biodiversity

Overall, respondents had moderate knowledge of biodiversity topics other than Red List and invasive species. These results are contrary to Boaitey *et al*. (2018) who found that in Canada, the public had low levels of knowledge. Frick *et al*. (2004) saw the same results, where respondents in Germany showed low levels of knowledge of biodiversity. However, these findings are in line with Kaltenborn *et al*. (2016) who found that people in Norway had fairly good knowledge about ecosystem services, environmental toxins, conservation of natural areas, loss of biological diversity and climate change, but had poor knowledge of Red List species. Understanding the knowledge that people have about different topics of biodiversity is important when implementing management strategies and policies. This will help also in awareness programmes of different environmental issues such as invasive alien species as it is one of the topics that respondents have little or no knowledge about as found in this study.

There were significant differences in the knowledge of some topics with gender with women having more knowledge than men. This again could be a result of having more females with tertiary education than men. This means that they have more awareness of the topics from their education background. These results do not correspond with findings by Chan *et al*. (2014) who found men more knowledgeable than women. Education played a role in the knowledge of the different topics of biodiversity. Tertiary educated respondents knew more. These results are not surprising because as one's education increases, their exposure to different topics increases through their studying. These findings parallel those of Abass *et al*. (2019) who found that respondents with higher education were more knowledgeable. The youth significantly more knowledge of most topics such as climate change, ecosystem services, biodiversity loss and conservation of natural areas than seniors and adults. This is contradictory to Tikka *et al*. (2000), who regards the youth to not be actively aware of environmental facts than the adults or seniors. The reason for the youth to know more could be because, majority of the youth has just come out of university or high school and have been taught about this from school. This means that for awareness strategies, the targeted age to increase awareness the most is adults and seniors. However, awareness projects are needed for the youth when it comes to invasive species and Red List species.

Regarding the knowledge generally about biodiversity, the majority of respondents scored an average of 6.0, indicating a moderate level of knowledge. This is similar to Paco and Lavrador (2017) who found that most of their respondents had high knowledge. Fiebelkorn and Menzel (2012) found that the people of Cosa Rica and Germany showed low levels of knowledge of

biodiversity which is contradictory to the findings of this study. The reason for the moderate levels of knowledge seen in this study could be because the majority (53 %) of the respondents have tertiary education and therefore that impacts the nature of these results to show more knowledgeable respondents than other studies who in their studies do not have a sample size leaning towards educated respondents.

There were no significant differences between age and education. This is in line with O'Bryhim and Parsons (2015), where they found that education and age had no effect on knowledge. Childhood background did not have an effect on knowledge. This contradictory to Prevot *et al*. (2018) who found that with increasing urbanisation, the level of knowledge is higher. The reason for this could be because both respondents live in the urban areas and hence past residency does not impact the knowledge that they have as they might have gained new knowledge because of where they stay currently. Similarly with gender, there were no significant differences. These findings are not in line with Nyhus *et al*. (2003) who found that men had higher scores than women. The reason for this could be when it comes to the general ideas of biodiversity, people are knowledgeable but taking it further deeply and asking them specific components of biodiversity, things change and differences between respondent's profile show.

3.5. Conclusion

Because biodiversity is crucial to human wellbeing it is important that policy and decision-makers across all spheres of human activity take it into their deliberations and planning. So too must the general public with respect to their attitudes towards biodiversity and the actions and decisions they take when going about their daily lives. However, there is a well-known relationship between what people value and their knowledge about that item. Thus, the more knowledgeable people are about biodiversity and the effects of its loss, the more likely they are to value it and thereby engage in positive activities related to biodiversity conservation.

However, biodiversity is a massive concept, ranging from genes to populations to species and ecosystems. Just at the species level alone, there are over 8 million species globally, of which only a quarter have been described, which illustrates the enormity of the potential knowledge domain. This means that any assessment of biodiversity knowledge must be selective and must deal with knowledge dimensions appropriate to the target audience.

This study examined levels of knowledge about species biodiversity amongst urban residents in a biodiversity hotspot. A key positive finding was that most people had heard of the term

and had a reasonable ability to define it. In other words, they know what it is. Additionally, there seemed to be reasonable appreciation of the drivers of biodiversity loss, and broad topics related to biodiversity generally, other than the conservation red list and invasive alien species. Respondents also scored reasonably well (an average of six out of ten) in relation to correctly answering general true or false statements about biodiversity. However, their knowledge of local species diversity was generally low, as indicated by the small number of local species they could name, and their very low self-rating of being able to name birds and trees in their own neighbourhood. Additionally, only a minority could name each of the national biodiversity symbols. Being able to list species and correctly identify those in a prepared list was higher for charismatic megafauna at national or even global scales. As such, highly endangered but small South African fauna were little known. Viewed all together the results indicate that respondents were familiar with the term and had a reasonable general knowledge of biodiversity issues and threats. But they had only limited knowledge of species in their immediate environment. This is likely to be at least partially explained by two aspects. The first is that the sample was of urban residents and it included respondents from poor urban neighbourhoods where there is very little urban green space and opportunity to experience or self-learn about biodiversity (Venter *et al*., 2019). The second is that, for the majority of respondents, television is the primary source of information about biodiversity, which has a bias towards charismatic and nationally or globally endangered species, particularly mammals (Torres-Merchan *et al*., 2018). A key finding was were the most respondents obtained the bulk of their information about biodiversity from television. This then explains, why, on average, respondents were better able to identify charismatic megafauna than endangered South African species.

As to be expected, the levels of knowledge and knowledge of what, is not uniform across any sample. My results generally corroborated much previous literature that more educated people have greater knowledge of environmental issues and biodiversity than those with less education. The results also showed that for some measures, those with a rural childhood had more knowledge than those with an urban childhood, although for other measures there was no difference. The findings with respect to gender were equivocal and varied quite markedly across the different measures used. They are also likely to intersect with education.

In conclusion, there was a general familiarity with the term biodiversity, what it means and threats to biodiversity. This provides a useful background for initiatives and campaigns to raise awareness and knowledge about more specific aspects of biodiversity and in particular local biodiversity and threats to local species and populations. More generally, it suggests the need

for initiatives in schools or via NGOs to promote knowledge of and engagement with local biodiversity to avoid the “extinction of experience” phenomenon. This requires greater urban greening in the poorer neighbourhoods of South African towns and cities.

CHAPTER 4: Concern about biodiversity and its loss in the MPA hotspot, South Africa

4.1. Introduction

According to Arsal and Atalar (2016), in Turkey, there has been a considerable increase in concern about environmental degradation over the last two decades. The concept of environmental concern is one that is not new. In the 1970s research into environmental concern became popular because of the substantial increase in lay person concern for the environment and its protection that peaked around Earth Day in 1970 (Wall, 1995). The general assumption that this research had was that the level of environmental concern "has a direct strong impact on people's behaviour in specific environmentally related domains like recycling, energy saving, buying environmentally friendly products or travel mode choice" and that this concern could be fundamental in solving environmenal issues (Bamberg, 2003:21; Samdahl and Robertson, 1989).

Environmental concern can be regarded as the degree to which a person is concerned about the dangers to the earth, and the consequences of such dangers for nature and future human generations (Arsal and Atalar, 2016). Stern and Dietz (1994) state that environmental concern is a result of a person's values and beliefs about the effects of environmental changes for valued objects. The values that are related to environmental concern are classified as egoistic, bio-spherical and social-altruistic values. Egoistic environmental concern is the belief that people are concerned about the environment if it affects them personally (Stern and Dietz, 1994). This means that concern is for self-interest. Bio-spherical concern is when people value or are concerned about the environment for its own sake (Stern and Dietz, 1994). Social-altruistic concern, on the other hand, is concern that people have when they believe that their actions can cause dire consequences to others and that they can prevent it (Stern and Dietz, 1994). For example, that a degraded environment may pose a threat to other people's health or well-being (Fransson and Garling, 1999).

Most researchers now view environmental concern as a general attitude. Chan *et al*. (2014) defined environmental concern as the general attitude that is associated with a person's behavioural intention. This echos Zimmer *et al*.'s (1994) definition that environmental concern is feelings about numerous different green issues. Prokop *et al*. (2015:222) describe environmental concern as "the tendency to think, feel, or act positively or negatively towards objects in our environment". Salvaggio *et al*. (2014) found that concern about the environment

tends to go together with having positive attitudes toward the protection of the environment and pro-environmental behaviours. This means that those who have positive environmental attitudes tend to have concern for it.

Studies found that education and age have a high correlation with levels of environmental concern (Abdul-Wahab and Abdo, 2010). Those who are younger and have better education were more likely to be concerned about the environment (Abdul-Wahab and Abdo, 2010). This is contradictory to Casey and Scott (2006) who found that in Australia those who were better educated, females and older people exhibited higher levels of concern.

Despite efforts to understand environmental concern, Udalov and Welfens (2021) conclude that there is still not much knowledge about the environmental concern that people have. Consequently, this study aimed to investigate if South African residents have concern about biodiversity and its loss. In this chapter, I investigate whether the urban people of the Maputaland-Pondoland-Albany hotspot are concerned about biodiversity and its loss. This was done by addressing three objectives, namely to:

1. Determine the level of concern, if any, about biodiversity and its loss
2. Investigate if concern about biodiversity and its loss is influenced by the respondent profile
3. Determine if concern is greatest about global or local scale environment phenomena

4.2. Methods

The details of data collection are provided in Chapter 2.

4.3. Results

The study used level of agreement and disagreement with statements to measure attitudes towards biodiversity and hence concern (Table 4.1 to 4.5). People generally agree that loss of biodiversity is important and government must do more to inform people about it. It was expressed that biodiversity loss will impact them personally. Furtherly, biodiversity loss was seen as greatest at global scale.

The same patterns can be seen in the demographics with all groups showing positive attitudes and hence are showing concern. Males are less concerned about biodiversity loss than females and its impact on them (Table 4.2). There were no differences between respondents who had urban and rural background (Table 4.3). Considering education, tertiary educated respondents

showed more concern over biodiversity than secondary educated respondents (Table 4.4). With age, seniors were more concerned than adults and the youth, on the other hand, adults were more concerned than the youth (Table 4.5).

Table 4.1: Percentage of respondents' level of agreement with statements about biodiversity loss

Statement	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	**Not sure**
1.Loss of biodiversity does not impact me.	31	37	15	8	1	8
2.Loss of biodiversity is only of scientific interest and does not mean anything to the average person.	30	39	20	2	1	8
3. Biodiversity loss is a natural process.	12	23	24	33	1	7
4. We cannot afford to lose our local biodiversity.	3	1	18	60	11	7
5. We cannot afford to lose our global biodiversity.	3	1	25	51	14	6
6. The government needs to inform people more on environmental issues.	2	1	5	57	29	6
7. Biodiversity loss does not happen much in my area.	4	22	50	14	2	8
8. Biodiversity loss does not happen much in South Africa.	10	40	35	6	1	8
9. Biodiversity loss happens a lot in the world.	3	2	16	54	16	9

Table 4.2: Percentage of respondents' level of agreement with statements about biodiversity loss according to gender

Statement	Male						Female						Chi-square result
	SD	D	N	A	SA	NS	SD	D	N	A	SA	NS	
1.Loss of biodiversity does not impact me.	25	40	14	12	-	9	36	35	16	5	2	6	X^2 =17.6; p<0.05
2.Loss of biodiversity is only of scientific interest and does not mean anything to the average person.	20	43	24	3	1	9	38	36	17	1	1	7	X^2 =17.3; p<0.05
3. Biodiversity loss is a natural process.	9	23	26	32	1	9	12	24	22	36	1	5	X^2 =5,1; p>0.05
4. We cannot afford to lose our local biodiversity.	4	2	18	61	9	6	-	1	18	61	13	7	X^2 = 2.3; p>0.05
5. We cannot afford to lose our global biodiversity.	4	2	25	54	9	6	1	1	27	47	20	5	X^2 = 17.4; p<0.05
6. The government needs to inform people more on environmental issues.	4	-	4	61	25	6	-	1	6	54	34	5	X^2 = 5.1; p>0.05
7. Biodiversity loss does not happen much in my area.	3	18	51	18	1	9	4	26	51	10	1	8	X^2 = 9.2; p>0.05
8. Biodiversity loss does not happen much in South Africa.	8	39	39	6	-	8	11	42	31	6	1	9	X^2 = 4.2; p>0.05
9. Biodiversity loss happens a lot in the world.	4	2	21	50	15	8	1	3	11	59	17	9	X^2 = 20.1; p<0.05

*SD- Strongly disagree *D- Disagree * N- Neutral *A- Agree *SA- Strongly Agree *NS- Not sure

Table 4.3: Percentage of respondents' level of agreement with statements about biodiversity loss according to childhood background

Statement	Rural						Urban						Chi-square result
	SD	D	N	A	SA	NS	SD	D	N	A	SA	NS	
1.Loss of biodiversity does not impact me.	31	41	15	7	-	6	31	35	17	9	2	6	$X^2 = 3.7$; $p>0.05$
2.Loss of biodiversity is only of scientific interest and does not mean anything to the average person.	29	41	19	-	1	10	29	39	22	2	2	6	$X^2 = 5.6$; $p>0.05$
3. Biodiversity loss is a natural process.	13	21	21	37	1	7	11	24	26	31	2	6	$X^2 = 3.5$; $p>0.05$
4. We cannot afford to lose our local biodiversity.	3	1	12	66	12	6	2	1	22	58	11	6	$X^2 = 6.2$; $p>0.05$
5. We cannot afford to lose our global biodiversity.	4	1	18	57	15	5	2	1	30	49	14	5	$X^2 = 8.1$; $p>0.05$
6. The government needs to inform people more on environmental issues.	4	-	5	55	31	5	2	2	5	59	28	5	$X^2 = 4.5$; $p>0.05$
7. Biodiversity loss does not happen much in my area.	5	22	46	16	2	9	3	23	54	13	-	6	$X^2 = 4.7$; $p>0.05$
8. Biodiversity loss does not happen much in South Africa.	11	44	33	2	1	9	9	39	38	8	1	6	$X^2 = 7.7$; $p>0.05$
9. Biodiversity loss happens a lot in the world.	4	3	13	53	18	9	2	2	19	57	15	6	$X^2 = 6.7$; $p>0.05$

*SD- Strongly disagree *D- Disagree * N- Neutral *A- Agree *SA- Strongly Agree *NS- Not sure

Table 4.4: Percentage of respondents' level of agreement with statements about biodiversity loss according to education

Statement	Tertiary						Secondary						Chi-square result
	SD	D	N	A	SA	NS	SD	D	N	A	SA	NS	
1.Loss of biodiversity does not impact me.	36	40	12	9	2	1	21	39	23	7	-	10	$X^2 = 24.6$; $p<0.05$
2.Loss of biodiversity is only of scientific interest and does not mean anything to the average person.	34	43	16	2	3	2	18	40	30	1	-	11	$X^2 = 29.3$; $p<0.05$
3. Biodiversity loss is a natural process.	15	27	26	27	3	2	6	21	23	39	-	11	$X^2 = 26.6$; $p<0.05$
4. We cannot afford to lose our local biodiversity.	4	2	11	63	18	2	2	1	26	61	2	7	$X^2 = 143.2$; $p<0.05$
5. We cannot afford to lose our global biodiversity.	4	2	20	53	19	2	2	1	31	52	6	7	$X^2 = 38.6$; $p<0.05$
6. The government needs to inform people more on environmental issues.	4	2	4	55	34	1	2	-	5	63	23	7	$X^2 = 13.6$; $p<0.05$
7. Biodiversity loss does not happen much in my area.	7	27	53	10	1	2	2	15	50	21	1	10	$X^2 = 34.4$; $p<0.05$
8. Biodiversity loss does not happen much in South Africa.	16	44	29	6	2	3	5	33	45	7	-	10	$X^2 = 38.5$; $p<0.05$
9. Biodiversity loss happens a lot in the world.	4	2	10	56	25	3	4	2	25	52	8	8	$X^2 = 48.5$; $p<0.05$

*SD- Strongly disagree *D- Disagree * N- Neutral *A- Agree *SA- Strongly Agree *NS- Not sure

Table 4.5: Percentage of respondents' level of agreement with statements about biodiversity loss according to age

Statement	Youth						Adults						Seniors					
	SD	**D**	**N**	**A**	**SA**	**NS**	**SD**	**D**	**N**	**A**	**SA**	**NS**	**SD**	**D**	**N**	**A**	**SA**	**NS**
1.Loss of biodiversity does not impact me.	37	40	9	7	-	7	28	38	19	8	1	6	27	45	-	27	-	-
Chi-square result	Yand A:X^2= 9.5; p>0.05 Yand S: X^2 =19.0; p<0.05 A and S: X^2= 72.4; p<0.05																	
2.Loss of biodiversity is only of scientific interest and does not mean anything to the average person.	37	44	14	-	-	5	25	41	22	2	2	8	27	27	36	-	-	9
Chi-square result	Y and A: X^2= 14.0; p<0.05 Y and S: X^2 =29.6; p<0.05 A and S: X^2= 17.9; p<0.05																	
3. Biodiversity loss is a natural process.	21	28	19	25	2	5	10	20	25	37	1	7	-	45	27	27	-	-
Chi-square result	Y and A: X^2= 22.2; p<0.05 Y and S: X^2 =8.9;p>0.05 A and S:X^2= 52.1; p<0.05																	
4. We cannot afford to lose our local biodiversity.	5	-	21	51	16	7	2	2	18	62	11	5	-	-	18	82	-	-
Chi-square result	Y and A: X^2= 12.0; p<0.05 Y and S: X^2 =47.2;p<0.05 A and S: X^2= 26.4; p<0.05																	
5. We cannot afford to lose our global biodiversity.	7	-	21	42	23	7	2	2	27	52	13	4	-	-	27	73	-	-
Chi-square result	Y and A: X^2= 27.6; p<0.05 Y and S: X^2 =61.1; p<0.05 A and S: X^2= 29.4; p<0.05																	
6. The government needs to inform people more on environmental issues.	7	-	-	44	44	5	2	1	7	58	27	5	-	-	-	100	-	-
Chi-square result	Y and A: X^2= 34.5; p<0.05 Y and S: X^2 =127.2; p<0.05 A and S: X^2= 72.4; p<0.05																	
7. Biodiversity loss does not happen much in my area.	7	28	47	12	2	4	4	19	53	15	1	8	-	27	45	18	-	9

Chi-square result	Y and A: X^2= 10.7; p>0.05 Y and S: X^2 =18.3;p<0.05 A and S: X^2= 10.3; p>0.05																	
8. Biodiversity loss does not happen much in South	19	37	33	5	2	4	10	39	36	6	1	8	-	45	45	-	-	9
Chi-square result	Y and A: X^2= 11.6; p<0.05 Y and S: X^2 =38.3;p<0.05 A and S: X^2= 20.2; p<0.05																	
9. Biodiversity loss happens a lot in the world.	2	-	6	66	20	6	3	3	21	50	16	7	-	-	9	73	9	9
Chi-square result	Y and A: X^2= 20.3; p<0.05 Y and S: X^2 =11.7;p<0.05 A and S:X^2= 27.0; p<0.05																	

*SD- Strongly disagree *D- Disagree * N- Neutral *A- Agree *SA- Strongly Agree *NS- Not sure *Y- Youth *A- Adults *S- Seniors

Participants were asked to rate the level of seriousness that they think loss of biodiversity is according to the different scales (Table 4.6). At local level, loss of biodiversity was regarded as “somewhat serious” with 35 % of respondents choosing it. For national level, loss of biodiversity was “serious” (44 %). Biodiversity loss at global level was rated by respondents to be “very serious” with 69 % of respondents choosing that option. Thus the seriousness with which respondents view biodiversity loss increases with scale. Combining “serious” and “very serious” indicated 53 % thought it was such at local scale, 83 % at national scale and 94 % at global scale.

Considering demographics, rural were more likely than urban to rate biodiversity loss as serious or very serious at all scales. There was not much difference between tertiary and secondary, except at local scale where tertiary (56 %) rated it as serious or very serious compared to secondary (44 %) (X^2= 24.07; $p<0.05$). Additionally, there was not much differences for gender as well, except at global scale where females (97 %) rated it as very serious or serious compared to males (90 %) (X^2 = 13.4; $p<0.05$). There was no difference by age.

Table 4.6: Percentage of how serious respondents think loss of biodiversity is according to the different scales

Scale	Level of seriousness	Percentage	Female	Male	Rural	Urban	Youth	Adults	Seniors	Tertiary	Secondary
Local	Not serious at all	8	3	10	7	10	5	11	-	4	10
	Somewhat Serious	35	38	33	26	30	37	33	46	36	44
	Serious	34	35	36	39	43	35	37	18	34	37
	Very serious	19	22	13	26	13	21	16	36	22	9
	Not sure	4	2	5	2	4	2	3	-	4	0
Chi-square result			X^2=8.10; p>0.05		X^2=15.80; p<0.05		Y and A: X^2= 5.76; p>0.05 Y and S:X^2= 28.16; p<0.05 A and S: X^2=53.87;p<0.05			X^2= 24.07; p<0.05	
National	Not serious at all	1	-	3	2	1	-	2	-	-	1
	Somewhat Serious	11	10	13	6	13	14	11	9	11	15
	Serious	44	45	43	38	51	40	47	36	45	53
	Very serious	39	41	36	51	30	44	36	55	40	29
	Not sure	5	4	5	3	5	2	4	-	4	2
Chi-square result			X^2= 4.67; p>0.05		X^2=23.58;p<0.05		Y and A: X^2= 6.63; p>0.05 Y and S: X^2=5.42; p>0.05 A and S: X^2=10.36; p<0.05			X^2= 4.03; p>0.05	
Global	Not serious at all	1	-	3	1	2	-	1	-	-	-
	Somewhat Serious	3	1	4	-	5	-	4	9	3	2
	Serious	25	21	27	21	27	24	26	18	23	32
	Very serious	69	76	63	75	65	74	68	73	72	64
	Not sure	2	2	3	3	1	2	1	-	2	2
Chi-square result			X^2= 13.4; p<0.05		X^2=12.37:p<0.05		Y and A: X^2= 6.68; p>0.05 Yand S: X^2= 11.01; p<0.05 A and S: X^2= 6.61; p>0.05			X^2=4.03; p>0.05	

As presented in Table 4.7, participants chose statements that they related to when it came to whether biodiversity will affect them personally. Forty-four percent of the respondents felt that they were already affected by biodiversity loss while 40 % said it will affect them in the future. Only 10 % said that it will not affect them but the next generation. This suggests that respondents are generally concerned that biodiversity loss is impacting them. Male, urban, the youth and secondary educated respondents had lower levels of concern as the majority of their respondents felt that loss if biodiversity does not impact them currently but will only do so in the future, whereas women, rural, adults, seniors and tertiary educated participants showed high levels of concern as they indicated that they are already affected by loss.

Table 4.7: Respondents (%) responses to statements related to whether biodiversity loss will affect them personally

Statement	**Percentage**	**Gender**		**Childhood**		**Age**			**Education**	
		F	**M**	**R**	**U**	**Y**	**A**	**S**	**T**	**Sec**
1.Yes, I am already affected	44	51	35	52	38	41	46	45	52	35
2.Yes, it will, not now, but in the future	40	38	43	35	41	42	39	36	37	42
3.No, not me but maybe the next generation	10	7	13	8	13	12	10	9	8	13
4.Not at all	5	3	7	4	6	5	5	10	2	8
5.Not sure	1	1	2	1	2	-	-	-	1	2

*F- Females *M- Males *R- Rural *U- Urban *Y- Youth

*A- Adults *S- Seniors *T- Tertiary *Sec- Secondary

When asked to choose a statement about their feeling towards nature, 75 % of the respondents chose the statement “I am part of nature”. About 17 % of the respondents chose the statement “I feel like I am part of nature when I visit natural parks or greenspaces”. Five percent of the participants felt that they are not part of nature, while only three percent were not sure. Slightly more rural (79 %) respondents felt that they were part of nature than urban (74 %). Almost all (91 %) of seniors felt that they were part of nature, 81 % of the youth, 75 % of adults felt the same sentiments. Similarly, a majority of tertiary (80 %), secondary (75 %) concurred with that. More males (79 %) than females (73 %) felt that they were part of nature. This actively illustrates that majority of respondents recognize themselves as an integral part of nature.

Respondents were asked to mention any benefits that they receive from biodiversity (Figure 5). The benefits were put into groups of ecosystem services. Provisioning services were the most mentioned benefit they get from biodiversity. It accounted for 33 % at local level, 25 % at national and 23 % at global level. However, the majority of the respondents were not sure what benefits they obtained from biodiversity. Numbers were low for cultural, supporting and regulatory services at all scales. The same patterns were found for all socio-demographic groups, with most people being unsure of what benefits they got from biodiversity.

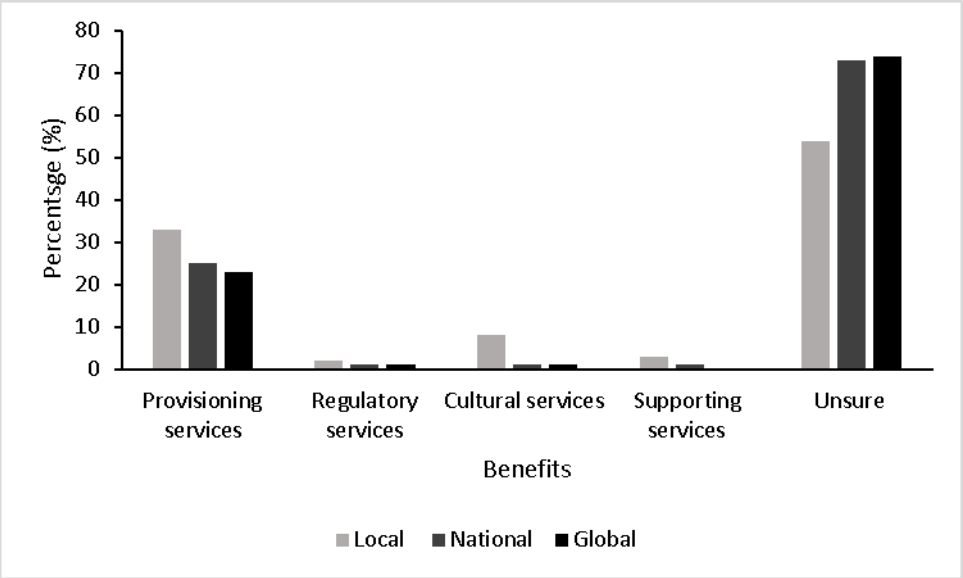


Figure 5: Benefits from biodiversity mentioned by respondents

The PCA indicates that willingness to donate to conservation of biodiversity, support for conservation of biodiversity and products consumed directly from nature are closely associated with age, but age had a negative association with changes noticed in the environment with older people noticing less change (Figure 6). Gender was positively associated with changes noticed in the environment with more women (37 %) noticing a change in nature than men (30 %). More so, gender was associated with conservation of biodiversity, again with marginally more females (95 %) agreeing to conservation than men (90 %). Education is closely related with changes noticed in the environment with tertiary (38 %) educated respondents noticing change in nature than secondary (31 %). There was little influence of childhood background with willingness to donate and other attributes. Looking at the corelation of the variables, changes to nature and willingness to donate were negatively correlated. However, there were correlations between conservation, willingness to donate and products consumed. This means that people who were pro conservation were likely to donate to conservation and consumed products such as plants and animals from nature.

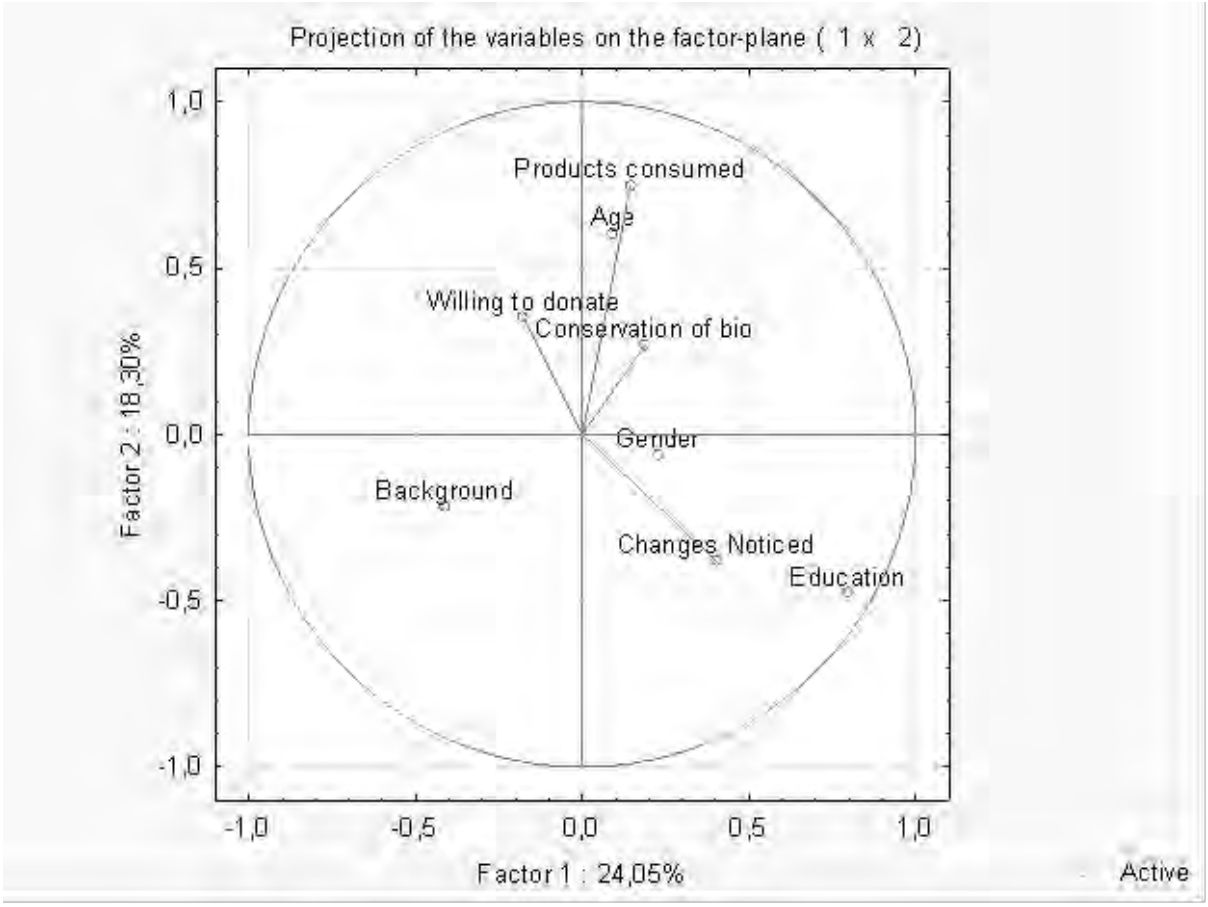


Figure 6: PCA showing the association between concern and respondent demographics

Respondents generally agreed to the need for conservation (71 %) Two percent said that biodiversity should not be conserved, and 27 % were not sure that biodiversity should be conserved. There were no significant differences in the response to conservation between age (youth and adults: X^2= 1.1; p>0.05; adults and seniors: X^2= 2.5; p>0.05; youth and seniors: X^2= 1.6; p>0.05), gender (X^2= 3.4; p>0.05), childhood background (X^2= 1.1; p>0.05) and education (X^2= 5.5; p>0.05) as the majority of all groups agreed that biodiversity should be conserved.

For those respondents that biodiversity should be conserved, they were further asked to explain why. Some of the respondents did not have a reason and for those that provided a reason, reasons for conservation of biodiversity were grouped according to use values and non-use values (Table 4.8). Reasons for conservation of biodiversity were mainly for use values (58 %) as evidenced by one respondent who said: “at least 40% of the world’s economy and 80% of the needs of the poor are derived from biological resources” (Male, aged 60, acting manager). Another said: “it is important for food and medicine. We hope even now that a covid remedy

will come out of a certain plant" (Male, aged 35, bank consultant). Additionally, one respondent said: "it's important for human life" (Female, aged 23, student).

There were significant differences ($X^2 = 5.6$; $p<0.05$) in the reasons for conservation between genders. For women (61 %), reasons for conservation were for use values while for men (51 %), they were for non-use values. Similarly for childhood background, significant differences existed ($X^2 = 61.9$; $p<0.05$) with rural (70 %) in support of conservation for use values and for urban (67 %) being in support for non-use values. There were no significant differences ($X^2 = 4.5$; $p>0.05$) in the value of conservation by education level as they all valued conservation for use values. Additionally, adults (81 %) had the same sentiments, with significantly ($X^2 = 103.9$; $p<0.05$) different views from the youth (59 %) that were in support of conservation for non-use values. There were no significant differences ($X^2= 3.2$; $p>0.05$) in the reason for conservation between the youth and seniors, however there were significant differences ($X^2 =38.4$; $p<0.05$) between seniors and adults with more adults in support of conservation for use values.

Table 4.8: Respondents (%) reason for conservation of biodiversity

Value	**%**	**F**	**M**	**R**	**U**	**Y**	**A**	**S**	**T**	**Sec**
Use value	58	61	49	70	33	41	81	50	78	68
Non-use value	42	39	51	30	67	59	19	50	22	32
Chi-square result		$X^2=5.7;p<0.05$		$X^2=61.9;p<0.05$		Youth and adults: $X^2=103.9$; $p<0.05$ Youth and seniors: $X^2= 3.2$; $p>0.05$ Adults and seniors: $X^2= 38.4$; $p<0.05$			$X^2 = 4.5$; $p>0.05$	

F- Females *M- Males *R- Rural *U- Urban *Y- Youth

*A- Adults *S- Seniors *T- Tertiary *Sec- Secondary

I asked respondents if they consume any products directly from the environment. Half of them claimed to consume products directly from the environment. There were significant differences in the products consumed by gender ($X^2 = 4.9$; $p<0.05$) with more men (56 %) consuming products from the environment than women (45 %). Similarly, there were significant differences where childhood background is concerned ($X^2 = 21.8$; $p<0.05$) with more rural (64 %) childhood people consuming nature than urban (41 %). With education, there were no significant differences ($X^2= 3.3$; $p>0.05$) in the products consumed directly from the environment. More adults (81 %) consumed ($X^2= 58.4$; $p<0.05$) products from the environment

than the youth (51 %) and higher than seniors (36 %) as well (X^2= 131.5; p<0.05). More youth consumed (X^2 = 9.0; p<0.05) products from the environment than seniors. The two products that were consumed directly from the environment were plants or animals. Plants accounted for 93 % of products consumed with only 17 % of respondents mentioning animal products. Looking at the type of products consumed in the different demographic profiles, the majority of each group consumed plants directly. Gender, childhood background and education did not play a role in the type of product consumed as there were no significant differences for the product valued for all groups. Age however, played a role as there were significant differences, more adults (86 %) consumed plants than the youth (74 %) (X^2 = 11.9; p<0.05). Similarly, more seniors (100 %) consumed (X^2= 6.7; p<0.05) plants than the youth (86 %). There were no significant differences (X^2= 1.9; p>0.05) between seniors and adults in products that they consumed directly from the environment.

One-third (34 %) of respondents said that there had been change to nature in their areas in the last five years. but almost half (43 %) said otherwise. Participants were further asked to elaborate on the changes that they have seen. These changes were grouped according to plant and the different animal groups (Table 4.9). About 42 % of respondents noticed a decrease in the visibility of insects while 37 % noticed a decrease for plants. Concentrating on the changes to nature as a form of concern, the study looks at the changes that each demographic group noted. Female respondents (44 %) noticed a decrease in plants while male respondents (42 %) noticed a change in insects instead. With education, secondary educated respondents noticed a change in insects (50 %) and tertiary educated noticed a decrease in plants (35 %). The rest of the respondents all noticed a decrease in plants more than the other groups of species.

Table 4.9: Percentage changes to nature that respondents noticed in the last five years

Species	**Decrease**	**Gender**		**Childhood**		**Age**			**Education**	
		F	**M**	**R**	**U**	**Y**	**A**	**S**	**T**	**Sec**
Mammals	15	5	21	10	9	15	14	-	19	19
Amphibians	-	-	-	-	-	-	-	-	-	-
Reptiles	-	-	-	-	-	-	-	-	-	-
Birds	5	3	6	5	-	-	4	33	4	-
Insects	42	28	42	28	25	26	34	-	28	50
Plants	37	44	23	41	39	42	32	67	35	23

*F- Females *M- Males *R- Rural *U- Urban *Y- Youth

*A- Adults *S- Seniors *T- Tertiary *Sec- Secondary

When asked if participants were willing to donate towards the conservation of landscapes, a place or ecosystem, about 60 % of the respondents were willing to donate. Thirty-nine percent of the respondents were not sure and only one percent were not willing to donate. Gender and childhood background did not play a role in the willingness to donate towards biodiversity conservation. There were no significant differences between gender (X^2= 1.0; p>0.05). Childhood backgrounds willingness to donate towards conservation of biodiversity was not significantly different (X^2= 3.8; p>0.05). Education played a role in the willingness to donate, with tertiary (75 %) educated respondents more (X^2= 29.48; p<0.05) willing to donate (Figure 7). Seniors (91 %) were more willing to donate than adults (62 %) (X^2=102.6; p<0.05) and the youth (67 %) (X^2= 70.3; p<0.05). There were no significant differences (X^2= 1.0; p>0.05) in the willingness to donate between youth and adults.

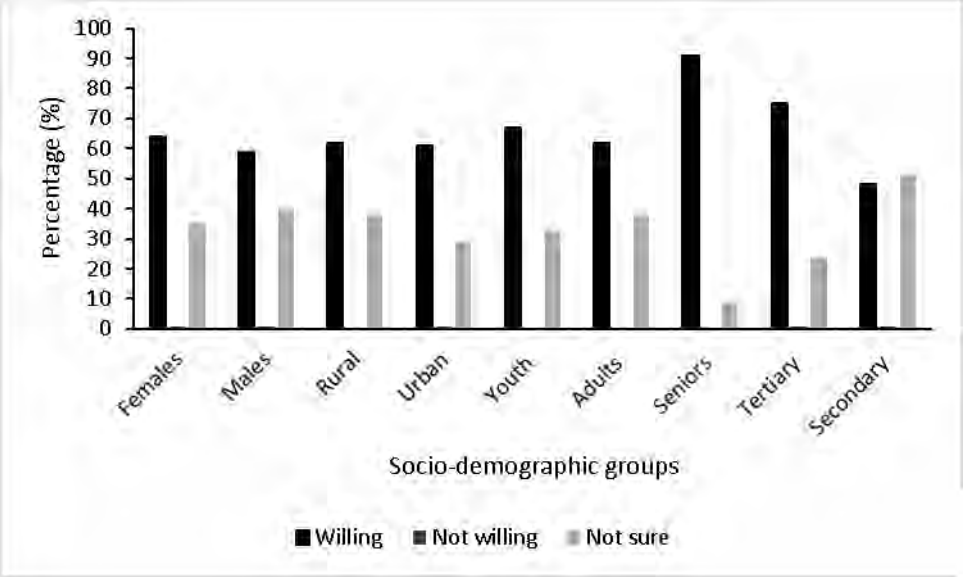


Figure 7: Proportion of respondents willing to donate to conservation

4.4. Discussion

4.4.1. Concern about biodiversity loss

This study revealed that people are generally concerned about biodiversity loss as consistent with other studies. Boaitey *et al*. (2018) found that the people in Canada had high levels of concern for biodiversity. Additionally, Prokop *et al*. (2008) found the same high concern from their participants in Slovakia. Gkargkavouzi *et al*. (2019) echoes the same findings in Greece, where people had high concern over biodiversity. This concern was shown in various aspects of this study. For one, 60 % of the respondents in this study said that they are willing to donate towards the conservation of biodiversity. This parallels with Cardenas and Lew (2016) that found that respondents in Ecuador were willing to donate towards conservation. Martin-Lopez *et al*. (2007) found that people in Spain were willing to pay for conservation. Gender did not play a role in the willingness to donate as there were no significant differences between females and males. This finding contradicts Lundberg *et al*. (2019) who found that in Finland, women were more likely to donate towards conservation than men. Tertiary educated respondents were more willing to donate, supporting Abdullah *et al*. (2014) who found that highly educated respondents in Malaysia were more willing to contribute for conservation. This can be related to their higher awareness of the topic from reading and general interest. Rahman and Matthew (2021) found that older people are more willing to donate. The results of this study are the same. This may be a result of them having more money to give than younger people. There were no differences between willingness in relation to childhood background. This may be because people are becoming more aware of the concern about biodiversity loss and where they were born does not influence their concern.

4.4.2. Conservation of biodiversity

Awareness of the changes to nature does not equal to high concern. Most of the respondents were unsure if there had been any loss of biodiversity in their immediate areas, however when respondents were asked if nature should be conserved, a majority of them agreed showing that they are concerned about the loss of biodiversity. Gkargkavouzi *et al*. (2019) found that people in Greece were in support of conservation and held positive attitudes towards it. Similarly, Walpole and Goodwin (2001) found that there was local support for the conservation of biodiversity in Indonesia. Socio-demographics did not play a role in the support for conservation as there were no significant differences between groups for its support. However, this is contradictory to Haensch *et al*. (2020), who noted that people in Australia who were female, highly educated and older were the ones who supported conservation the most.

4.4.3. Biodiversity values

The results of this study indicate that all respondents recognise that biodiversity needs to be conserved, and that it plays a vital role in their lives as revealed by the reasons given for conservation. There were significant differences in the reasons for conservation based on gender, childhood background and age, but not for education. Women favoured conservation for use values while men favoured non-use values. Tikka *et al*. (2000) found that men find nature satisfying for relaxation, personal autonomy and authority and not for obtaining food. The findings of this study, therefore, are in line with Tikka *et al*. (2000). Women being in support for use values is contradictory to Gkargkavouzi *et al*. (2019) who found that women in Greece valued nature mostly for non-use values. The reason for the different results could be because, Greece is a developed country, and hence the women from that country may not directly use products from the environment. In contrast, South Africa is a developing country, and many women in this country substitute some of their needs through consuming products directly from nature (Shackleton and Shackleton, 2004).

When it comes to education, the results of this study corroborate Gkargkavouzi *et al*. (2019) who found that there are no significant difference in the valuing of nature based on education. Considering childhood background, differences existed where rural were in support of use values and urban for non-use values. This echoes the findings of Rauwald and Moore (2002) who found that rural participants from Trinidad favoured use value reasons. A reason for this could be because rural childhood respondents interacted with nature more from when they were growing up such as fetching wood, eating wild fruit, or even getting medicine from medicinal plants and hence value the conservation of biodiversity for use values. The youngsters differed from the adults as they were supportive of conservation for non-use values, meaning that they regarded biodiversity important for aesthetic purposes.

These results indicate that the values attributed to biodiversity differ between the demographic groups. More so, it means that people have different concerns for the environment as argued by Stern and Dietz (1994). Women, rural childhood and adults appear to have egoistic concern about biodiversity loss as the support for conservation for use values fall under this concern, concern for the environment for oneself. On the other hand, men, urban childhood and the youth show bio-spherical concern about biodiversity loss, i.e. concern for the environment for its own sake.

This study has found that those who support conservation for non-use values and hence have bio-spherical concern, were less likely to consume products from the environment. Fewer urban childhood and the youth consumed products from the environment and supported conservation for non-use values. In contrast, rural childhood and adults were more likely to consume products from nature and prioritized use values for conservation. The differences were seen for gender, where reasons for conservation did not match with the propensity to consume products from nature. More men consumed products from the environment than women. Men often go hunting and fishing, resulting in them consuming the products they catch. As noted by Tikka *et al*. (2000), men may go out to hunt for relaxation and personal autonomy reasons and not necessarily for food. This then explains why they consume more but also place high value on conservation for non-use values.

4.4.4. Attitudes towards biodiversity

With the view in literature that environmental concern is identified as an attitude (Arcury and Christianson, 1990; Bamberg, 2003; Fransson and Garling, 1999), this study shows that most respondents have positive attitudes towards biodiversity and hence show, concern over it. These findings support Nisiforou and Charalambides (2012) who noted that in Cyprus, 70 % of the respondents showed a positive attitude towards biodiversity and its protection. Women showed more positive attitudes and hence were more concerned than men. This is in line with Haensch *et al*. (2020) who found that females have greater concern over the environment than men as did Glifford and Nilsson (2014). Tikka *et al*. (2000) suggested that women are more concerned because the environment the context for taking care of their children, because when the environment is clean and safe it is conductive for survival and for welfare of their children.

With regards to education, those that had tertiary education were more concerned than secondary educated respondents. These results are similar to Murgado-Armenteros *et al*. (2020) who found that in four countries in Europe, secondary educated respondents were less concerned than those with tertiary education. Similarly, Gifford and Nilsson (2014) found that people with mored education are more concerned. Samdahl and Robertson (1989) suggest that people who have the most concern are those that are well educated and young. While this narrative may be true for education, this study found the opposite result when it came to age. More older people were concerned about biodiversity than the youngsters. The results of this study are supported by Murgado-Armenteros *et al*. (2020) who that found young people were less concerned. More so, most of the young respondents agreed with the statement that biodiversity loss does not affect them personally now, but it will in the future, therefore their

concern about it is not something they thinking about currently. There were no significant differences in the attitudes towards biodiversity and concern between childhood background. This contrasts with Fransson and Garling (1999), who found that urban residents are more concerned than rural residents because they are more exposed to environmental deterioration such as pollution of the air, water and land.

This study found that most people are concerned about biodiversity loss as it impacts them at a personal level. Some of the respondents said that loss was already affecting them. We further see the role of gender, education and age in concern for loss, as women, older respondents and tertiary respondents were more concerned about biodiversity loss as they said it is already affecting them. Men, the youth and secondary educated were less concerned as they felt loss was not impacting them currently. However, they did recognise that loss of biodiversity might impact them in the future. This means that these groups of people are currently not concerned but perhaps they will start being concerned once they are impacted personally. Rural childhood showed more concern of biodiversity loss than urban childhood.

Testing for attitudes towards biodiversity loss, this study found that most respondents have a positive attitude towards biodiversity as they chose statements that related to acknowledging that humankind is responsible for the deterioration of the environment and that they would support restrictions on overuse of natural resources. These positive attitudes were seen in the majority of the respondents acknowledging that they were part of nature. This is in line with Bakhtiari *et al*. (2014) who found that in Scania, Sweden, people showed positive attitudes and that they felt part of nature. This means that people find themselves as an internal part of nature and hence concern for biodiversity loss is high amongst respondents.

4.4.5. Concern about biodiversity loss at local or global scale?

Concern for biodiversity loss increased with spatial scale as respondents said that seriousness of loss was very serious at global scale and somewhat serious at local scale. Additionally, the majority of all demographic groups found loss at global scale to be very serious.Similarly most said that there was not much biodiversity loss in their area or in South Africa, but is in the world. These findings are in line with Nisiforou and Charalambides (2012), who found that in Europe people regarded biodiversity loss at global scale to be a very serious problem. When looking at the attitudes towards biodiversity loss at different scales using level of agreement with statements, scale did play a role as the majority of the respondents showed to have positive attitudes towards biodiversity and showed concern for biodiversity global scale more.

4.5 Conclusion

Biodiversity loss is amongst the biggest threats to human welfare, and perhaps very existence, facing humanity in the 21st century. Therefore, it is imperative that people around the globe are more informed of the causes, rates and consequences of that of loss, and are made aware of the choices and actions available to them. Whether people will act on the choices and options depends on their awareness of the issues and the level of concern that they attribute to biodiversity loss.

The results from this chapter show that the respondents attributed a high level of seriousness to the issue of biodiversity loss. Across a number of the results females seemed to be more concerned than males about biodiversity loss, and those with higher education more so than those with less education. However, across the sample most were unsure of the benefits that they received from biodiversity, even though almost half (44%) said that they were already affected by the loss of biodiversity. Despite many of them claiming to have noticed decreases in the abundance of different taxa in their immediate areas, most considered biodiversity loss to be far more serious at global and national scales than at the local scale. They do not appear to have internalised that the summation of losses at the local level is what scales up to national and global levels.

Perhaps disassociating from local level changes is an unconscious means of absolving oneself from action to reduce or prevent biodiversity loss? In fact, an almost equal proportion (40%) said that they were currently unaffected by biodiversity loss, but expected to be so in the future, and another 10 % said it would be the next generation, showing quite significant polarisation of opinions around the perceived personal impacts of biodiversity loss, and hence concern. That said, 60 % of the respondents said that they would be willing to donate towards the conservation of biodiversity, demonstrating that they were prepared to be part of the solution. This provides some light that urban citizens in the MPA hotspot might be willing to help in combating biodiversity loss, but a strong case for doing so at the local level clearly still needs to be made. The willing ness to donate was similar across the different demographics. However, concern for biodiversity as shown by participants in the study does not necessarily mean that they have pro-environmental behaviour. Shah and Parsons (2019) stated that concern for the environment does not equate to behavioural change. Hence, further studies can further investigate this notion.

CHAPTER 5: Synthesis, conclusions and recommendations

5.1. Introduction

Biodiversity is declining rapidly around the globe due to human activities (Clayton *et al*., 2017). This is despite biodiversity being vital for numerous ecosystem functions such as water supply, pollination, climate regulation, food production, erosion control, recreation, soil creation, sense of place, etc. In the end, biodiversity loss threatens the well-being of humans and possibly their very existence (Skogen *et al*., 2018). However, Clayton *et al*. (2017) notes that the changes to in local environments and biodiversity are frequently not directly visible to many people. Consequently, declines in species abundance or numbers often goes unnoticed and beyond the experience of many people, particular those in urban areas. Although the issue of biodiversity may feel foreign to most people, there have been many initiatives and efforts to address biodiversity loss. The international treaties such as the Convention on Biological Diversity and The Strategic Plan for Biodiversity are some of the overarching, globally supported strategies that have been used, especially to increase environmental education. However, any strategies, whether global or local must be informed by understanding the knowledge that the public has about biodiversity loss to provide information about the acceptance of human-induced change and if people are in support of conservation efforts (Shah and Parsons, 2019).

The findings of this thesis were based on interviews in three towns in the Maputaland-Pondoland-Albany Hotspot. Random household interviews were used to assess the knowledge and concern that people have about biodiversity and its loss. This study sought to determine if respondents were familiar with the term and knew about biodiversity loss. Further, this study sought to determine if there was concern about biodiversity loss amongst respondents. This chapter provides the main conclusions related to the objectives of the study as well the study limitations and policy recommendations and future research coming from the study. The policy recommendations are based on the interpretation of the data and insight gained from it by the researcher.

5.2. General conclusions

5.2.1. Familiarity with the term and forces leading to biodiversity loss

The findings of this study indicate that most people are generally aware of the term biodiversity. Further, having heard of the term and ability to define the term were related, i.e. those respondents who had heard about the term were more likely to be able to define it. Nevertheless, it was evident that people have different understandings of what biodiversity means, which are generally more simplistic than scientific definitions but are inclusive of all dimensions of biodiversity. These findings corroborate previous studies, such as Prasad *et al*. (2015) in India and Fischer *et al*. (2020) in Europe reporting general familiarity with the term amongst laypersons. Seemingly this general awareness could be at least linked to television, as it was reported to be the primary source of information about biodiversity.

The respondents regarded pollution as the leading driver of biodiversity loss at local and national levels, while climate change was deemed as the leading force at global level. Respondents possibly consider pollution as a significant driver since they can directly see its effects in their neighbourhoods when faced with pollution of the land, air and water. This echoes several other studies that also found pollution to be the primary driver that people consider as leading to biodiversity loss (Hunter and Brehm, 2003; Shah and Parsons, 2019). However, Hunter and Brehm (2003) caution that many laypersons may incorrectly extrapolate the causes of biodiversity loss from one site or context to another, ignoring or not appreciating other possible drivers in the second setting. Thus, there is an increased propensity for generalisation.

5.2.2. Knowledge of biodiversity and its loss

The study found that urban residents of the MPA Hotspot had moderate general knowledge about biodiversity and its loss. This was evident by the numeric scores assigned to responses provided by respondents when assessing their knowledge of various topics related to biodiversity and biodiversity loss. In contrast, species literacy was low because most mentioned that they could name only a very small proportion of the birds and trees in their local neighbourhood, nor could they provide the proper common names of images of endangered species other than globally recognized megafauna. The bias towards global or national megafauna has also been noted by others, such as Nates *et al*. (2010) in rural Argentina and Hunter and Brehm (2003) in Utah (USA). Furthermore, despite concern about biodiversity loss professed by the majority of respondents, they were unable to identify smaller, non-

mammalian, endangered South African species. This may mean that the aim of the IUCN Red List to make people more aware that certain species are threatened with extinction has not been fulfilled in the MPA hotspot. In fact, most respondents had never heard of the Red List.

When it came to gender and knowledge, this study found that women tended to have more knowledge of biodiversity loss than men, which is contradictory to other studies (Hunter and Rinner, 2004; Mkonyeni *et al*., 2017; Tikka *et al*., 2000). This finding can be attributed to the nurturing roles that women traditionally have, potentially resulting in them having more knowledge in relation to caring for the environment. This may also be associated with the higher emphasis on use value of biodiversity amongst women as found in this study.

Jensen (2002) suggested that formal knowledge that people have of the environment is typically directly proportional to their education status. Findings of this study concurred with this, showing that those that had tertiary education had more knowledge about biodiversity than respondents with secondary education. However, such correlations deal with only formal education status. The is also a need to account for informal education, such as people learning about the environment and biodiversity by living or working it. This is why rural people may often have higher knowledge about certain aspects of biodiversity even though the levels of formal education are lower. This is particularly so when it comes to naming of local species, as evident in this study (Tables 3.6) and 3.7). The youth generally knew more about biodiversity than their older counterparts. Fransson and Garling (1999) noted that environmental problems are viewed as most threatening to the youth more than older persons. This could be the reason why the youth are more knowledgeable, it is because they have involved themselves in learning about it and also their recent education also has taught them about biodiversity loss.

5.2.3. Concern for biodiversity loss

The findings of this study suggest that there is widespread concern for biodiversity loss as a general phenomenon. These findings are supported by George *et al*. (2016) who noted that concern in the United States was increasing since 1978. Jarrar and Gheith (2013) found that the people of Asia are concerned. Hunter and Brehm (2003) found the same results in Utah, USA. This is interpreted as a complex mix of greater rates of loss at local scale, and greater awareness about biodiversity loss prompted by more global campaigns and television exposure about loss of valuable habitats (such as tropical forests, wetlands, and polar regions) and charismatic fauna. It is likely that internet programmes and articles are beginning to play a

prominent role too in sensitising people to issues related to biodiversity loss. Although there are suggestions are it too is biased in favour of a narrow suite of globally charismatic species (Ballouard et al. 2011). More so, this study found that gender does play a role in concern for biodiversity with women showing more concern than men as found in other studies (Gifford and Nilsson, 2014; Haensch *et al*., 2020; Torkar, 2016). Wall (1995) noted age and education were one of the only variables that predicted concern. Wall (1995) further said that younger, better educated people were more likely to be concerned. The results of this study agree with Wall (1995) in the aspect of education only, the people who had tertiary education were more concerned than those that had secondary education. Considering age, the younger respondents were not more concerned than older people, instead older people were more concerned.

5.2.4. Does knowledge equate to concern for biodiversity loss?

Fransson and Garling (1999) found that knowledge about the environment influences respondents' attitude towards it and hence concern. Twenty-one years later Murgado-Armenteros *et al*. (2020) reported a similar result, arguing that greater knowledge about biodiversity leads to greater concern for it. In this study, I found similar results for gender and for education. Women had higher knowledge and had more concern for biodiversity loss than men who showed less knowledge and a lower level of concern for biodiversity loss. This is deemed to be a result of women having more positive attitudes towards nature and therefore care for nature (Tikka *et al*. 2000) and therefore this care results in concern. Those with higher education were more knowledgeable and had higher concern for biodiversity loss. This suggests that the level of education one has influences the concern one has about biodiversity.

5.3. Limitations of study

The main limitation of the study is that in its methods, it required self-reported knowledge and concern, which could always be biased because of social desirability. More so the self-reporting of concern may be because some respondents want to appear as environmentally conscious. However, as Prevot *et al*. (2018) argue, what people say still provides some insight into their concerns and information about their knowledge. The sample of this study was skewed towards people with education above primary school, meaning that I did not get a sample that spans all educational levels and so repeating this to get a fair representation, could result in different findings. In fact, in multiple several less educated respondents in a household declined to participate or they called on another, more educated household member to be the respondent once they heard that the study was about levels of knowledge. Despite the skewed sample in

terms of education, the broader patterns by gender, age and childhood upbringing are likely to be valid. The corona virus also posed a challenge because many people were afraid to interact with the researcher and hence refused to participate in the study.

5.4. Policy implications and recommendations

The results of this study showed that there is widespread and general concern about biodiversity loss, even though levels of knowledge of biodiversity were only moderate, the benefits of biodiversity poorly understood and the ability to name local and threatened species was low. The study also reported that there are varying levels of concern related to demographics, with the youth, our next generation of leaders being the least concerned. Based on these results, the study recommends the following:

1. Government at all scales (from local to national) need to raise attention about the benefits of biodiversity and hence the consequences of biodiversity loss. This can be done through education and awareness campaigns and social media posts about significance of biodiversity loss, conservation tips, how individual citizens and households can help through their own behaviours (for example through recycling, planting indigenous species in their gardens, participating in clean-up campaigns or removal of invasive species) and through getting involved in local conservation projects. These campaigns should be accessible to everyone and information and posts should be in lay terms and translated into different languages to improve accessibility to all in the country. Municipalities should take advantage of environmental days such as National Arbor Day, International Day of Biodiversity, World Wetlands Day, Earth Day and many more to do public events in their areas.

   Experts and academics need to form partnerships with municipalities to make sure this awareness and building of knowledge around biodiversity is factual and reporting current trends and solutions. More so, experts can help with producing policy briefs, pamphlets and articles on various media related to increasing knowledge about local species, biodiversity loss at local level and many other topics related to biodiversity so that they can reach different target groups of gender and age so that concern about it may increase as well as support for preservation.

2. Education in schools at primary and secondary level should include the topic of biodiversity and it benefits for daily living more in their syllabus and also include regular contact with nature outside of the classroom in order for students to develop knowledge and support for conservation. This recommendation of nature experiences might be unrealistic for government schools as they are often non-fee paying schools, however the government should put a budget aside for these experiences even if they do them once a year as part of their commitment to raising awareness in their commitment to the Convention on Biological Diversity. Partnership with environmental or conservation-minded NGOs could also help achieve this aim. Formal education materials should also include traditional or indigenous knowledge.

3. Both officials and NGOs/CBOs should seek to profile *local* biodiversity more. Examples of initiatives for such include:

    a. place- and street names named after local species,
    b. establishment or maintenance of nature trails or small parks in accessible places with information boards on what biodiversity occurs in the area, and the benefits that it provides,
    c. local festivals to celebrate biodiversity events, such as the flowing or fruiting of a particular local species (e.g. the yam festival in Nigeria or the acacia festival in Portugal), or arrival of migratory species (e.g. the San Quintin Bay Bird Festival in Mexico to celebrate the arrival of migratory birds, or perhaps the sardine run or whales in South Africa),
    d. promote artisanal products from local biodiversity, and
    e. local competitions (e.g. between schools or teams of laypersons) around naming of local species on a particular day (such as the national bird day in South Africa).

Such efforts will increase the public's knowledge of biodiversity and hence potentially grow support for conservation policies (Hunter and Rinner 2004).

Recommendations for further research for interested stakeholders and researchers is to further explore knowledge of biodiversity on other aspects that were not covered in this study to include knowledge about genetic and ecosystem diversity. Further research is needed in understanding the knowledge and concern that people have of biodiversity loss and therefore,

further research can be done in other areas of the country and in places that are not a biodiversity hotspot to test if knowledge and concern is any different. This study did not include environmental behaviour. Further research is needed to test if concern is corelated with pro-environmental behaviour.

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Appendices

Appendix 1: Survey Questionnaire

Knowledge about biodiversity in Maputaland-Pondoland-Albany hotspot

The purpose of this questionnaire is to find out the knowledge that people have about biodiversity and its loss. Therefore, the aim of this questionnaire is to understand the knowledge and concern (if any) that people have of biodiversity and its loss and if it is about global or local biodiversity and its loss. The questionnaire is completely anonymous. Sharing of personal details such as gender, age and occupation are optional.

1. Are you a member of any environmental organisation or society or NGO? If yes, please tell us the name of the organisation

□Yes, _____ □No

2. Do you regularly watch environmental programmes on tv? □Yes □No

3. Have you visited a game/nature reserve in the last 5 years? □Yes □No

4. Have you heard of the term biodiversity? □Yes □No □I am not sure
If yes, what do you understand the term to mean?

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5. Please pick a sentence that you think defines the term biodiversity from the following?

- ❑ Diversity of plants and animals
- ❑ All animals, nature and humans that live on Earth
- ❑ Diversity of landscapes and number of different beings in a given area
- ❑ A mix of several species which manage to live together

6. Choose the option you agree the most with:

□I am part of nature □I am not part of nature

□I feel like I am part of nature when I visit natural parks or greenspaces

10. Where do you think you usually hear of the term biodiversity?

□Never heard of term biodiversity □Daily newspaper □ Television □School □Radio □Journals □Others

11. Name any five animals/plants that are from South Africa.

- o
- o
- o
- o
- o

12. Name any five animals/plants that you know that are not from South Africa.

- o
- o
- o
- o
- o

13. Name any plant or animal that occur specifically from your area

- o
- o
- o
- o
- o

14. What is the:

National tree of SA	National bird of SA	National animal of SA	National flower of SA

15. Do you recognise any of the following species? Please name them

A.

B.

C.

D.

E.

F.

G.

H.

I.

J.

K.

L.

16.Please rate your level of knowledge with respect to the following topics:

Environmental topic	**Poor**	**Fairly poor**	**Fairly good**	**Good**	**Never heard about**
Ecosystem services					
Invasive species					
Climate change/global warming					
Pollution of air, water and land					
Red List species					
Conservation of natural areas					
Biodiversity loss					

17. Are you aware of any threats to biodiversity? If yes, could you tick the relevant ones according to the different levels

Local level (within province)	**National level**	**Global level**
❑Climate change	❑Climate change	❑Climate change
❑Habitat loss	❑Habitat loss	❑Habitat loss
❑Pollution	❑Pollution	❑Pollution
❑Increasing human population	❑Increasing human population	❑Increasing human population
❑Invasive species	❑Invasive species	❑Invasive species
❑Overexploitation of resources	❑Overexploitation of resources	❑Overexploitation of resources
❑None of the above	❑None of the above	❑None of the above

18. How serious do you think biodiversity loss is

In your area	**In South Africa**	**Globally**
□Very Serious	□Very Serious	□Very Serious
□Serious	□Serious	□Serious
□ Somewhat serious	□ Somewhat serious	□ Somewhat serious

□Not serious	□Not serious	□Not serious

19. Do you think decline or loss of biodiversity will impact you personally?

□ Yes, I am already affected □ Yes, it will, not now, but in the future

□ No, not me but maybe the next generation □Not at all

20. 1. When you travel in your neighbourhood approximately what % of the street trees do you know the names of:

0%; <1%; maybe 5%; maybe 10%; 11-25%: 25-50%; >50%

20.2. When you travel in your neighbourhood approximately what % of the birds do you know the names of:

0%; <1%; maybe 5%; maybe 10%; 11-25%: 25-50%; >50%

20.1. Do you or people in your neighbourhood get any benefits from biodiversity at the …….level? If yes, list them and then rank the top ones (max of five).

Local level	**National level**	**Global level**

21. Can you name 3 animal and 3 plant species that are regarded as endangered at the different levels below?

Globally	**South Africa**	**Region**	**District**
Plants ❑ ❑ ❑ ❑ no, I cannot Animals ❑ ❑ ❑	Plants ❑ ❑ ❑ ❑ no, I cannot Animals ❑ ❑	Plants ❑ ❑ ❑ ❑ no, I cannot Animals ❑ ❑	Plants ❑ ❑ ❑ ❑ no, I cannot Animals ❑ ❑

	❑	❑	❑

22. Is there any plant or animal that you consume directly from the environment? Which one do you value the most?

22.1 How would you feel if it were to disappear?

23. Lets talk, if you were to donate any amount of money to conservation of a place/landscape/ecosystem (Aquatic or on land), what would it be?

24. Are there any changes since you were young that you have noticed in nature(plants and animals disappearing or appearing perhaps) that you have noticed in your area? Please tell me about them.

25.Do you think biodiversity should be conserved (protected or looked after) and why?

□Yes □No □Not sure

Why?

26. Please tick the level of agreement or disagreement with the following statements:

Statement	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
1.Loss of biodiversity does not impact me.					
2.Loss of biodiversity is only of scientific interest and does not mean anything to the average person.					
3.Biodiversity loss is a natural process					
4.We cannot afford to lose our local biodiversity					
5.We cannot afford to lose our global biodiversity					
6.The government needs to inform people more on environmental issues.					
7.Biodiversity loss does not happen much in my area.					
8.Biodiversity loss does not happen much in South Africa.					
9.Biodiversity loss happens a lot in the world.					

27. Please tick statement that you mostly agree with below:

□ The ecological crisis facing humankind has been largely exaggerated.

□Humankind is abusing the environment

□It is not humans' responsibility to protect endangered animals from extinction.

□I would support restrictions on overuse of natural resources to support conservation.

28. True or false

Statement	True	False
1.The fynbos region of the western cape is one of the most florally biodiverse in the world.		
2.Polar bears are more endangered than African wild dogs.		
3.By world standards, SA does not have much biodiversity.		
4. There is not anything I can do to slow down or prevent biodiversity loss.		
5.The karoo is one of the most biodiverse arid regions of the world.		
6. The coastal region of KZN is a known hotspot of biodiversity.		
7. Approximately 30% of all commercial medicines are developed from wild species.		
8. There are less than 300 bird species in South Africa.		
9. Biodiversity provides us with food and energy.		
10. People who say that pollution is harming our marine species are lying.		

29. Gender

Male		Female		Other	

30. How old are you?_____

31. What is your occupation/type of work?

□

□Student □Unemployed/Pensioner □Would rather not say

32.Which type of area do you live in?

□Location □Suburbs □ Town □ Farm/rural area/small holdings

33. Did you grow up in a rural or urban area? □ Rural □ Urban

34.Highest education attained?_____

Is there anything more that you would like to share with me?

Thank you so much for participating.