

LOCAL PERCEPTIONS OF ENVIRONMENTAL INSECURITY AND WILDLIFE  
CONSERVATION IN THE MNISI TRIBAL AUTHORITY, MPUMALANGA, SOUTH  
AFRICA

By

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## **ABSTRACT**

### **LOCAL PERCEPTIONS OF ENVIRONMENTAL INSECURITY AND WILDLIFE CONSERVATION IN THE MNISI TRIBAL AUTHORITY, MPUMALANGA, SOUTH AFRICA**

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Environmental insecurity is a relatively new expression within the broader space of security. Many contributors to local and global insecurity are also threats to environmental security which represent the interconnectedness and complexity of environmental insecurity. Local perceptions from local areas such as the Mnisi Tribal Authority (MTA) are often useful to decision-makers working to reduce harm from environmental insecurity. In order to understand the local perceptions of the MTA, I set three objectives for this research: *i)* explore local perceptions of environmental insecurity and its perceived relationships with other forms of insecurity; *ii)* compare and contrast local perceptions of risk associated with environmental and other forms of insecurity; *iii)* explore relationships between factors influencing and being influenced by environmental insecurity. Data were collected with face to face interviews (N = 211) with residents of the Mnisi Tribal Authority in Mpumalanga, South Africa, in 2019. Variables including village location, age, children in the household, land ownership status, and gender had a significant influence on residents' risk perception to various insecurities including environmental, food, and water. Among study residents, environmental insecurity is influenced and affected by a range of variables. Local perceptions from the MTA and other local areas are crucial to understanding this relationship. Interpreting and analyzing the perceived risks at all levels can be a key to designing policies that aid in insecurity reduction at local, regional, and global levels.

This thesis is dedicated to my Mother and Father along with the amazing people and wildlife in Mnisi Tribal Authority and South Africa.

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## **KEY TO ABBREVIATIONS**

Greater Limpopo Transfrontier Conservation Area (GLTFCA)

Kruger National Park (KNP)

Likelihood Ratio Test (LRT)

Mean Squares (MS)

Mnisi Tribal Authority (MTA)

Pearson's Correlation (PC)

Research Assistant (RA)

Southern African Wildlife College (SAWC)

Sustainable Development Goals (SDGs)

Variance Component (VC)

CHAPTER 1:  
ENVIRONMENTAL INSECURITY INTRODUCTION AND OVERVIEW WITHIN THE  
MNISI TRIBAL AUTHORITY, MPUMALANGA, SOUTH AFRICA

## 1.1 INTRODUCTION

### *1.1.1. Security in the Anthropocene*

Security is a concept that has endured substantial change over the past 50 years, although it has remained central to geopolitics, foreign relations, interstate and intercommunity decision-making, and local governance (Miller, 2001; Detraz, 2009; Elliott, 2015). Experts rarely define security consistently, nor is it consistently perceived by demographic groups organized according to gender, wealth, status, age, ethnicity, or location (Brauch, 2015; Spring, 2009). The global ubiquity and local variation of the security concept makes it both a highly important and complex issue for sustainable development (Spring, 2009; Hardt, 2012). I define security as the state of being free from constraints of danger, threat, harm or risk (Detraz, 2009; Hardt, 2012; Elliott, 2015; Busby, 2018). Security may manifest in various forms and has developed from the traditional sense of national security focused on defenses against either domestic or international threats, to a global understanding that encompasses everything from having enough food to feed your family to being able to have the health resources provided to you by your local and national government when in need (Elliott, 2015; Mohammadpour et al., 2019).

Traditional security is conceptualized as safety from crime, independence from threat with the ability to feel safe, and the perception that one is secure in their surroundings (Boholm et al., 2016). In the past, security was said to be event driven (e.g., a car being stolen) (Miller, 2001; Romero, 2014). National security, the ability of nations to protect their borders from physical and other harms inflicted by others, emerged as a priority after 9/11/2001 (Spring et al. 2009). As the world has globalized through connected economies and online communities, the concept of security has broadened in scope (Ezeonu & Ezeonu, 2000; Miller, 2001; Hough, 2018). Environmental security considers risks posed by and to the environment which threaten survival

of local populations (Gore et al., 2016; Busby, 2018; Meissner et al., 2018). When people don't have enough food, water, natural resources or shelter, it creates insecure situations that can directly or indirectly amplify other harms (Spring, 2009; Spring et al., 2009; Gore et al., 2016; Busby, 2018). Some environmental problems such as global climate change are slow-onset risks. The chronic nature of environmental insecurity often creates a "force multiplier" for instability when combined with the political dynamic in a region (Goodman, 2012). Clean water scarcity coupled with declines in marine biodiversity, for example, can stress growing human populations, often in places that are already facing weak governance systems (Rice & Garcia, 2011; Goodman, 2012). Implicitly, environmental security involves connections to national security because preventing threats to the environment—providing security—prevents threats to national security (Farbotko, 2018). For example, in 2009, the U.S. Navy formed The Task Force on Climate Change in response to changing climate conditions. Following that, in 2010, the U.S. Department of Defense formally recognized climate change as a factor to consider when planning for national security risks (La Shier & Stanish, 2017). It is important for decision-makers to understand how environmental change augments other risky conditions and how environmental impacts interact with other harms and threats in a particular location (Carter, 2018). Decision makers are pressed to plan appropriately to ensure security in diverse threat landscapes (Hezri & Hasan, 2006; O'Brien, 2011).

The notion of security is important for politics and foreign relations because it associates the label with prioritized spending and action and enables a commonality of purpose among diverse actors (Goodman, 2012). Nations invest heavily in defense spending in pursuit of national security; thus, there are many experts that offer a technical assessment of security risks, prevention mechanisms and probabilities. Environmental problems have been securitized leading to the

human dimensions of environmental change being more directly incorporated into science and policy decisions (Bennett et al., 2017; Christie et al., 2017). Human dimensions promote thinking about public perceptions and taking a “people-centered” approach; it enables explicit consideration of gender, vulnerability, risk perception and human geography (Decker et al., 2012; Bennett et al., 2017).

Although there is now fairly broad agreement that security is important at a local level and a geopolitical level, there appears to be scant research quantifying and qualifying local perspectives on the topic, particularly regarding the environment (Spring et al., 2009; O’Brien, 2011; Kahler & Gore, 2015; Gore et al., 2016). Thus, efforts to plan, implement, and test programs and policies designed to enhance security for vulnerable people and places lack key information upon which to build evidence. To these ends, my thesis aims to build knowledge about local people’s perceptions of environmental insecurity and its connection to, or lack thereof, other forms of insecurity and potential factors such as age, gender, and living location. Three objectives of my thesis were to: *i*) explore local perceptions of environmental insecurity, including perceived relationships with other forms of insecurity, *ii*) compare and contrast local perceptions of risk associated with environmental and other forms of insecurity, and *iii*) explore relationships between factors, including non-security factors and demographics, influencing and being influenced by environmental insecurity.

## 1.2 CASE STUDY OVERVIEW

### *1.2.1. Research Design*

I conducted research using a case study design. I chose the case study design because it can narrow down a broad field, is useful when researching an issue in an area that has not been research extensively, while also bringing an understanding to a complex theory looking at the

relationships between variables (Harrison et al., 2017; Yin, 2018). Case study design also applies to social science when looking at real-life situations and trying to expand the basis of research for future researchers (Yin, 2018). However, generalizing the findings to a broader population can be difficult especially if certain findings only relate to the questioned population, small population samples can lead to missing data making interpretation of data difficult, constant exposure to the people and study site can lead to bias from the researcher's data interpretation, and it is tough to interpret cause-and-effect relationships (Anastas, 1999; Gerring, 2004; Mills et al., 2010; Stake, 2010; Yin, 2018). I implemented a case study design because the three research objectives were broad, looked at relationships between variables, and looked to narrow down a broad range of research questions for future researchers.

#### *1.2.2. Mnisi Tribal Authority*

Within my thesis, I focus on the Mnisi Tribal Authority (MTA) residents and their perceptions and thoughts of environmental insecurity and various items potentially related to environmental insecurity. The MTA is in Bushbuckridge, Mpumalanga, South Africa near the Great Limpopo Transfrontier Conservation Area (Berrian et al., 2016; Khunoana et al., 2019). The GLTFCA is a united conservation area across three international boundaries, South Africa, Zimbabwe, and Mozambique (Ntuli et al., 2019). Conservationists created the park in 2002 after being conceived in 1990 (Chiutsi & Saarinen, 2017; Sundström et al., 2019). The Great Limpopo Transfrontier Park is made up of three national parks: Mozambique's Limpopo, South Africa's Kruger, and Zimbabwe's Gonarezhou (Ntuli et al., 2019; Gore et al., 2020).

The GLTFCA also contains private and state-owned conservation areas in South Africa and Zimbabwe (Gore et al., 2020; Peace Parks Foundation, 2020). The GLTFCA has several goals

listed in the International Treaty (Gore et al., 2020). These include encouraging relations with different stakeholders and working to build up ecotourism in the area (Gore et al., 2020).

Animals and plant life are copious in the GLTFCA, and in South Africa's Kruger National Park, which borders MTA lands (Peace Parks Foundation, 2020). Anti-poaching remains a priority for the GLTFCA (Sundström et al., 2019; Gore et al., 2020). Theoretically, wildlife has the opportunity to be a great benefit to MTA residents (Snyman, 2017; Gumede & Nzama, 2019). Economies based on wildlife are associated with ecotourism and sustainable use provide benefits for communities when the community is involved and able to partake in the formation of the economies (Gumede & Nzama, 2019; Litheko & Potgieter, 2020). Benefits may include, for example, economic, physical, or ecological impacts (Spenceley & Goodwin, 2007; Sandbrook, 2010; Snyman, 2014).

In addition, charismatic mega-fauna, along with other wildlife, has a potentially vital role to play in attracting visitors for ecotourism in areas experiencing high rates of environmental insecurity, such as the MTA (Lindsey et al., 2007; Bhatt & Dhakal, 2018). However, a range of risks are also associated with wildlife (Ravenelle & Nyhus, 2017). Ecotourism also has risk associated with it. COVID-19 has shown that ecotourism failing because of unforeseen circumstances can negatively impact local communities who rely on the income of international tourists as well as largely negatively effecting conservation and anti-poaching efforts funded by tourism (De Bellaigue, 2020).

In this region, livestock necessity is tied to the close proximity to wildlife areas (Berrian et al., 2016). The cohabitation of humans, domestic animals, and wildlife is important for members of the MTA and is reflected in how conservation programs do in the region (Berrian et al., 2016). Over 50,000 people live in MTA lands, many of which use the environment for livelihoods and

sustenance (Lehohla, 2012; Berrian et al., 2016). The combination of variables can lead to many insecurities overlapping in the MTA. Environmental, water, and crime insecurity were a large priority of the MTA Board while all types of insecurity influenced the overall three research objectives.

### *1.2.3. Collaboration Partners*

The MTA has a lengthy history of collaboration with the Southern African Wildlife College. The Southern African Wildlife College and the Mnisi Tribal Authority leaders invited Michigan State University to take part in the collaboration and help build understanding about local perceptions of environmental insecurity and its connection to other types of insecurity in the region. Security is an important issue in the areas bordering MTA lands. The villages comprising the MTA are full of biodiversity. The interaction between conditions may affect insecurity. For example, firewood is a main energy source for many households (Findlay & Twine, 2018). Firewood use is often a monetary savings strategy due to a lack of alternative livelihood options in the MTA (Findlay & Twine, 2018). Firewood strongly links to insecurity in the MTA because the main source of firewood is illegal deforestation. Deforestation has a much broader impact than just losing wooded areas in the MTA as appraisals have found deforestation contributes to soil erosion, biodiversity loss, and degraded drinking water quality (Uhunamure et al., 2016). The Board of the MTA was interested in learning more about the environmental and other insecurities within their area and created priority questions to be addressed by the research.

### *1.2.4. Mnisi Tribal Authority Questions About Environmental Insecurity*

MTA leaders prioritized several questions and ideas relevant to environmental security in the region.

- 1) What is known about public perceptions of unique types of conservation/ environmental crimes within the MTA, including illegal littering, and poaching?
- 2) How is village crime associated with deforestation and other environmental crimes?
- 3) How can deforestation in the MTA be reduced and are there alternatives?
- 4) What is known about public perceptions of different types of natural phenomena such as drought within the MTA?
- 5) What kinds of solutions do you think you might suggest (asking researcher) for the MTA given what you know about the situation and the data you collected from the MTA?
- 6) What does the data show that can help potentially reduce poaching in and around the MTA?

#### *1.2.5. Thesis Structure*

Residents of the MTA agreed on the 6 questions presented above without conjunction of the 3 research objectives presented earlier - I informed the MTA what my overall research interests were, and they created the 6 questions they thought would apply to their own needs. Their six questions did not inform my three objectives however, the three objectives helped influence the six questions and data used to analyze the MTA priority questions overlapped with the three thesis research objectives. The “dual” research projects were pursued because the research team wanted to ensure the community’s questions were answered - a key observation of the MTA was that many researchers take their data and don’t collaborate or try to give back to the community from which they derive the data. Therefore, this thesis builds on the same dataset but is formatted as two different products: Chapter 2 explores the six questions from the MTA and is formatted as a report for the MTA and SAWC as the primary audience. Chapter 3 is framed around the three research objectives and is written for a broad academic audience, with the content to be translated into a

peer-reviewed article after the thesis is approved. However, there is some repetition of data that applies to both the MTA's questions and the three research objectives.

### 1.3 MATERIALS AND METHODS

#### *1.3.1. Community Entry into Mnisi Tribal Authority Lands*

I collaborated with the Southern African Wildlife College (SAWC) and the Mnisi Tribal Authority (MTA) in Mpumalanga, South Africa for this research. I ascertained approval for community entry within the MTA once I met with the representatives of the MTA. The MTA liaison working at the SAWC introduced me to the MTA Board of Directors, where they granted approval to conduct research with the surrounding villages. The MTA liaison leveraged pre-existing relationships with and helped hire the research assistants (RAs) through a college preparatory program at the SAWC. The MTA liaison and I conducted field work along with the RAs, creating a team of eight, of whom three RAs were male and five were female. I led a weeklong training session at the SAWC for the RAs and MTA liaison. Training included an overview and deep dive into the research and objectives, how to conduct proper structured interviews including a full read through of the questionnaire in English and Tsonga, Kobo Toolbox, responsible conduct in research, and the importance of following protocol to lower any forms of bias in the field.

Data collection protocols started a pilot test. I asked RAs to perform test questionnaires with family and friends to make sure they felt comfortable with the instrument and then went through the questions myself with the RAs. Pilot testing also involved one day of field-based data collection. I supported consistency in data collection through daily meetings each morning to discuss goals for the day and any issues that RA's may have come across in the field previously. I reviewed the survey data from the day before too, to discuss with the team and minimize mistakes

and inconsistencies. For example, RAs had different interpretations of the questions and we worked through the entire questionnaire as a team to make sure every person agreed. I met with all interested MTA representatives (board members and stakeholders) prior to my departure back to Michigan State University, once data collection was completed and preliminary analysis was conducted. A final meeting took place where I presented an overview of the data analysis, including results associated with the three thesis objectives and the six priority MTA questions.

### *1.3.2. Ethics Statement*

Michigan State University's Committee on Research Involving Human Subjects Internal Review Board reviewed and determined the study (STUDY00002577) to be exempt under 45 CFR 46.104(d) 2(ii). At the start of all interviews, I required residents to consent verbally to take part in the questionnaire before any data collection started and to also consent prior to entering any personal property or homes. I provided written consent instructions in English and Tsonga for participant review. The introductory statement can be found in the Appendix along with copies of the questionnaire in English and Tsonga. I did not collect information linking a person's name and recorded all residents as a numeric so no personal information and answers would link to their identity.

### *1.3.3. Questionnaire Instrument*

I planned the questionnaire for this study using KOBO Toolbox (Kobo Toolbox, 2020). KOBO is a free, cloud-based system for researchers and humanitarians to collect fieldwork data. The questionnaire contained 149 questions. I organized all questions into different sections and each section had a brief explanatory introduction. The sections, in order as presented in the questionnaire were, *Warm-up/introductions*, *Mnisi Tribal Authority*, *Harm Thoughts*, *Harm Response 1*, *Harm Response 2*, *Nature Mythology*, *Food Security*, *Health Security*, *Water Security*,

*Environmental Security, Education and Employment, Trust, Traditional Crime Perspective, Activities, and Conclusion (Demographics).*

I answer the six primary MTA questions using answers primarily from *Harm Thoughts, Water Security, Environmental Security, Traditional Crime Perspective, and Activities* while all sections were used to answer the three research objectives. Ten of the 149 questions were sociodemographic questions. Demographic variables included gender, village, age, occupation, employment status, years lived in the area, ethnicity, ownership of land, size of land in km<sup>2</sup>, and how many children were present in their household. All other questions were Likert-type scale questions. Likert-type questions were in either 7-point or 10-point scales to increase reliability of the questionnaire (Croasmun & Ostrom, 2011). Seven-point Likert-type scales were used in the majority of the questions to allow for a neutral position while ten-point Likert-type scales were used to measure the risk that residents associated with environmental threats in the section titled *Harm Thoughts* because even-numbered Likert-type scales force a resident to choose a position without the option for neutrality (Brown, 2000; Croasmun & Ostrom, 2011).

The SAWC provided a translator to translate the KOBO questionnaire from English to Tsonga and then from Tsonga to English to avoid any confusion in the field from RAs having to self-translate the questionnaire. All questionnaires were administered in Tsonga in the field with English being used for clarification if needed. RAs and the MTA liaison provided feedback on the questionnaire in both languages to make sure that RAs were not translating in the field differently than other RAs. Both versions can be found in the Appendix (p. 94).

#### *1.3.4. Sampling Protocol*

The MTA comprises 15 villages. I selected ten villages sampled in this study based on recommendations from and permissions granted by the MTA Board (e.g., traditional authority).

Village selection, recommended by the MTA, included a representation of different geographic proximities to the protected areas surrounding the MTA and population sizes of villages to encompass a wide variety of participation and opinions to create the most viable and accurate sample size possible (Moore et al., 2010).

Modified systematic quota sampling was used to achieve research objectives (Singleton et al., 2005). This sampling is simple and direct. I based my modifications (quota sampling combined with systematic sampling) on a lack of available lists of residents in the population of the chosen villages and a desire to fill a male/female quota in our sample population (Singleton et al., 2005). My goal was to design a sampling frame that reflected the target population, but I was also cognizant that this can be an unrealistic goal in conservation social science (Singleton et al., 2005). It was impractical for me to create an accurate list of the entire MTA population. Thus, I recognize the sampling design represents the specific, known population with defined characteristics (see population description table). A key advantage of our sampling design was decreased bias by researchers in selection of cases which is an important mechanism of scientific control (Trochim, 2020).

I first calculated the population density of each village cluster by dividing the 2011 census population (most recent population data obtainable) by the area size in km<sup>2</sup> (Frith, 2011; Lehohla, 2012; Statistics South Africa, 2020) (Table 1). I then calculated 2% of the population density for each village to derive a village quota to create a reasonable sample size for the time I was able to spend in the country (Singleton et al., 2005). I divided each quota into a male and female ratio. Based on 2011 census data, females outnumbered males by 54% to 46%. When the calculated quota was an even number, I set our target sample as being half male and half female. Where the calculated quota was an odd number, I alternated between male and female to receive an extra

interview, according to the alphabetical order of the villages. The calculated margin of error for this questionnaire was about 5.65%.

<b>Table 1: Sampling protocol list of villages within the in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019) including population from the 2011 census (most recent available data), area size (km<sup>2</sup>), population density, and quotas.</b>						
Village Name	Population Size (2011)	Area Size (km <sup>2</sup> )	Population Density (people/km <sup>2</sup> )	2% of population	Male Quota	Female Quota
Clare A & B	2,772	2.49	1,113.25	22	11	11
Gottenburg	400	0.6	666.67	13	7	6
Hlavekisa	2,563	2.38	1076.89	22	11	11
Hluvukani	9,631	7.67	1255.67	25	12	13
Islington	4,560	5.82	783.51	16	8	8
Ludlow	5,766	7.06	816.71	16	8	8
Manyeleti	2,260	1.96	1153.06	23	12	11
Tintswalo Village	8,836	7.21	1224.99	25	13	12
Welverdiend	7,601	6.12	1241.99	25	13	12
Whitecity / Burlington	4,154	4.16	998.56	20	10	10
Total	39,707	45.47	873.26	207	104	103

After calculating the male/female quota sample size for each village, I used a random number generator to determine the order in which I would interview each village: Islington, Clare A & B, Welverdiend, Manyeleti, White City/ Burlington, Tintswalo Village, Gottenburg, Hlavekisa, Hluvukani, and Ludlow. The data collection team worked through this ordered list of villages daily and moved to the next village on the list when sampling concluded in a single village. Two villages were not interviewed on the same day except for extenuating circumstances (Singleton et al., 2005).

Within each village, I used systematic sampling to interview every  $K_{th}$  person based on randomized start times of day (e.g., I used a random number generator to determine the start time of our interviewing between the hours of 0800-1200). Systematic sampling is when there is a

specified sampling interval (K) and also a random start (random time generator) chosen from the MTA population (Burger & Silima, 2006). I chose ten as the sampling interval (K) based on Singleton et al. (2005) and randomized the initial case with which I started on each research day. I instructed all RAs to only intercept residents on the street. I selected the Kth door (i.e., residence) when this was not possible and when no potential candidates were on the streets. If the Kth interview was asked to be interviewed and denied the option, the next person of the correct gender based on the RA's instructions was asked to participate until one agreed to partake. To ease any bias including social desirability bias, I asked residents to take part in the questionnaire alone with only the RAs in the room (Grimm, 2010). Social desirability bias happens when a participant in a study answers a question based on what they think others would deem socially acceptable (Grimm, 2010).

Each of the eight RAs followed the same randomized start time, initial case, and sampling interval. Not all RAs were in the field each day because of personal and work conflicts. I randomly assigned half of the RAs present each day to interview males and half to interview females. The RA's and team leaders at SAWC were asked if they thought not aligning gender with candidates would lead to bias. They decided that less bias would happen from random sampling compared to gender paired sampling. If an odd number of RAs were taking part in the interviews for the day, I alternated between male and female having one extra interviewer. All RA teams started at different drop off locations within the village limits. The end location for all RAs was the village administrative office in each specific village. I remained in electronic messaging contact with RAs during participant interviews and halted research when village quotas were met. I was present in the field on all days of research. I kept RAs in pairs for safety protocol, meaning that both assistants were present in the room or on the street while we conducted the questionnaire.

### *1.3.5. Technology and Data Storage*

To achieve research objectives, I used the KOBO Toolbox Data Collection software application run on Android devices in the field with GPS coordination enabled. If needed, RAs used their personal Android devices as a backup in case the original device failed or ran out of battery. The SAWC provided the primary collection instruments for the duration of the study. I backed up all data at the conclusion of each questionnaire day. I cleared all devices the SAWC owned clean of the data at the conclusion of the research. Each questionnaire including locating a resident, introductions, and conducting the full questionnaire took approximately 30 minutes to 1 hour to complete.

### *1.3.6. Index Creation (Latent Variable Creation)*

I used an identical procedure for creating all summative indexes (e.g., latent variables) (Sarlis & Gallhofer, 2014). I chose summative indexes because I gave no additional weight to any question within an index (Dillman et al., 2009; Triezenberg et al., 2014). I assessed each insecurity concept using multiple items designed to form summative scales (Table 17) for each index and its component questions (Dillman et al., 2009; Triezenberg et al., 2014). I calculated Cronbach's alpha in SPSS to assess the internal consistency between the set of questions used to create each index (Croasmun & Ostrom, 2011). Cronbach's alpha looks at internal consistency between item responses to see if they have a correlation with each other while also looking at variance within a set of questions (Vaske, 2008; Croasmun & Ostrom, 2011). A minimum value of 0.60 is valid for internal consistency within indexes created with greater than 10 questions and as low as 0.50 for indexes created with less than 10 questions (Vaske, 2008; Nunnally & Bernstein, 2010; Pallant, 2016) (see Appendix for indexes, variables, and Cronbach's alpha rankings).

### 1.3.7. Data Analysis

Though several debates around which statistical tests provide the most accurate inferences for ordinal, Likert-type scales data, I chose parametric tests because they are robust against violations of statistical assumptions, as normality of the residuals, without being overly conservative (Norman, 2010). In addition, researchers have found that parametric ( $t$ -test) and non-parametric methods (Mann-Whitney test) produce very similar type I and type II error rates (Winter et al., 2010). Lastly, ordinal data with 5 or more values within a question can be used as continuous data with no added harm to a statistical model (Johnson & Creech, 1983; Zumbo & Zimmerman, 1993; Norman, 2010; Sullivan & Artino, 2013). Based on that, I performed all analyzes using parametric approaches, specifically a Linear Mixed Model. I chose this model specifically due to the hierarchical structure (nesting) of my data, allowing me to take the different effect of the 10 villages into account (Fox, 2015; UCLA: Statistical Consulting Group, 2020). The analysis of each question/index was performed using the following Linear Mixed Model:

$$y = \mathbf{X}\beta + \mathbf{Z}u + e$$

where  $y$  is the vector of responses;  $\beta$  is a vector fixed effects associated to the age (continuous variables), ethnicity (“Tsonga” and “Non-Tsonga”), sex, land ownership status (owns the land or not), and employment status (employed or unemployed) of the residents;  $u$  is the vector of the random effect of townships (villages), with  $u \sim N(0, \sigma_u^2)$ ; and  $e$  is the vector of residuals, with  $e \sim N(0, \sigma_e^2)$ .  $X$  and  $Z$  are the design matrices that associate fixed and random effects to the response variable. LRT and F-Tests were used to verify if the predictors have a significant impact on the response variable(s). Later, I checked the homoscedasticity and the normality of the residuals, and, if necessary, I normalized the data using the Box-Cox transformation of the data

and re-ran the model (Box & Cox, 1964; Gurka et al., 2006; Osborne, 2010). The model described above was fitted using the lme4-R package (Bates et al., 2015).

I also wanted to investigate whether certain aspects of insecurity are related to environmental risk. Simple linear regressions were used to evaluate this as well as predictor variables impact on a particular questions outcome if further analysis was needed (Pak & Oh, 2010). These analyses were performed using SPSS v.26 (IBM Corp, 2019).

CHAPTER 2:  
CONCEPTUALIZING ENVIRONMENTAL INSECURITY WITHIN A BROADER THREAT  
LANDSCAPE: INSIGHTS FROM THE MNISI TRIBAL AUTHORITY RESIDENTS

## 2.1 RESULTS

The MTA Board collectively identified six priority questions. The questions were based off of the overall broad scope of the three research objectives and are discussed below broken down by each question. The goal of this chapter is for the results to be used by the MTA and their members for educational interventions.

### 2.1.1. Demographics

A total of 213 interviews from the ten different villages were completed – more than the planned 207 (Table 1) because exact timing communication lacked in the field and a few extra interviews were conducted. I reduced the 213 interviews down to a total of 211 interviews (female  $n = 105$ , male  $n = 106$ ) due to the fact that two residents did not complete enough of the interview and/or stopped in the middle of the interview due to having to attend to personal matters. Sampling quotas for each village were still achieved (Table 2). Residents self-reported their employment status (no = 128, 60.70%, yes = 83, 39.30%). The majority of residents identified as Tsonga ( $n = 186$ , 88.10%), however other ethnic groups were represented in the final sample including Pedi ( $n = 6$ , 2.80%) Sotho ( $n = 16$ , 7.60%), Swati ( $n = 1$ , 0.50%), Xhosa ( $n = 1$ , 0.50%), and Zulu ( $n = 1$ , 0.5%). The majority of residents ( $n = 114$ , 54.30%) did not own land.

**Table 2: This study explored local perceptions (N = 211) of perception of risk associated with different types of crime in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Ten villages comprised the study sample, with approximate equal parity (2% of the village population/km<sup>2</sup>) between villages.**

Village	Frequency of Interviews	Percent of Interviews
Clare A and B	22	10.4
Gottenburg	22	10.4
Hlavekisa	22	10.4
Hluvukani	25	11.8
Islington	18	8.5
Ludlow	16	7.6
Manyeleti	16	7.6
Tintswalo Village	25	11.8

Table 2 (cont'd)

Wolverdiend	25	11.8
City/Burlington	20	9.5
<b>Total</b>	<b>211</b>	<b>100</b>

### 2.1.2. Question 1: Public Perceptions of Environmental Crime

The MTA's first question focused on public perceptions of different types of environmental crime. Residents' village of residence significantly affected perception (Table 3). Three villages (i.e., Gottenburg, Islington, and Wolverdiend) consistently had an increased risk perception when compared to all villages. Two villages (i.e., White City/Burlington and Tintswalo Village) tended to have decreased risk perception compared to all villages. Averages of risk perception including all 10 environmental crimes ranged from 4.74 to 5.98 with an average risk perception rating of 5.49 measured on a 10-point Likert-type scale.

**Table 3: Means and standard deviations by village of resident's perception of threats in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Means and standard deviations were calculated for all environmental threats presented to the residents.**

Village		Cattle Theft	Deforestation	Development	Drought	Erosion	Littering on Land	Littering in Water	Mosquito/Disease	Over-grazing	Poaching
Clare A and B	Mean	5.36	7.77	3.05	6.68	4.46	7.64	5.67	5.64	5.00	6.96
	SD	3.43	2.78	2.34	3.30	2.96	2.72	3.44	2.54	3.65	2.65
Gottenburg	Mean	5.86	8.36	4.00	7.27	5.24	6.59	5.55	5.32	5.00	6.46
	SD	3.50	2.59	2.58	2.73	2.97	3.22	4.00	3.14	2.70	3.57
Hlavekisa	Mean	3.64	7.30	1.27	6.55	5.41	6.68	4.59	4.90	6.68	3.23
	SD	2.75	2.90	0.88	2.26	2.20	2.51	2.79	3.70	2.19	2.31
Hluvukani	Mean	5.36	6.72	4.04	5.92	5.21	5.92	4.17	4.12	5.08	4.72
	SD	3.03	2.75	2.42	2.68	2.48	2.40	2.33	2.52	2.94	2.61
Islington	Mean	8.00	8.11	4.06	7.06	3.72	6.56	6.00	6.28	3.94	5.78
	SD	2.77	2.42	3.39	3.05	3.08	4.05	3.07	3.32	3.13	3.10
Ludlow	Mean	7.88	7.56	3.81	5.69	5.44	7.56	5.63	4.31	5.81	2.94
	SD	3.16	2.94	2.56	3.09	3.18	2.53	3.72	3.20	3.35	2.38
Manyeleti	Mean	4.94	7.69	2.06	6.40	4.00	5.44	3.63	4.56	4.19	4.50
	SD	2.84	2.60	1.57	2.61	1.41	2.94	2.42	2.71	2.90	2.07
Tintswalo Village	Mean	3.96	6.24	4.48	4.96	6.40	8.28	6.08	6.32	4.64	5.28
	SD	2.89	3.11	2.47	3.03	3.73	2.44	3.14	3.08	3.19	3.31
Wolverdied	Mean	5.20	8.52	5.20	7.44	4.29	8.24	4.88	4.76	6.16	5.12
	SD	3.37	2.49	2.90	3.42	3.16	2.49	3.21	2.73	3.28	3.26
White City	Mean	5.35	7.25	2.15	5.15	5.37	4.95	4.25	4.60	4.72	5.75
	SD	3.69	3.11	1.42	2.87	2.34	3.12	3.70	3.39	3.29	3.39
Total	Mean	5.43	7.53	3.49	6.32	5.00	6.85	5.06	5.10	5.17	5.13
	SD	3.36	2.82	2.61	2.99	2.90	2.99	3.24	3.06	3.12	3.11

The Linear Mixed Model showed that residents' village affected perceptions of cattle theft (VC = 1.11, LRT = 6.83,  $p < 0.05$ ), littering on land (VC = 0.87, LRT = 9.15,  $p < 0.05$ ), littering in water (VC = 0.60, LRT = 3.95,  $p < 0.05$ ), poaching (VC = 1.23, LRT = 10.69,  $p < 0.05$ ), and stock theft (VC = 0.38, LRT = 6.94,  $p < 0.05$ ). Age predicted risk perceptions associated with cattle theft (MS = 116.49,  $F = 12.10$ ,  $p < 0.05$ ), deforestation (MS = 106.03,  $F = 14.44$ ,  $p < 0.001$ ), littering on land (MS = 73.83,  $F = 10.01$ ,  $p < 0.05$ ), and littering in water (MS = 154.07,  $F = 18.10$ ,  $p < 0.05$ ). Gender predicted perceptions of cattle theft (MS = 42.72,  $F = 4.44$ ,  $p < 0.05$ ). Also, noteworthy land ownership significantly affected perceptions on land littering (MS = 44.46,  $F = 6.03$ ,  $p < 0.05$ ) with landowners having a smaller risk perception than non-landowners ( $B = -1.20$ ,  $SE = 0.49$ ,  $p < 0.05$ ).

### 2.1.3. Question 2: Deforestation in the MTA

The MTA's second priority question was how deforestation on MTA lands could be more effectively addressed. Importantly, deforestation is illegal on MTA lands. Among the total sample, deforestation was rated as the highest of ten threat activities presented ( $M = 7.53$ , median = 9.00) (Table 4).

<b>Table 4: Ten threats to environmental security within the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Tsonga translation may be shortened for ease of reading. Mean and standard deviation presented for the 211 residents. Likert-type Scale ranged from 1-10 with 1 being lowest perception of threat and 10 being the most.</b>		
Environmental Risk	Tsonga Translation	Mean (SD) Range 1-10
Deforestation	Ku tsemeleriwa ka nhova/Minsinya.	7.53 (2.82)
Littering on Land	Ku lahliwa ka thyaka laha swinga fanelangiki	6.85 (2.99)
Drought	Dyandza	6.32 (2.99)
Cattle Theft	Ku yiviwa ka tihomu	5.43 (3.36)
Overgrazing	Ku rimiwa ka ndhamu leyi tlulaka mpimo	5.17 (3.12)
Poaching	Ki hlotiwa ka swiharhi swingari enawini	5.13 (3.11)

Table 4 (cont'd)

Mosquito/Disease	Vuvabyi bya Malaria lebyi kumekaka ka tinsuna	5.10 (3.06)
Littering in Water	Ku thyakisiwa ka mati emadan'wini	5.06 (3.24)
Erosion	Ku khukuriwa ka misava hi mpfula.	5.00 (2.90)
Development	Nhluvuko	3.49 (2.61)

As outlined above, the Linear Mixed Model shows, among sociodemographic effects measured, the only significant variable that predicted risk perception associated with deforestation was age (MS = 106.03,  $F=14.44$ ,  $p < 0.05$ ) (Table 5). Exploring that in more detail, individuals under 35 years of age perceived the least threat from deforestation ( $M = 6.97$ ) while individuals over 55 years reported the highest perceived risk of deforestation ( $M=8.68$ ). For every ten years a residents age increased, average answers increased by 0.72 points ( $B = 0.07$ ,  $SE = 0.02$ ).

**Table 5: Local perceptions (N = 211) about the threat perception of deforestation in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Included are Mean Squares (MS), Variance Components (VC), F tests (F), LRT (likelihood ratio test value) and respective p-values for threats of harms and environmental harms within the MTA community. Significant p-values are denoted with \* symbol.**

	Deforestation		
<b>Fixed Effects</b>	<b>MS</b>	<b>F</b>	<b>P</b>
Age	106.03	14.45	0.00*
Children in House	0.28	0.04	0.84
Gender	2.95	0.40	0.53
Employed	17.68	2.41	0.12
Owens land	16.43	2.24	0.14
Ethnicity	0.55	0.08	0.78
<b>Random effects</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>
Village	0.22	1.10	0.30
Residual	7.34		

The questionnaire also asked about frequency of activities within the MTA, including deforestation. Analysis exhibited that MTA residents' village location had significance on perceived frequency of deforestation ( $VC = 0.196$ ,  $LRT = 5.358$ ,  $p < 0.05$ ), dichotomous when compared to risk perception from the threat of deforestation (as shown in table 5:  $VC = 0.22$ ,  $LRT$

= 1.096,  $p > 0.05$ ). This is critical to note when implementing deforestation-related education in certain villages. A mean of 5.80 and a median of 7.00 was reported for perceived frequency of deforestation across villages (Table 6). Based on a simple linear regression, residents agreed that deforestation had a negative effect on their community, causing harm to the environment and local communities. Deforestation negatively effecting communities positively affected environmental insecurity risk perception ( $B = 0.53$ ,  $SE = 0.03$   $p < 0.0001$ ).

<b>Table 6: Perceptions of effect and frequency of deforestation in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Included are mean, standard deviation, and median for deforestation risk perceptions within the MTA community. Likert-type scale was from 1-7 with 1 being lowest risk perception or frequency perception.</b>			
	Deforestation Harms the Environment	Deforestation has Negative Impact on Community	Perceived Frequency of Deforestation
Mean	5.83	4.81	5.80
$\sigma$	1.80	2.23	1.68
Median	7.00	6.00	7.00

Lastly, deforestation influenced perceptions of food insecurity. Residents who had an elevated risk perception of deforestation also had an elevated risk perception of food insecurity. Perception of detrimental effects of deforestation to the environment had a positive effect on risk perception associated with food insecurity ( $B = 0.18$ ,  $SE = 0.06$ ,  $p < 0.05$ ).

#### *2.1.4. Question 3: Traditional Crime and Environmental Crime*

The MTA's third priority question focused on traditional crime in villages and the association with environmental crimes. Traditional crime perceptions measured included assault, burglary, drug crimes, murder, rape, and sexual assault. A participant's village location had a significant effect on perceptions of assault ( $VC = 0.38$ ,  $LRT = 7.87$ ,  $p < 0.05$ ), burglary ( $VC = 0.30$ ,  $LRT = 7.04$ ,  $p < 0.05$ ), drug crimes ( $VC = 0.36$ ,  $LRT = 6.30$ ,  $p < 0.05$ ), and murder ( $VC = 0.56$ ,  $LRT = 8.73$ ,  $p < 0.05$ ) – i.e., all crimes other than rape and sexual assault. Across all villages,

residents perceived traditional crimes as concerns. Residents rated burglary ( $M = 5.75$ ,  $SD = 1.71$ , median = 6.00) as the largest concern among traditional crimes followed by assault ( $M = 5.46$ ,  $SD = 1.89$ , median = 6.00), drug crimes ( $M = 5.23$ ,  $SD = 2.01$ , median = 6.00), sexual assault ( $M = 5.06$ ,  $SD = 2.03$ , median = 6.00), rape ( $M = 4.98$ ,  $SD = 2.09$ , median = 6.00), and murder ( $M = 4.98$ ,  $SD = 2.30$ , median = 6.00). The mean response for all traditional crimes was 5.24 with a constant median of 6.00.

Residents were less concerned about non-traditional crimes ( $M = 4.86$ ) than traditional crimes. However, out of all crime concerns measured, deforestation ranked most concerning to residents ( $M = 5.80$ , median = 7.00). Other non-traditional crimes including cattle theft ( $M = 3.66$ , median = 3.00) and littering in water sources ( $M = 4.08$ , median = 4.00) were perceived to be less of a concern while crimes such as stock theft ( $M = 5.26$ , median = 6.00) and land littering ( $M = 5.50$ , median = 6.00) were perceived at about the same mean ranking as traditional crimes across all residents. Perception of concern with assault, burglary, murder, rape, and sexual assault were all significantly (positively) correlated with the environmental index (Table 7), but drugs were not.

<b>Table 7: Pearson correlation and statistical significance of traditional crimes and the environmental index within the Mnisi Tribal Authority, Mpumalanga, South Africa and the surrounding area (May – July 2019). Included are assault, burglary, drugs, murder, rape, and sexual assault.</b>						
Crime	Assault	Burglary	Drugs	Murder	Rape	Sexual Assault
Correlation Coefficient	.24	.40	.20	.24	.39	.27
Sig. (2-tailed)	.00*	.00*	.03*	.00*	.00*	.00*

#### *2.1.5. Question 4: Public Perceptions of Natural Phenomena Risk*

The MTA's fourth priority question focused on perceptions of risk associated with natural phenomena such as drought. Residents reported relatively high perceptions of risk associated with drought, with most agreeing to strongly agreeing that drought was a concern. Perceptions were

collected regarding drought harm ( $M = 6.55$ , median = 7.00), drought threat ( $M = 6.32$ , median = 6.00), ability to recover from drought ( $M = 6.00$ , median = 7.00), water for community crops ( $M = 5.40$ , median = 6.00), to water for personal crops ( $M = 5.27$ , median = 6.00) (Table 8). The age of residents significantly affected perceptions of worry concerning recovery from drought ( $MS = 19.74$ ,  $F = 9.61$ ,  $p < 0.05$ ). Starting at age 18, every year a resident's age increased, their risk perception increased by 0.03 points related to drought recovery worry ( $B = 0.03$ ,  $SE = 0.01$ ,  $p < 0.05$ ). Worrying about lack of water for community crops ( $MS = 51.13$ ,  $F = 14.45$ ,  $p < 0.05$ ) was affected by age. Residents risk perception increase by 0.05 points for every year older ( $B = 0.05$ ,  $SE = 0.01$ ,  $p < 0.05$ ). Age significantly affected risk perceptions related to water for personal crops ( $MS = 79.80$ ,  $F = 21.17$ ,  $p < 0.05$ ) with every year a resident was older increasing their risk perception by 0.06 points ( $B = 0.06$ ,  $SE = 0.01$ ,  $p < 0.05$ ). One point is one full step up or down on the Likert-type scale (i.e., 1 to 2). Also noteworthy was employment status, land ownership, and gender, all having significant effect on residents' answers about drought risk perception. Employed residents had a decrease in risk perception by 0.75 points compared to unemployed residents, landowners' risk perception decreased by 0.59 points while males had significantly lower risk perceptions with a decreased average risk perception of 0.85 points. Gender also played a significant role in risk perception when looking at risk perceptions related to worrying about lack of water for community crops. Males once again had a decreased risk perception when compared to females ( $B = -0.92$ ,  $SE = 0.27$ ,  $p < 0.001$ ).

**Table 8: Residents perceived risk and perceived worry about situations directly related to drought within the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Calculated mean, standard deviation, and median are included for each village within the questionnaire. A 7-point Likert-type scale was used.**

Village		Drought Harms the Environment	Worry About Lack of Water for Personal Crops	Worry About Lack of Water for Community Crops	Worry About Drought Recovery
Clare A and B	Mean	6.41	5.36	5.32	5.32
	$\sigma$	0.59	1.97	1.73	1.70
	Median	6.00	6.50	6.00	6.00
Gottenburg	Mean	6.68	5.73	5.55	6.55
	$\sigma$	1.13	1.83	1.95	0.91
	Median	7.00	7.00	6.00	7.00
Hlavekisa	Mean	6.32	5.50	5.73	5.96
	$\sigma$	1.39	2.52	2.31	1.53
	Median	7.00	7.00	7.00	6.50
Hluvukani	Mean	6.80	5.28	5.64	6.40
	$\sigma$	0.50	2.35	2.04	0.87
	Median	7.00	6.00	7.00	7.00
Islington	Mean	6.94	5.82	5.78	6.17
	$\sigma$	0.24	1.98	1.77	1.82
	Median	7.00	7.00	7.00	7.00
Ludlow	Mean	6.06	5.94	5.69	6.19
	$\sigma$	1.91	2.02	2.44	1.52
	Median	7.00	7.00	7.00	7.00
Manyeleti	Mean	6.19	6.00	6.27	6.19
	$\sigma$	1.52	1.31	1.03	0.83
	Median	7.00	7.00	7.00	6.00
Tintswalo Village	Mean	6.84	4.16	4.56	5.80
	$\sigma$	0.37	2.08	2.18	1.71
	Median	7.00	5.00	5.00	6.00
Welverdiend	Mean	6.84	5.32	5.28	5.96
	$\sigma$	0.47	1.84	1.93	1.21
	Median	7.00	6.00	6.00	6.00
White City/Burlington	Mean	6.10	4.15	4.65	5.50
	$\sigma$	1.17	2.43	2.13	1.96
	Median	7.00	4.50	5.00	6.00
Total	Mean	6.55	5.27	5.40	6.00
	$\sigma$	1.04	2.13	2.02	1.47
	Median	7.00	6.00	6.00	7.00

A participant's worry about having a reliable source of drinking water had a positive effect on their perceptions of risk associated with food insecurity ( $B = 0.30$ ,  $SE = 0.06$ ,  $p < 0.0001$ ) as well as their worry about having a reliable source of water for non-drinking purposes ( $B = 0.38$ ,  $SE = 0.06$ ,  $p < 0.0001$ ). Residents reported that worrying about having enough water for their personal crops ( $B = 0.36$ ,  $SE = 0.05$ ,  $p < 0.0001$ ) and their communities having enough water for their crops ( $B = 0.29$ ,  $SE = 0.06$ ,  $p < 0.0001$ ) both had a positive effect on perceptions of food insecurity. Lastly, worrying about recovering from drought had a positive effect on food insecurity risk perception ( $B = 0.30$ ,  $SE = 0.08$ ,  $p < 0.0001$ ).

#### 2.1.6. Question 5: Insight into Environmental Insecurity Solutions

The fifth priority question posed by the MTA focused on translating insight from the data collected into potential educational and intervention solutions for betterment of MTA residents. With regards to trust, I asked residents their thoughts on trust and related subjects within their community and surrounding areas. The trust index was positively correlated with the environmental index ( $r(211) = 0.15$ ,  $p < 0.05$ ), with trust also being positively correlated with education and employment as well as negatively correlated with poaching (Table 9).

<b>Table 9: Pearson Correlations of seven insecurity indexes within the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Statistical significance is denoted with asterisks. One asterisk for statistical significance at the 0.05 level and two for the 0.01 level.</b>							
	Crime	Education and Employment	Environmental	Food	Poaching	Trust	Water
Crime	1	0.07	<b>0.38**</b>	<b>0.19**</b>	<b>0.20**</b>	0.10	<b>0.20**</b>
Education and Employment	0.07	1	0.00	-0.09	0.03	<b>0.24**</b>	0.07
Environmental	<b>0.38**</b>	0.00	1	<b>0.48**</b>	<b>0.15*</b>	<b>0.15**</b>	<b>0.59**</b>
Food	<b>0.19**</b>	-0.09	<b>0.48**</b>	1	0.01	0.12	<b>0.47**</b>
Poaching	<b>0.20**</b>	0.03	<b>0.15*</b>	0.01	1	<b>-0.15*</b>	0.08
Trust	0.10	<b>0.24**</b>	<b>0.15**</b>	0.12	<b>-0.15*</b>	1	0.10
Water	<b>0.20**</b>	0.07	<b>0.59**</b>	<b>0.47**</b>	0.08	0.10	1

Trust, and concepts related to trust, such as corruption and integrity were associated with very high-risk perception rankings throughout the MTA. Residents ranked worrying about corruption ( $M = 5.92$ ,  $\sigma = 1.73$ , median = 7.00) as the largest singular trust issue while also showing a large distrust in local government ( $M = 2.97$ ,  $\sigma = 2.13$ , median = 2.00) and national government ( $M = 3.64$ ,  $\sigma = 2.314$ , median = 3.00). Residents ranked trust in rangers in the surrounding protected areas and game reserves ( $M = 4.97$ ,  $\sigma = 2.00$ , median = 5.00) significantly higher (Table 10).

**Table 10: Residents perceptions on trust within the Mnisi Tribal Authority, Mpumalanga, South Africa and the surrounding area (May – July 2019). Included are the mean, standard deviation, and median. A 7-point Likert-type scale was used with 1 being completely disagree and 7 being completely agree with the statement.**

Factors	Corruption Worry	Local Govt. Trust	Local Police Integrity	Nat. Govt. Trust	Ranger Trust	Trust (general)	Trust Index
Mean	5.92	2.97	3.15	3.64	4.97	4.49	4.19
$\sigma$	1.73	2.13	2.12	2.31	1.99	2.37	1.22
Median	7.00	2.00	3.00	3.00	5.00	5.00	4.00

Worry about corruption had a positive effect on environmental insecurity risk perception ( $B = 0.30$ ,  $SE = 0.04$ ,  $p < 0.0001$ ). Lastly, trust varied by village (Table 11).

**Table 11: Residents perceptions on trust by village within the Mnisi Tribal Authority, Mpumalanga, South Africa and the surrounding area (May – July 2019). Included are the mean, standard deviation, and median for all villages measured.**

Village		Corrupt. Worry	Local Govt. Trust	Local Police Integrity	Nat. Govt. Trust	Ranger Trust	Trust	Trust Index
Clare A and B	Mean	6.23	2.41	3.18	2.68	5.32	5.00	4.14
	$\sigma$	1.19	1.71	2.06	2.01	1.70	1.95	1.24
	Median	7.00	2.00	2.50	2.00	5.50	5.50	4.08
Gottenburg	Mean	5.36	3.09	3.05	3.36	4.86	4.91	4.11
	$\sigma$	2.38	1.95	1.99	1.99	1.89	2.25	1.15
	Median	7.00	3.00	3.00	3.00	5.00	5.50	4.00
Hlavekisa	Mean	5.23	3.00	3.96	4.59	5.73	4.77	4.55
	$\sigma$	2.25	2.49	2.63	2.59	1.88	2.56	1.32
	Median	7.00	2.00	4.00	5.50	7.00	7.00	4.75
Hluvukani	Mean	6.32	3.00	2.80	3.40	4.52	4.84	4.15
	$\sigma$	1.22	2.02	2.12	2.52	2.24	2.34	1.19

Table 11 (cont'd)

	Median	7.00	2.00	2.00	2.00	5.00	6.00	4.17
Islington	Mean	6.33	3.11	3.22	3.28	4.39	4.67	4.17
	$\sigma$	1.14	2.68	2.67	2.63	2.40	2.81	1.69
	Median	7.00	1.50	1.50	2.00	4.00	6.50	3.17
Ludlow	Mean	6.38	3.69	3.63	4.19	5.31	3.13	4.39
	$\sigma$	0.96	2.06	2.06	2.23	2.02	2.09	1.15
	Median	7.00	3.50	3.50	4.50	6.50	3.00	4.50
Manyeleti	Mean	5.75	3.06	2.69	3.75	5.25	4.94	4.24
	$\sigma$	1.61	2.46	1.89	2.62	1.48	2.49	1.39
	Median	6.00	2.00	2.00	3.00	5.00	6.50	3.92
Tintswalo Village	Mean	6.16	2.32	3.28	3.68	4.84	4.72	4.17
	$\sigma$	1.21	1.70	1.86	2.12	1.84	2.01	1.10
	Median	7.00	2.00	3.00	4.00	5.00	5.00	4.33
Wolverdind	Mean	6.24	3.20	2.72	3.68	5.16	4.16	4.19
	$\sigma$	1.69	2.24	2.09	2.12	2.12	2.53	1.05
	Median	7.00	3.00	2.00	4.00	6.00	4.00	4.00
White City/Burlington	Mean	5.10	3.10	3.10	3.95	4.35	3.45	3.84
	$\sigma$	2.43	2.15	1.86	2.31	2.08	2.35	1.06
	Median	6.50	3.00	3.00	4.00	4.00	2.50	3.67
Total	Mean	5.92	2.97	3.15	3.64	4.97	4.49	4.19
	$\sigma$	1.73	2.13	2.12	2.31	1.99	2.37	1.22
	Median	7.00	2.00	3.00	3.00	5.00	5.00	4.00

### 2.1.7. Question 6: Poaching Perceptions

The final priority question posed by the MTA focused on perceptions of wildlife poaching in and around the MTA. Study residents reported perceptions on ten species known to inhabit MTA lands and the surrounding area. There was significant variation across individual villages ( $VC = 0.13$ ,  $LRT = 8.21$ ,  $p < 0.05$ ) on perception of frequency (Table 12). Across all villages sampled, the top four species perceived to be poached were rhino (*Ceratotherium simum* and *Diceros bicornis*) ( $M = 4.10$ ), impala (*Aepyceros melampus*) ( $M = 2.59$ ), elephant (*Loxodonta africana*) ( $M = 2.11$ ), and pangolin (*Manis temmenickii*) ( $M = 2.04$ ) (Table 12). Across all villages sampled, the three species perceived to be poached least frequently were wild dog (*Lycaon pictus*) ( $M = 1.64$ ), leopard (*Panthera pardus*) ( $M = 1.73$ ), and hyena (*Hyaena brunnea*) ( $M = 1.85$ ).

Residents from Gottenburg ( $M = 2.98$ ,  $SD = 1.85$ , median = 2.70), Tintswalo Village ( $M = 2.48$ ,  $SD = 1.47$ , median = 1.90), and White City/Burlington ( $M = 2.48$ ,  $SD = 1.47$ , median = 1.80) perceived poaching rates to be higher compared to other villages. Gottenburg and White City/Burlington had higher frequency perceptions than all other villages. Participants had lower perceptions of poaching frequency in Hlavekisa ( $M = 1.60$ ,  $SD = 1.04$ , median = 1.20), Islington ( $M = 1.77$ ,  $SD = 1.547$ , median = 1.00), and Clare A and B ( $M = 1.81$ ,  $SD = 1.14$ , median = 1.40), with residents' perceptions ranking under the average of all villages ( $M = 2.17$ ).

Residents were asked about their perceived environmental harms associated with poaching. Residents age ( $MS = 8.030$ ,  $F = 5.009$ ,  $p < 0.05$ ), children living in their household ( $MS = 8.263$ ,  $F = 5.155$ ,  $p < 0.05$ ), and land ownership status ( $MS = 7.846$ ,  $F = 5.155$ ,  $p < 0.05$ ) all had significant influence on their perceptions. Risk perception of the threat to their local community attributed to poaching was influenced by age ( $MS = 29.059$ ,  $F = 10.661$ ,  $p < 0.05$ ), children living in their household ( $MS = 16.494$ ,  $F = 6.051$ ,  $p < 0.05$ ), and ethnicity ( $MS = 17.218$ ,  $F = 6.317$ ,  $p < 0.05$ ).

<b>Table 12: Residents perceptions of frequency of individual animals being poached. The table is broken down by villages in the Mnisi Tribal Authority, Mpumalanga, South Africa (May - July 2019)</b>												
Village		Elephant	Hyena	Impala	Leopard	Lion	Pangolin	Python	Rhino	Vulture	Wild Dog	Total
Clare A and B	Mean	1.46	1.36	1.59	1.41	1.46	1.36	1.67	4.41	1.86	1.55	1.81
	Std. Deviation	0.91	0.90	0.96	0.96	1.06	0.90	1.20	2.06	1.28	1.18	1.14
	Median	1.00	1.00	1.00	1.00	1.00	1.00	1.00	5.00	1.00	1.00	1.40
Gottenburg	Mean	2.82	2.36	3.59	2.36	2.27	3.27	2.91	5.14	2.91	2.18	2.98
	Std. Deviation	1.89	1.62	2.36	1.59	1.72	1.96	1.88	2.05	1.93	1.53	1.85
	Median	3.00	2.00	3.50	2.00	1.00	4.00	2.50	5.50	2.50	1.00	2.70
Hlavekisa	Mean	1.91	1.14	1.96	1.48	1.29	1.41	1.55	3.10	1.05	1.14	1.60
	Std. Deviation	1.38	0.66	1.65	1.08	0.90	1.05	1.06	1.73	0.22	0.66	1.04
	Median	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	1.20
Hluvukani	Mean	2.08	1.56	2.32	1.40	1.08	2.29	1.75	4.56	2.00	1.38	2.04
	Std. Deviation	1.35	1.04	1.44	0.87	0.28	1.52	1.11	1.61	1.41	0.77	1.14
	Median	1.00	1.00	2.00	1.00	1.00	1.50	1.00	5.00	1.00	1.00	1.55
Islington	Mean	1.53	1.67	2.11	1.29	1.35	1.77	1.67	2.78	2.11	1.39	1.77
	Std. Deviation	1.46	1.65	2.11	0.77	0.10	1.79	1.33	2.37	2.03	0.98	1.46
	Median	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ludlow	Mean	2.31	2.13	2.50	1.94	1.94	2.06	2.13	3.00	1.81	1.81	2.16
	Std. Deviation	1.54	1.50	1.71	1.44	1.44	1.39	1.41	1.51	1.33	1.33	1.46
	Median	1.00	1.00	1.50	1.00	1.00	1.00	1.00	3.50	1.00	1.00	1.30
Manyeleti	Mean	2.25	2.38	3.00	1.38	1.38	1.44	2.00	3.69	1.44	1.31	2.03
	Std. Deviation	1.39	1.59	1.86	1.03	1.03	1.03	1.55	2.18	1.21	0.87	1.37
	Median	2.00	1.50	3.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00	1.65

Table 12 (cont'd)

Tintswalo Village	Mean	2.72	2.08	3.40	2.16	2.16	2.35	2.17	4.56	2.38	2.21	2.62
	Std. Deviation	2.05	1.41	1.98	1.43	1.46	1.43	1.81	2.38	1.61	1.41	1.70
	Median	2.00	1.00	4.00	1.00	1.00	2.00	1.00	5.00	1.00	1.00	1.90
Wolverdiend	Mean	1.76	1.92	2.12	1.72	1.60	2.20	1.84	4.16	1.64	1.52	2.05
	Std. Deviation	1.33	1.55	1.48	1.51	1.35	1.66	1.34	2.15	1.22	1.23	1.48
	Median	1.00	1.00	2.00	1.00	1.00	1.00	1.00	5.00	1.00	1.00	1.50
White City/Burlington	Mean	2.21	2.10	3.40	2.05	1.90	2.00	2.16	4.90	2.10	1.75	2.46
	Std. Deviation	1.72	1.41	2.01	1.43	1.45	1.37	1.30	1.48	1.29	1.21	1.47
	Median	1.00	1.00	3.50	1.00	1.00	1.00	2.00	5.00	1.50	1.00	1.80
Total	Mean	2.11	1.85	2.59	1.73	1.65	2.04	1.98	4.11	1.95	1.64	2.17
	Std. Deviation	1.57	1.38	1.87	1.28	1.27	1.53	1.45	2.09	1.48	1.18	1.51
	Median	1.00	1.00	2.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00	1.40

Older residents' viewpoints on poaching harming the environment increased by 0.20 points for every ten years ( $B = 0.02$ ,  $SE = 0.01$ ,  $p < 0.05$ ) and increased their perception of harm to their community by 0.38 points for every ten years ( $B = 0.04$ ,  $SE = 0.01$ ,  $p < 0.05$ ). Having children in the household decreased their perception of harm to the environment due to poaching ( $B = -0.10$ ,  $SE = 0.05$ ,  $p < 0.05$ ) and decreased their perception of harm to their location community ( $B = -0.15$ ,  $SE = 0.06$ ,  $p < 0.05$ ). Land ownership had the same effect, decreasing a participant's risk perception of poaching harm to the environment ( $B = -0.49$ ,  $SE = 0.22$ ,  $p < 0.05$ ), while identifying as Tsonga had the opposite effect, significantly increasing a residents risk perception of harm to their community ( $B = 0.90$ ,  $SE = 0.36$ ,  $p < 0.05$ ). Poaching was positively correlated with crime perceptions (Table 13).

**Table 13: Local perceptions (N = 211) measuring the perception of frequency of individual animals poached in and around the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Included are Mean Squares (MS), Variance Components (VC), F-tests (F), LRT (likelihood ratio test value) and respective p-values for perception of individual poached animals within the Mnisi Tribal Authority. Significant p-values denoted with \*.**

Elephant Poaching				Hyena Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	4.05	1.80	0.18	0.41	0.24	0.62
Children in House	2.10	0.94	0.34	2.76	1.62	0.21
Gender	3.27	1.45	0.23	1.49	0.87	0.35
Employed	0.71	0.32	0.58	0.21	0.12	0.73
Owns Land	0.12	0.05	0.82	2.09	1.22	0.27
Ethnicity	1.51	0.67	0.41	0.00	0.00	0.10
Random effects	VC	LRT	P	VC	LRT	P
Village	0.14	2.97	0.09*	0.12	3.61	0.06*
Residual	2.25			1.71		

  

Impala Poaching				Leopard Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	0.03	0.01	0.92	1.18	0.77	0.38
Children in House	0.81	0.27	0.61	1.28	0.83	0.36
Gender	17.37	5.73	0.02*	0.37	0.24	0.62
Employed	0.26	0.09	0.77	0.21	0.14	0.71
Owns Land	1.64	0.54	0.46	2.40	1.57	0.21

Table 13 (cont'd)

Ethnicity	1.14	0.38	0.54	0.59	0.39	0.54
<b>Random effects</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>
Village	0.38	10.01	0.00*	0.11	4.04	0.04*
Residual	3.03			1.53		

Lion Poaching				Pangolin Poaching		
<b>Fixed Effects</b>	<b>MS</b>	<b>F</b>	<b>P</b>	<b>MS</b>	<b>F</b>	<b>P</b>
Age	1.86	1.29	0.26	0.01	0.00	0.95
Children in House	0.10	0.07	0.79	5.05	2.35	0.13
Gender	0.91	0.63	0.43	2.01	0.93	0.34
Employed	1.97	1.36	0.25	0.63	0.29	0.59
Owns Land	1.33	0.92	0.34	0.20	0.09	0.76
Ethnicity	1.60	1.10	0.30	0.00	0.00	0.96
<b>Random effects</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>
Village	0.11	4.59	0.03*	0.25	8.74	0.00*
Residual	1.45			2.15		

Python Poaching				Rhino Poaching		
<b>Fixed Effects</b>	<b>MS</b>	<b>F</b>	<b>P</b>	<b>MS</b>	<b>F</b>	<b>P</b>
Age	0.01	0.01	0.94	0.85	0.21	0.65
Children in House	0.88	0.42	0.52	0.82	0.20	0.65
Gender	4.44	2.14	0.15	4.80	1.20	0.28
Employed	0.01	0.01	0.94	1.62	0.41	0.53
Owns Land	0.01	0.01	0.94	2.74	0.68	0.41
Ethnicity	0.54	0.26	0.61	0.00	0.00	0.99
<b>Random effects</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>
Village	0.07	1.12	0.29	0.53	8.95	0.00*
Residual	2.07			4.00		

Vulture Poaching				Wild Dog Poaching		
<b>Fixed Effects</b>	<b>MS</b>	<b>F</b>	<b>P</b>	<b>MS</b>	<b>F</b>	<b>P</b>
Age	0.45	0.22	0.64	0.01	0.01	0.92
Children in House	0.38	0.19	0.67	0.01	0.01	0.94
Gender	5.81	2.83	0.09	0.06	0.04	0.84
Employed	0.29	0.14	0.71	0.00	0.00	0.98
Owns Land	0.87	0.42	0.52	0.01	0.01	0.92
Ethnicity	0.48	0.23	0.63	0.01	0.01	0.93
<b>Random effects</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>
Village	0.15	4.14	0.04*	0.08	2.96	0.09*
Residual	2.05			1.36		

## 2.2 DISCUSSION

Insecurity is a concept cutting across sustainable development and conservation problems (Zohdi et al., 2007; Winchester et al., 2018). Insecurity solutions are ideated on multiple variables, scales, and actors (Bogardi et al., 2012; Poppy et al., 2014; Henry, 2017). Local-level perspectives on the causes and consequences of insecurity are invaluable. By observing such information, decision-makers can make more informed decisions (Meissner et al., 2018). Local perceptions can aid policy-making decisions (Gore et al., 2016). They also can help differentiate between various interventions, helping to illustrate where and how these interventions can take place and help. Based on data herein, crime is closely correlated with various types of insecurity. There are many types of individuals involved in exploitation of natural resources ranging from those who perform subsistence crimes to those who are involved in large crime syndicates. Local knowledge has the potential to provide unique insight for law enforcement authorities and decrease the severity and frequency of crime events that in turn help reduce the threat to the earth's ecosystems and biodiversity (Hariohay et al., 2019).

I helped illustrate the complexity of local perspectives about insecurity. Public risk perceptions of traditional (e.g., assault, murder, rape) and environmental crimes (e.g., deforestation and poaching), the risk associated with natural phenomena (e.g., drought), and other potential insecurities (e.g., food) all have the potential to affect one another. Insight translated from public risk perception has the potential to be a powerful tool for global law enforcement, policymakers, and many other global actors. If resolving insecurity is an aim of decision-makers, then information about the issues that matter to local people can be at the forefront of thought processes and resolutions.

### *2.2.1. Deforestation, its Effects, and Potential Solutions*

Study participants perceived deforestation as being the human activity posing the greatest threat to environmental security based on the 10 choices provided. The wood used from deforestation in the MTA is primarily used as an energy source for cooking and heating. Globally, about 33 % of the population relies on burning biomass for their cooking and heating needs, and in Africa, they meet 90 % of household energy demand with the burning of biomass (Dilger et al., 2016; Yadav & Devi, 2018). Wood burning inside the household, which is common, emits toxic substances and soot into the air, posing health risks for people inside the home (Dilger et al., 2016; Niranjana & Thakur, 2017). Burning of biomass emits ambient particulate matter that has the potential of warming up the micro-climate of a region (Uhunamure et al., 2016). Within the MTA, primary energy sources other than wood burning are lacking, and perceived support from the government and other potential sources is average. Assessments have found deforestation for energy is a key contributor to soil erosion, biodiversity loss, and degraded drinking water quality (Uhunamure et al., 2016).

Globally, deforestation is linked with food insecurity (Shriar, 2002; Chakravarty et al., 2012; Houghton, 2012; World Resources Institute, 2017; Vu et al., 2017; Meyfroidt, 2018). Food insecurity increased because of growth in population and resulting land transformation from forest to agriculture (Ngome et al., 2019). Concurrent with changes in the MTA due to population growth and land being turned over for agricultural purposes, my results revealed that increased risk perception of deforestation on the community was positively correlated and positively affected risk perceptions on food insecurity. Age also played a significant role in risk perception associated with deforestation, leading to a few potential remedies to help aid food security along with efforts to reduce deforestation. Younger MTA residents had the least risk perception related to

deforestation. Taking this into account, younger populations could be educated on deforestation and its negative outcomes while older populations, already with a higher than average risk perception, could be used for the actual implementation of anti-deforestation techniques in the community. When implementing education and interventions within the MTA, coupling deforestation techniques along with an age element might have a positive effect and help decrease food insecurity within the MTA (Uhunamure et al., 2016; World Resources Institute, 2017; Ngome et al., 2019).

Multiple solutions could help minimize risks to security caused by deforestation in the MTA. Alternative energy sources such as solar power, solar cookers, and hydroelectric power are options that may provide viable alternatives to using wood fuel for energy, although each carry associated risks (Wentzel & Pouris, 2007; Uhunamure et al., 2016; Korkovelos et al., 2018; Moran et al., 2018). Cost-sharing and logistical collaboration among local, regional, and national governments are also essential ingredients for effective alternative energy creation (Skinner, 2014; Uhunamure et al., 2016; Moran et al., 2018). New agricultural practices could also serve as a potential solution. Working to create off-farm income opportunities has been shown to lessen pressures on the land and forested areas. The cultivation and encouragement for home gardens and perennial crops especially among poor households have been shown to have a positive influence on reducing deforestation and food insecurity (Shriar, 2002).

#### *2.2.2. Natural Phenomena (e.g. Drought)*

Drought, a natural and chronic phenomenon impacted by climate change, was perceived as high risk. The water storage capacity of a region is a key limiting factor related to the water security of dense population centers (Ehsani et al., 2017). Residents of the MTA were highly concerned with drought and the negative effects it has on their community. MTA Board Members brought up

large hydropower dams and irrigation schemes to address energy and water insecurity along with drought. MTA residents found this to be an attractive solution. Many times, in high-income countries, responses to disasters such as drought come with a swift infrastructure response such as dams and levees that ultimately change the flow of water in a region, often with unintended, diverse, negative impacts (Palmer, 2010). Because of the interplay and stressors that factor in water systems, every country and region is unique. However, across many contexts we have seen that large hydroelectric dam construction can disrupt river ecology, can end up costing nearly double pre-building estimates, increase greenhouse gases, displace residents, and increase political corruption (Ansar et al., 2014; Leslie, 2014; Kirchherr et al., 2016; Korkovelos et al., 2018; Moran et al., 2018). Therefore, large dams are most likely not the answer for the MTA (Leslie, 2014; Korkovelos et al., 2018; Moran et al., 2018), particularly because of the relationship between biodiversity and dams, which can lead to other unintended consequences such as a loss of native species or lower quality of water (Korkovelos et al., 2018; Palmer, 2010). Negative results also include the elimination of native fish that keep algae under control or a negative effect on another watershed in future years that leads to declines in freshwater and economic benefits for the region (Palmer, 2010). Before the MTA creates any hydropower solutions, policymakers ideally need to take all possibilities into account and the government needs to be transparent in public hearings (Skinner, 2014; Moran et al., 2018). Historical evidence suggests that human water security correlates positively with the availability and amount of storage capacity a region has at its disposal (Vörösmarty et al., 2010).

A move towards a holistic small-scale water management system to reduce water demand and increase water security is a potential option for the MTA (Kirchherr et al., 2016; Ehsani et al., 2017; Moran et al., 2018). Therefore, the creation of small hydropower solutions has the potential

to be a solution. Small hydropower as a technology is often presented as being one of, if not the best suited potential power supply for South Africa (Kaunda et al., 2012). Generally, small hydro refers to low capacity power plants that can range from around 1.5MW to 50MW depending on the country of origin (Opperman, 2018). It can be geographically targeted, reduces the amount of transmission required which lessens the loss of energy, and the initial cost is significantly less than large hydropower options (West, 2019). The chance to improve energy, food, and water security while also helping to lessen the risk of disaster are all potential outcomes in the MTA due to alternative forms of energy including pond restoration, small scale cookers, and small hydropower (Wentzel & Pouris, 2007; Ansar et al., 2014; Korkovelos et al., 2018; Moran et al., 2018)

### *2.2.3. Poaching and Traditional Crime*

The perceived risk of wildlife poaching among study participants was low. On the Likert-type scale, many residents perceived frequencies being lower than four, showing small perceived frequency in their village and surrounding areas. However, important village level and age differences emerged, with certain villages perceiving higher overall poaching risks and higher perceived risk for certain species over others [e.g., rhino over python (*Python sebae*)]. Among the ten animals queried in the survey, residents perceived rhinos as being the most at risk from poaching. Age also played a significant influence on poaching and snaring in all cases. This is interesting because perception does not equal reality. The harm by poaching to the community and environment is a singular effect, no matter if a resident is eighteen or eighty years old. Increased age resulted in increased risk perception of poaching and snaring harms to the community and environment. Previous literature based in Tanzania found that younger individuals (between 18 and 36 years of age) were more apt to poach and commit conservation crimes while younger males were more involved in bushmeat hunting in the Serengeti (Loibooki et al., 2002; Hariohay et al.,

2019). Higher ages were not as likely to be involved in conservation crimes, as self-reported. Younger residents in the MTA could therefore be under-reporting perception of poaching frequency due to their involvement in the illicit activities. Suspected reasons include the fact that poaching, and snaring are gruelling, physical activities that make the task much more difficult for older individuals (Hariohay et al., 2019; Huang & Chen, 2020). The current study did not gain information regarding participation in the activities, but the results from my study would suggest that age is a determinant for poaching related activities in the MTA due to older residents having a lower perception of frequency of poaching within the MTA compared to younger residents.

Three other key findings were apparent: *i*) land ownership decreased a participant's risk perception of poaching's harm to the environment, *ii*) land ownership and employment status heavily influences snaring risk perception related to community environmental harm, and *iii*) poaching perceptions affect traditional crime perceptions. Previous studies have documented that land ownership and employment status may affect participation in conservation crimes in game reserves, while education can play a role in stopping illegal behavior (Hariohay et al., 2019; Huang & Chen, 2020). Bushmeat poaching in Serengeti National Park was also conducted by non-livestock owners, which usually correlates to non-landowners (Loibooki et al., 2002). However, previous research has implied that land ownership, access to land, and livestock ownership on the land, may not be the only focal point for interventions (Ceppi & Nielsen, 2014). Instead of focusing on poor, non-educated, non-landowners as the potential perpetrators, looking at other factors is crucial to gaining a whole picture (Knapp, 2012). Different factors including boredom, formation of identity, and looking for a thrill could drive poachers (Knapp, 2012). Village location compared to protected areas was also found to increase consumption of bushmeat while increased protection status at the PAs was shown to lessen consumption (Hariohay et al., 2019). Within my study, land

ownership split almost evenly among questionnaire residents with 46 % owning land and 54 % being non-landowners. Land ownership did not have significance on the poaching index nor the crime index within my study. Previous research points to land ownership being a factor, however, when thinking about interventions within the MTA, addressing the issue may be more complex. Poaching data from the surrounding PAs (distinct sections of land with the long-term goal of conservation) and National Parks could aid in understanding the relationship between land ownership and poaching along with following up in the area looking into village location relative to parks and actual poaching statistics.

Help from PAs and National Parks coupled with the contributions of criminologists may help ease crime insecurity and poaching risks. Help can come from aiding in statistical analysis, providing boots on the ground based on criminological assessment, and using local input to aid in deterrence. In the past, conservation biology was and is the catalyst for population and PA management interventions (Garbero, 2017). Studying and viewing the issue starting with a fresh lens of criminology could have dramatic positive effects in reduction. Traditional crime is typically found in clusters or crime ‘hotspots’ (Almanie et al., 2015; Malleson & Andersen, 2015; Gore et al., 2016). Traditional crime can also typically be found in units of analysis including but not limited to the victims, streets, and paths they used to get around, accommodations, products, and a temporal aspect (Malleson & Andersen, 2015; Garbero, 2017). Recent wildlife crime literature has shown that poaching can be and is many times in hotspots because of the use of certain routes, location of transport ports such as airports, and location compared to markets and roads while previous research triangulates my findings and has shown that wildlife crime is like traditional forms of crime, especially in terms of the use of drug trafficking routes and hotspots of locations (Ayling, 2013; Wasser et al., 2018; Zafra-Calvo et al., 2018). Within the MTA, this spatial

distribution can be seen within the significance village had on poaching perceptions. Understanding the spatial distribution along with the temporal distribution of these crime hotspots has been proven effective in helping to combat these crimes (Wasser et al., 2018). The location of a participant's village was a significant variable concerning crime and poaching perceptions based on Linear Mixed Model analysis. I did not measure village proximity to roads in this study. However, future research could yield insight based on previous research. In Kruger National Park, South Africa, about 90 % of all rhino poaching incidents occurred within 2.5 km of a road (Garbero, 2017). This is not an anomaly or grouped just in developing countries; in the Northwest United States for example, the Coastal Redwoods are an endangered species (Marteache & Pires, 2019). They have burls at the base of their trunks that are being cut off and made into furniture. It correlates closely to the removal of elephant tusks or rhino horn because it leaves the entire organism vulnerable to outside risks that it normally would not be susceptible to (Marteache & Pires, 2019). Offenders cutting off these burls, much like the poachers removing rhino horn in South Africa, are targeting areas close to roads and markets (Marteache & Pires, 2019).

#### *2.2.4. Implications for Education and Other Interventions*

Situational crime prevention (SCP) concerns itself with the opportunity, rather than strictly focusing on the offender of crime (Tilley & Sidebottom, 2014). It comprises opportunity reducing measures that can be broken down into five categories including increasing the effort placed on the offender, increasing the risk to the offender, reduction in the rewards, removing the excuses for the offender, and reduction of provocations (POP Center, n.d.). Within the MTA, they could address the relationship between poaching and traditional crime with criminological methods such as SCP. The potential use and implantation of proven traditional crime prevention methods to combat wildlife crime are positive. Assessing the current situation in the MTA, further research

needs to include proximity to roads, markets, and other factors influencing perpetrators. In the meantime, focusing on what experts have researched and looking at SCP methods could be a key to reducing traditional and conservational crime in the MTA and surrounding areas.

Including local people in solutions to ease environmental and other forms of insecurity is paramount for success (Gore et al. 2016). Local perceptions may connect to educational or other interventions designed to enhance the security of all types. An intervention to address environmental insecurity within the MTA could also create alternatives for income, identifying potential income sources followed by education and implementation. Two alternatives for alternative incomes are community-based ecotourism and soil, more specifically, agriculture and agribusiness. Agriculture and agribusiness are estimated to be worth 1 trillion dollars by 2030 in Africa (Munang & Mgendi, 2014).

The MTA is a relatively remote and rural area. Ecotourism has a high potential economic impact in areas like this by cultivating financial growth, opportunity, and natural resource conservation (Kim et al., 2019). Ecotourism also can positively affect other household livelihood strategies such as agriculture and home businesses (Kim et al., 2019). Ecotourism and game reserves also present a potential, advantageous collaboration for the MTA. Kruger National Park is one of the largest conservation areas globally and offers the potential to be of expert use to the MTA. Previous research done in Kruger National Park has shown that residents of the towns of Cork and Belfast were proud of the KNP but did not feel that they were truly connected (Strickland-Munro et al., 2010). The Makuleke Concession, an agreement between the Makuleke people of Northeast South Africa and the National Government, is a great example of the possible positive benefits from ecotourism (Kotze, 2020). It is also a warning of the potential risk of resilience to shock and outside factors. The spread of COVID-19 has had a profoundly negative impact on the

ecotourism industry in Africa, many times even cutting off sources of income for protected areas with biodiversity (Refisch, 2020). The Makuleke community has had its primary source of income cut off and many experts think if things don't improve quickly, the economy may never fully recover (Kotze, 2020). Before implementing any interventions, expectations need to be realistic on both sides. Potential improvements in local people gaining more inclusive and steady access include tour operator stops at stalls, education at local schools, and transparency in hiring practices (Strickland-Munro et al., 2010). Previous research has shown that these will be policy-making decisions which make it crucial for local involvement in that process. South African ecotourism is a booming market with a significant upside in the post-apartheid era, and there are still many potential financial opportunities to take part in that which not only help the people of the MTA but also help the preservation of biodiversity in the surrounding areas, producing a powerful symbiotic relationship (Koelble, 2011).

By some measures, agriculture also has an enormous potential as an alternative income generator. Current income generators in the MTA are diverse and not limited to small and informal businesses (Spaza shops), employment in conservation organizations, temporary employment in various paid leadership/skill programs/internships, civil employment, tourism supply chain, local fresh produce production, traditional healing, harvesting of natural resources for sale, social security grants, funeral services, illegal wildlife trade, and farming. Sixty percent of Africa's workforce depends on agriculture. Food exports were 30% less than imports in 2011, and the rising population is increasing the desire for nutritious and varied food, all of which create a viable potential opportunity for income (Thornton, 2008; Munang & Mgende, 2014). Investing and improving in this realm can also lessen the dependence on finite opportunities such as temporary jobs, unemployment grants, illegal wildlife trades, harvesting of natural resources, and traditional

healing, which could run out eventually in the MTA. Agricultural cooperatives could be a possibility. However, there are setbacks such as a limit to credit, constrained markets, and lack of education (Ortmann & King, 2007). Implementing and teaching home gardening might be a better option to start for self-sufficiency and skill learning (Baiyegunhi & Makwangudze, 2013). Based on personal interaction, the current cultural norm is both pastoral and arable agriculture Production ideally should not focus strictly on expansion. This potentially short-sighted thought has the potential to throw the food system off and could have the most negative impact on small-time farmers and the environment (Munang & Mgendi, 2014). In the MTA, perceptions of food insecurity relate to crime insecurity, environmental insecurity, and water insecurity. When thinking about new policy, thinking about agriculture as a remedy to lessening insecurity in the MTA could be a great option.

#### *2.2.5. Question for Future Research*

Annual follow-ups to see if risk perceptions change based on differing factors, such as drought, would be highly beneficial for theoretical analysis along with practical implementation. While performing research during the summer of 2019, the MTA was amidst drought and the literature has shown that drought is a key contributor to risk perception in other facets of life (Bahta et al., 2016; Carlton et al., 2016). Annual repetition would allow for future research to collaborate and compare drought data from the 2019 study to see if the impact of the drought influenced drought risk perception. An annual return to the MTA would also allow for a greater sample size, which would be more indicative of the population. A larger sample size would also allow other portions and villages within the MTA to be part of the study, broadening the population sample and giving a more accurate view of the population (Anderson et al., 2017). This could allow the data to be potentially extrapolated more easily to other populations similar to the MTA (Faber &

Fonseca, 2014). Increasing the sample size in subsequent studies could increase the precision of estimates along with increasing the power to conclude other populations that are not similar to the MTA (e.g. rainforest regions, higher or lower GDP) (Institute for Work and Health, 2008).

Deforestation was a concern for the residents of the MTA and the local government. It has also been shown deforestation and the risk perception associated with it is an issue in other studies in South Africa and also across the whole of Africa (Watts, 2003; Pröpper & Vollan, 2013; Uhunamure et al., 2016; Ngome et al., 2019). Looking deeper into deforestation in future research could give us a deeper understanding of the context. For example, are products of deforestation strictly used for energy within the MTA or are residents commodifying the wood and natural resources to aid and supplement their current lifestyle based on subsistence living (Pröpper & Vollan, 2013)? Are forests and other areas around the MTA, which private entities or government agencies own, increasing the perception that natural resources hold no value as more land is owned by private entities (McKittrick, 2008; Watts, 2003)? Last, looking into control of access and the enforcement of laws and their correlation with underfunded and understaffed protection agencies could shed light on why MTA residents have the perceptions they do (Pröpper & Vollan, 2013).

#### *2.2.6. Study Limitations*

Globally, drought is a driver of insecurity (Twongyire et al., 2019). Sub-Saharan Africa, and South Africa, experience drought in cycles. The current drought cycle has lasted from 2018 to the present and is reported in the media as being one of the worst on record drastically and critically affecting the food supply in Southern Africa (Lynn, 2019). The current drought cycle has been most severe in the Northern and Eastern Cape regions; however, the study site was also experiencing stressful conditions (Muller, 2019). The drought in South Africa could have led to

biased results on drought compared to other years or populations. Data in this thesis was cross-sectional, therefore replicating perceptions of drought risk would help equivocate results.

As previously mentioned, previous research looking into local perceptions of risk perception focusing on environmental security is scant. This factor makes comparing this research to previous research without making some educated leaps difficult. Sample size could be a limiting factor in data analysis and the projection of results across other populations. However, a factor in choosing a Linear Mixed Model analysis approach was the ability to generalize these findings to similar villages or groups of people. However, study design and sample size may be a limiting factor in generalizing results from this study to other populations similar to the MTA.

CHAPTER 3:  
LOCAL PERCEPTIONS ON THE CAUSES AND CONSEQUENCES OF  
ENVIRONMENTAL INSECURITY

### 3.1 INTRODUCTION

Climate change, increasing global population, and environmental variation such as the rapid drying of rivers and lakes, and depletion of aquifers, can all lead to increased socio-ecological stress causing environmental insecurity (Rice & Garcia, 2011; Carlton et al., 2016; Busby, 2018). These stresses can be dynamic and interact with national and other types of insecurity such as food and water (Goodman, 2012). Environmental insecurity is not only a cause of biodiversity decline and social instability but also a consequence (Gore et al., 2016). Environmental security is not a universally defined term, although it consistently manifests across socio-ecological systems and is a widespread policy aim (Zurlini & Muller, 2008). The concept typically refers to people having enough nutritious food, sufficient water, and natural resources to live and prosper (Detraz, 2009; Spring, 2009; Elliott, 2015; Gore et al., 2016). As the world has blurred boundaries between conservation governance and national defense sectors, the scientific field of environmental security has emerged to support decision-making (Hezri & Hasan, 2006; Goodman, 2012). Obtaining a state of environmental security, especially at a local level, is complicated by insufficient evidence about how local people perceive and respond to environmental insecurity (Goodman, 2012).

Environmental security can link to other forms of security (Detraz, 2009; Spring, 2009; Elliott, 2015; Gore et al., 2016; Busby, 2018). For example, food security connects to environmental security directly with the expansion of energy use, production, and consumption by (Naylor et al., 2007). For example, biofuels growth can affect food security by affecting agricultural development patterns, which can affect prices in the markets (Naylor et al., 2007). However, the literature appears to be lacking evidence exploring relationships between *types* of security (e.g., environmental security, food security, poaching, water security), with most literature

looking at a singular security and factors affecting it (Rice & Garcia, 2011; Loftus, 2015). Using local perceptions to address the gap between the interactions of insecurity could help improve policies to address all environmental insecurities (Ntuli et al., 2019).

This chapter aims to help to fill in knowledge gaps about the relationship between various forms of insecurity. I aim to root out the main causes of insecurity, find relationships between factors, and assist local people and policy makers with new local insecurity information. It addresses individual factors such as local perceptions of nature mythology and environmental insecurity along with an understanding about environmental insecurity and its relationship to other forms of insecurity. Local communities are key to this understanding, as they experience both the causes and consequences of environmental insecurity (Baird et al., 2009; Gore et al., 2016; Ntuli et al., 2019).

### 3.2 BACKGROUND

Other studies in South Africa have focused on environmental security factors such as food and nutrition (Govendar et al., 2016; Bakari & Ahmadi, 2018). These studies highlight the utility of incorporating local perspectives. Locally, such insight can give communities taking part in the research because it helps give them a voice. Scientifically, these studies help gain theoretical insight that could inform more effective decision making (Gore et al., 2016). The current relationship between distinct types of security may undermine economic performance, good governance, and key objectives of SDG's. Interpretation of local perspectives have the potential to root out the main cause of security issues while assisting policy makers in creating laws that not only help the local people but also help the country in terms of the economy, national security, and its wildlife (Gore et al., 2016).

### *3.2.1. Objectives Overview*

The goal of this chapter is to explore local perceptions about the causes and consequences of environmental insecurity within the Greater Mnisi Tribal Authority Region (MTA), Mpumalanga, South Africa. Given the evolution of environmental security literature from a conservation perspective, I wanted to focus this research on conservation related environmental insecurity. I chose the MTA because it exhibits high levels of biodiversity and is surrounded by private game reserves and national parks (including directly next to Kruger National Park) which are leading the global push in conservation efforts. I am interested in environmental insecurity outcomes in such regions and studying other forms of insecurity interactions in such areas.

The three research objectives were to: *i*) explore local perceptions of environmental insecurity, including perceived relationships with other forms of insecurity; *ii*) compare and contrast local perceptions of risk associated with environmental and other forms of insecurity; *iii*) Explore relationships between factors, including non-security factors and demographics, influencing and being influenced by environmental insecurity.

To contextualize the objectives, I first describe the literature offering different conceptualizations of security. An in-depth overview of multiple factors in environmental insecurity is utilized to give a broad overview of the complex nature of the subject. I then present key results from analysis designed to support each of the three objectives and conclude with a discussion about noteworthy points for conservation decision making that explicitly considers conservation social science.

### 3.3 DIFFERENT CONCEPTUALIZATIONS OF SECURITY

#### *3.3.1. Environmental Security*

Environmental security is a contemporary concept (Graeger, 1996). Definitions differ significantly depending on the context of the conversation. Certain themes emerge including people need to have access to an adequate amount of food, water, and natural resources to live (Spring, 2009; Gore et al., 2016; Busby, 2018). Themes also include having the ability to pay for and have contact and access to sources of natural resources that are healthy (Spring et al., 2009; Busby, 2018). Included in this is the ability to recover from natural disasters that cause social and economic problems for those involved and even those that are indirectly involved.

Environmental security takes into account how changes to the environment can negatively affect national security, its effects on armed conflict, and threat to human security (Elliott, 2015). For all countries, environmental changes are a national security problem (Elliott, 2015; Nellemann et al., 2016). Problematically, traditional pressures and threats to a nation are the predominant focus when thinking about environmental security (Barnett, 2020). For example, governments will focus on the violence between social groups that erupts from natural resource depletion while labeling it strictly as conflict but will not focus on the cause of the conflict, the natural resource depletion (Barnett, 2020). Many of the world's most vulnerable people depend on natural resources as their primary source of livelihood (Norfolk, 2004; Twyman & Slater, 2005; Balbi et al., 2019). As natural resources change, often decreasing, because of human interaction, environmental security will become deeper entrenched in human security and policymakers will need to focus on the viewpoints of local people to help solve the crisis (Elliott, 2015).

Previous research rarely touches on the concept of interconnectedness (Barnett, 2020). Global interconnectedness makes environmental security complex, especially when looking at

crime, poaching, and political instability that all stem from environmental insecurity. For example, a person in a rural, resource-dependent village, poaches an animal (crime insecurity and poaching) because they do not have access to food (food insecurity). They also need a source of water because they don't have clean water access to provide their children (water insecurity). They don't have a reliable local or federal government to help them out with health supplies if their children or themselves were to get ill (lack of trust and governmental insecurity). The single act of poaching connects globally when that poached animal is trafficked and shipped, for example via an airport in Africa with criminal syndicate shipping routes to a large buyer where ivory has been known to be purchased illegally on the black market (Wasser et al., 2018). Environmental security has developed into a concept that revolves around interconnectedness with many moving parts and can affect parties worldwide. I outline key forms of security within this interconnected framing below.

### *3.3.2. Food Security*

Food security is defined as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO et al., 2019, p. 186). We can then think of food insecurity as the failure and inability to access those secure and nutritious foods to grow (Govender et al., 2016). More pertinent to my research, other groups have recently created new definitions stating that food and nutrition insecurity is the absence of wholesome food that the human body needs to grow and mature properly, while finding a direct relationship between food insecurity and poverty (World Health Organization, 2000; Poppy et al., 2014; Agarwal, 2018). This ‘absence’ can relate to access or lack of money to purchase goods such as food (Govender et al., 2016).

Along with poverty, rapidly increasing population growth is linked to food insecurity (Walker, 2016). Up to 2015, there has been recent progress with food security globally with global undernourishment steadily dropping from 14.5% in 2005 to 10.6% in 2015, but positive change is often limited to regions and countries where the birth rate and fertility rates are low (Walker, 2016; FAO et al., 2019). However, since 2015, food insecurity and the amount of undernourished people globally is rising (FAO et al., 2019). The International Food Policy Research Institute (IFPRI) published the Global Hunger Index (GHI) in 2015 and showed that the largest, and the most food insecure, of all the highest GHI scores were found in Sub-Saharan Africa and South Asia (Walker, 2016). Fast forward to today, Sub-Saharan Africa and South Asia are still the highest scores ranked on the 2019 *Global Hunger Index by Severity* (Grebmer et al., 2019).

### 3.3.3. Water Security

Concurrent with food security, water security is a pressing global issue that has been prioritized by the global sustainable development community (Bogardi et al., 2012). Water security is a broad term encompassing ensuring healthy water related ecosystems, that all people are able to access safe water that is cost effective, and also lessening the water-related risks to people such as drought. (Grey & Sadoff, 2007; Bogardi et al., 2012; Meissner et al., 2018).

Water security is pertinent as the United Nations estimates there will be a rapid increase in the global population facing water scarcity issues, with possibly 700 million people being relocated due to water scarcity issues by the year 2030 (Hameeteman, 2013; Olson, 2013; UN-Water, 2020). Water security is a major factor in Africa, with the Seychelles and South Africa among the most secure countries, while Malawi and Madagascar are the least secure (Holmatov et al., 2017; Meissner et al., 2018). Water security is complex and much like food security, it is tied to a multitude of variables such as age and sex. In addition, like other types of security, water security

is defined depending on the source. Water security in the MTA might be defined much differently than it is in Cape Town or Johannesburg, which is why it is important to use local perceptions to relieve water insecurity.

#### *3.3.4. Crime Security*

Within my thesis, there are two categories of crime insecurity outlined: traditional crime including burglary, drug crimes, murder, and rape, and environmental crime including deforestation (illegal wood taking), water and land littering, and poaching. Poaching, one of many global environmental crimes and traditional crime are directly linked (Collins et al., 2017; Wasser, et al. 2018). Environmental crime is increasing daily on a global scale and has a reach that is further than natural resource and habitat destruction including access to food, water, and shelter and potentially affecting crime rates (Nellemann et al., 2016; York, 2019).

Not only does organized traditional crime lead to environmental degradation, it also can threaten legitimized governments (Zimmerman, 2003). Offenders can weaken a stable political system, put stress on their local and legal economy, and most times directly or indirectly, bring corruption to society and developing countries (Zimmerman, 2003). Organized crime is often associated with the drug trade, but it has just as large of an impact within poaching and the illicit trade of animals and animal parts (Van Uhm, 2016; Wasser et al., 2018). Powerful groups conduct organized crime with many layers that enlist the use of corruption and tactful trade routes to pull off their schemes and jobs (Wasser et al., 2018). There are many examples of organized crime within the illicit animal trade, such as the use of airports and organized crime channels to export goods from country to country (Wasser et al., 2018).

Thinking about environmental issues and natural resources in terms of security is a relatively new concept that should receive more merit and educational interventions, as it plays a

large role in the illicit animal trade (Hariohay et al., 2019; Naro et al., 2020). Douglas & Alie (2014) bring up the concept of viewing natural resources as *high-value* resources that can have destabilizing effects on wildlife industries and influencing global and national security. High-value resources are those that might deliver revenues, usually substantial in their natural states. Examples can include oil, uranium, and diamonds (Douglas & Alie, 2014). When managed properly, these items can support a country's economy with interventions such as ecotourism, help with national security, and can even raise living standards (Lujala & Rustad, 2011). However, some suggest that the opposite effect happens, and these high-value resources cause more issues than were originally present (Douglas & Alie, 2014).

Undermining economic performance and environmental governance is connected with wildlife. Wildlife can speed up unstable government incentives and possibly weaken and destabilize economic development (UNEP, 2009). This can overall influence accountability, weaken development, including when there is an exposure to economic shock, and impact corruption and environmental policies (Douglas & Alie, 2014).

### *3.3.5. Trust*

Trust is a crucial part of any community, group, or institution. This is especially true of post-apartheid South Africa where many believe that South Africa may develop like other liberated, post-colonial countries, where the actions of the liberators eventually turned into the government bodies strictly based on what they did for the liberation movement (Friedman, 1999; Askvik, 2008). Previous studies show that trust in the South African Government is related to a residents identity linked to race, party preference, nationalism, and political integration while also being linked to performance, leading one to believe that a combined approach in evaluating trust may be the best approach (Mishler & Rose, 2002; Askvik, 2008).

Trust can also lead to non-payment in local authorities, much like the MTA, leading to forms of insecurity because payments are not being remitted (Fjeldstad, 2004). Political legitimacy theory suggests that proper tax payments are greatly influenced by a residents' trust in their government (Fauvelle-Aymar, 1999; Tyler, 2006; Kirchler et al., 2008; Ali et al., 2014). Legitimacy comes from the trust that the government will act for the common good (Ali et al., 2014). Compliance may come from three different aspects of trust, *i*) trust that the government will use the revenue for the services that the residents want and expect *ii*) trust that the government will collect and distribute the revenue fairly, and *iii*) trust that other residents will take part and pay their share of the taxes or fees (Fjeldstad, 2004). These concepts of trust all play into the trust that interacts with the assembly of insecurity concepts within the MTA and are important to note.

### *3.3.6. Nature Myths*

Risk perceptions can affect attitudes about biodiversity, trust in local management and government agencies, and partiality towards types of risk management (Muter et al., 2013; Gore et al., 2016). Cultural theory of risk plays a large roll in assessing local perceptions of responses to conservation, biodiversity exploitation, and insecurity in a bottom-up approach (Douglas, 1978; Gore et al., 2016). There are four categories within cultural theory based on various cultural attributes including egalitarian, fatalistic, hierarchical, or individualistic (Douglas, 1978; Gore et al., 2016). There are four responses that are seen based on cultural theory that include counteraction, disregarding, modifying or dismissing (Douglas, 1978; Gore et al., 2016). "Myths of nature" are individuals' perceptions of risks that are shaped by cultures socially constructed myths about nature (Douglas & Wildavsky, 1983; Dake, 1992; Gore et al., 2016). These myths are internalized by people, reshaped, and then influence their thoughts about nature, conservation, and environmental problems (Dake, 1992). These perceptions by local residents can help policy

makers assess agreement to future and current insecurity interventions to see how they will be responded to at a local level (Gore et al., 2016).

### 3.4 RESULTS

#### *3.4.1. Explore Local Perceptions of Environmental Insecurity, Including Perceived Relationships with Other Forms of Insecurity*

The first objective was to characterize other forms of insecurity connected to environmental insecurity, including the relationships between them (e.g., crime insecurity, food insecurity, water insecurity, trust insecurity, and poaching). All residents recognized environmental insecurity as some threat in the MTA ( $M = 4.87$ , range: 0-7,  $SD = 0.85$ ). Table 14 displays the correlations between the above factors. Environmental insecurity is correlated with crime insecurity  $r(211) = 0.38, p < 0.01$ , food insecurity  $r(211) = 0.48, p < 0.01$ , poaching  $r(211) = 0.15, p < 0.05$ , trust insecurity  $r(211) = 0.15, p < 0.05$ , and water insecurity  $r(211) = 0.59, p < 0.01$ .

<b>Table 14: Pearson Correlations of five insecurity indexes related to environmental insecurity within the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Statistical significance is denoted with asterisks. One asterisk for statistical significance at the 0.05 level and two for the 0.01 level. Figures in bold font are significant.</b>						
	Crime	Environmental	Food	Poaching	Trust	Water
Crime	1	<b>0.38**</b>	<b>0.19**</b>	<b>0.20**</b>	0.10	<b>0.20**</b>
Environmental	<b>0.38**</b>	1	<b>0.48**</b>	<b>0.15*</b>	<b>0.15**</b>	<b>0.59**</b>
Food	<b>0.19**</b>	<b>0.48**</b>	1	0.01	0.12	<b>0.47**</b>
Poaching	<b>0.20**</b>	<b>0.15*</b>	0.01	1	<b>-0.15*</b>	0.08
Trust	0.10	<b>0.15**</b>	0.12	<b>-0.15*</b>	1	0.10
Water	<b>0.20**</b>	<b>0.59**</b>	<b>0.47**</b>	0.08	0.10	1

Individual demographic factors did not play a large role in influencing residents risk perceptions on environmental insecurity. Table 15 displays the six fixed factors and one random factor that went into data analysis. The only factors that had significance on a resident's answer

was their age, employment status, and ownership of land status. With every year that a resident was older in the MTA, their risk perception on environmental insecurity increased by 0.35 points per year. Village location played had almost zero influence on a resident's risk perception. This means that overall risk perception of environmental insecurity across the MTA is consistent with a mean of 4.66 and standard deviation of 0.94.

<b>Table 15: Local perceptions (N = 211) about environmental factors in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Included are Mean Squares (MS), Variance Components (VC), F tests (F), LRT (likelihood ratio test value) and respective p-values for threats of harms and environmental harms within the MTA community. Significant p-values are denoted with *.</b>			
	Environmental Index		
<b>Fixed Effects</b>	<b>MS</b>	<b>F</b>	<b>P</b>
Age	26.50	36.21	0.00*
Children in House	0.92	1.26	0.26
Gender	0.56	0.77	0.38
Employed	3.22	4.40	0.04*
Owns Land	7.41	10.12	0.00*
Ethnicity	2.49	3.40	0.67
<b>Random Effects</b>	<b>VC</b>	<b>LRT</b>	<b>P</b>
Village	0.00	0.00	1.00
Residual	1.24		

Lastly, water insecurity in the MTA positively correlates with crime insecurity, environmental insecurity, and food insecurity. Data from residents in the MTA exhibited a strong correlation  $r(211) = 0.47, p < 0.01$ ) between water insecurity and food insecurity which could be taken into account when creating education and interventions.

#### *3.4.2. Compare and Contrast Local Perceptions of Risk Associated with Environmental and Other Forms of Insecurity*

Explorations of this relationship revealed that increased risk perceptions of poaching threatening local communities ( $B = 0.29, SE = 0.04, p < 0.05$ ) and poaching harming the environment ( $B = 0.29, SE = 0.05, p < 0.05$ ) influenced risk perceptions within the environmental

insecurity index. Village location impacted the poaching index (LRT = 8.20, VC = 0.13,  $p < 0.05$ ). The top three most threatening harms to the MTA community as perceived by the MTA residents were drought, deforestation, and littering on land while development within the MTA was perceived to be the least threatening (Table 16).

<b>Table 16: Perceived risk ranking of ten threats to environmental security according to residents (N = 211) in the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019).</b>		
<b>Environmental Risk</b>	<b>Tsonga Translation</b>	<b>Mean (SD) Range 1-10</b>
Deforestation	Ku tsemeleriwa ka nhova/Minsinya.	7.53 (2.82)
Littering on land	Ku lahliwa ka thyaka laha swinga fanelangiki	6.85 (2.99)
Drought	Dyandza	6.32 (2.99)
Cattle theft	Ku yiviwa ka tihomu	5.43 (3.36)
Overgrazing of cattle	Ku rimiwa ka ndhamu leyi tlulaka mpimo	5.17 (3.12)
Poaching of wildlife	Ki hlotiwa ka swiharhi swingari enawini	5.13 (3.11)
Mosquitoes (disease vector)	Vuvabyi bya Malaria lebyi kumekaka ka tinsuna	5.10 (3.06)
Littering in water	Ku thyakisiwa ka mati emadan'wini	5.06 (3.24)
Erosion of soil	Ku khukuriwa ka misava hi mpfula.	5.00 (2.90)
Development	Nhluvuko	3.49 (2.61)

Residents' heightened risk perceptions of *deforestation had a negative impact on their community* ( $M = 4.81$ ,  $SD = 2.23$ ) had a positive impact on perceptions of concern about environmental insecurity ( $B = 0.53$ ,  $SE = 0.03$ ,  $p < 0.0001$ ) along with residents' risk perception that *deforestation harms the environment* ( $B = 0.14$ ,  $SE = 0.04$ ,  $p < .05$ ). Residents age ( $p < 0.05$ ,  $F = 4.41$ ,  $MS = 21.25$ ) and ethnicity ( $p < 0.05$ ,  $F = 3.56$ ,  $MS = 17.16$ ) also factored into their perception on the negative impact of deforestation to their community.

Littering on land was a highly rated threat by residents ( $M = 6.85$ ,  $SD = 2.99$ ). The effect of pollution and littering on land had a positive effect on environmental insecurity. Residents also worried that they did not have a reliable way of disposing of trash legally. Village location affected the results ( $LRT = 5.91$ ,  $VC = 0.29$ ,  $p < 0.05$ ). Residents showed pollution (littering/trash) had a negative impact on their communities ( $M = 5.88$ ,  $SD = 1.55$ ). Age affected perceptions ( $F = 7.60$ ,  $MS = 17.47$ ,  $p < 0.05$ ) and these overall perceptions had a positive impact on overall environmental insecurity within the MTA. Last, higher perceived frequency of land littering positively affected risk perception of environmental insecurity ( $B = 0.22$ ,  $SE = 0.04$ ,  $p < 0.01$ ). Perceived frequency was significantly impacted by a participant's village ( $p < 0.0001$ ,  $LRT = 11.22$ ,  $VC = 0.38$ ), age ( $p < 0.05$ ,  $F = 6.04$ ,  $MS = 15.77$ ), and if the participant was a landowner ( $p < 0.05$ ,  $F = 7.06$ ,  $MS = 18.45$ ). Along with land littering, littering in water, which was not ranked as highly (Table 1), but which still was thought of as a threat, also had a positive effect on environmental insecurity ( $B = 0.33$ ,  $SE = 0.33$ ,  $p < 0.01$ ).

### *3.4.3. Explore Relationships Between Factors, Including Non-security Factors and Demographics Influencing and Being Influenced by Environmental Insecurity*

All residents recognized environmental insecurity as some threat in the MTA ( $M = 4.66$ , range: 0-7,  $SD = 0.94$ ), while gender revealed insignificant differences (Female  $M = 4.94$ , Male  $M = 4.81$ ) in perception. A majority of residents (81.52%) acknowledged biodiversity exploitation because of deforestation was happening frequently. Of those approximately 82%, more than half acknowledged deforestation happened every day. In the form of poaching ( $M = 2.18$ , range: 0-7,  $SD = 1.14$ ), residents perceived biodiversity exploitation to be much lower than deforestation. Although gender was not statistically significant, there was a sizeable difference between

perceptions of men ( $M = 2.34$ ,  $SD = 1.23$ ) and women ( $M = 2.02$ ,  $SD = 1.01$ ) in perceptions of poaching frequency.

Only one index was noteworthy when looked at through the lens of gender - risk perception related to water insecurity ( $p < 0.05$ ,  $F = 8.38$ ,  $MS = 14.42$ ). Gender did not have any significance related to crime, education and employment, environment, food, poaching, and trust. Risk perception related to running out of food, not being able to afford food, worrying about not having money to purchase food, and having to eat less because of lack of food were all not affected while the wish for more food was the only significant result with women wishing for the ability to have more food than men ( $p < 0.05$ ,  $F = 4.60$ ,  $MS = 14.24$ ).

Trust was a key component of Objective 3. I asked residents their thoughts on trust and related subjects within their community and surrounding areas. The trust index was positively correlated with the environmental index ( $r(211) = 0.15$ ,  $p < 0.05$ ), with trust also being positively correlated with education and employment as well as negatively correlated with poaching (Table 17).

<b>Table 17: Pearson Correlations of seven insecurity indexes within the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Statistical significance is denoted with asterisks. One asterisk for statistical significance at the 0.05 level and two for the 0.01 level.</b>							
	Crime	Education and Employment	Environmental	Food	Poaching	Trust	Water
Crime	1	0.07	<b>0.38**</b>	<b>0.19**</b>	<b>0.20**</b>	0.10	<b>0.20**</b>
Education and Employment	0.07	1	0.00	-0.09	0.03	<b>0.24*</b>	0.07
Environmental	<b>0.38**</b>	0.00	1	<b>0.48**</b>	<b>0.15*</b>	<b>0.15*</b>	<b>0.59**</b>
Food	<b>0.19**</b>	-0.09	<b>0.48**</b>	1	0.01	0.12	<b>0.47**</b>
Poaching	<b>0.20**</b>	0.03	<b>0.15*</b>	0.01	1	- <b>0.15*</b>	0.08
Trust	0.10	<b>0.24**</b>	<b>0.15**</b>	0.12	<b>-0.015*</b>	1	0.10
Water	<b>0.20**</b>	0.07	<b>0.59**</b>	<b>0.47**</b>	0.08	0.10	1

Trust, and concepts related to trust, such as corruption and integrity were associated with very high-risk perception rankings throughout the MTA. Residents ranked worrying about corruption ( $M = 5.92$ ,  $\sigma = 1.73$ , median = 7.00) as the largest singular trust issue meaning that out of all risk perceptions studied MTA residents felt that corruption in the MTA was the most worrisome. MTA residents also showed a large distrust in local government ( $M = 2.97$ ,  $\sigma = 2.13$ , median = 2.00) and national government ( $M = 3.64$ ,  $\sigma = 2.314$ , median = 3.00). Residents ranked trust in rangers in the surrounding protected areas and game reserves ( $M = 4.97$ ,  $\sigma = 2.00$ , median = 5.00) significantly higher (Table 18).

<b>Table 18: Residents perceptions on trust within the Mnisi Tribal Authority, Mpumalanga, South Africa and the surrounding area (May – July 2019). Included are the mean, standard deviation, and median. A 7-point Likert-type scale was used.</b>							
<b>Factors</b>	Corruption Worry	Local Govt. Trust	Local Police Integrity	Nat. Govt. Trust	Ranger Trust	Trust (general)	Trust Index
<b>Mean</b>	5.92	2.97	3.15	3.64	4.97	4.49	4.19
<b><math>\sigma</math></b>	1.73	2.13	2.12	2.31	1.99	2.37	1.22
<b>Median</b>	7.00	2.00	3.00	3.00	5.00	5.00	4.00

Worrying about corruption had a positive effect on environmental insecurity risk perception ( $B = 0.16$ ,  $SE = 0.03$ ,  $p < 0.0001$ ). Lastly, trust varied by village (Table 19).

When exploring the relationship between environmental insecurity and myths of nature (i.e., beliefs that nature finds balance or that the environment is random), residents agreed that the environment and nature is random (64%,  $n = 135$ ,  $M = 5.03$ ,  $SD = 1.77$ ) and that the environment always finds a way back to balance (55%,  $n = 115$ ,  $M = 4.65$ ,  $SD = 1.96$ ). A majority (93%,  $n = 197$ ,  $M = 6.30$ ,  $SD = 1.309$ ) of residents felt that environmental harms are unacceptable and need to be stopped while also accepting that there are environmental harms and the justifications to manage those harms (79%,  $n = 166$ ,  $M = 5.78$ ,  $SD = 1.59$ ). I asked if they would ignore environmental harms because there was nothing they themselves could do to ease them. Residents'

answers were split in opinion, with less than a majority on either side ( $M = 3.80$ ,  $SD = 2.31$ ). However, a majority of residents disagreed that environmental harms create new opportunities for creativity, innovation, and development (54%,  $n = 114$ ,  $M = 3.44$ ,  $SD = 2.14$ ) and that harms are best ignored or avoided (59%,  $n = 126$ ,  $M = 3.36$ ,  $SD = 2.37$ ).

**Table 19: Residents perceptions on trust by village within the Mnisi Tribal Authority, Mpumalanga, South Africa and the surrounding area (May – July 2019). Included are the mean, standard deviation, and median for all villages measured.**

Village		Corruption Worry	Local Govt. Trust	Local Police Integrity	Nat. Govt. Trust	Ranger Trust	Trust (Gen.)	Trust Index
Clare A and B	Mean	6.23	2.41	3.18	2.68	5.32	5.00	4.14
	$\sigma$	1.19	1.71	2.06	2.01	1.70	1.95	1.24
	Median	7.00	2.00	2.50	2.00	5.50	5.50	4.08
Gottenburg	Mean	5.36	3.09	3.05	3.36	4.86	4.91	4.11
	$\sigma$	2.38	1.95	1.99	1.99	1.89	2.25	1.15
	Median	7.00	3.00	3.00	3.00	5.00	5.50	4.00
Hlavekisa	Mean	5.23	3.00	3.96	4.59	5.73	4.77	4.55
	$\sigma$	2.25	2.49	2.63	2.59	1.88	2.56	1.32
	Median	7.00	2.00	4.00	5.50	7.00	7.00	4.75
Hluvukani	Mean	6.32	3.00	2.80	3.40	4.52	4.84	4.15
	$\sigma$	1.22	2.02	2.12	2.52	2.24	2.34	1.19
	Median	7.00	2.00	2.00	2.00	5.00	6.00	4.17
Islington	Mean	6.33	3.11	3.22	3.28	4.39	4.67	4.17
	$\sigma$	1.14	2.68	2.67	2.63	2.40	2.81	1.69
	Median	7.00	1.50	1.50	2.00	4.00	6.50	3.17
Ludlow	Mean	6.38	3.69	3.63	4.19	5.31	3.13	4.39
	$\sigma$	0.96	2.06	2.06	2.23	2.02	2.09	1.15
	Median	7.00	3.50	3.50	4.50	6.50	3.00	4.50
Manyeleti	Mean	5.75	3.06	2.69	3.75	5.25	4.94	4.24
	$\sigma$	1.61	2.46	1.89	2.62	1.48	2.49	1.39
	Median	6.00	2.00	2.00	3.00	5.00	6.50	3.92
Tintswalo Village	Mean	6.16	2.32	3.28	3.68	4.84	4.72	4.17
	$\sigma$	1.21	1.70	1.86	2.12	1.84	2.01	1.10
	Median	7.00	2.00	3.00	4.00	5.00	5.00	4.33
Welverdiend	Mean	6.24	3.20	2.72	3.68	5.16	4.16	4.19
	$\sigma$	1.69	2.24	2.09	2.12	2.12	2.53	1.05
	Median	7.00	3.00	2.00	4.00	6.00	4.00	4.00
White City/Burlington	Mean	5.10	3.10	3.10	3.95	4.35	3.45	3.84
	$\sigma$	2.43	2.15	1.86	2.31	2.08	2.35	1.06
	Median	6.50	3.00	3.00	4.00	4.00	2.50	3.67
Total	Mean	5.92	2.97	3.15	3.64	4.97	4.49	4.19
	$\sigma$	1.73	2.13	2.12	2.31	1.99	2.37	1.22
	Median	7.00	2.00	3.00	3.00	5.00	5.00	4.00

Study residents reported perceptions of poaching on ten species known to inhabit MTA lands and the surrounding area. Across all villages sampled, the top four species perceived to be poached were rhino (*Ceratotherium simum* and *Diceros bicornis*) ( $M = 4.10$ ), impala (*Aepyceros melampus*) ( $M = 2.59$ ), elephant (*Loxodonta africana*) ( $M = 2.11$ ), and pangolin (*Manis temmenickii*) ( $M = 2.04$ ) (Table 11). Across all villages sampled, the three species perceived to be poached least frequently were wild dog (*Lycaon pictus*) ( $M = 1.64$ ), leopard (*Panthera pardus*) ( $M = 1.73$ ), and hyena (*Hyaena brunnea*) ( $M = 1.85$ ).

There was significant variation across individual villages ( $VC = 0.13$ ,  $LRT = 8.21$ ,  $p < 0.05$ ) on perception of frequency (Table 12, 13). Residents from Gottenburg ( $M = 2.98$ ,  $SD = 1.85$ , median = 2.70), Tintswalo Village ( $M = 2.48$ ,  $SD = 1.47$ , median = 1.90), and White City/Burlington ( $M = 2.48$ ,  $SD = 1.47$ , median = 1.80) perceived poaching rates to be higher compared to other villages. Gottenburg and White City/Burlington had significantly higher frequency perceptions than all other villages. Participants had lower perceptions of poaching frequency in Hlavekisa ( $M = 1.60$ ,  $SD = 1.04$ , median = 1.20), Islington ( $M = 1.77$ ,  $SD = 1.547$ , median = 1.00), and Clare A and B ( $M = 1.81$ ,  $SD = 1.14$ , median = 1.40), with residents' perceptions ranking under the average of all villages ( $M = 2.17$ ).

Residents were asked about their perceptions of environmental harms associated with poaching. Residents age ( $MS = 8.03$ ,  $F = 5.01$ ,  $p < 0.05$ ), children living in their household ( $MS = 8.26$ ,  $F = 5.16$ ,  $p < 0.05$ ), and land ownership status ( $MS = 7.85$ ,  $F = 5.16$ ,  $p < 0.05$ ) all had significant influence on their perceptions. Risk perception of the threat to their local community attributed to poaching was influenced by age ( $MS = 29.06$ ,  $F = 10.66$ ,  $p < 0.05$ ), children living in their household ( $MS = 16.49$ ,  $F = 6.05$ ,  $p < 0.05$ ), and ethnicity ( $MS = 17.21$ ,  $F = 6.31$ ,  $p < 0.05$ ). Older residents' viewpoints on poaching harming the environment increased by 0.20 points for

every ten years ( $B = 0.02$ ,  $SE = 0.01$ ,  $p < 0.05$ ) and increased their perception of harm to their community by 0.38 points for every ten years ( $B = 0.04$ ,  $SE = 0.01$ ,  $p < 0.05$ ). Having children in the household decreased their perception of harm to the environment due to poaching ( $B = -0.10$ ,  $SE = 0.05$ ,  $p < 0.05$ ) and decreased their perception of harm to their location community ( $B = -0.15$ ,  $SE = 0.06$ ,  $p < 0.05$ ). Land ownership had the same effect, decreasing a participant's risk perception of poaching harm to the environment ( $B = -0.49$ ,  $SE = 0.22$ ,  $p < 0.05$ ), while identifying as Tsonga had the opposite effect, significantly increasing a residents risk perception of harm to their community ( $B = 0.90$ ,  $SE = 0.36$ ,  $p < 0.05$ ). Also, noteworthy, poaching was positively correlated with crime perceptions (Table 20).

**Table 20: Local perceptions (N = 211) measuring the perception of frequency of individual animals poached in and around the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019). Included are Mean Squares (MS), Variance Components (VC), F-tests (F), LRT (likelihood ratio test value) and respective p-values for perception of individual poached animals within the Mnisi Tribal Authority. Significant p-values denoted with \*.**

Elephant Poaching				Hyena Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	4.05	1.80	0.18	0.41	0.24	0.62
Children in House	2.10	0.94	0.34	2.76	1.62	0.21
Gender	3.27	1.45	0.23	1.49	0.87	0.35
Employed	0.71	0.32	0.58	0.21	0.12	0.73
Owns Land	0.12	0.05	0.82	2.09	1.22	0.27
Ethnicity	1.51	0.67	0.41	0.00	0.00	0.10
Random Effects	VC	LRT	P	VC	LRT	P
Village	0.14	2.97	0.09*	0.12	3.61	0.06*
Residual	2.25			1.71		

Impala Poaching				Leopard Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	0.03	0.01	0.92	1.18	0.77	0.38
Children in House	0.81	0.27	0.61	1.28	0.83	0.36
Gender	17.37	5.73	*0.02	0.37	0.24	0.62
Employed	0.26	0.09	0.77	0.21	0.14	0.71
Owns Land	1.64	0.54	0.46	2.40	1.57	0.21
Ethnicity	1.14	0.38	0.54	0.59	0.39	0.54
Random Effects	VC	LRT	P	VC	LRT	P

Table 20 (cont'd)

Village	0.38	10.01	0.00*	0.11	4.04	0.04*
Residual	3.03			1.53		

Lion Poaching				Pangolin Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	1.86	1.29	0.26	0.01	0.00	0.95
Children in House	0.10	0.07	0.79	5.05	2.35	0.13
Gender	0.91	0.63	0.43	2.01	0.93	0.34
Employed	1.97	1.36	0.25	0.63	0.29	0.59
Owns Land	1.33	0.92	0.34	0.20	0.09	0.76
Ethnicity	1.60	1.10	0.30	0.00	0.00	0.96
Random Effects	VC	LRT	P	VC	LRT	P
Village	0.11	4.59	0.03*	0.25	8.74	0.00*
Residual	1.45			2.15		

Python Poaching				Rhino Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	0.01	0.01	0.94	0.85	0.21	0.65
Children in House	0.88	0.42	0.52	0.82	0.20	0.65
Gender	4.44	2.14	0.15	4.80	1.20	0.28
Employed	0.01	0.01	0.94	1.62	0.41	0.53
Owns Land	0.01	0.01	0.94	2.74	0.68	0.41
Ethnicity	0.54	0.26	0.61	0.00	0.00	0.99
Random Effects	VC	LRT	P	VC	LRT	P
Village	0.07	1.12	0.29	0.53	8.95	0.00*
Residual	2.07			4.00		

Vulture Poaching				Wild Dog Poaching		
Fixed Effects	MS	F	P	MS	F	P
Age	0.45	0.22	0.64	0.01	0.01	0.92
Children in House	0.38	0.19	0.67	0.01	0.01	0.94
Gender	5.81	2.83	0.09	0.06	0.04	0.84
Employed	0.29	0.14	0.71	0.00	0.00	0.98
Owns Land	0.87	0.42	0.52	0.01	0.01	0.92
Ethnicity	0.48	0.23	0.63	0.01	0.01	0.93
Random Effects	VC	LRT	P	VC	LRT	P
Village	0.15	4.14	0.04*	0.08	2.96	0.09*
Residual	2.05			1.36		

### 3.5 DISCUSSION

#### *3.5.1. Overview*

From climate change being recognized as a national security threat by the U.S. Department of Defense in 2010 to COVID-19 redefining water, food, and biodiversity exploitation security issues, environmental security is long-lasting and will have an enduring impact on lives (La Shier & Stanish, 2017; Wilkinson & Tellez-Chavez, 2020). Understanding the assessed risks and perceived risks associated with these various types of insecurities at all levels will be key to supporting policies and policymakers that aid in risk reduction. Many outcomes associated with environmental insecurity such as biodiversity loss are irreversible once they reach a certain threshold, making it imperative to understand the perceptions of local people to help in problem-solving and educational interventions (Gore et al., 2016; Naro et al., 2020).

Current goals such as the United Nations SDG's bring environmental security and insecurity to the forefront of discussions about policy decisions, conservation decisions, and national security (United Nations Department of Economic and Social Affairs, 2020). The 17 SDG's encompass globally agreed upon agendas and goals for a global action towards a more sustainable tomorrow (Fullman et al., 2017; Fourie, 2018; Wong & van der Heijden, 2019; United Nations Department of Economic and Social Affairs, 2020). One challenge facing individual countries is aligning the SDG's with national plans already in progress - South Africa adopted a National Development Plan (NDP) in September 2012, before the UN organized the SDGs (National Planning Commission: South Africa, 2012). The NDP's focal points latch onto the SDGs. However, regarding gender, there appears to be ambiguity. SDG's, much like various securities, are complex in that they have many measurements that assess them while we tie them into different factors such as age and gender.

### *3.5.2. Gender Disparity: Lack Thereof*

Gender theory postulates that security is linked to the enablement of each person, and to the abilities to foster constructive environments of where insecurity is not present (Hoogensen & Stuvøy, 2006). Research associated with environmental security risks which try to answer empirical questions regarding the effects of environmental security and its connection to other variables, taking into account the perceptions of local people being affected, is not commonplace. The UN's update closely associates the SDGs and factors such as gender - one can conjecture that gender is important to reducing insecurity (United Nations Department of Economic and Social Affairs, 2020). The disadvantages women of the world face do not operate in isolation and are related to factors such as location and wealth. These combinations of factors create various and substantial disadvantages for women from clean water, educational advancement and access, and employment opportunities (UN Women & DE, 2019). Current research suggests that risk perceptions about environmental degradation are heightened in women when compared to men, and there are strong associations between gender disparity and food insecurity (Sundström et al., 2019; Aziz et al., 2020).

Interestingly, there were few clear gender disparities for perceived risk within the MTA's studied population. Gender did not play a significant role in the crime, education and employment, environment, food, poaching, and trust indexes. Previous research in the same area has shown that women are less likely to condemn commercial poaching and less willing to participate in anti-poaching interventions (Sundström et al., 2019). It was noteworthy to see that gender did not return as a significant result more often. I would have also thought I would see some major disparities in items like deforestation, as women are the primary collectors for their households (Agrawal, 2001).

I think a plausible reason for gender not playing a larger role is because the communities are very close knit, leading to common perceptions on many variables.

### *3.5.3. Gender, Food Insecurity, Water Insecurity, and Deforestation*

Women play a central role in efforts to achieve food security, particularly at the household level (Agarwal, 2018). Food security is consistent access to food that properly provides nutrition to every person (Tibesigwa & Visser, 2016). Women are the dominant food producers, managers and consumers and they allocate a disproportionate amount of their time in processing and preparing food (Agarwal, 2018). Women's roles in enhanced food security depend on access to land and depends on diverse social norms. Women when compared to men usually have less bargaining power which can lead to disadvantages in the way they are able to contribute to a household (Kiewisch, 2015). It also depends on laws that are created by males that give privilege and prime access of land to males (Agarwal, 2018). Land ownership statistics from various countries illustrate these imbalances between men and women. For example, in Ghana, women own just 10 % of household lands, and in Kenya women own 5 % of the land (Agarwal, 2018). Within Sub-Saharan Africa, South Africa has the largest percentage of female-headed households (e.g., 42%) while the range for other parts of Africa are as low as 9.5% and as high as 29.5% (Tibesigwa & Visser, 2016).

The sizable economy of South Africa contributes to a satisfactory supply of food when assessed at a national level, but when local and household level statistics are assessed, food insecurity statistics are much higher (Tibesigwa & Visser, 2016). The impacts from climate change on South Africa's food crop output are estimated to result in diverse and dramatic declines. For women at local levels, it may magnify these impacts, as they already face many vulnerabilities that men do not (Tibesigwa & Visser, 2016). We also know men are closely connected with efforts to

overcome child malnutrition and increase access to nutritional crops (Tibesigwa & Visser, 2016). Malnutrition and food insecurity at the household level affect child survival rates, while they have found overall nutrition and health have all to be greater when women own assets and derive their own income (Bhattarai et al., 2015; Agarwal, 2018). Climate change-driven changes to women's allocation of time dedicated to these aforementioned household activities will probably further complicate successful, sustainable development. In at least these regards, it is unsurprising that attaining SDG 5 is considered being worthwhile in its connections to other sustainable development issues (Agarwal, 2018).

The MTA Board members brought up the possibility of a dam for the MTA to aid in water insecurity reduction. They acknowledged the lack of water and energy leading to insecurity while speaking about how it was a large burden on the MTA which would correlate to previous research showing that an overall decrease in water use led to increased perceived depression scores (Workman & Ureksoy, 2017). The main issue addressed by the MTA was a lack of governmental support and funding, which backs up the current literature noting that water resource management needs a highly integrated approach to aid in sustainable development (Ikhlayel & Nguyen, 2017; Fourie, 2018).

The SDGs are working to achieve water related accomplishments with SDG 6. SDG 6 focused on clean water and sanitation for all. Target 6.1 and 6.3 focus on worldwide and fair sources of water for all while also incorporating the reduction of pollution and littering in water sources (United Nations Department of Economic and Social Affairs, 2020). Target 6.6 focuses on water-related ecosystems aiming to achieve protection and restoration by 2030. The goals are intertwined with other SDG's, aimed at reducing overall environmental insecurity. However, efforts to reduce water insecurity and needs at a local level can have unintended environmental

side effects at global and regional levels. The SDG's contribute to the needed cross-style analysis and management and ensure the UN's assessment tools are not purely focuses on a single scale (Bhaduri et al., 2016). The interconnectedness of pressures on depletion of natural resources can have unwanted consequences on the water system globally. Actions at the local level to reduce water insecurity may cause greater stress at regional and global levels (Bhaduri et al., 2016).

Along with water security, the MTA cannot safeguard food security without the cooperation and a sense of proprietorship from all levels of government (Fourie, 2018). Food insecurity is increasing in many places around the world due to climate change and other causes, including in South Africa (Masipa, 2017). Due to inconclusive deforestation data in South Africa, I looked at other deforestation data from countries such as Cameroon. Cameroon is home to approximately 22 million hectares (ha) of tropical forests, which are about the size of Mexico (World Resources Institute, 2017). Since 2003, 3.3 million ha of those forests have been cut, directly resulting in food insecurity because deforestation and land degradation are key contributors and links to food insecurity (World Resources Institute, 2017; Ngome et al., 2019). Findings showed that food insecurity decreased in areas where deforestation had yet to happen, while areas that were moderately and extremely deforested had raised levels of food insecurity, and overall that household food insecurity increases with increased deforestation (Ngome et al., 2019).

Deforestation is a large threat to the MTA based on local perceptions. Food insecurity is also a large problem with many residents wishing for more food, not being able to purchase nutritional food, and not eating at certain meals to make sure that others in their household don't go hungry. With a lack of alternative energy sources for household electrification and cooking, there is no end in sight for wood burning as the primary source of fuel for MTA households.

With all of these factors, food insecurity could keep increasing with the constant increase in deforestation linked to wood burning. There is a recognition that alternative sources of energy for the MTA are warranted. Concurrent with fears and perceptions felt in the MTA over deforestation, food insecurity is a multifaceted issue and is a crucial factor when looking to lessen environmental insecurity. When addressing food insecurity, it could be handled by going further than working to address increased food production or decreased poverty level. The policy could change to include natural resource management aspects along with the promotion of nutrition education in addition to increasing financial inputs to food production and distribution among others (Ngome et al., 2019).

#### *3.5.4. Trust*

Working on interventions to increase trust between the MTA and its citizens, notably a very difficult task to accomplish, would not only possibly help communication for furthering a positive community, it could positively affect food and water security and lessen perceptions of risk associated with drought and other naturally occurring disasters (Fourie, 2018). This could happen because trust research shows that residents are more likely to pay their taxes if they trust that their government is acting in their best interest (Fjeldstad, 2004; Askvik, 2008). With increased payment remittance, the MTA could use funding for new small hydro systems to eliminate water insecurity (eliminating drought risk perception and natural disaster risk perception), new nutritional food intervention programs, and other educational and intervention systems to help the community.

Within the MTA and according to participating residents, there seems to be a disconnect between the people and the government, based on the perception of trust outlined above. Trust in local and national municipalities was relatively low among residents. One aspect of a disconnect

that is demonstrated by the dam is that this is an idea from the MTA Board and not the people. Yes, the MTA Board members are community members, but they are also elected officials who could have multiple agendas leading them to believe in a certain intervention. However, the current negative perceived disconnect has the potential to be a positive within the MTA. There are connections between trust and other forms of insecurity that can be used to the MTA's advantage, such as the correlation to education and employment risk perceptions and exploring options for positive change in both categories. On the one hand, these connections make figuring out and deciphering insecurity issues challenging, yet, on the other hand it can help in insecurity reduction. Insecurity reductions can theoretically be reduced quicker and more efficiently due to these connections. For example, perceptions of risk of environmental insecurity and trust are positively correlated  $r(211) = 0.15, p < 0.05$ . Data suggests that if environmental insecurity issues are resolved in the MTA, this could increase trust in local and national governments. Also, if trust increases, this could help increase environmental security. In turn, this could lead to on time remittance of tax payments and people caring more and trusting more in their government. Additional research would equivocate these relationships. The interconnectedness flows through the MTA and it is up to the MTA to utilize it to their advantage.

#### *3.5.5. Nature Myths*

It is typical to perceive greater risk associated when things are involuntary, catastrophic in scale, severe, worrying, or unfamiliar (Gore et al., 2007; Hanisch-Kirkbride et al., 2013; Gore et al., 2016). It is not surprising that drought was highly rated, and development (e.g., road and infrastructure development in their community) was perceived as having a low risk, as South Africa was in a drought during the entirety of the research. However, development could have been ranked low on the risk perception scale due to want of new roads and development within

the community and lack of experience with development. While data collection was taking place, there were large development projects happening in the MTA. New roads were being built to lessen the drive and commute time between certain locations. Even though the construction was noisy and intrusive at the times, many residents in conversations voiced their appreciation which could also lead to the risk perception being low.

Noteworthy is the fact that deforestation and littering on land were the top two highest perceived risks out of the ten environmental harms presented to residents. Neither deforestation nor littering on land fit in the frame of involuntary and catastrophic, as both are man-made and voluntary. A majority (93%,  $n = 197$ ,  $M = 6.30$ ,  $SD = 1.309$ ) of residents felt that environmental harms are unacceptable and need to be stopped while also accepting that there are environmental harms and the justifications to manage those harms (79%,  $n = 166$ ,  $M = 5.78$ ,  $SD = 1.59$ ). This is extremely important and could help the MTA in reduce perceived and assessed insecurity. Based on data collected as part of this thesis, more than 9 out of 10 residents felt that environmental harms were unacceptable. However, just driving around the MTA, one witnesses constant littering, trash fires, pollution, and other environmental crimes. There is a disconnect between the opinions of the residents and their actions which could be due to social desirability bias and wanting to not be perceived as saying the wrong answer (Grimm, 2010). However, there could be other causes of this such as a lack of support felt by the residents from the local and national government. In unrecorded conversations, residents explained that there is nowhere to put the trash and there is only one choice. They stated that “we have to purchase the food in the communities, and we have to get rid of the trash somewhere.” That *place* is on the ground and out the car window. There is an opportunity increase governmental support in the MTA.

### *3.5.6. Littering*

Perceptions of litter and littering behavior are important to understand because most times the populations that are littering the most are part of and close to important conservation sites (Carmi, 2019). Also, littering that does not directly happen in a certain area can affect other areas because of wind and water movements (Watts et al., 2017). Behaviorally, littering usually has a negative connotation while being antisocial, unhealthy, and unpleasant to observe (Kort et al., 2008; Carmi, 2019). Litter and the act of littering have obvious health effects such as broken glass in the streets and public areas leading to cuts and infections, while the mix of material in food littering can lead to disease and bacteria being spread (Carmi, 2019). Littering also can reduce public appeal, potentially highly important in the MTA if the land is to be used for conservation areas, private game reserves, or other alternative opportunities for income. Last, and potentially most important in this context, is that littering can affect crime rates along with the ability to endanger and kill wildlife (Barnes et al., 2009; Campbell et al., 2014; Carmi, 2019).

Littering can affect crime rates in two major ways. First, because of the sight of the refuse, it announces that residents of an area will tolerate violations of the social order and will most likely not speak up and intercede to stop crime or conduct that goes against the law (Muñoz-Cadena et al., 2012; Carmi, 2019). Second, because of the unappealing and chaotic local environment, many people will stay inside of their dwellings furthering a lack of relationships with neighbors and personal ownership of public places which can lead to loss of social control. Sometimes, these situations can inspire behavior leading to increased crime rates, with neighbors refusing to help preserve publicly held spaces in their community (Muñoz-Cadena et al., 2012; Carmi, 2019).

My results suggest that people who believe littering to be a large threat to their community perceive increased frequency of traditional crimes. These relationships could help reduce crime

rates and supporting interventions to crime reduction within the MTA due to the correlation between littering and crime in the MTA. The global community needs to be made aware of threats like littering and other variables related to environmental insecurity. Awareness is the first step in combating and lessening environmental insecurity in local communities to the global community.

### *3.5.7. Poaching*

The areas surrounding conservation areas such as the MTA are poached heavily (Massé, 2019; Witter & Satterfield, 2019). Poaching has become a huge factor in the global criminal economy. Poaching is a phenomenon inadequately addressed by conservation biology alone in part because of its connections to environmental insecurity because it can “undermine conservation investments, educational programs, public-private partnerships, and can involve extreme violence” (Kahler & Gore, 2015, p. 49). Rhino poaching, and efforts to combat it, in Mozambique’s Greater Lebombo Conservancy, illustrate some aspects of the local dimensions of environmental insecurity (International Anti-Poaching Foundation, n.d.). In 2015, local villagers severely attacked two rangers while transporting alleged poachers to a holding cell. A history of distrust between rangers, villagers, and poachers helped fuel the violence (Massé, 2019). If policy makers do not take into account, the actual reality of situations and only take into account the situation as they perceive it, it will not take care of environmental security issues (Brookfield, 1969; Baird et al., 2009) The human violence surrounding wildlife poaching helps illustrate the relationship between environmental and traditional forms of security. As seen in India and Botswana, state actors are creating policies, without integrating local perceptions, that have implications on environmental security, specifically around poaching (Lopes, 2014; Mogomotsi & Madigele, 2017). Shoot-to-kill policies are policies that allow for the use of deadly force by rangers and officers if a poacher is seen or does not cooperate in an incident. These policies are often considered an extreme form of

governance (and often a human rights violation), but they seem to be more widely adopted over time (Messer, 2010; Lopes, 2014). These policies are not always viewed as good governance because they go above and beyond the traditional fines and jail terms and use lethal tactics to decrease poaching (Duffy et al., 2019). Such types of policies continue to be implemented though because they can generate specific conservation outcomes. But what if these policies do not get at the root of why environmental insecurity/poaching is occurring?

Poaching in the MTA is a complex problem to address. This being a case study with only one year of data does not mean this data is representative of poaching everywhere. However, in my research, there were factors such as age, children living in the household, and land ownership that played a large role in poaching perceptions and could be a jumping off point. Younger MTA residents showed less concern for the harm that poaching was having on their community as well as perceiving the frequency of poaching to be lower overall when compared with the older generation. Among study participants, having more children in a household and owning land also decreased the perception that poaching was harming the community. Interventions in the MTA could be directed towards a younger generation. Many MTA residents stated that they would like to own their own business. There are potential connections between anti-poaching, conservation, and the surrounding game reserves in which younger MTA residents could take advantage of. Education on the possibility of ecotourism and other related business endeavors could lessen the appeal to poach. Poaching is lucrative; however, it is extremely dangerous and not a reliable, steady source of income. In the future, research could investigate a more in depth look at the variables and work towards solutions that could be beneficial to the wildlife as well as the MTA residents. Further research could include looking specifically at individual effects within the MTA to see how they really affect poaching and poaching rates in the MTA.

### 3.8 CONCLUSION

Environmental insecurity in the MTA is a multifaceted and interconnected concept. It influences and is influenced by other forms of insecurity. However, it is not significantly affected by individual factors such as village location. Deforestation, littering, and drought all contributed to increased risk perception and need of interventions. Gender predicted very few differences regarding environmental insecurity and was also insignificant in most measurements taken other than water insecurity. Nature myth perceptions could influence resident's willingness to take part in interventions, while trust needs to be worked on and cultivated in the MTA for those interventions to become plausible. Poaching frequency is significantly affected by village location and should be looked into further in conjunction with crime statistics. Lastly, age, children in the household, and ethnicity influenced perceptions that poaching threatened the local community. Environmental insecurity is extremely interconnected with other forms of insecurity and countless factors affect and are affected by it. There is an opportunity to conduct a broad study of environmental insecurity that includes local perceptions, along with the assistance of other viewpoints to get the full picture.

Within my research, the theme of interconnectedness emerged regarding environmental insecurity. These themes included food, water, trust, poaching, and crime (traditional and environmental). Within these subunits of environmental insecurity, multiple demographic factors influenced risk perception associated with each subunit. These included age, number of children within a household, biological sex, if a person was currently employed (job security), ownership of land, ethnicity, and what village they lived in and where this was located compared to certain landmarks such as Kruger National Park. We should therefore look at insecurity as both individual components and collectively to get the full picture of environmental insecurity. Looking at

securities individually, they can be assessed differently, providing a perspective to potential solutions and intervention creations. When taken as a single entity, we can analyze variables to see if individual factors are affecting each type of insecurity, which might affect change on another insecurity threat positively. I base all the possibilities of ideas and interventions presented on risk perceptions and questions remain that need to be empirically studied further by the scientific community, taking into account the local perspective.

Local communities are impacted strongly by securitization policies (Balzacq et al., 2016; Gore et al., 2016). Securitization is when an issue is understood not only as a political subject and talking point, but as a threat to a referent object, while this politicization can sometimes justify the use of extreme measures on the behalf of national security (Scott, 2012; Taureck, 2006). There is insufficient understanding about perceptions of these local communities who experience insecurity and who are directly impacted by policies and programs designed to reduce insecurity. Previous studies have primarily looked at the relationships between land use and various factors such as economic constraints (Baird et al., 2009). While this is useful, decision makers need local perceptions to aid in arbitrating the influence these factors have on decision makers (Baird et al., 2009).

Over 50 years ago, Brookfield stated that, “decision-makers operating in an environment base their decisions on the environment as they perceive it, not as it is. The action resulting from decision, on the other hand, is played out in a real environment”. (Brookfield, 1969; Baird et al., 2009). This statement rings true today and this lack of understanding can inhibit design and evaluation of effective interventions designed to help communities affected by environmental insecurity (Gore et al., 2016). Sociodemographic information will aid local perspectives (e.g. age, employment status, gender, income). Global and regional perspectives can overshadow local

perspectives and can make creating policy to help in insecurity lessening even more difficult (Gore et al., 2016). This research is a first step in understanding how local perspectives interact with global policy and interventions to help with the growing environmental insecurity globally.

## APPENDIX

## APPENDIX

### *Local Risk Perceptions Questionnaire 2019: Mnisi Tribal Authority, Mpumalanga, South Africa*

#### **Is verbal consent granted?**

**Warm Up/Introduction (This first set of questions are examples of the types of questions I will be using.)**

On a scale of 1 to 7, with 1 being completely disagree and 7 being completely agree, please tell me how much you agree with the following statement. Morogo should be served at all meals. My favorite sport is fútbol (soccer).

**Mnisi Tribal Authority (This set of questions asks your personal experience within local Mnisi Tribal Authority society and culture. Please tell me the extent to which you agree with each statement pertaining to the last full year which is 365 days. Nature means the environment, the Earth, or the living world and includes people.)**

My ideal job would be my own business.

It is important to preserve our customs and cultural heritage.

Important questions for our society should not be decided by experts but by the people.

Having order in my community is unpopular.

I worry about conflicts between social groups in my community.

In a family, adults and children should have the same influence in decisions.

It is important to me that in the case of important decisions in my family that everyone is asked.

We have to accept the limits in our life if we want or not.

There is no use in doing things for other people--you only get it in the neck in the long run.

Institutions (an established organization or corporation (such as a bank or university) especially of a public character) should be organized in a way that everybody can influence important decisions.

I don't join clubs of any kind.

The freedom of the individual should not be limited for reasons of preventing crime.

The police should have the right to listen to private conversations when investigating crime.

When I have problems, I solve them on my own.

An intact (where both biological parents are present in the home) family is the basis of a functioning society.

I prefer clear instructions from my superiors about what to do. If you don't currently have a superior, think about a time that you had a superior. For example: in school.

Order in my community is an important virtue.

I would not participate in civil action (A civil action is an action that is brought to enforce, redress or protect a private or civil right. It is a non-criminal litigation) groups because the ones in power do only allow what they like.

I prefer tasks where I work something out on my own.

**Harm Thoughts (The following questions ask how certain environmental harms compare to each other. Environmental harms are threats, risks, hazards, or chances. Environment is the natural world including nature, people, plants, animals, water, and all living things. Please think about the last full year when answering)**

Harvesting of non-dry wood (all wood other than wood that has fallen due to natural causes) poses harms to the environment.  
Drought poses harms to the environment.  
Political crises' pose harm to my community.  
Poaching poses a threat to my local community.  
Poaching poses harms to the environment.  
Snaring poses harms to the environment.  
Snaring poses harm to my community.

**Please rank the following harms in order of least to most threatening within my community and the areas surrounding my community, with least threatening being #1 and most threatening being #10.**

Cattle Theft  
Development  
Drought  
Erosion  
Illegal Logging (Deforestation)  
Littering/Pollution of the Land  
Littering/Pollution of the Water  
Mosquitoes (spread of disease)  
Overgrazing  
Poaching

**Harm Response 1 (People who are responsible have many ways in which they can go about managing harms to the environment, or nature. These questions ask your experience with different management reactions. Please think about the last full year when answering.)**

I accept there are environmental harms and the justifications to manage those harms.  
Environmental harms are unacceptable and need to be stopped.  
I try not to know about environmental harms because there is nothing I can do about them.  
Environmental harms create new opportunities for creativity, innovation, and development.

**Harm Response 2 (This set of questions focuses on your experience with how different types of harm should be coped with. By cope, I mean respond in a systematic way. Please think of the last year when answering these questions.)**

Harms are best ignored (avoided).  
Harms are best deterred (stopped).  
Harms are best adapted to (modified).  
Harms are best welcomed (accepted).

**Nature Mythology (This set of questions focuses on your thoughts of the environment/nature. Please think about the last full year when answering.)**

The environment/nature always finds its way back to a balance.  
Small changes made by people have very big impacts on the environment/nature.  
The environment/nature forgives events to a certain point.  
The environment/nature is random.

**Food Security (This set of questions focuses on the food that you and members of your family eat. By food, I mean grains, legumes, vegetables, meat and fish that you can cook. Please think about the last full year when answering.)**

I worry that my family may run out of food before I have money to buy food again.

I worry that I may not be able to afford to buy adequate food.

I wish I could buy more food if I had more money.

My family has run out of food because we do not have more money to buy food.

I eat less than I want to because I do not have enough money to buy food.

Have the children of your family, according to you, not had enough to eat because you do not have enough money to buy food?

Has your family ever eaten the same type of food for several consecutive days because you do not have enough money to buy different food?

Do you have enough money to buy healthy and nutritious food for the children of your family?

Sometimes a person's body weight drops because of not eating enough. Has your body weight dropped in the last year because of the lack of food?

**Health Security (This set of questions focuses on your thoughts of health services and traditional medicines. Please think about the last full year when answering.)**

If someone in my community gets sick, they have reliable governmental medical support to rely on.

I worry about becoming infected with HIV.

The government provides the necessary and needed health services to my community.

The use of animals and animal parts is acceptable for use in traditional medicine practices.

Traditional medicine is a reliable option to solving illness and medical issues.

**Water Security (This set of questions focuses on the water that you consume as well as the water you use for crop production and non-drinking purposes. Please think about the last full year when answering.)**

I worry about having a reliable supply of drinking water.

I worry about having a reliable source of water used for non-drinking purposes.

I worry about potential human-wildlife conflict at local water sources.

I worry about having enough water for my personal crops.

I worry about my community having enough water for their crops.

I worry about potential wildlife contamination at local water sources.

I worry about how healthy the rivers are.

**Environmental Security (This set of questions focuses on your experiences with natural resources as well as environmental factors that affect your daily lives. Please think about the last full year when answering.)**

I worry about having a reliable source of natural resources to live.

I worry about environmental crime in my community.

I worry about having healthy land to grow food on.

I worry about my ability to recover from drought.

I have a reliable source of energy.

I can rely on my government to provide continuous, reliable energy.

I have reliable protection from disease.

My community believes we can rely on our national government.  
I have reliable natural resources to live.  
The Mnisi Tribal Authority, as a whole, is good at protecting nature.  
I have a reliable way of disposing of trash legally.  
I worry about deforestation (the illegal taking of wood) having a negative impact on my community.  
I worry about pollution (littering/trash) having a negative impact on my community.  
I have a reliable way of acquiring energy for my household other than wood burning.

**Education and Employment (This set of questions focuses on your thoughts on educational opportunities and employment opportunities. Please think about the last full year when answering.)**

The surrounding wildlife institutions provide my community opportunities for employment.  
I worry about either keeping my job or losing my job.  
I feel well prepared to enter the workforce.  
The educational opportunities provided to my children prepare them well for eventual employment.  
I have opportunities for legal employment.  
I have the opportunity to advance my education.

**Trust (This set of questions looks at your thoughts on trust within your community and surrounding areas. Please think about the last full year when answering.)**

A person is better off if he/she doesn't trust anyone.  
I have a trustworthy national government.  
I trust that my local police acts with integrity.  
I worry about corruption in my community.  
I have a trustworthy local government.  
I trust the rangers in the surrounding protected areas and game reserves.

**Traditional Crime Perspective (These next questions focus on your perspective about traditional crimes in your community. These questions focus on your community and not you specifically. Please think about the last full year when answering.)**

I worry about crime in my community.  
Traditional crime, for example, theft and violence, in my community should be addressed prior to crime involving the environment.  
Traditional crime is more detrimental to my community when compared to environmental crime.  
I am concerned about assault in my community. According to SAPS, assault consists of unlawfully and intentionally applying force to the person of another; inspiring a belief in another person that force is immediately to be applied to him or her.  
I am concerned about burglary in my community. Burglary is the criminal offense of breaking and entering a building illegally for the purpose of committing a crime.  
I am concerned about drug related crimes in my community.  
I am concerned about rape in my community. According to SAPS, rape consists of intentional unlawful sexual intercourse with a woman without her consent.  
I am concerned about sexual assault in my community. Sexual assault is the illegal sexual contact that usually involves force upon a person without consent or is inflicted upon a person

who is incapable of giving consent (as because of age or physical or mental incapacity) or who places the assailant (such as a doctor) in a position of trust or authority

I am concerned about stock-theft in my community. According to SAPS, theft consists of the unlawful appropriation of moveable corporeal property belonging to another with intent to deprive the owner permanently of the property.

I am concerned about murder in my community. According to SAPS, murder is the unlawful and intentional killing of a human being.

**Activities (The following questions ask your experience with how often the following activities happen in this area. We will be using a scale of 1 to 7. 1 being absolutely none and 7 being every day. Be assured I am not asking how much or whether YOU do these activities, simply how much you think these activities are happening here. I am not interested in self-incrimination and I AM NOT law enforcement. Please think about the last year when answering these questions.)**

How much cattle theft happens in my community?

How much illegal taking of wood happens in my community?

How much littering, on the land, happens in my community?

How much littering, in the water, happens in my community?

How much elephant poaching happens in the area surrounding my community?

How much hyena poaching happens in the area surrounding my community?

How much impala poaching happens in the area surrounding my community?

How much leopard poaching happens in the area surrounding my community?

How much lion poaching happens in the area surrounding my community?

How much pangolin poaching happens in the area surrounding my community?

How much python poaching happens in the area surrounding my community?

How much rhino poaching happens in the area surrounding my community?

How much vulture poaching happens in the area surrounding my community?

How much wild dog poaching happens in the area surrounding my community?

**Conclusion (These final questions focus on your background. This information will be private and will NEVER be associated with your responses.)**

Age:

Primary Job:

Years lived in area:

Ethnicity/Tribe (Please list all):

Owner of Land (yes or no)?

Size of Land (km)

Sex: [0 = male] [1= female]

Number of children currently living in household:

Township/Village/Area:

Other Comments:

*Full Questionnaire (Tsonga)*

**Mpfumelelo wo vulavula wu nyikiwile:**

**Masungulo (ntlawwa wa swivutiso leswo sungula I xikombiso xa swivutiso leswi ndzinga ta swi tirhisa eka nkambelo-vutivi (interview) leyi)**

**Eka xikalo xo sukela ka #1 ku fika ka #7, #1 u hlamusela leswanku “a ndzi pfumelelani na swona na kantsongo”, #7 u hlamusela leswaku “ndzi pfumelelana na swona swinene”.Ndzi kombela undzi byela leswaku u pfumelelana ku fikela kwini na switetimendhe leswi ngata landzela.**

Matsavu ma fanele ku dyiwa xikan’we ni swakudya swa siku na siku.

Ntlangu lowu ndzi wu rhandzaka ngopfu I bolo ya milenge.

**Vuhosi bya ka Mnisi (Ntlawwa lowu wa swivutiso wu kambisisa matitwelo ya wena n’wini hi vukorhokeli bya laha Vuhosini byaka Mnisi na Ndhavuko waka n’wina laha tikweni)**

**Ndzi kombela u ndzi byela leswaku u pfumelelana ku fikela kwihi ni switetimendhe leswi landzelaka hinkwaswo. Switetimendhe leswi landzelaka swi kongomisiwe eka lembe leri hundzeke hinkwaro.Ntumbunuko swi vula mbango, misava, xin’wana na xin’wana lexi kumekaka laha misaveni ku katsa na vanhu.**

Ntirho lowu ndzi vonaka wundzi fanerile I ku fambisa bindzu ra mina n’wini.

Swina nkoka ku hlayisa ndlela ya xinto yo endla swilo na ndhavuko wa hina.

Swivutiso swa nkoka leswi kongomaneke na rixaka ra hina aswi fanelanga ku bohiwa hivanhu la vanga na ntokoto. Swifanele ku boiwa hi vini va ndzhawu.

Ku va swilo swi famba kahle emugangeni wa wena aswi tolovelekanga.

Ndza vilerisiwa hi ntlimbano lowu nga kona exikari ka ti nxaka-nxaka ta vanhu emugangeni wa mina.

Endyangwini, lavakulu ni lavatsongo vafanele ku va ni vutihlamuleri byo ringana eku tekeni ka swiboho.

Swina nkoka eka mina leswaku endyangwini waka hina unwana ni unwana a vutisiwa mavonelo ya yena loko swita ekutekeni ka swiboho swa nkoka.

Hi fanele ku amukela leswi hi kotaka ku swi fikelela evuton’wini bya hina, hambi swihi tsakisa ni loko swi ngahi tsakisi.

A swi pfuni nchumu ku pfuna vanhu van’wana- hikuva loko nkarhi wu famba va to tshamela ku ku karhata.

Swikolo swa mfumo swi fanele ku va hindlela leyi nga ta endla leswaku un’wana ni un’wana a kota ku va xiphemu xo teka swiboho ehenhla ka swona.

Andzi ngheneleli eka mintlawwa yihi kumbe yihi.

Ntshuxeko wa munhu awu fanelanga wu pimiwa hikokwalaho ko ringesa ku hunguta vugevenga.

Loko ndziri na ti nkingha ndzi ti ahlulela tona ndziri ndzexe.

Ndyangu lowu khomaneke I masungulo ya rixaka leri tirhaka kahle/leri ngata kota ku tirha hi ndlela leyinene.

Ndzi tsakela swileriso leswi nga erivaleni eka va rhangeri va mina hi leswi ndzi faneleke ku swi endla. (Loko unga ri na murhangeri ehleketa hinkarhi lowu awu ri na murhangeri, Xikombiso; exi kolweni.)

Swina nkoka kuva swilo swi famba kahle emugangeni wa mina.

Andzinge ngheneleli xitereko, hikuva lava fambisaka tiko va endla ntsena ku rhandza ka vona. Ndzi tsakela mintiro leyi ndziti ahlulelaka swilo/swiphiqo ndziri ndzexe.

**Miehleketo yo onha (Swivutiso leswi landzelaka swikambisisa leswaku maonhelo yo karhi ya mbango ya yelana njhani. Ku onhiwa ka mbango i vuxungeti, vuchavisi, vunghozi kumbe ku teka machansi. Mbango I misava katsaka ku katsa vanhu, swihlahla, swiharhi, mati na swilo hinkwaswo leswi hanyaka. Ndzi kombela u ehleketa hi lembe leri hundzeke hinkwaro loko u hlamula swivutiso lesi landzelalaka)**

Ku rhotiwa ka tihunyi to tsakama swi xungeta ku onha mbango.  
Dyandza ri xungeta ku onha mbango.  
Tinkingha ta tipolitiki ti xungeta ku kavanyeka rihanyo e mugangeni wa mina.  
Ku hlota lokungariki nawini ku xungeta rihanyo emugangeni wa mina.  
Ku hloliwa ka swiharhi swingari enawini swi nga onha mbango.  
Ku rhiyiwa/phasiwa ka swiharhi swi nga onha mbango.  
Ku rhiyiwa/phasiwa ka swiharhi swi nga onha emugangeni wa mina.

**Kala tinkingha leti landzelaka u sungula hi leti ti nga ta nghozi swinene mugangeni wa wena wena na ti ndhawu leti nga ku suhi na wona. Leti nga chaviseki ngopfu ti nyike #1 leti chavisaka ngopfu ti nyike #10.**

Ku yiviwa ka tihomu.  
Nhluvuko  
Dyandza.  
Ku khukuriwa ka misava hi mpfula.  
Ku tsemeleriwa ka nhova/Minsinya.  
Ku lahliwa ka thyaka laha swinga fanelangiki/ ku thyakisiwa ka moya hi ku hisetela swilo.  
Xikombiso..moya lowu sukaka eti femeni.  
Ku thyakisiwa ka mati emadan`wini /ku laheteriwa ka thyaka emadan`wini/laha ku ngani mati.  
Vuvabyi bya Malaria lebyi kumekaka ka tinsuna.  
Ku rimiwa ka ndhawu leyi tlulaka mpimo.  
Ku hloliwa ka swiharhi swingari enawini.

**Nhlamulo ya nxungeto #1 (Vanhu lava nga ni vutilamuleri lebyinene vani tindlela to tala to lawula ku vavisiwa ka mbango kumbe ntumbunuko. Swivutiso leswi swi kambisisa matitwelo ya wena hi vurangeri byo hambana hambana lebyi unga hlangana na byona. Ndzikombela u ehleketa hi lembe leri hundzeke hinkwaro loko u karhi u hlamula swivutiso leswi)**

Ndza pfumela leswaku swi kona leswi onhaka mbango, na tindlela to swi lawula tikona.  
Swionha mbango aswi amukeleki, swi fanele kusiveriwa.  
Ndza ringesa ku va ndzi nga tivi nchumu hi swilo leswi onhaka mbango hikuva andzi nge endli nchumu ku swi sivele.  
Swilo leswi onhaka mbango switisa kucinca, nhluvuko na tindlela to endla mintirho.

**Nhamulo ya nxungeto #2 (swivutiso leswi landzelaka swi kongomane na matitwelo ya wena leswaku kunga endliwa yini hi minxungeto le yinga kona yo hambana- hambana.Loko ndzikuku nga endliwa yini ndzi ringesa ku hlamusela leswo; hi nga angula njhani hi xitepe-hixitepe? Leswi se ndzi nga vutisa hi minxungeto yo hambana-hambana eka swakudya, Ntumbunuko, ku hlayiseka ka wena na mati, upfumelelana ku fikela kwihi na switetimendhe leswi landzelaka?)**

Swi nga antswa ngopfu loko minxungeto leyi yi nga tekeriwi enhlokweni.

Swi nga antswa ngopfu loko minxungeto leyi yo herisiwa.

Swi nga antswa ngopfu minxungeto leyi yo toloveriwa.

Swi nga antswa ngopfu loko minxungeto leyi yo amukeriwa.

**Swivuriso swa ntumbunuko (Swivutiso leswi landzelaka swi langutisisa eka maehleketelelo ya wena hi mbango/ntumbunuko. Ndzi kombela u ehleketa hi lembe leri nga hundza hinkwaro loko u karhi u hlamula swivutiso leswi)**

Mbango/ntumbunuko wa swi kota ku tlhelela ematshan'wini ya wona minkarhi hinkwayo.

Ku cinca ku tsongo loku ku endliwaka hi vanhu ku na swita-ndzhaku leswikulu eka ntumbunuko/mbango.

Ntumbunuko/mbango a wu twisiseki.

**Ku tiyisiseka ka swakudya (swivutiso leswi landzelaka swi langutisisa swakudya leswi wena na va le ndyangwini wa wena mi dyaka swona. Swakudya leswi swi katsa, tiboncisi, matsavu, nyama na tihlampfi leswi mi swi swekaka. Ndzi kombela u ehleketa hi lembe leri nga hundza hinkwaro loko u karhi u hlamula swivutiso leswi)**

Ndza vilerisiwa hileswaku ndyangu wa mina wunga heleriwa hi swakudya ndzi ngase kuma mali yo xava swin'wana swakudya nakambe.

Ndza vileririwa hileswaku swinga endleka ndzi nga swi koti ku xava swakudya swo ringana ndyangu wa mina.

Andzita xava swakudya swo tala loko andziri mali yo tala nyana.

Ndyangu wa mina wu heleriwile hi swakudya hikuva a hi na mali yo xava swin'wana.

Ndzi dya swakudya switsongo hikuva andzina mali yo ringanela yo xava swakudya.

Hi mavonelo ya wena, vana va le kaya ka n'wina vadya swakudya switsongo hikokwalala ko pfumaleka ka mali yo xava swakudya endyangwiniwa ka n'wina?

Xana ndyangu waka n'wina wu dya swakudya swa mihlovo un'we masiku yo hlaya hikwalaho ko pfumaleka ka mali yo xava swakudya?

Una yona mali yo ringanela ku xavela vana vaka n'wina swakudya leswi akaka miri?

Minkarhi yin'wani ku nyuhela ka munhu ka ehla hikuva va a nga dyi swakudya swo ringanela.

Wunga va wa wena miri wu ehlile eka lembe leri nga undza hi kokwalaho ko pfumala swakudya?

**Ku tiyisiseka ka taRihanyo (swivutiso leswi landzelaka swilangutisisa maehleketelelo ya wena hi vukorhokeli bya swarihanyo na mimirhi ya xinto. Ndzi kombela u ehleketa hi lembe leri nga hundza hinkwaro loko u karhi u hlamula swivutiso leswi)**

Loko munhu a vabya emugangeni wa mina, byi kona kukorhokeli bya mfumo bya rihanyo lebyi byi n'wi pfunaka.

Ndza vilerisiwa leswaku ndzi nga tluleriwa/ngheneriwa hi vuvabyi bya HIV.

Mfumo wu hi nyika kukorhokeli lebyi faneleke ni lebyi pfumalekaka e mugangeni lowu ndzi tshamaka ka wona.

Ku tirhisiwa ka swiharhi na swirho swa swona eku endleni ka mirhi ya xinto swa pfumeleleka emugangeni wa mina.

Mimirhi ya xinto yi tshembhekile ku herisa mavabyi na tinkingha ta mimirhi.

**Ku tiyisiseka ka vukorkokeli bya mati (swivutiso leswi landzelaka swilangutisisa mati lawa u matirhisaka ku nwa no sweka na mati lawa u wa tirhisaka swin'wana handle ko nwa no sweka. Ndzi kombela u ehleketa hi lembe leri nga hundza hinkwaro loko u karhi u hlamula swivutiso leswi)**

Ndza vilerisiwa hi ku kuma vukorhokeli bya mati yo nwa lebyi tshembhekeke.

Ndza vilerisiwa hi ku kuma vukorhokeli bya mati yo tirhisa swin'wana handle ko nwa.

Ndza vilerisiwa hi ku kavanyetana ka vanhu na ntumbunuko lokoswita eka timhaka ta mati.

Ndza vilela loko ndzi hleketa leswaku ndzi ngaka ndzi nga vi na mati yo enela yo cheleta swibyariwa swa mina.

Ndza vilela loko ndzi hleketa leswaku muganga wa hina wunga tshuka wu nga vi na mati yo enela yo cheleta swibwariwa.

Ndza vilela loko ndzi hleketa leswaku swiharhi/ntumbunuko wu nga kuma mati lawa nga tengangiki/mati yoka manga basangiki ku suka eka vukorhokeri bya mati laha mugangeni wa hina.

Ndza vilerisiwa hi mabaselo/rihanyo ra minkova.

**Ku hlayiseka ka mbango (swivutiso leswi landzelaka swi lagnutisisa matitwelo ya wena hi switirhisiwa swa ntumbunuko na swin'wana swa mbango leswi khumbhaka vutomi bya wena masiku hinkwawo. Ndzi kombela u ehleketa hi lembe leri nga hundza hinkwaro loko u karhi u hlamula swivutiso leswi)**

Ndza vilela loko ndzi hleketa leswaku ndzi ngaka ndzi ngavi na switirhisiwa swa ntumbunuko leswi nga kotaka ku ndzi pfunaka ku hanya.

Ndza vilerisiwa hi swiendlo swo ka swi ngari enawini leswi onhaka ntumbunuko emugangeni wa mina.

Ndza vilela loko ndzi hleketa leswaku ndzinga pfumala misava yo nona yo byala ka yona swakudya.

Ndza vilerisiwa loko ndzi hleketa leswaku swi nga tshika swi ndzi tikela ku ya emahlweni na vutomi endzhaku ka dyandza.

Ndzi na mphakelo wa gezi wo tshembheka.

Mfumo wa mina wu tshembhekile ku ndzi nyika mphakelo wa gezi lowu nga kavanyetiweki minkarhi hi nkwayo.

Ndzina nsivelo lowu tshembhekeke eka switsongwa-tsongwana.

Muganga wa mina wa tshembha leswaku hinga langusela swo tala eka mfumo wa tiko ra hina.

Ndzina switirhisiwa leswitsembhekeke swa ntumbunuko leswi ndzi pfunaka ku hanya.

Vuhosi byaka Mnisi hi nkwayo bya swi kota ku sirhelela ntumbunuko hindlela ya leyinene.

Ndzi na ndlela leyi tshembhekeke yo lahla thyaka ku ya hi nawu.  
Ndza vilerisiwa hi ku tsemeleriwa ka swihlala ( swinga ri enawini) hikuva swita tisa swita-ndzhaku swo ka swi ngari kahle emugangeni wa mina.  
Ndza vilerisiwa hi ku thyakisiwa/ ku lahleteriwa ka thyaka hi ndlela leyi nga amukelekeki, ku swi nga tisa swita-ndzhaku swo ka swi kari kahle emugangeni wa mina.  
Ndzina ndlela yo tshembheka yo tisa gezi endlwini ya mina handle ko tirhisa ndzilo(tihunyi).

**Dyondzo na Vuthori (swivutiso leswi landzelaka swi langutisisa miehleketo ya wena loko swita eka tidyaondzo dyondza na ti timhaka ta mintirho. Ndzi kombela u ehleketa hi lembe leri hundzeke hi nkwaro loko u karhi u hlamula swivutiso leswi)**

Swikolo swa ntumbunuko leswi nga ekusuhi na muganga wa mina swa hi pfuna hi mintirho ni dyondzo.  
Ndzi ti twa ndzi ti lulamiserile ku sungula ku tirha.  
Tidyondzo leti nyikiwaka vana va mina ti ta va pfuna no ku valulamisela ku sungula ku tirha kunga ri khale.  
Ndza tshemba leswaku ndzi ta tirha to tirha mintirho leyi nga enawini.  
Ndzi tona tindlela to yisa emahlweni tidyondzo tamina.

**Ku tshembheka (swivutiso leswi landzelaka swi langutisisa matitwelo ya wena hi vutshembheki lebyi nga kona emugangeni wa wena ni miganga leyi kumekaka eku suhi.Ndzi kombela u ehleketa hi lembe leri hundzeke loko ukarhi u hlamula)**

Swa antswa kuva munhu anga tshembhi munhu.  
Mfumo wa mina wu tshembhekile.  
Maphorisa ya le kusuhi na mina ya tirha hi ku tshembheka.  
Ndza vilerisiwa hi vu kungundzwana lebyi nga emugangeni wa mina.  
Mfumo wale kusuhi (masipala) na mina wu tshembhekile.  
Ndzi tshembha valayisi va swiharhi na ntumbunuko (Rangers) lava tirhaka emintangeni leyi nga kusui na muganga wa mina.

**Mavonelo hi vugevenga (ku yiva, kudlaya...etc) emugangeni (swivutiso leswi landzelaka swi langutisisa matitwelo ya wena hi vugevenga lebyi nga kona emugangeni wa wena. Swivutiso leswi swi kongomisiwile eka muganga wa wena hinkwawo hayi eka wena. Ndzi kombela u ehleketa hi lembe leri hundzeke loko ukarhi u hlamula)**

Ndza vilerisiwa hi vugevenga lebyinga emugangeni wa mina.  
Swina nkoa ngopfu ku lwisana na vu gevenga bya tiko hi nga se lwisana na vugevenga bya mbango/ntumbunuko emugangeni wa mina.  
Vugevenga bya tiko (Vukhamba, Ku onha) swi fanele ku ahluriwa hi ngase sungula ku ahlula ka onhiwa ka mbangu.  
Vugevenga byale tikweni byi onha swinene emugangeni wa mina ku tlula vugevenga bya mbango.  
Ndzi vilerisiwa swinene hi ku sukeriwa ka vanhu emugangeni wa mina. Hikuya hi nawu wa maphorisa ya laha afrika-Dzonga ku sukela munhu I ku n'wi twisa kuvava hi tindlela to hambana-hambana.

Ndzivilerisiwa ngopfu hi ku tshoviwa etindlwini laha mugangeni wamina. Ku tshova I ku nghena etindlwini ta vanhu handle ka mpfumelelo wa vona hi xikongomelo xo yiva kumbe ku onha etindlwini ta vona.

Ndzi vilerisiwa hiswi dzidziharisi emugangeni wa mina

Ndza vilerisiwa hi ku pfinyiwa ka vavasati emugangeni wa mina, Hikuya hi nawu wa maphorisa laha tikweni, ku pfinya I ku endla swa masangu ni wansati handle ka mpfumelelo wa yena.

Ndza vilerisiwa hi ku vavisiwa ka vanhu hi swa masangu. Ku vavisiwa hi swa masangu i kuva munhu a endla timhaka ta masangu handle ka mpfumelelo na munhu loyi anga swi koteki ku nyika mpfumelelo.

Ndza vilerisiwa hi ku yiviwa ka timpahla e mugangeni wa mina, hikuya hi maphorisa ku yiviwa ka timpahla I ku teka nhundzu ya munhu anga ku nyikanga mpfumelelo.

Ndza vilerisiwa hiku dlayiwa ka vanhu emugangeni wa mina. Hikuya hi nawu wa maphorisa kudlaya I ku teka vutomi bya munhu un'wana.

**Swiendlo (Swivutiso leswi landzelaka swi vutisisa hi kuya hi vutivi bya wena leswaku swiendlo lesi swi humelela kangani emugangeni lowu. Hi ta tirhisa xikalo xo sukeka ka #1 ku fika ka #7. #1 yi hamusela leswaku aswi humeleli, #7 yihlamusela leswaku swihumelela masiku hinkwawo. Ndza tiyisisa leswaku andzi vutisi kumbe kuhlamusela leswaku wena wa endla swiendlo leswi ndzinga taswi vutisa. Ndzi vutisa leswaku u ehleketa leswaku swiendlo leswi swi nga va swi humelela kangani emugangeni wa wena? Andzi lavi kutiva hi nawu lowu u wu tluleke/tlulaka andzi tirhi ku bohisa milawu. Ndzi kombela u hleketa hi lembe leri hundzeke loko u hlamula swivutiso leswi.)**

Ku yiviwa ka tihomu emugangeni wa mina ku humelela kangani?

Kurhoteriwa ka tihunyi swingari enawini swi humelela kangani emugangeni wa mina?

Ku thyakisiwa ka misava hiku lahleteriwa ka thyaka swihumelela ku fikela kwini emugangeni wa mina?

Ku thyakisiwa ka mati swi humelela ku fikela kwini emugangeni wa mina?

Ku hlotiwa ka tindlopfu handle ka pfumelelo ku humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka swipena handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka tinghala handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka tiyingwe handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka tihumba handle ka mpfumelelo swi humelela kangani emintangeti leyi leyi kumekaka kusuhi na muganga wamina?

Ku hlotiwa ka tinyoka handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka timhelembe handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka swinyenyana handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

Ku hlotiwa ka timbyana ta nhova handle ka mpfumelelo swi humelela kangani emintangeni leyi kumekaka kusuhi na muganga wa mina?

**Mahetelelo (swivutiso leswi swi langutisisa vuxoko-xoko bya wena n'wini.Vuxoko-xoko lebyi byi tava bya xihundla nakambe byi nge hlanganisiwi na tinhlamulo ta wena)**

Malembe :

Utirhayini/Ntirho wa wena :

I Malembe mangani u tshama emugangeni lowu :

Rixaka :

N'wini wa misava (Ina kumbe Ee)? :

Xiave/ Misava yi kule ku fika kwihi ?(KM) :

Vununa/Vusati : (0 =Wanua) (1= Wansati) :

Nomboro ya vana la va ha tshamaka kaya ka wena :

Vito ra Muganga/Tiko ra wena:

Swin'wana leswi u lavaka ku swi engetela :

## *Cronbach's Alpha and Index Creation*

### **Crime:**

- I worry about crime in my community
- Traditional crime, for example, theft and violence, in my community should be addressed prior to crime involving the environment.
- Traditional crime is more detrimental to my community when compared to environmental crime.
- I am concerned about assault in my community.
- I am concerned about burglary in my community.
- I am concerned about drug related crimes in my community.
- I am concerned about rape in my community.
- I am concerned about sexual assault in my community.
- I am concerned about stock-theft in my community.
- I am concerned about murder in my community.

### **Education and Employment:**

- The surrounding wildlife institutions provide my community opportunities for employment
- I feel well prepared to enter the workforce
- The educational opportunities provided to my children prepare them well for eventual employment.
- I have opportunities for legal employment
- I have the opportunity to advance my education.

### **Environmental:**

- I worry about having a reliable source of natural resources to live.
- I worry about environmental crime in my community.
- I worry about having healthy land to grow food on.
- I worry about my ability to recover from drought. I have a reliable source of energy.
- I have reliable natural resources to live.
- I worry about deforestation having a negative impact on my community.
- I worry about pollution (littering/trash) having a negative impact on my community.
- I have a reliable way of acquiring energy for my household other than wood burning.

### **Food:**

- I worry that my family may run out of food before I have money to buy food again.
- I worry that I may not be able to afford to buy adequate food.
- I wish I could buy more food if I had more money.
- My family has run out of food because we do not have more money to buy food.
- I eat less than I want to because I do not have enough money to buy food.

### **Poaching:**

- Elephant poaching
- Hyena poaching

- Impala poaching
- Leopard poaching
- Lion poaching
- Pangolin poaching
- Python poaching
- Rhino poaching
- Vulture poaching
- Wild dog poaching

**Trust:**

- A person is better off if he/she doesn't trust anyone.
- I have a trustworthy national government.
- I trust that my local police acts with integrity

I have a trustworthy local government

I trust the rangers in the surrounding protected areas and game preserves.

**Water:**

- I worry about having a reliable supply of drinking water.
- I worry about having a reliable source of water used for non-drinking purposes.
- I worry about potential human-wildlife conflict at local water sources.
- I worry about having enough water for my personal crops.
- I worry about my community having enough water for their crops.
- I worry about potential wildlife contamination at local water sources.
- I worry about how healthy rivers are.

<b>Table 21: Cronbach's alpha internal consistency test for indexes used within the data analysis of the Mnisi Tribal Authority, Mpumalanga, South Africa (May – July 2019)</b>		
<b>Index</b>	<b>Alpha</b>	<b># of Questions</b>
<i>Crime</i>	.884	10
<i>Education and Employment</i>	.661	5
<i>Environmental</i>	.617	9
<i>Food</i>	.860	5
<i>Poaching</i>	.901	10
<i>Trust</i>	.615	5
<i>Water</i>	.833	7

*Ethics Statement (English)*

Michigan State University's Committee on Research Involving Human Subjects IRB# (Fill in) reviewed and approved all methods and procedures used in this research. Prior to all participation during the study, all participants were read an introduction that presented a general synopsis of the research and asked for verbal consent. This was available in either English or Tsonga depending on the request of the potential participant. The statement read as follows, "My name is (fill in with current interviewer name)." I am a researcher working with a researcher from "MICHIGAN STATE UNIVERSITY" and in conjunction with the Southern African Wildlife College. I would like to talk to you about your opinions about the Mnisi Tribal Authority and the South African environment because you live in an area of South Africa that is near a world-renowned conservation area and multiple protected areas, some of which are used by people for their daily lives. Sometimes the environment is conserved as a park. I am trying to understand what local people think about the environment and human activities that can affect the human-environment relationships to improve the relationship for people and the environment. There are no wrong answers to the questions that I will ask. Your participation will help researchers understand the relationship between environmental security, natural resource use, and the lives of local people. Results from this study will be summarized in a report and presented in person or electronically to the Mnisi Tribal Authority, Southern African Wildlife College, and Michigan State University with the goal to help the lives of local people and wild animals.

The researcher that I work for, works at a university in the United States that sets rules about how I do my research. Some of these rules are that personal information such as your name will never be associated with your responses. Also, the information you share with me is private

and under your control. I will only give your interview a number. I will take any information you are willing to share with me back to my university and study the entire group of interviews I obtain, as opposed to individual interviews. The location of this village will not be named in association with your name. The money to support this study comes from their university, Michigan State University; they support international sustainable development science.

You may choose not to participate in the interview at any time. You may also choose to not answer a particular question of the interview. If you do not understand the question, please ask and I will be happy to explain in greater detail. You must be at least 18 years of age to participate in this interview. By saying "Yes I understand" you are telling me that you are at least 18 years of age and want to participate. The entire interview should take about 30 minutes of your time. Do you have any questions before we get started?" In all instances, participants had to verbally consent to participate in the study before data collection commenced.

*Research Questionnaire Introduction in English*

South Africa Mnisi Tribal Authority Research

June/July 2019

“My name is FILL IN.” I am a researcher working with a researcher from “MICHIGAN STATE UNIVERSITY” and in conjunction with the Southern African Wildlife College. I would like to talk to you about your opinions about the Mnisi Tribal Authority and the South African environment because you live in an area of South Africa that is near a world-renowned conservation area and multiple protected areas, some of which are used by people for their daily lives. Sometimes the environment is conserved as a park. I am trying to understand what local people think about the environment and human activities that can affect the human-environment relationships to improve the relationship for people and the environment. There are no wrong answers to the questions that I will ask. Your participation will help researchers understand the relationship between environmental security, natural resource use, and the lives of local people. Results from this study will be summarized in a report and presented in person or electronically to the Mnisi Tribal Authority, Southern African Wildlife College, and Michigan State University with the goal to help the lives of local people and wild animals.

The researcher that I work for, works at a university in the United States that sets rules about how I do my research. Some of these rules are that personal information such as your name will never be associated with your responses. Also, the information you share with me is private and under your control. I will only give your interview a number. I will take any information you are willing to share with me back to my university and study the entire group of interviews I obtain, as opposed to individual interviews. The location of this village will not be named in

association with your name. The money to support this study comes from their university, Michigan State University; they support international sustainable development science.

You may choose not to participate in the interview at any time. You may also choose to not answer a particular question of the interview. If you do not understand the question, please ask and I will be happy to explain in greater detail. You must be at least 18 years of age to participate in this interview. By saying "Yes I understand" you are telling me that you are at least 18 years of age and want to participate. The entire interview should take about 30 minutes of your time. Do you have any questions before we get started?

### *Research Questionnaire Introduction in Tsonga*

Ndzavisiso lowu kongomisiweke eka Vuhosi Byaka Mnisi eAfrika Dzonga

Khotavuxika/Mawuwani 2019.

Hi mina “NAME” ndzi mulavisisi loyi a tirhisanaka ni mulavisisi un’wana wo huma eMICHIGAN STATE UNIVERSITY .Hina vambirhi hi tirhisana na Southern African Wildlife College (SAWC).Ndzi tsakela ku vulavurisana na n’wina hi matitwelo ya n’wina hi vuhosi byaka Mnisi na ndzhawu ya Africa Dzonga, hikuva mitshama emugangeni kumbe eka xiphemu xa Afrika-Dzonga lexi nga ekusuhi na ntanga/mintanga leyi tivekaka misava hinkwayo hi ku hlayisa ntumbunuko.Yin’wana ya mintanga leyi yi pfuneta vanhu va laha mugangeni eku hanyeni kavona masiku hinkwawo. Minkarhi yin’wana mbango wu hlayisiwa hindlela yo hundzuriwa ntanga lowu sirheleriweke. Ndzi ringeta ku twisisa leswaku vanhu lava tshamaka eka ndzhawu leyi va ehleketa yini hi mbango na swiendlo swa vanhu leswi swi kanganyisaka vuxaka exikarhi ka vanhu na mbango, leswi ndzi swi endlela ku kota ku kuma tindlela to antswisa vuxaka exikarhi ka vanhu na mbango. Akuna tinhlamulo to ka ti ngari tona eka swivutiso leswi ndzingata swi vutisa. Ku nghenelela ka wena swita pfuna valavisisi ku twisisa vuxaka exikarhi ka kuhlayisa mbango, ku tirhisiwa ka switirhisiwa leswi hi swi kumaka eka ntumbunuko na vutomi bya vanhu lava hanyaka eka muganga lowu. Mbuyelo wa ndzavisiso lowu wuta komisiwa eka xiviko wu tlhela wu nyikiwa Vuhosi byaka Mnisi ,Southern African Wildlife College na Yunivhesithi ya Michigan. Xiviko lexi xita tisiwa Kunene eka vanhu lava vuriweke kumbe xi rhumeriwa hitindlela tin’wana loko ku xi tisa swi nga koteki. Xikongomelo xa ndzavisiso na xiviko iku pfuna vanhu lava hanyaka eka ndzhawu leyi na Swiharhi. Yunivhesiti leyi ndzi tirhaka eka yona eUnited States yi ndzi vekele milawu leyi ndzi faneleke ku yi landzelela loko ndzi karhi ndzi endla xiviko lexi. Yinwana ya milawu leyi hi leswaku

vuxoko-xoko bya wena byo fana na mavito ndzi nga byi paluxi eka tinhlamulo ta wena, na vuxokoxoko lebyi unga ta ndzi nyika byona byi ta va xihundla byi thlela byi tirhisiwa hi leswi wena u swi lavisaka xi swona. Ndzi ta nyika ntsena nkambelo-vutivi (interview) ya wena nomboro. Ndzi ta thlelela na vuxokoxoko hinkwabyo lebyi u unga ta ndzi nyika byona eYunivhesithi ya Michigan laha ndzi ngata fika ndzi langutisisa vuxoko-xoko hinkwabyo lebyi ndzi byi kumeke ka vanhu hinkwavo xikan'we, kungari kulangutisisa vuxoko-xoko bya munhu hi un'we-un'we. Swinge paluxiwi leswaku ndzhawu leyi yi kumeka kwihi. Mali leyi seketelaka ndzavisiso lowu yi huma eYunivhesithi ya mina kunga Michigan State University; Yunivesithi ya Michigan yi seketela ku antswisiwa ka sayense leyi pfunaka nhluvuko wa misava hinkwayo.

Unga hlawula ku ka unga ha vi xiphemu xa ndzavisiso lowu nkarhi wihi na wihi. Unga hlawula ku ka u nga hlamuli swinwana swivutiso swa ndzavisiso lowu. Loko xivutiso unga xi twisisi ndzi kombela u ndzi byela ndzi ta tsakela ngopfu kuku hlamusela xona hi vuenti. U boheka ku vana Khume-nhungu(18) wa malembe ku kota ku nghenelela ndzavisiso lowu. Hi kuvula leswaku “ina ndza swi twisisa” undzi hlamusela leswaku una khume-nhungu wa malembe kumbe ku tlurisa na swona u lava ku nghenelela eka ndzavisiso lowu. Kuva u hlamula swivutiso leswi hinkwaswo swi yi ta teka kwalomu ka Makume Ntlhanu (25) wa ti minetse ta nkarhi wa wena. Una swivutiso hingase sungula?

*Likert-Type Scale*

1. Absolutely None/Never
2. Rarely
3. Occasionally
4. Not Sure
5. Frequently
6. Very Frequently
7. Every Day

*Environmental Harms Likert-Type Scale*

1. Least Threatening
- ...
10. Most Threatening

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