

The relationship between rapid
densification of the peri-urban areas and
land degradation: A case study of
Nadi/Henley Dam area, Msunduzi
Municipality

By Cebolenkosi Nontuthuzelo Zuma

Student No. 213513444

A Dissertation Submitted in Partial Fulfilment of the Requirements of the
Degree for Master Development Studies

The School of Built Environment and Development Studies

Supervisor: Professor Catherine Sutherland

Abstract

Land degradation is a process that is associated with the misuse and mismanagement of land through activities such as agriculture, livestock raising and deforestation. Land degradation is not often attributed to the risks that arise from rapid unplanned development in peri-urban areas. This study focuses on the rapid densification of peri-urban areas taking place on traditional authority land, or Ingonyama Trust land in KwaZulu-Natal, and its associated impacts on land degradation. The research identifies why people are moving, when the rapid densification began and how the natural vegetation and landscape have been altered. The study also considers the physical characteristics that make areas prone to land degradation. The socio-ecological context was also considered to determine if it plays a role in determining the extent of land degradation. The case study approach was instrumental in obtaining the findings, as it allowed for an interdisciplinary research approach to be applied in one particular area. The results concluded that there is a relationship between land degradation and rapid densification, which is intensified by the increasing demand for land in the areas of Nadi and Henley Dam. Factors such as accessibility to land and freedom of ‘construction’, with no controls through planning and building regulations, are some of the pull factors that influence the rapid densification in these areas.

Declaration

I, Cebolenkosi Nontuthuzelo Zuma, declare that

- (i) The research reported in this dissertation, except where otherwise indicated, is my original work.
- (ii) This dissertation has not been submitted for any degree or examination at any other university.
- (iii) This dissertation does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from other persons.
- (iv). This dissertation does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - a) their words have been re-written, but the general information attributed to them has been referenced;
 - b) where their exact words have been used, their writing has been placed inside quotation marks and referenced.
- (v) Where I have reproduced a publication of which I am an author, co-author or editor, I have indicated in detail which part of the publication was actually written by myself alone and have fully referenced such publications.
- (vi) This dissertation does not contain text, graphics or tables copied and pasted from the Internet unless specifically acknowledged, and the source being detailed in the dissertation and in the References sections.

Candidate Signature:

Supervisor Signature:

Date:

Date:

Dedication

“...Let there be light, open the eyes of the blind, purify our hearts in Your fire,

Breathe in as we pray, Jesus have Your way....”

To the Almighty and Ever seeing

To my family (the Ladies: ST, PN, NS & VS) and

To my daughter, Ongeziwe.

Acknowledgements

I gratefully acknowledge the funding received from the NRF SANCOOP Climways project through Professor Catherine Sutherland.

I am very grateful to the respondents to the questionnaires and the interviews that spared a few moments to talk to me and made this research a success.

I am thankful to the leaders in the community of Nadi and Henley Dam; the Ward 4 Councillor, Councillor Hamilton Zondi, *iNduna* Nxumalo, Mr Ngubane and the Late Head *iNduna*, Mr Zuma. Your support made my research a pleasure.

Thank you to my helpful, considerate supervisor Professor Catherine Sutherland for spending time working with me on this dissertation. Thank you for your guidance, advice and patience.

I appreciate the support that my family, particularly my grandmother, *uMaDuma* (Mrs ST Zuma), for being with me on this long journey.

I appreciate ALL of you.

Table of Contents

Abstract.....	ii
Declaration.....	iii
Dedication	iv
Acknowledgements	v
List of Figures.....	x
List of Tables	xi
List of Appendices.....	xii
Chapter 1: Introduction	1
1.1 Introduction.....	1
1.2 Background	1
1.3 Research Problem	2
1.4 Motivation for the Study Area.....	3
1.4.1 Geography and Location of Nadi (<i>eMbizane</i>) and Henley Dam Areas.....	4
1.5 Value of the Study	4
1.6 Research Aim and Objectives	5
1.6.1 Main Research Questions.....	6
1.7 Hypothesis.....	6
1.8 Dissertation/Chapter Outline.....	7
Chapter 2 The Natural Environment and Development: A Review of Change.....	8
2.1 Introduction.....	8
2.2 Theoretical Framework.....	8
2.2.1 Global Environmental Theories: Sustainability and Sustainable Development...9	
2.2.2 Development and the Environment.....	10
2.3 Natural Environment and Development.....	11
2.3.1. Defining the Environment.....	11
2.3.2 Biodiversity	12
2.3.3 Ecosystem Services.....	13
2.3.4 Peri-Urban Environments.....	14
2.4 Land Degradation	15
2.4.1 Understanding Land Degradation	15
2.4.2 Defining Land Degradation	16
2.4.3 Types of Land Degradation	17
2.4.4 Different Causes of Land Degradation	20

2.5 Land Use	21
2.5.1 Land Use Change and Impacts.....	22
2.5.2 Integrated Land Management	23
2.6 Urban Sprawl.....	25
2.6.1. Rural-Urban Relationships: Where is the convergence?	26
2.7 Peri-Urban Areas: Rural but not Rural	27
2.7.1 Peri-Urban Sprawl.....	27
2.7.2 The Value of Peri-Urban Development.....	29
2.7.3 Sprawling of Cities: The Consequences.....	31
2.8 Governance and Land acquisition.....	32
2.8.1 Governance and Land Management.....	32
2.8.2 Traditional Governance in Developing Countries:.....	33
2.8.3 Land in the Peri-Urban Area: Ownership, Acquisition, and Tradition	34
2.8.4 Summary.....	36
Chapter 3: Contextual Background and Current Trends relating to the Case Study in South Africa.....	37
3.1 Introduction.....	37
3.2 Msunduzi Municipality: Social and Economic indicators	37
3.3 Vulindlela Local Area: Social Dynamics, Land and Governance	37
3.3.1 Land, Governance and Governance Structures: Roles and Relevance	38
3.3.2 Land Allocation: Protocol and Practise.....	40
3.4 Ingonyama Trust Board Land: Tenure and Current Land Reform Issues	41
3.4.1 Land Ownership and Tenure.....	41
3.4.2 Current Discussions: Land Reform	42
3.5 The Natural Environment: Ecological Infrastructure and the Physical Environment	43
3.5.1 Ecological Infrastructure and Open Spaces	43
3.5.1.1 Municipal Open Spaces Systems (MOSS) of Msunduzi Municipality	44
3.5.2 Physical Attributes: Slope formation, soil types and vulnerabilities	44
3.6 Relevance of the Case Study: Nadi (<i>eMbizane</i>) and Henley Dam Case Study	45
3.7 Summary.....	46
Chapter 4: Research Methodology	47
4.1 Introduction.....	47
4.2 Nature of Research: Case Study	47
4.2.1 Data Collection	47

4.3 Sampling: Method(s) and Participants	48
4.4 Ethical Matters: Ethical Clearance and Gatekeepers	49
4.5. Primary Data Collection Methods.....	50
4.5.1 Questionnaire	50
4.5.2 Focus Group	51
4.5.3 Interviews.....	52
4.5.4 Visual Land Degradation Assessment.....	52
4.6 Observation	53
4.6.1 Study Area Observation	53
4.6.2 Participant Observation	54
4.7 Secondary Data Methods	55
4.7.1 Documents: Books, Municipal Document Plans and Pertinent Legislation(s)....	55
4.7.2 Visual Documents: Maps and Aerial photographs	55
4.7.3 Pertinent Legislation(s)	56
4.8 Data Analysis.....	56
4.8 Summary.....	57
Chapter 5: Review of the Data and Results of the Case Study	58
5.2 The State of the (Natural) Environment in Nadi (<i>eMbizane</i>) and Henley Dam.....	58
5.2.1 Geological Characteristics: Topography and Slope	58
5.2.2 Soil: Types(s) and Properties	59
5.2.3 The Biomes of Msunduzi Municipality: Vegetation Types and Threatened Ecosystems.....	60
5.2.4 Impacts on Natural Vegetation as a Result of Rapid Densification	64
5.3 The Governance of Peri-Urban Areas Surrounding Nadi (<i>eMbizane</i>) and Henley Dam	65
5.3.1 Leadership: Traditional Authority and Municipal Dual Governance.....	65
5.3.2 Land: The Process of Allocation and Acquisition.....	67
5.3.3 Municipal Plans and Objectives for the Areas.....	68
5.4 Social Processes Driving the Land-use Change in Nadi (<i>eMbizane</i>) and Henley Dam	72
5.4.1 The Movement of People to the Peri-Urban Surrounds.....	72
5.5 Social and Environmental Changes in Nadi (<i>eMbizane</i>) and Henley Dam	77
5.5.1 The Trend of Change and Densification.....	81
5.6 Emerging Socio-Ecological Relations in Nadi (<i>eMbizane</i>) and Henley Dam.....	85
5.7 Climate Change an Additional Burden and Loading on the Landscape.....	88
5.7.1. The Immediate Effects of Rainfall.....	88

5.7.2 The Socio-Ecological Consequences of the Change	90
5.8 Summary.....	93
Chapter 6 Recommendations and Conclusion	94
6.1 Introduction.....	94
6.2 Evaluation.....	94
6.3 Recommendations	96
6.3.1 Governance.....	96
6.3.2 Planning	97
6.3.3 Environmental Awareness	98
6.4 Conclusion	98
References	100
Appendices.....	107

List of Figures

Figure 1. 1: The locality of Nadi (eMbizane) and Henley Dam outside Pietermaritzburg, Kwa Zulu-Natal.	4
Figure 3. 1: The distribution of Traditional Authority Areas in Vulindlela, Pietermaritzburg, Kwa Zulu-Natal.	39
Figure 5. 1: The vegetation types found in Msunduzi Municipality.....	62
Figure 5. 2: The threatened vegetation types and biomes in Msunduzi Municipality.....	63
Figure 5. 3: The SDF showing existing residential neighbourhoods within the Municipal boundary 2015. (Source Msunduzi Municipality).....	70
Figure 5. 4: The existing Major Open Spaces and Proposed Major Open Spaces for Msunduzi Municipality 2015. (Source Msunduzi Municipality).	71
Figure 5. 5: The pull factors of Nadi (<i>eMbizane</i>) (A) and Henley Dam (B).	73
Figure 5. 6: The number of years living in Nadi (<i>eMbizane</i>) with an insert of the percentage of homesteads that have a second home elsewhere.....	75
Figure 5. 7: The number of years living in Henley Dam with an insert of the percentage of households with a 2nd home elsewhere.....	76
Figure 5. 8: The different methods of plot preparation techniques used in Nadi (<i>eMbizane</i>) (A) and Henley Dam (B).	78
Figure 5. 9: Two prepared plots in Nadi (<i>eMbizane</i>) where A is manual labour method and B used a TLB.....	79
Figure 5. 10: The amount of vegetation removed during plot preparation phase at Nadi (<i>eMbizane</i>) (A) and Henley Dam (B).	79
Figure 5. 11: The prominent land degradation features that were observed in Nadi (<i>eMbizane</i>) (A) and Henley Dam (B) areas.	82
Figure 5. 12: Man-made interventions to hold the soil and prevent the down-slope movement of the soil. (Photograph: <i>Cebolenkosi Zuma</i> 2018).	83
Figure 5. 13: Rills and fledging gullies forming on the edge of a platform. (Photograph: <i>Cebolenkosi Zuma</i>).	84
Figure 5. 14: How people understand environmental risks in Nadi (eMbizane) (A) and Henley Dam (B).	86
Figure 5. 15: South African rainfall maps for January 2012-2018. (Source: South African Weather Services).	88

Figure 5. 16: The Henley Dam area in November 2018 as a fully developed neighbourhood with predictions of areas that are more likely to flood on the banks of the Msunduzi River. (Source: Google Earth 2018).89

Figure 5. 17: The effects of environmental change in Henley Dam (A) and Nadi (*eMbizane*)(B).92

List of Tables

Table 4. 1: The details of the interviews that formed part of the study.52

Table 5. 1: Prominent Geotechnical issues in the Pietermaritzburg Area & the possible implication for developments. (Source: Adapted from Richards et al., 2006).91

List of Appendices

Appendix 1: Major characteristics of urban sprawl. (Source: Adapted from Cobbinah & Amoako 2014).	107
Appendix 2: Factors that influence urban expansion and the responses in the peri-urban and rural areas. (Source: Ravetz et al. 2013).	107
Appendix 3: The Henley Dam area in 2006, 2010, 2014 and 2018 (clockwise) at different levels of development. (Source Google Earth 2018).	108
Appendix 4: The Nadi (eMbizane) area in 2006, 2010, 2014 and 2018 (clockwise) at different levels of development. (Source Google Earth 2018).	109
Appendix 5: (A and B): Plot preparation on two sites in Nadi (eMbizane) and Henley Dam visible red soil. (Photographs by Cebolenkosi Zuma 2018).	110
Appendix 6: The grassland on the slope of Nadi (eMbizane) where A shows the grassland with an old platform clearing and B is the opposite side of the hill with a newly prepared cut-and-fill platform. (Photograph: Cebolenkosi Zuma 2018).	110
Appendix 7: (A and B): The current vegetation cover in (A) Nadi (eMbizane) and (B) Henley Dam.	111
Appendix 8: Increase dust seen on the grass along the gravel road in Henley Dam. (Photograph: Cebolenkosi Zuma 2018).	111
Appendix 9: Questionnaire Survey.	115
Appendix 10: Interview Schedule 1 (Community Induna).	116
Appendix 11: Interview Schedule 2 (Community/Ward Councillor).	117
Appendix 12: Interview Schedule 3 (Community Elder).	118
Appendix 13: Visual Indicators of Land Degradation (Source: adapted from Stocking & Murnaghan 2002) (1).	119
Appendix 14: Visual Indicators of Land Degradation (Source: adapted from Stocking & Murnaghan 2002) (2).	120

Chapter 1: Introduction

1.1 Introduction

There is a need to understand how unplanned human settlements impact the environment, particularly where land supports people's livelihoods as a primary resource. As a result of access to land in the peri-urban areas of municipalities in KwaZulu-Natal, which are under traditional authority governance on Ingonyama Trust land, people are constructing the city from below, outside of formal planning processes, beyond the urban boundary (Sim *et al.*, 2018). However, the potential environmental (land) impacts need to be accounted for as a result of the rapid densification of the peri-urban areas. There has been ongoing research into the peri-urban areas' housing trends (Sim *et al.*, 2016; Mbatha & Ngcoya, 2019) but, there is a need to understand the densification and housing trends outside of the urban development boundary and how it relates to changes in the environment, most notably land degradation.

1.2 Background

The rapid change in peri-urban areas impacts and transforms the overall environmental integrity and the way of life in these areas (Sutherland *et al.*, 2016). There is an emphasis on the negative impacts of the rapid development of houses in the peri-urban areas, which directly impacts the environment and ecosystem services. Rural/ peri-urban areas form the ecological buffer or green belts for the urban areas (Sutherland *et al.*, 2016). Concern for the environment and the threats facing valuable ecosystem services resulted in the Millennium Ecosystem Assessment (MEA) publication. This assessment shifted the conception that humans can exploit the environment to meet development needs to humans being part of the circle of ecosystem regeneration (Sutherland *et al.*, 2016).

The province of KwaZulu-Natal has land under the jurisdiction of the Ingonyama Trust Board, with *amakhosi*¹ that serve as the custodians of the land. The Traditional Leadership and Government Framework Act (Act 41 of 2003) gives the traditional authority the right to participate in policy and legislation formation and the responsibility of allocating land sustainably (COGTA, 2012). A set of guidelines were established by COGTA, such as building distance from rivers, lakes and roads, which gives guidance to the allocating authority when allocating land to people (COGTA, 2012). It is important to note that numerous factors need to be taken into consideration when ‘zoning’ an area suitable for housing, as poorly informed decisions have the potential to induce land degradation (Xulu, 2014). Land degradation does not stop at simply reducing the overall integrity of the land itself. However, the spill-over effects influence the natural environment and human well-being. There is a need to define the concept of land degradation from the socio-ecological perspective while drawing on the scientific definition of the term. The conversion from one land use to another has contributed to the degradation of the land and, ultimately, the environment (Khresat *et al.*, 1998, cited in Xulu, 2014).

1.3 Research Problem

In Nadi (*eMbizane*) and Henley Dam, the rapid and intense densification of land for housing development, without adequate planning and building controls being recognised nor adhered to, is creating risk in the area. The construction of houses in areas with particular environmental characteristics, which make the land susceptible to land degradation, leads to the transformation of the landscape that increases environmental and social risk.

¹ A collective term for *Inkosi* which is a Nguni (Zulu) word comparable to Chief as *Ingonyama* is King.

1.4 Motivation for the Study Area

The Nadi (*eMbizane*) and Henley Dam study areas are experiencing rapid land-use change over a short period. The natural infrastructure is being altered and removed at a very high rate, which is cause for concern. This dissertation focuses on establishing if rapid development has any relationship with the process of land degradation. The study considers the physical characteristics of the Nadi (*eMbizane*) and Henley Dam areas, the socio-ecological relations between the people and the environment and land-use change. The literature on the impacts of rapid densification of peri-urban areas on land degradation in South Africa and what drives this density is limited. Therefore, this study contributes to this body of knowledge. This dissertation aims to start a conversation from the socio-ecological perspective on how governance, physical characteristics such as slope and vegetation type, and people can lead to change and land degradation.

1.4.1 Geography and Location of Nadi (*eMbizane*) and Henley Dam Areas

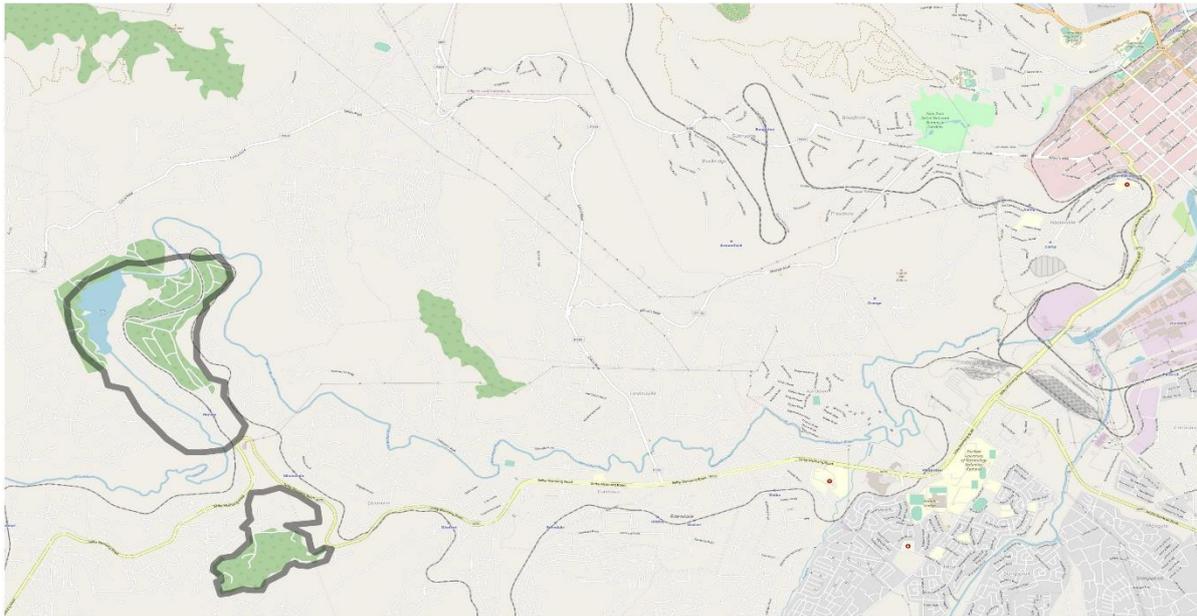


Figure 1. 1: The locality of Nadi (*eMbizane*) and Henley Dam outside Pietermaritzburg, Kwa Zulu-Natal.

The study areas are located in the rural hinterlands outside Pietermaritzburg in Msunduzi Municipality, KwaZulu-Natal. These areas are under Traditional Authority jurisdiction. Before 1994, the area was part of KwaZulu's homeland except for the Henley Dam area, which forms part of the land owned by Umgeni Water, which manages the uMgeni Catchment and provides water to the municipalities in the catchment.

1.5 Value of the Study

In Msunduzi Municipality, the peri-urban areas and the rural hinterlands form part of Pietermaritzburg's Green Open spaces. The development of households and the land-use change negatively impact the planned uses and need for open spaces, with their associated ecosystem services. The sloping topography of Nadi (*eMbizane*) and parts of Henley Dam and rainfall patterns and associated storm events increase land degradation risk. The negative impacts of unplanned housing development on biodiversity and ecological infrastructure are high. The study serves to raise awareness about the possible risks associated with rapid, unplanned development on steep landscapes and potentially have shallow soils. The study in

Henley Dam and Nadi (*eMbizane*) can serve as a reference point for other municipalities that have an issue with peri-urban growth that is unplanned and how best to address the issue. This research aims to shift the narrative of environmental management research on land degradation to include socio-ecological, and governance dimensions, rather than having an environmentally (physical environment) focused approach.

1.6 Research Aim and Objectives

Aim:

Understand the trends that influence or cause the rapid densification of the peri-urban areas in KwaZulu-Natal using the emerging peri-urban residential areas of Nadi (*eMbizane*) and Henley Dam. These two examples will be used to map the land-use change and identify the possible occurrence of the degradation of the natural environment, which includes grassland (vegetation cover) and impact on the land. The change will be monitored over ten years (2006-2016) using satellite imagery and aerial photography.

The objectives of this study are:

1. To identify the trends that influence the rate and pattern of densification in the Msunduzi Municipality
2. To map the observable trends of densification over ten years (2006-2016) in Nadi (*eMbizane*) /Henley dam area.
3. To identify the potential impact that the land-use change has on the land in Nadi (*eMbizane*) /Henley Dam using aerial photography and satellite imagery
4. To identify the potential for and presence of land degradation in Nadi (*eMbizane*) /Henley Dam area using aerial photography and satellite imagery.
5. To reflect on the implication of this land-use change on people & the environment for the people of Nadi (*eMbizane*) & Henley Dam.

1.6.1 Main Research Questions

The main research questions are formulated to guide the research and facilitate a better understanding of the objectives. The questions are:

1. Why are people moving?
2. What processes are governing and managing the movement of people into these areas?
3. When did the densification of housing development start to occur rapidly?
4. How has the natural vegetation and landscape been altered?
5. What physical characteristics make the areas prone to land degradation?

1.7 Hypothesis

The hypothesis to be tested in this research is:

H₀: Rapid movement of the people into the peri-urban areas has an impact on the land and leads to land degradation

H₁: Rapid movement of the people into the peri-urban areas does not impact the land and does not lead to land degradation.

1.8 Dissertation/Chapter Outline

The dissertation has six chapters in total, and they are:

Chapter 1 is the introduction to the dissertation. It provides a brief outline of the research by presenting the study's background, its aims and objectives, and the synopsis of chapters in the dissertation.

Chapter 2 presents the theoretical framework and literature in the context of the case study research. This chapter serves the purpose of illustrating the main theoretical concepts and ideas used in analysing the results. The conceptual framework focuses on theory on changes in land use and environmental degradation.

Chapter 3 provides the background to the case study and includes the municipality's local plans and land issues identified in secondary reports. This chapter brings context to the broad literature presented in Chapter 2. It brings in the South African perspective on land issues, management, and degradation.

Chapter 4 presents the methods/methodology used in the research to collect data, outlines the process followed in data analysis and briefly discusses the limitations associated with the study and the research methods.

Chapter 5 presents the research findings while simultaneously discussing the findings in relation to the literature review. The analysis and results from the field study are also presented.

Chapter 6 is the concluding chapter. The closing remarks are made, and recommendations based on the findings are presented. The chapter also reviews whether the research had addressed the research objectives and answered the research questions.

Chapter 2 The Natural Environment and Development: A Review of Change

2.1 Introduction

The natural environment supports all life, and development happens within its carrying capacity. With the changes in the population, change in lifestyle and socio-economic needs, development is bound to occur. This has consequences on the environment which may have a ripple effect over time. This is where the environmental theoretical frameworks come in to understand the change and subsequently devise response mechanisms to ensure the natural environment's longevity (in some cases, prosperity).

2.2 Theoretical Framework

The current theories that frame the conversation around the environment, land degradation and ecosystem services are broadly driven by the fundamental understanding or definition of the environment itself. The general questions that then arise are how is the environment changing? What or who is changing the environment? How is the environment responding, and what should be done? Theories on environment and development, which have emerged since the late 1980s and the 1990s, have primarily sought to respond to humans' impact on the environment. These have been influenced by the tensions between posterity and economic growth and environmental ethics. The dawn of the modern environmental movement in the 1960s led to the era of environmental action, resulting in the global framework of sustainable development. Environmental management is central to sustainable development when bringing together environmental issues, land (the need to develop) and ecosystems services. The Stockholm Declaration of 1972 serves as the first global environmental governance landmark, which had a set of principles (Nhamo & Inyang, 2011). Sustainable development frameworks

(theoretical/conceptual) have evolved primarily from this Declaration (26 principles) and the Brundtland Report, *Our Common Future*, published by WCED in 1987 and the UNCED Rio Summit of 1992.

2.2.1 Global Environmental Theories: Sustainability and Sustainable

Development

The resounding themes in the global environmental policy framework(s) are sustainability, sustainable development and ecological modernisation; and sustainability science as a discourse as well. Sustainability science is a nuance of sustainability, focusing on the resilience of social and ecological systems by adopting an interdisciplinary approach to natural environment sustainability and human-environment relationships (Kates, 2011).

Hardin's doomsday essay in the 1960s, *The Tragedy of the Commons*, served as a warning of what could happen, which led to the paradigm shift from economically based models to sustainability. Sustainability theory was first introduced in the Brundtland report in 1987 when sustainable development was embraced as an acceptable development model. Sustainability theory could ensure that current development needs are met "...without compromising the ability of the future generations to meet their own needs" (WCED 187; 08 cited in Nhamo & Inyang, 2011; 11). Scoones (2007) also supports this thought by highlighting that sustainability should be when the natural environment can recover from pressures/ shocks and return to environmental equilibrium.

We are currently in the "age of sustainability and sustainable development" (Scoones, 2007; 591), which means that the environmental framework is simultaneously working towards a sustainable future in development. The definition of sustainable development adopted during the UN Earth Summit of 1992 resulted in the setting up Agenda 21 as a global action plan for implementing sustainable development (UNCED, 1992 cited in Nhamo & Inyang, 2011). At

the core of sustainable development are the implied understanding of environmental governance and the capacity to govern (capable administration across the triple bottom line). This 'assumed' existence of governance led to the introduction of Agenda 21, which was a bottom-up approach to sustainability by introducing local initiatives geared towards sustainability (Selman, 1998 cited Scoones, 2007).

Under sustainable development, the current development framework is the Sustainable Development Goals of 2015, proposed at the UNEP Rio Summit of 2012 after the preceding Millennium Development Goals (MDGs) were nearing their deadline in 2015 (Griggs, 2013). The SDGs goals are different from the MDGs because of their progressive nature of being goals for the environment and people; the SDGs contain "a call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity" (UNDP, 2015). 17 SDGs guide development within sustainable development discourse.

The triple-bottom-line in sustainability, which balances ecological integrity, social justice, and economic development, is a necessary background to the SDGs, keeping it aligned with our Common Future principles (Nhamo & Inyang, 2011). Development had to move forward from the impacts of modernist technology, acknowledge the realities of finite resources and the limited ability of the biosphere to absorb the "cumulative negative impacts from human impacts" (Nhamo & Inyang, 2011; 12).

2.2.2 Development and the Environment

The Brundtland Commission Report of 1987 was followed by the exploration of development ideas that were cautious of the environmental impact and tried to attain sustainable development. This was accompanied by fostering ideas of land use planning in relation to land potential (Beinat & Nijkamp, 2010). Development is a term that is used to cover changes (growth) in the social, economic and political senses (Fair, 1982). According to Cadman *et al.*

(2010), development is the process of social and economic change, which improves society. Barrow (1995) agrees to the view that the definition of development is fluid as “definitions of development reflect the current values, what was deemed development in the past may not be regarded as today” (Barrow, 1995: 01). There is a variation in the position and dominance of humans in the environment and development relationships. However, there is no diverting from the fact that development frequently relates to environmental problems (Barrow, 1995). The development process always produces environmental issues as the environment supports the development planned to take place. The alteration of the environment due to opportunities that allow development can be identified, revealing the impact of development on the environment (Barrow, 1995).

2.3 Natural Environment and Development

It is indisputable that for development to occur, the environment needs to be the support structure. Global environmental conditions prompted environmental threats, particularly over the long-term perspective (Beinat & Nijkamp, 2010). Defining the environment is important because, from the definition, the central theme of what constitutes the environment is made clear.

2.3.1. Defining the Environment

The environment is the inter-relationship that exists between all biotic and abiotic elements that exist in each area. The term ‘environment’ incorporates a host of aspects of the biophysical (green) and social (brown) situations (Nhamo & Iyango, 2011). The green perspective addresses the natural environment (biotic and abiotic) interactions and relationships (Nhamo & Inyang, 2011). The green perspective explores ecosystem health (ecosystem services), land degradation and environmental protection (Nhamo & Inyang, 2011). The brown perspective focuses on the results of the peoples’ interactions with the environment, such as environmental

injustices, waste management, and socio-economic relations, including poverty and unemployment (Nhamo & Inyang, 2011). This review section will focus on biodiversity, ecosystems services, and elements of the brown agenda that form part of the environment (natural environment) and development relationships.

2.3.2 Biodiversity

Biodiversity is at the core of understanding the natural environment and how these systems could react to changes. Biological diversity (biodiversity) is the variety of life on earth and the web of natural interactions that result from the wide variety of flora and fauna (including the micro-organisms), which are set apart by different genetic makeups (Egoh *et al.*, 2009 cited in DEA, 2015). The systems and interaction(s) between the different organisms (plants, animals, and micro-organisms) lead to the establishment of certain services which maintain the health of ecosystems within nature (DEA, 2015). Together these systems form ecological infrastructure (Jewitt *et al.*, 2020; DEA, 2015), which provide ecosystem(s) services. The higher the biodiversity, the more established and resilient ecosystems become (Douglas, 2008).

Ecosystem disturbances impact localised ecosystems and humans' wellbeing and livelihoods (DEA, 2015), particularly those relying on functioning and healthy ecosystems. Gough & Yankson (2006) present a case study in Pantang, Ghana, where the livelihoods (farming) changed because of the growth in residential developments, which led to the disturbance of the pond ecosystem that provided water. Increased human disturbances such as over-cultivation, timber plantations, residential development are the most common disturbances to ecosystems (Gough & Yankson, 2006). The foundation for a well-functioning ecosystem and provisioning of ecosystem services is highly dependent on the quality, variability, distribution, and condition of biodiversity or habitat makeup (Loreau *et al.*, 2001 cited in DEA, 2015).

2.3.3 Ecosystem Services

Each ecosystem is different because of the living creatures, including humans, that are part of the interacting community. Ecosystems are the providers of several essential goods and services known as ecosystem services (Jewitt *et al.*, 2020; Sutherland & Mazeka, 2019; DEA, 2015). These services sustain and protect the lives of humans in many ways. Ecosystem services are benefits people get from nature which are divided into provisioning services, regulating services, supporting services and cultural services (DEA, 2015; MEA, 2005). Ecosystems services also support the natural environment and other by-products of the brown agenda by performing various services within a given ecosystem or habitat. These services also act as shields or absorbers of stress and pressures that may affect the environment.

In the Millennium Ecosystem Assessment (MEA) framework, people are included in the web of ecosystem interactions, as they play an integral part in the system's stability (MEA, 2005). The MEA framework stated that the four forms of ecosystem services are equal in terms of the importance of their roles. However, according to Lankford *et al.* (2011), there has been an increased emphasis on provisioning services, which led to the neglect of the regulatory, cultural and supporting services. This could be why there has been a noticeable increase in the degradation of these 'arms' of ecosystem services, mainly linked to biodiversity loss, particularly in Southern African countries (DEA, 2015). The threats to ecosystem services are the same as those that threaten biodiversity, and the accelerated biodiversity loss requires urgent governance strategies (Kenward *et al.*, 2011).

2.3.3.1 Ecosystem Resilience

Ecosystems are complex systems. This complexity and diversity allow them to recover from degradation (moderate) when the degrading factors are removed (Nel & Driver, 2012, cited in DEA, 2015). Ecosystem resilience can resist disturbance, and resilience would mean that the ecosystem can re-organise itself to the changes and maintain ecological functions (Douglas,

2008; Cadman *et al.*, 2010). The resilience of an area is an essential indicator of the degree to which the ecosystem is stable (Cadman *et al.*, 2010), including the land component. A resilient ecosystem is essential to achieve sustainable development, ensuring economic activities and other human pressures do not erode the ecosystem's capacity to deliver the ecosystem service (Chevallier, 2014). The shorter the recovery time after a disturbance in an ecosystem, the greater the resilience (Douglas, 2008).

2.3.4 Peri-Urban Environments

The peri-urban area or rural-urban interface is a critical part of the planning of the city because that is where influences of urbanisation technically (traditionally) end and the natural environment or open space for the city starts. However, the peri-urban interface with a lower density (Douglas 2006)- is rapidly changing, and the natural environment in this area is being threatened by urbanisation and urban sprawl (Boon *et al.*, 2016). Biological diversity and ecological infrastructure in these areas are linked to the overall health and well-being of the urban, peri-urban and rural communities; therefore, the changes have dire impacts.

The change in ecosystems services due to the disturbance of habitats in any area undermines the natural barriers provisioned by ecosystems, which increases the environment's vulnerability to extreme events, such as floods and landslides (Boon *et al.*, 2016). The rapid development of these areas can be attributed to the growing demand for land, housing, and developed countries such as England, the need to have a safe environment to raise children in (Simon *et al.*, 2006; Gargiulo *et al.*, 2012). It has been observed globally (with a focus on developing nations) that in the process of development, the environment and ecosystems' worth is undervalued (Nel & Driver, 2012 cited in DEA, 2016).

2.4 Land Degradation

Issues surround land degradation have been debated since the United Nations Development Program (UNDP) Rio Earth Summit, where Agenda 21 was adopted. Land degradation comprises a series of interacting elements (Bai *et al.*, 2008). It has linkages with numerous other problems resulting in forming a nexus problem (Xulu, 2014). This phenomenon results in the need to understand land degradation and consider what the effects and impacts are in relation to other features, which in this case, is the densification of peri-urban areas, without adequate planning and land use management controls.

2.4.1 Understanding Land Degradation

Land degradation is a phenomenon that is a threat to precious resources: land and soil. The land (and soil) supports every part of our society; vegetation, people and built infrastructure. Therefore, when the land starts to undergo the process of being degraded, the effects or impacts are felt by everyone. FAO & UNEP (1999) describe the land as an essential natural resource to ecosystems. Land degradation may not be an issue or threat for people who live in cities but for those living in rural areas, who live off the land, land degradation is a significant issue (Hoffmann & Ashwell, 2001).

The level of vulnerability to land degradation is associated with land formations and specific soil types. Certain soil types will be prone to different forms of land degradation, and soil erosion, namely desertification, gullying, soil creep and soil sealing. Environmental problems related to the soil/land, such as soil erosion, are reaching disturbing proportions in Sub Saharan Africa (Kakembo & Rowntree, 2003). This has resulted in soil loss that is not in proportion with the rate at which soil formation occurs (Van der Merwe, 1995 cited Kakembo & Rowntree, 2003). It is unfortunate that the disturbance in the environment, namely land and soil, occurs

mainly in pasture lands, communal gardens and former plantations. These land-use types are most susceptible to eroding factors in nature (Kakembo & Rowntree, 2003).

2.4.2 Defining Land Degradation

Land degradation is a process that falls under environmental degradation. It affects soil fertility, arability and overall health, including soil erosion and desertification (UNCCD, 2008). UNEP (1992) defines land degradation as the decrease in the land's productive capacity, either temporary or permanent. The United Nations Conference on Desertification was one of the first platforms that led to the definition of land degradation (UNCCD, 2008). This came after observations before the United Nations Earth Summit in Rio, which showed that the amount of land being altered and degraded is growing each year, particularly in developing nations, namely Africa and South America (UNCCD, 2008). Land degradation is the process (inverse/negative) on the land that leads to the breaking down of the land integrity and produces particular landforms such as rills, gullies, and dongas while making the land less able to support specific activities and ecosystems functions (Nüsser & Grab, 2002).

Some studies show that land degradation negatively impacts a series of natural processes and people's livelihoods because arable land is decreased (Kakembo & Rowntree, 2003). The soils quickly lose essential components such as moisture/water, overall pH is altered, and essential nutrient balance is changed as land degradation occurs. Land degradation includes the various form of soil degradation, the human impacts underlying the process, deforestation and lowering of arable land for production (FAO, 1993; Nüsser & Grab, 2002). Habitats are also altered when the land is not at its optimum level. This means that particular fauna and flora species could either be lost or displaced because of the change in the land within their natural habitats.

Land degradation is prompted by any form of stress to the environment, which alters the balance. Land degradation is described as a symptom of change in the environment. The stress

within a partial environment or area could be from within the natural environment or from human activities and external stresses to the environment (Nüsser & Grab, 2002; Liniger *et al.*, 2013). Liniger *et al.* (2013) further highlight that land or environmental degradation is not solely a result of human activities. Other elements can naturally occur, such as aggressive water channels, strong winds and steep slopes (Nüsser & Grab, 2002).

The 'natural' causes of land degradation are changes in temperature, a shift in the times(s) that seasonal rainfall occurs, the frequency and intensity of rainfall and dust storms. Currently, the causes can be linked to climate change (accelerated climate change by the Anthropocene). Causes of land degradation such as drought and floods occur more frequently due to macro-climatic events like El Nino and La Nina. Topography and slope also impact the type of land degradation (Nüsser & Grab, 2002; Chalise *et al.*, 2019). From the slope of an area, one can roughly predict the rate at which a particular area can experience land degradation (Liniger *et al.*, 2013) and how fast the process will progress from one stage to another.

2.4.3 Types of Land Degradation

Land degradation can occur in different ways, which brings about a variation in the type of degradation found on the earth's surface. There are five main types of land degradation, and they are all defined by a common degradation factor (Liniger *et al.*, 2013). These groups are soil erosion by water, soil erosion by wind chemical soil/ land deterioration, physical deterioration, water degradation, and biological degradation (Chalise *et al.*, 2019; Liniger *et al.*, 2013). The type of land degradation that can be found in different places depends on erodibility factors (Chalise *et al.*, 2019) of the area, which ties in well with the different causes that lead to land occurrence degradation.

Erosion of the soil is the most common form of land degradation, especially in regions with vulnerable soils, which are dry and less dense. Water causes soil erosion by removing the

topsoil through a process known as a surface wash or sheet erosion (Liniger *et al.*, 2013; Nüsser & Grab, 2002). The removal of the topsoil through sheet wash in the peri-urban areas of northern Nigeria in Kano is very high, as the area densifies through housing development and the existence of stands that have been left unattended (Binns & Maconachie, 2006). Water erosion strips the nutrient-rich layer of the soil, particularly when the soil is compacted or crusted (Liniger *et al.*, 2013; Nüsser & Grab, 2002). Other types of water-induced land degradation are gully erosion landslides (soil is saturated with large quantities of water), coastal erosion (decreasing of the beach caused by extreme wave action) and sediment deposition downstream after being carried in water through traction and suspension (Liniger *et al.*, 2013).

Soils that are more granular and sparser/less dense are more susceptible to being eroded by the wind; this could include the topsoil's displacement by wind action. This form of erosion is most common in semi-arid to arid areas where temperatures are hot (Chalise *et al.*, 2019). The wind can displace and unevenly deposit soil material, which causes deflation in other areas. According to Liniger *et al.* (2013; 07), "deposition is the opposite effect and can be equally uneven, in places damaging vegetation, buildings, roads and polluting water (*inter alia* lakes, reservoirs, rivers)". In the village of Kano, Nigeria, wind erosion is a by-product of the rapid development of houses on land that was previously used for farming; the soil is often left bare (Binns & Maconachie, 2006).

Chemical soil deterioration is characterised by the alteration of the chemical make-up of the soil. Chemical land and soil deterioration manifest in the form of the decline in soil fertility, which leads to the reduction in the amount of organic matter and the net decrease of vital nutrients. The soil pH is altered as the soil is chemically degraded, which results in acidification (Chalise *et al.*, 2019; Liniger *et al.*, 2013).

Physical land degradation focuses on both soil and land deterioration. This includes soil compaction where the soil structure is altered to a stage where trampling on it results in the soil clamping together, sealing or crusting when the soil pores get clogged by “fine soil material and development of a thin impervious layer at the soil surface obstructing the infiltration of rainwater” (Liniger *et al.*, 2013; 08). Waterlogging, subsidence of organic soils and settling of soil are also common forms of physical soil degradation (Liniger *et al.*, 2013), especially in South-Eastern regions of Africa, such as the Lesotho Highlands (Nüsser & Grab, 2002), parts of India and Nepal (Chalise *et al.*, 2019).

Water degradation describes the soil's damage in relation to the content of water that is available/ present in the soil. This is different from the erosion of soil by water that has been discussed above because, in this form of degradation, water is not the cause but the subject. In water degradation, aridification is the decrease in the soil moisture content, the change in the flow regime as the quantity of water or surface water changes, the fluctuation of groundwater or aquifer level, or the lowering of the groundwater table because of “over-exploitation or reduced recharge of groundwater” (Liniger *et al.*, 2013; 08).

This is further supported by the observation of Nüsser & Grab (2002) in the study done in the Lesotho-Highlands, with a particular focus on the effects of water degradation on wetlands. Lingier *et al.* (2013) further discuss other ways soil moisture is degraded, such as the decline in surface water quality because of increased sedimentation and pollutants in the water. The decline in groundwater quality primarily results from human-induced pollutants seeping into the aquifers and the decrease of the wetland ability to buffer events like flooding and extreme localised droughts (Chalise *et al.*, 2019; Lingier *et al.*, 2013 & Nüsser & Grab, 2002).

Biological degradation is another common part of land degradation and can be observed without extreme scientific methods. The biomass in any area is essential because it serves many

roles, including protecting the soil and binding the soil together; when absent, the soil becomes vulnerable. Biological degradation encompasses vegetation cover issues, total biomass, habitats, life in the soil, diversity of species and biological control (Liniger *et al.*, 2013). The start of land degradation is often a result of the increase in biological deterioration. This is the reduction in vegetation cover leading to an increase in areas with unprotected soils, prompting habitat loss as vegetation diversity decreases. (Liniger *et al.*, 2013). There are other aspects of biological degradation as part of land degradation, such as the loss of soil life as there is a steady decline in "soil micro-organisms (earthworms and termites) and micro-organism (bacteria and fungi) in quality and quantity" (Liniger *et al.*, 2013: 09). The type of land degradation or soil degradation that can be found in different places is primarily dependent on erodibility indices. This aligns well with the different causes that lead to the occurrence of land degradation.

2.4.4 Different Causes of Land Degradation

The types of land degradation and how the process manifests itself are as diverse as the causes; the causes are usually a 'response' to stress and pressure. McGregor & Thompson (1995) term these 'stressors' and 'pressures' on the environment as geomorphological responses. The different initiating stressors and pressures could be natural degradation hazards, direct and underlying causes (FAO, 1993). FAO (1993) states that the physical environment, such as steep slopes, falls under natural hazards because of the high hazard of water erosion (Nüsser & Grab, 2002) discussed in the types of land degradation. Mostly, natural land degradation touches on different types of land degradation. Variations do occur based on the different geomorphological characteristics per region.

The direct causes of land degradation are mostly pressure-driven, and according to FAO (1993), it is usually a result of inappropriate land use and unsuitable land management.

Deforestation is a significant problem in several developing countries, such as the south of Asia and Africa. The conditions, climatic and soil compositions in these vulnerable regions make degradation easier to occur. Deforestation removes vegetation cover, either for the biomass to be used as fuel (firewood) and clearing for farming or settlements. Overgrazing is another cause of degradation to the land, which forms part of inappropriate land use, especially if the overgrazing is taking place on steep slopes (Chalise *et al.*, 2019; Nüsser & Grab, 2002).

For every direct cause of land degradation to occur, there needs to be an underlying factor that would trigger the process. According to FAO (1993), the lack of foresight brings about the underlying factors of land degradation causes. They are the issue of land shortage, unstable land tenure, socioeconomic pressures, poverty, and even population increase (Chalise *et al.*, 2019) or overcrowding. Land degradation is most prominent in developing countries such as South Asia (FAO 1993) and Africa, with increasing population, poverty and inequality, and pressures for housing and farming (Binns & Maconachie, 2006). Lack of proper land use management and established land administration is recognised globally as the most prevalent underlying cause of land degradation due to human activities (Binns & Maconache, 2006; Jones 1995 & FAO 1993).

2.5 Land Use

According to Adjekumhene (2002) cited in Nyarko & Adu-Gyamfi (2012), the concepts of land-use and development are all related in one way or another. The concept of ‘development’ is multidimensional and is often viewed from a land development perspective. A land development perspective allows for the broadening of the term development to include all land in different states, from natural areas to the redevelopment of land that has been occupied (Adjekumhene, 2002 cited in Nyarko & Adu-Gyamfi 2012). The value that land holds as a

resource becomes highly treasured (Nyarko & Adu-Gyamfi, 2012) and the value(s) could be inflated.

The land cover of an area is usually a reflection of a host of environmental and social factors (Aspinall & Hill, 2008) present or near that area. The human presence and activities that produce a change in land cover (Etter & McAlpine, 2008), examples would be agriculture, residential developments, and mining. This is the reason why Etter & McAlpine (2008; 82) state that “most human-induced land cover change is directly related to land use.” Land use can be defined by factors such as society. These factors make the concept of land use require an interdisciplinary approach in its understanding. Aspinall (2008) states that within the study of earth systems (natural environment included), land use should be part of a functioning earth system because land use reflects socio-ecological relations (Aspinall, 2008). Etter & McAlpine (2008) allude to Aspinall's (2008) statement by highlighting the relationships or interactions between the biophysical environment and humans.

2.5.1 Land Use Change and Impacts

Land-use change is monitored in relation to original or preceding land use and time (Aspinall, 2008; Aspinall & Hill, 2008). This is why concepts such as culture, the social aspect, the economy, and policy influence land change which prompts the need to understand the factor of relevance in the land-use change debate (Aspinall & Hill, 2008; Etter & McAlpine, 2008; Hill, 2008). Land-use change has become an issue to be debated within the global environmental change discussion because of the threats that land use creates in relation to other current issues such as climate change, loss of biodiversity and deforestation (Beinat & Nijkamp, 2010). It has been observed that land-use change is always accompanied by economic development (Beinat & Nijkamp, 2010), which usually translates into socioeconomic development. Land use has changed drastically in peri-urban areas since the early 1970s

(Gough & Yankson, 2000). Over time, it has been observed that land use in peri-urban areas in Africa is continuously changing (Nyarko & Adu-Gyamfi, 2012). The development trends and land-use change in the peri-urban areas have become skewed towards residential use (Nyarko & Adu-Gyamfi, 2012).

Soil erosion, loss of natural habitat and increased soil exposure to the elements are primarily the negative results of land-use change. Aspinall (2008) describes the impacts of land-use change and land cover changes as a phenomenon that is measured spatially and progressively (time) in relation to extent and impact. Gough & Yankson (2000) describe how Accra's peri-urban area mainly was forest before the trees were felled mostly for agricultural purposes, which have now been taken over by people using the area predominately for residential purposes; these changes in the land-use have impacts on the natural environment.

2.5.2 Integrated Land Management

The increase in development issues related to the environment, society, and economy calls for a more integrated approach and a greater focus on sustainability and sustainable development (UNCTAD, 1997). Land Management is the process by which the land resources are put to practical use within a guiding framework (Nyarko & Adu-Gyamfi, 2012). To carry out the land management process, there is a need to identify the three key land management attributes: tenure, value, and use (Dale & McLaughlin 2000 cited in Nyarko & Adu-Gyamfi 2012). These will allow land management to be placed as a key land administration process (Nyarko & Adu-Gyamfi, 2012) which will, in turn, allow for the governance structures to address issues of social and political importance. The separation of key roles between the state and customary governance does not enable or support integrated land management or inclusive environmental management as there is limited 'conversation' between the traditional leaders and the state when it comes to land development (Gough & Yankson, 2000).

A dual system of land management in a developing country like Ghana shows the importance of inclusive land management because, in Ghana, the state has a simple role of registering and issuing deeds which Gough & Yankson (2000) describes as having limited control over customary land, resulting in non-progressive land management. This leads to the realisation that land management, particularly in developing countries such as Ghana and Nigeria, depends on the type(s) of land tenure in an area within the country. Integrated Land Management's primary goal is to ensure that the land benefits society today and ensures that future generations can still benefit from the resource (UNCTAD, 1997). This statement alludes to the definition of sustainability and sustainable development as per the Brundtland Commission Report of 1987. Integrated Land Management's successful practice is based on having a substantial understanding of the key pillars of sustainable development, paying attention to natural resources within the economics of development (Beinat & Nijkamp, 2010).

According to the Dutch Committee for Long-Term Environmental Policy (1994, cited in Beinat & Nijkamp, 2010), effective formulation and practice of Integrated Land (use) Management rely heavily on understanding the five phases of the human-environment relationship. These phases are (Beinat & Nijkamp 2010; 04):

1. environmental degradation as a side effect;
2. environmental degradation as a cost factor;
3. the environment as a boundary condition;
4. the environment as a policy-determining factor;
5. the environment as an objective.

The fifth phase is critical because current debates put the environment as the object to protect. Therefore, as a guide and instrument, effective policy emerges from this phase (Beinat & Nijkamp, 2010). The formulation of policy is most effective if coupled with a model; Aspinall (2008) emphasises formulating spatially integrated models that are dynamic, including natural

and human systems. Such models could aid in predicting change and the responses of the environment.

2.6 Urban Sprawl

The irregular and unplanned growth and expansion of the urban area into areas categorised as the city's periphery (Cobbinah & Amoako, 2014) is known as urban sprawl. The expansion usually occurs through the growth of residential areas and the creation of new urban centres to decentralise services. This is the emergence of a different pattern of development (low density) compared to the typical urban development trends that are highly dense (Cobbinah & Amoako, 2014).

Sprawl is becoming a common feature of cities this century, especially for vastly industrialised cities (Cobbinah & Amoako, 2014). The process of sprawl not only translates into the physical ideas such as building styles but also the social ideas of the urban areas are transferred to the periphery (Cobbinah & Amoako, 2014). The horizontal expansion of cities as they sprawl can lead to an increase in informality. Urban growth is not linear, particularly the construction of houses or development for residential purposes (Kombe, 2003). According to Kombe (2003), the 'popularity' of urban growth through sprawl occurs in three phases: namely, the infancy/starting, booming, and saturation stages; each of these stages builds on the other as the progress occurs, and this is most recognisable in residential land-use.

In the starting stages, the current land use, primarily agriculture, is beginning the change process to accommodate new residences. The booming stage begins when the land in the surrounding urban core becomes attractive to the middle and high-income households, which result in housing development becoming denser (Kombe 2003). The saturation stage is the final stage where there is a shortage of open land to develop more houses, and open spaces become

limited within the communities that have reached this stage (Kombe 2003). These stages can also be seen in the development of the peri-urban areas for residential purposes as well.

2.6.1. Rural-Urban Relationships: Where is the convergence?

Rural and urban are terms that are used regularly. Simon *et al.* (2006) state that these terms are used loosely to describe an area/region based on its use. The terms can also be used exclusively to denote differences that exist. These differences range from the density of the area, population size right through to the way the people live. Simon *et al.* (2006) explore the idea of distinctiveness and the existence of a dichotomy in the rural and urban settlement. They state that an absolute difference does not exist; there are fused characteristics as one nears the 'line' separating the urban and the rural. These influences do fade as one moves away from the immediate periphery of urban areas into the rural or countryside, as per the description of Simon *et al.* (2006).

Having a line that separates the urban from the rural is problematic in the spatial governance of urban areas. No line shows where the grasslands and forest meet the city boundary. The urban-rural line stemmed from the colonial process of suburbanisation (Simon *et al.*, 2016). The Urban Development Line (UDL) in eThekweni Municipality has established itself as a spatial planning instrument or mechanism used for 'governance' and allows spatial planning to be more strategic and focused (Sims *et al.*, 2015). The existence of the UDL can be seen to be answering the 'tough' spatial issues, but also it has exacerbated the notion of differences between the city and the countryside (Simon *et al.*, 2006). Alternatively, the existence of the UDL has come to a point whereby the people are pushing this line and 'bringing the city' to the areas where they are most comfortable living an urban-rural life.

Moreover, the idea of 'bringing the city' to where one is comfortable comes from the observable trends of migration in South Africa where people are frequently on the move from the rural to

the urban and back again, which creates a pattern of circular migration that is mainly characterised by having multi-local households (Simon *et al.*, 2006). The typical 'rural areas are what are known as the transition zones. The distinctiveness that Simon *et al.* (2006) refer to is largely affected by sprawl, urban sprawl, and peri-urban sprawl. The emergence of the term 'peri-urban' comes from the characteristics of displaying the features of both urban and rural (Allen, 2003). There are many reasons why peri-urban areas have emerged as 'preferred' locations for all classes within society in developing and developed regions. Torres (2007) quotes land regulations, taxation (rates), public housing policy, and its implementation. In addition to the reason for moving to the peri-urban areas as per the analysis of Torres (2007), Doan & Oduro (2012) states that the development and rehabilitation of road networks in the peri-urban areas present the ability for residents of the peri-urban area to travel to the cities with ease.

2.7 Peri-Urban Areas: Rural but not Rural

Peri-urban refers to the unregulated district far from the city centre (Torres 2011); the 'regulation' refers to being outside of the jurisdiction of the city management. These areas are often 'defined' using their characteristics because they do not have a simple definition; thus, using standard features to put meaning to the term (Ravetz *et al.*, 2013). The areas on the city's immediate periphery are typically described as low-income areas with poor housing conditions (Torres, 2011).

2.7.1 Peri-Urban Sprawl

Peri-urban sprawl expands these areas where the land-use is mainly for residential purposes (Torres, 2011; Torres, 2007). In industrialised/developed countries, this may be a zone for industries (Simon *et al.*, 2006; Douglas, 2006). The rate at which these areas (peri-urban) grow is discussed using the trends they exhibit, which are analysed and used to describe the meaning

of these trends. The freedom of expansion influences the growth trend in peri-urban areas because of the lack of regulation (Torres, 2007) and land market prices that provide access to land for people, particularly the poor or low income (Torres, 2011; Torres, 2007).

The main driver(s) of peri-urban sprawl is access and affordability. People have access to land (Torres, 2011; Torres, 2007) and build homes according to their needs/financial status metropolitan regulation. This is supported by an increase in the demand for residential areas. In Accra, Ghana, there was rapid urban growth; people moved into the peri-urban areas, previously sparsely populated (Gough & Yankson, 2006). As sprawl takes place, the defining characteristics become more explicit, particularly those that pertain to the dependence on transportation to commute to the areas of productivity (the city) daily (Ravetz *et al.*, 2013). This results in the peri-urban zones being the most common and preferred living area as it can be associated with affluence in developed countries, while in some developing world countries, the growth is in the peri-urban areas as informal settlements/slums (Ravetz *et al.*, 2013; Torres, 2011).

The cities in developing countries experience the growth of peri-urban areas because of mass rural-urban migration and population growth, leading to the movement of certain human activities (influenced by social dynamics) and industrial activities to the urban fringe (Ravetz *et al.*, 2013; Mbiba & Huchzermeyer, 2002). The nature of the peri-urban areas may lead to the co-existence of "upscale residential development and low-income self-built housing" (Grant, 2009 cited in Doan & Oduro 2012; 1307). In developing countries, the population growth in peri-urban areas could potentially induce peri-urban sprawl as the rate of rural-urban migration occurring in the cities precedes the local government's infrastructural plans (Doan & Oduro, 2012). Simon *et al.* (2004), cited in Doan & Oduro (2012), state that it is common for people to settle on peri-urban land before essential services, such as water and electricity, are provisioned. This was observed in villages surrounding cities like Kumasi where in-migration

and increase in population are 'bringing the city closer' (Simon *et al.*, (2004) cited in Doan & Oduro, 2012) as the village sprawls in both directions (into the rural hinterland and towards the urban fringe).

Allen (2003) asserts that in developing countries, peri-urban areas are most likely to lack accessibility in terms of the reliance on automobile transport, lack infrastructure and services such as water and sanitation. A major contributing factor to the expansion of the peri-urban areas is that of the major cities, particularly in the developing regions, undergoing significant industrialisation, which motivates more people to move from the rural areas to cities to seek employment (Ravetz *et al.*, 2014). This growth puts a strain on the amount of accommodation available (also affected by affordability), which prompts a continuous influx of people to settle in the peripheries of urban regions (Torres, 2011; Torres, 2007 & Simon *et al.*, 2006). The peri-urban areas also provide a different environment for the people instead of the lifestyle in the urban areas (Cobbinah & Amoako, 2014) or the townships.

The growth process in these areas shows the different value systems for different people in society (Douglas, 2006). The sprawling of peri-urban areas has negative and positive consequences, depending on how those consequences are observed. For example, in La Bawaleshie, Accra, the influx of people post-1995 led to an increase in service delivery such as installing piped water, connecting electricity, and maintaining roads (Gough & Yankson, 2006). There was an increase in the quality of life for the people who lived in La Bawaleshie.

2.7.2 The Value of Peri-Urban Development

The value of the peri-urban areas to an individual is influenced by several things, particularly their socioeconomic status (Allen, 2003). To understand the rate of growth in peri-urban areas at a broader scale, the different values attached to the development of the peri-urban areas, including activities that occur in these areas, need to be acknowledged (Douglas, 2006). The

value that a person or sector attaches to peri-urban areas influences the growth trend, the land use that dominates and the rate at which the growth occurs. The value systems of the different classes in society and the sectors that could potentially have interests in the peri-urban areas (Douglas 2006) differ. These values systems are not typical of the developing world but also embody the values attached to peri-urban areas in developed nations, particularly in Europe, as the movement of families with young children from urban suburbia to peri-urban or rural areas is common (Cobbinah & Amoako, 2014).

The description of the peri-urban areas implies that the poor find these areas suitable to settle in and potentially occupy the land for residential and agricultural purposes, as to industrial developers. The peri-urban areas present the advantage of being close to where primary resources are being sourced, particularly timber, gravel and sand mining (Douglas, 2006). The middle-class value the peri-urban areas solely for recreational and residential purposes to 'exploit' and 'experience' a rural lifestyle, whereas local government may demarcate these areas for the use of landfills, airports, and zoning for toxic industries as practised in cities such as Mexico City (Torres, 2011; Douglas, 2006). In Accra, Ghana, it has been observed that the people that acquire land in peri-urban areas are primarily the middle and higher-income earners who tend to build large villas; unfortunately, these areas are usually under-serviced (Gough & Yankson, 2006). The environmental management sector and conservationists value the peri-urban areas as open spaces for the urban/city area as they usually contain valuable ecosystem services and preserved woodlands (Douglas, 2006). These values and uses drive constant development in these areas, but they (development trends) remain uneven and inconsistent (Allen, 2003).

2.7.3 Sprawling of Cities: The Consequences

Douglas (2006) states that peri-urban areas are being regularly changed. These transitional areas juxtapose both rural and urban activities, which are primarily human-induced modifications (Douglas, 2006; Gough & Yankson, 2006). The most evident consequence of the unplanned and uncontrolled growth of peri-urban areas is the impact on the environment. The natural environment is degraded, the land becomes 'stressed' and prone to degradation, and agricultural land loses its fertility and is reduced in size because of the land-use change (Cobbinah & Amoako, 2014; Torres, 2007). One of the first observable issues with peri-urban growth is that the areas experiencing the most activity are most likely to have a reduction in the level of soil fertility; the quality of water can change, and the removal of trees takes place (Binns & Maconachie, 2006). Deforestation in the periphery of urban areas is a considerable challenge. It is the product of the unmanaged growth of the urban areas outwards toward the peri-urban areas and the expansion of the peri-urban areas themselves in the rural areas (Torres, 2011).

Torres (2007) discusses the impacts of peri-urban and urban sprawl, mainly from the perspective of the poor. He describes those that settle in these areas as the 'invisible' people within the city, resulting in the exclusion of certain people from public policies. Development that occurs during sprawl, whether it is urban sprawl or peri-urban sprawl, is most vulnerable to natural disasters such as landslides and flooding if developments take place on vulnerable areas (Torres, 2011). The city's growth, be it for industrial uses or residential occupation, can lead to positive consequences because life improves for those who already live in the area as the state provides more services.

2.8 Governance and Land acquisition

2.8.1 Governance and Land Management

The governance form and system in a place is essential because it can allow for a better understanding of rules/laws, regulations, practices and the way of life in an area (Holzinger *et al.*, 2016). The term governance is centred around the political steering function in communities. According to Holzinger *et al.* (2016), governance is the organisation and rules that aim to regulate behaviour and assist in decision-making for the collective. Governance and land management in developing countries operate in the domain of a plural polity environment whereby at least two systems of governance are involved (Nyarko & Adu-Gyamfi, 2012) in leadership and decision-making. Polity dualism is the existence/co-existence of two separate political and legal systems in the same territory/region. Both rules and practices apply to the same people (Buur & Kyed, 2007 cited in Holzinger *et al.*, 2016). It is popular for developing countries such as Namibia, Ghana, and Nigeria to have a governance system where traditional leadership forms of governance coexist with the governance and political institutions of the state's laws (Holzinger *et al.*, 2016).

In a dual governance system, the traditional system of governance and customary law is recognised as a form of governance within a country (Holzinger *et al.*, 2016). According to Allen (2003), the existence of overlapping institutions, in this case, the traditional authority and the state, could result in a difference in the overall spatial and physical responsibilities. The differentiation in key roles, which transcends into the different spatial and physical responsibilities discussed by Allen (2003), could result in a situation whereby the authority of a singular governance system would hold more authority and worth to the people (Holzinger *et al.*, 2016).

In the case of Ghana, the roles are separated. The Traditional Authority is responsible for land allocation, maintaining harmony amongst the people and heading the traditional council that oversees land ownership or leasing² (Gough & Yankson, 2006). The state's role and mandate focus on the socio-economic development of communities by delivering services like road construction/maintenance and provisioning of basic resources like access to water and electricity (Gough & Yankson, 2006). Several questions are currently being asked regarding understanding the different forms of parallelism of state and traditional governance, issues of cooperation between the two forms of governance and issues of democracy (Holzinger *et al.*, 2016) in relation to tradition and customs. Neo-traditionalists respond to the concern of 'democracy and traditional governance' by highlighting their view that traditional leadership and governance maintains their harmony within a co-external governance environment through elements such as consensual decision-making and encouraging public participation (Adedeji, 1994).

2.8.2 Traditional Governance in Developing Countries:

The value of traditional governance stems from it being in practice for a long time. It is usually characterised by the past and the identity of ethnic communities (CCMT, 2015). Englebert (2002), cited in Holzinger *et al.* (2016), states that in the early 1990s, there was an increase in the number of traditional governance practices in societies in Sub-Saharan Africa, Latin America, and South Asia. This led to large shares of the population in developing regions living under dual governance structures. In Ghana, Nigeria and Zimbabwe, peri-urban land is most likely to fall under customary land controlled by the chiefs and the council of elders (Gough & Yankson, 2006). Regarding land under the traditional governance and customary law system, the chief and the council of elders possess the allodial title to the customary land. However,

² Communally owned land cannot be privately owned by individuals therefore in legal terms, there is a 99/100-year lease from the Custodian of the land of the people, the Chief.

this council is expected to adhere to the concept of posterity and put the interests of future generations to heart (Gough & Yankson, 2006).

In Ghana, the development of the peri-urban land should be drawn and planned by the Town and County Planning Department offices; however, the rate at which the development occurs exceeds the capabilities of the government offices, which makes it primarily uncontrolled (Gough & Yankson, 2006). It is critical to establish that traditional governance systems are tiered because traditional authority refers to persons or organisations. In contrast, traditional political institutions refer to the organisation and rules that exist. Holzinger *et al.* (2016) illustrate how the term 'traditional governance' is more holistic because it encompasses the subject(s) of traditional authority, discusses the issues of traditional procedures (as per the ethnic group norms) and includes rules of significance dealing with issues of land, security and resource allocation.

2.8.3 Land in the Peri-Urban Area: Ownership, Acquisition, and Tradition

Allocation of land in the rural areas/ areas under traditional authorities is linked closely with the roles and separation of governance roles discussed by Allen (2006) above. Although this is most evident in Southern Africa, Gough & Yankson (2006) observed the same increase in land demand and inter-governance structure conflict in other parts of Africa. Land acquisition and allocation result in an environmental planning catastrophe, particularly when the institutions are polarised and not well-defined in the policy. Allen (2003) asserts that environmental problems, mostly related to planning in the peri-urban interface, could result from severe institutional fragmentation, complete disregard for guidelines issued by mandated departments, which exist in a different sphere of governance and the limited power of the municipality.

Moreover, customary land cannot be sold, but leaseholds can be sold to new acquirers (CCMT, 2015). These payments' value(s) was previously a modest gift as a tribute to the chief, but this

has since changed to reflect the changing economic land market and land value(s). Gough & Yankson (2006) state that the increasing demand for customary land has led to an increase in the value of peri-urban land in Accra, Ghana. This observation by Gough & Yankson (2006) alludes to the remarks made by Herbt (2000) cited in Holzinger *et al.* (2016) with regards to the diversification of land tenure and land acquisition within traditional governance practice. Title deeds are an essential aspect or symbol when it comes to land issues and ownership.

This conflict issue between conservation and development (land allocation) is a feature of different decision-making procedures and policies, shaped by socio-economic patterns (Beinat & Nijkamp, 2010). According to Aspinall (2008), resilience, sustainability, and issues of adaptability (of the land) should be considered when considering community development, which is where land use planning comes into play. Prior planning allows time for the land to be examined (land systems) in relation to pre-existing land uses and land cover, whether the land cover is natural or otherwise. Land allocation is an essential branch of traditional governance and practises. Herbst (2000) has recognised the traditional authorities as central political actors in present-day Africa.

There is an observable evolution of acquiring land in the peri-urban areas in West Africa and Sub-Saharan Africa from traditional methods to more capital-driven methods giving birth to new African land markets (Gough & Yankson, 2000) at the grassroots. Gough & Yankson (2000) states that the overall control of land and land management in Ghana is like other West African countries because the indigenous tenure systems are still the most prevalent in land transactions. In current day Ghana, the land has become a primarily commodified asset that can be transferred from one person or chief to the next. A study done by Gough & Yankson (2000) shows that at least 90 per cent of the population in the peri-urban villages surrounding Accra had purchased their land from a chief or headman. At least six per cent received the land

as a gift, and the remaining four per cent got the land through family allocations. Similar dynamics in land acquisition have prevailed through time.

2.8.4 Summary

This chapter presented the theories and major concepts on land degradation, sustainability and development of peri-urban areas. Cornerstone conceptual and theoretical frameworks were presented to show how there has been progress in environmental consciousness as the world strives for more sustainable development. There is an emphasis on sustainability because of the Brundtland report. The discussion of resources (land and the environment) shows that the environment is the primary factor within the triple-bottom-line that sustainability advocates for. The literature review also brings together the environmental and social aspects of development to unpack the issues that affect the environment when rapid densification occurs in peri-urban areas.

Chapter 3: Contextual Background and Current Trends relating to the Case Study in South Africa

3.1 Introduction

The current development trends in Kwa Zulu-Natal, particularly in Nadi(eMbizane) and Henley Dam, relate to a host of things such as governance/institutional arrangements and The environmental parameters could be concerning the climate in the areas, topography geology (soil conditions) that could increase land degradation susceptibility. The land debate in South Africa by reviewing land ownership, the Ingonyama Trust's role, and the study's relevance through the 'Motlanthe Report' on legislative reform in post-apartheid South Africa is an essential additional issue related to the South African context of development and how change occurs.

3.2 Msunduzi Municipality: Social and Economic indicators

Msunduzi Municipality is situated within the uMgungundlovu District Municipality. It is home to the capital city of Kwa Zulu Natal, Pietermaritzburg. The Municipality is located along the busy N3 corridor between Durban and Johannesburg.

3.3 Vulindlela Local Area: Social Dynamics, Land and Governance

Vulindlela is the most remote and least developed local area within the Msunduzi Municipality Boundary (Msunduzi Local Municipality, 2015). The Municipality adopted the concept of Area Based Management Plans in 2010 (Msunduzi Local Municipality, 2017) to try and support development in the area. The Area Based Management Plan includes detailed planning, particularly in formulating the Spatial Development Framework and implementing wall-to-wall schemes to initiate projects and development strategies (Msunduzi Local Municipality, 2017). Vulindlela Local Area is located west of Pietermaritzburg, with the land mostly held

under the Ingonyama Trust. It is therefore categorised as a Traditional Authority Area. The area of Vulindlela covers approximately 28000 ha of land, which is predominantly rural and peri-urban (Msunduzi Local Municipality, 2017).

The Vulindlela area has a peculiar development trend (Msunduzi Local Municipality, 2017). There have been observable population growth in the area. The area's projected annual population growth rate between 2014 and 2050 is 2,00% per annum (Msunduzi Local Municipality 2015). The land uses found in the area are dispersed residential, grazing land, cultivated land, indigenous forests, and timber plantations (Msunduzi Local Municipality, 2017). About 65% of the agricultural landholding of Msunduzi Municipality is found in Vulindlela. It is also a hub for Existing Major Open Spaces (Conservation use), while there are also proposed Major Open Spaces that have been identified for conservation, situated in the area as well (Msunduzi Local Municipality, 2015).

3.3.1 Land, Governance and Governance Structures: Roles and Relevance

The dynamics of land, land ownership and governance in the Vulindlela area is complex and varies. Within the Msunduzi Municipality boundary, the Vulindlela area is the only area where dual governance is present. There is an isolated case of privately owned land that is owned by Umgeni Water in the Henley Dam area (Msunduzi Local Municipality, 2016). The ten wards of Vulindlela each have councillors. They are overseen by *Amakhosi*, namely the *Mafunze* TA, *INadi* TA, *Mpumuzu* TA, *Nxamalala* TA and *Ximba* TA (Figure 3.1) (Msunduzi Local Municipality, 2016; Ingonyama Trust Board, 2016).

3.3.2 Land Allocation: Protocol and Practise

The five Traditional Councils of Vulindlela Local area all have land under the ITB, which gives them jurisdiction within the boundary of Council, the right to give authority/ consent and allocate sites which the *izinduna* or *Inkosi* undertakes (COGTA, 2016; Ingonyama Trust Board, 2016). Ideally, the site allocation process is started off by an application; residential, commercial, institutional, servitudes and other related site application(s) (COGTA, 2016). The applications are submitted to the Traditional local council through *Induna*.

A set of guiding principles (guidelines) needs to be upheld when allocating land in the Traditional Authority areas under Ingonyama Trust. The principles speak about where the Traditional council can allocate land, dual interaction between municipal councillor and the Traditional Council in the case of formalising each party with the land use plans of the area and the protocol of transfer from one person to the next (COGTA, 2016). Preservation of prime land and the municipal open area spaces is essential because of the need to ensure that the natural environment and cultural capital of significance to the people are preserved (COGTA, 2016).

Private sale or transfer of land allocated to any individual cannot be transferred without written notification to the Traditional Council. The Council will give consent -or not- based on plausible reasons (COGTA, 2016). This means that in the Traditional Authority jurisdiction, private sales of land are prohibited. This prohibition accounts for the range of guidelines that inform the site's location that can be allocated. According to COGTA (2016), there are building lines that protect the people and conserve the environment; they state that no site within 100m from the river edge, high water and traditional authority council boundary can be allocated to any individual for any sort of use. The other guidelines state that the building line should be at least 30m away from the edge of a national road, 15m away from a provincial road and at least 8m from the local roads (COGTA, 2016).

3.4 Ingonyama Trust Board Land: Tenure and Current Land Reform

Issues

The land that the Ingonyama Trust administrates is vast, and the King (*Ingonyama*) is the trustee and Chairperson of the Ingonyama Trust Board (Centre for Law and Society, 2015). The King and the Trust hold some powers. However, the law (Ingonyama Trust Act of 1994) also provides land rights to the communities and individuals in the areas under the Trust (Centre for Law and Society, 2015). In KwaZulu-Natal, the land is divided according to clans under a Traditional Leader (*Inkosi*) who is answerable to the King as per Zulu customary Law(s) (Ingonyama Trust Board, 2016). The amendment of the Act in 1997 resulted in the creation of the Board, which functions separately from the Trust, which manages the Trust (includes the land asset).

3.4.1 Land Ownership and Tenure

Land within the Ingonyama Trust cannot be owned individually but instead is owned communally. The communal ownership of land is a clan collective under each demarcated area of Traditional Council jurisdiction (Ingonyama Trust Board, 2016). There is a share for each clan member, which can be claimed from the Traditional Council after the due procedure as stated by the practice of Zulu customary law(s). The South African Constitution speaks to the land under the ownership of Ingonyama Trust in Section 25. There is the protection of every clan member, whether they have a registered title deed or not, regarding their share of the communal land. This is protected through the law. The ownership of land under the Ingonyama Trust Board is seen as a mechanism that can potentially address land ownership issues based on historical inequalities (Ingonyama Trust Board, 2016).

3.4.2 Current Discussions: Land Reform

The current debates around access to land and land reform are centred around the call for the redistribution of land through the expropriation of land without compensation that was first tabled by the Former President of the Republic, Mr Zuma and subsequently, His Excellency Mr Ramaphosa. This escalating attention to land issues in South Africa has shone a light on the amount of land owned by the different races and the security of tenure of those that already have access to the land (Panel, 2017). The Report on The High-Level Panel on the Assessment of Key Legislation and the Acceleration of Fundamental Change covered Land Reform and Restitution in South Africa, as these are aspects provided for in the Constitution of South Africa. The Report states that many people have insecure land tenure, particularly those living in areas of customary tenure that are former homelands, farm dwellers, and people who live on the fringes (rural-urban fringe) and in informal settlements.

There is an emphasis on tenure reform that goes hand in hand with restitution and redistribution. It can ensure tenure for those with insecure land tenure and provide land rights (Panel, 2017). The unequal access to land in South Africa and the call to redistribute the land because of the Land Acts of 1914 and 1936 to which the Constitution made a requirement “that people should have equitable access to land to address past dispossession.” (Panel, 2017: 202). Land Restitution seeks to address the issues of those that were dispossessed of the land after the passing of law(s), which enabled forced removals (Panel, 2017). The applications submitted to fulfil the restitution claims before 1998 have yet to be received. This escalated that demand for land in urban areas and the spill-over to the peri-urban areas, which are prime agricultural lands and serve as green open spaces in many cities in South Africa, particularly in KwaZulu-Natal. This has led to the increased urbanisation of peri-urban areas because people need land to build on and Traditional Authority land is more accessible.

The Ingonyama Trust land is currently the most accessible land for formerly disadvantaged groups (Black people). However, the Report states certain areas where tenure security is threatened even under the Ingonyama Trust land. *Amakhosi* reportedly deny land rights to people to give mining and other large-scale capital investment (Panel, 2017). SABC News once reported a case in Mtubatuba, KwaZulu-Natal, where people were being relocated because the coal mine in the area needs to expand. The report suggests that these mining rights only enrich the few and exclude those most vulnerable, threatened land rights.

3.5 The Natural Environment: Ecological Infrastructure and the Physical Environment

The Msunduzi Municipality is part of the Greater uMngeni River Catchment and is situated at the beginning of the Midlands region; the city of Pietermaritzburg is in the basin of the Msunduzi River and its tributaries (Msunduzi Local Municipality, 2017). The altitude within the municipality ranges from 495 to 1797 meters above sea level and slopes from east to west. Most of the areas within the municipal boundary comprise both the Savanna and grassland biomes (Hugo, 2004). These biomes are found in areas characterised by dry winters and summer rainfall, in the range of at least 250mm to 2000mm per annum (Hugo, 2004). These climatic and biodiversity indicators make the region more suitable for plantations, but the soils are most susceptible to leaching (Hugo, 2004).

3.5.1 Ecological Infrastructure and Open Spaces

The free services delivered to people by nature are ecosystem services or ecological infrastructure (SANBI, 2012 cited in Msunduzi Local Municipality, 2015). Msunduzi Municipality prides itself in being a Municipality that strives to achieve sustainable urbanism by enhancing the City's ecological infrastructure (Msunduzi Local Municipality, 2017). The positive integration of green space within cities and planning for the different extents of green

space is crucial for achieving sustainable urbanism (Msunduzi Local Municipality, 2015). According to the SDF report of 2015, restoration and enhancement of naturally functioning systems start growing the city's ecological infrastructure base. The most threatened ecological infrastructure within Msunduzi Municipality is wetlands (Msunduzi Local Municipality, 2016). These wetlands are also included in the Municipal Open Space System (MOSS).

3.5.1.1 Municipal Open Spaces Systems (MOSS) of Msunduzi Municipality

The Municipal Open Space System (MOSS) is presented in a layer. It contains information about the natural environment, such as threatened ecosystems, key species (vegetation) and strategic conservation areas (Msunduzi Local Municipality, 2015). It informs conservation planning, monitors ecological assets, and outlines their value and use to the City (Msunduzi Local Municipality, 2015). The MOSS layer includes ecological assets and public open spaces such as parks as they contribute to human well-being and a holistic living environment (Msunduzi Local Municipality, 2015).

3.5.2 Physical Attributes: Slope formation, soil types and vulnerabilities

The Msunduzi Municipality/Pietermaritzburg areas are primarily covered by the Pietermaritzburg formation, which forms part of the Ecca group with dolomite patches (Turner, 2007; Richards *et al.*, 2006). This formation stretches from the Mpumalanga province to the southern parts of KwaZulu-Natal, along the province's interior basin (Turner, 2007). The different formation types resulting in the formation of different soil types have different levels of susceptibility to elements such as rain and wind. This affects processes such as weathering and soil formation. The soil's depth also impacts the amount of organic matter (vegetation) found in the different soil types.

Rock formations that belong in the Ecca group are eroded rapidly, which results in the formation of the current valley or subdued relief (Richards *et al.*, 2006). The nature of the

Dwyka group rocks (influence of the granite) results in rounded hill slopes characterised by steep slopes; this gives the slopes a convex profile (Richards *et al.*, 2006). This nature (convex profile) coupled with the easily erodible characteristics of the Dwyka Formation leads to the accumulation of thick colluvial deposits, making its way to the foot of the slopes that form part of the Greater Msunduzi Municipality area (Richards *et al.*, 2006).

3.6 Relevance of the Case Study: Nadi (*eMbizane*) and Henley Dam Case Study

The case study looks at the rapid densification and the impacts of the development in the Nadi (*eMbizane*) area and Henley Dam area on land degradation and the potential for land degradation. The study identifies the slope, precipitation patterns and the population density trend.

Pietermaritzburg is situated at the bottom of the valley, and the study areas are situated on the areas that start to rise high to the West of Msunduzi Municipality. The Vulindlela area constitutes one of the highest points in the city, and Henley Dam and Nadi (*eMbizane*) areas are found in areas with slopes steeper than 1:4. These steep slopes characterise almost 90% of the Greater Vulindlela area. This would lead to the assumption that the soil formation in the area does not allow packing or creating sedimentary layers of the soils, as they are most susceptible to soil movement and more prone to land degradation forms.

These high slopes coupled with the influences of a mean annual rainfall of between 900mm 920 mm of rainfall per annum, soil erosion is likely to occur, but the rates at which soil erosion can occur are unknown. That is why this needs to be considered, in conjunction with the rate of deforestation and vegetation removal in the Henley Dam and Nadi (*eMbizane*) areas as more people move into the area. The Msunduzi Municipality has acknowledged that the area is

rapidly densifying. However, the reasons why people are moving into the area need further research and documentation.

3.7 Summary

This chapter presented the background of Msunduzi Municipality and the two case study sites. It provided the context within which the peri-urban areas are changing rapidly. This is evident in the projected annual population change and the changing dynamics of the rural and peri-urban areas of Msunduzi Municipality. The Vulindlela Local Area was described, and the natural characteristics of the area and its socio-political realities were outlined, which included the governance in the area. The land debate and the accessibility of land for black South Africans is central to and driving the change in the rural and peri-urban areas as we know them. Having presented the context of this research's case studies, the following chapter outlines the methodology adopted in the study.

Chapter 4: Research Methodology

4.1 Introduction

For the research to efficiently achieve all the set aims and objectives and the interdisciplinary nature of the study, a diverse number of research methods were needed. This research methodology chapter presents the main research approaches, including the data collection and techniques used.

4.2 Nature of Research: Case Study

The case study methodology was chosen as the primary methodology for the research because it is ideal for in-depth research with a focused scope. The research strategy within a case study setting is flexible. It allows a few research strategies to be used during data collection and analysis (Taylor, 2016). The case study used a mixed-methods approach, a hybrid of qualitative and quantitative research design. The case study was descriptive (Yin, 2014 cited in Taylor, 2016) as it was used to explain what was happening in the area of Henley Dam and Nadi (*eMbizane*).

4.2.1 Data Collection

The primary data collection was conducted by administering a questionnaire, taking photographs, conducting interviews, and holding a focus group discussion (planned) and field observations. The interviews, questionnaires³ and focus group discussions were undertaken to obtain insights from identified stakeholders (community members and the leaders) on the issues of change (environmental and social). Pertinent documents from Msunduzi Municipality, Department of Co-Operative Governance and Traditional Affairs in KwaZulu-

³ The interview schedule and questions in the questionnaire were in English for ease; the researcher directly translated each question for the participant into isiZulu.

Natal were referred to/consulted. These documents helped identify the critical plans and policy frameworks that are ‘forecasted’ for the areas. An analysis of maps – weather maps, physical or topographical maps, and population density maps- make up the second data collection and analysis phase. The maps were monitored periodically to see change per year, influenced by the availability of satellite images (per specific year) and the quality of the images. A set of remotely sensed photographs sourced from *Google Earth* were used to discern land-use changes over time. An additional ‘passive’ data collection method of observation was used. The mixed-methods approach described above enabled the researcher to strategically use the different strengths of each method to enable a coherent, evidence-based argument. The different methods used in the study had different strengths and weaknesses; when used together, the strength of the results increased.

4.3 Sampling: Method(s) and Participants

The case study used two sampling methods to fulfil the study's purpose: purposive sampling and random-systematic sampling. The community's main stakeholders were sampled using purposive sampling (for the interviews), and random-systematic sampling was used for the questionnaire. The study population was the people of Kwa Mnyandu⁴ living in the lower *eMbizane* area, Nadi and Henley Dam. A series of characteristics namely framed this: people who have lived in the area for less than ten years and owned land and or a homestead in the ‘new’ area of Nadi (*eMbizane*) and Henley Dam. The ‘less than ten years’ selection criteria fit into the research timeline of densification between 2006-2016. These criteria were used in identifying homesteads suitable for this research.

⁴ The Kwa Mnyandu area is a section of the *INadi* Tribal Authority which the two study areas, Nadi(*eMbizane*) and Henley Dam, are part of. This area is defined by the existence of *Induna*, part of the Traditional Council of *iNkosi uZondi*. *Induna* Nxumalo is responsible for the Kwa Mnyandu section.

An additional parameter that was set for the respondents for the questionnaire was age. The respondent had to be at least 18 years or older to answer the questionnaire. However, an adult/homestead owner was preferred. The questionnaires were then administered in the two areas using the random-systematic sampling approach. This sampling method allowed each household to have an equal chance to be selected for the questionnaire but had to be after a regular interval of three houses along the road. The invitations to the focus group were handed out along with the questionnaire to interested persons.

The prominent stakeholders were also identified using the purposive sampling method, and they were specifically identified for an interview. The interview's guiding parameter was that an individual had to be in a leadership position or had such a status in the community. It is important to note that participation in the focus group, answering the questionnaire and doing an interview was all voluntary, as per the ethical requirements of UKZN.

4.4 Ethical Matters: Ethical Clearance and Gatekeepers

The ethical clearance requirements were addressed during the early phases of the project timeline. The application for ethical clearance was supported by a signed gatekeeper's letter and authorisations obtained from the *INadi* Traditional Authority in the study areas. The community's representative, *induna* Mr Zuma, the Head *Induna* for the *INadi* Traditional Council, was approached regarding the study in 2017. Before the study commenced, a new gatekeeper's letter was signed by the *induna* of Kwa Mnyandu, a section of the *INadi* Tribal Authority and the Ward Councilor. The key aims and objectives were explained before the gatekeeper granted access to the areas. The respondents to the questionnaires are presented as 'respondents' during the discussions phase. Ethical approval was granted for this study by the HSSREC Ethics Committee at UKZN. The ethical approval number is HSS/1147/017M.

4.5. Primary Data Collection Methods

This section details the primary data collection methods that the researcher used to collect data from the people and community after identifying the prominent stakeholders and, with the aid of the sampling methods mentioned in 4.2, which identified households best suited to participate in the research. The methods were namely photography of the study site, questionnaires, interviews, and a focus group.

4.5.1 Questionnaire

A total of 30 questionnaires were conducted in Nadi (*eMbizane*) and Henley Dam through the community members' voluntary participation that was part of the target population. Each area had 15 households that participated in answering the questionnaire. The questionnaire was a collection of open and closed-ended questions asked to the participating respondents (*see Appendix 9*). The researcher conducted the questionnaires from the 3rd of November 2018 until the 17th of November 2018. The questionnaire contained questions centred around the subject of the environment and land. McLafferty (2015) states that questionnaires are efficient tools to gather information from people to acquire diverse information. Questionnaires prompt people to be comfortable to share their general attitudes and opinions to the subject matter of the research.

According to Mc Lafferty (2015), administering a questionnaire can be very strategic in places where primary data is lacking, particularly in developing countries that do not keep updated data sources or when they are outdated. The open-ended questions in the questionnaire allowed the participant/respondents to share as much information about that specific question, based on their construction of the issue. This made it easier to capture the respondents' views (Mc Lafferty, 2015), which may have been missed with the close-ended questions at the beginning

of the questionnaire. Open-ended questions in a questionnaire added rich and personal aspects to the responses (Mc Lafferty, 2015).

A disadvantage of having open-ended questions in the questionnaire can lead to a scenario where there are no fixed categories, making analysis challenging (Mc Lafferty, 2015). The questionnaire in the study was corrected for this by using both fixed and opened-ended questions. This helped to limit vast variability in the responses. Other challenges experienced while administering the questionnaire included persons unwilling to participate and participants with shallow, one-word responses that lacked depth. In Henley Dam, the main challenge was to get people to participate in the questionnaire because of the fear that comes from the Court Interdict issued to the people by Umgeni Water, the owner (holds the title deed of the area). There was a general fear that the researcher was an agent from Umgeni Water.

4.5.2 Focus Group

The focus group's purpose was to have open conversations in a group setting to answer some of the pressing questions and come up with an answer that does not reflect an individual's perception. This focus group was viewed as an extension or a follow-up from the individual household questionnaire and formed part of the 'citizen science' aspect of the case study. The people were asked to draw their area in how they saw it and highlight the critical areas to them, showing their households on the map. The target participants were sampled from the area and were a group of females from the Nadi (*eMbizane*) area. The researcher issued the invites after interacting with the community members during the questionnaire phase of the case study research.

Unfortunately, the focus group discussion was unsuccessful because nobody showed up on the day scheduled for the discussion. It is unfortunate that on the 24th of November, the day scheduled, the participants who had shown to have an interest in taking part could not make it,

many citing homely duties and obligations that they had. The dynamics of the general responses to community gatherings and meetings discussed later in this chapter (*see section 4.5.2*) seemed to have held about the focus group's attendance.

4.5.3 Interviews

Interviewees were identified based on the leadership positions they hold in the community. The selection of respondents for interviews was also informed by the responses from people when answering the questionnaire. The responses then enabled the researcher to draft interview schedules (*see Appendices 10, 11 & 12*) that contain the central theme of the research after reflecting on the responses. Identifying the key stakeholders allowed the researcher to categorise the key informants, such as the gatekeepers and the community elder(s). These people were selected based on the researcher's assumption that they had relevant information that would be key in the research. The researcher reached out to a few people based on their positions in the community. The interview schedule was centred around the questions of governance, planning and the overall environmental change in Henley Dam and Nadi (*eMbizane*).

Interviewee	Date of interview	Place of interview
Ward Councillor	09/11/2018	Msunduzi City Hall
Induna (INadi TA, KwaMnyandu Section)	10/11/2018	Homestead
Community Elder	11/11/2018	Homestead

Table 4. 1: The details of the interviews that formed part of the study.

4.5.4 Visual Land Degradation Assessment

The study used the basic Visual land degradation assessment form (*see Appendices 13 & 14*) to assess the prevalence of certain land degradation features in Nadi (*eMbizane*) and Henley Dam. A form was developed with the visual indicators of land degradation. The form was

adapted from Stocking & Murnaghan (2002) to fit the context of the study. The land degradation indicators were quantified using a tally system which was then translated onto MS Excel and analysed using pie diagrams.

4.6 Observation

Observation during fieldwork allows the researcher to compare the findings with insight (after interaction with participation/community). Observation enables the researcher to draw out any disparities and highlight areas of interest. It is a form of extrinsic primary data collection.

4.6.1 Study Area Observation

The study area's observation allowed the researcher to identify prominent features of the social and natural environment. The social environment observation entails observing the social interactions in the area, which forms part of ethnographic research. Observing this allows for identifying how people live. Others would call this the need to capture reality, as people tend to change when asked questions and asked for their personal opinions.

Observation enabled the researcher to contextualise the questionnaire responses (along with the general attitudes of subjects). In this research, the critical attitudes observed were towards the natural environment (natural vegetation) and land. The time(s) at which these observations were made was crucial as routines change at different times of the day. The questionnaire rollout coincided with the rush for the December holidays, which put pressure on the research activities.

The study area observations were essential for insights into the current natural environment in the area as data portals, such as the local municipality's, may be outdated. Observing in the field allowed the researcher to bridge the gap between the existing data and the current state of the environment (enables the ground-truthing of data). The natural environment had been observed remotely for close to a year, and the changes were significant (relating to the critical

subject matters). The photographs were taken in the field by the researcher documented the change in the landscape. The challenge came when some respondents did not want their houses and homesteads photographed. This meant that some interesting land phenomena were not be captured.

4.6.2 Participant Observation

The participants who agreed to answer the questionnaire were observed to understand how people behaved while answering questions. The observation was done from the time when the researcher approached the individual in their homestead. This included the introduction, presenting the documents to confirm the study's validity and how open the participant is about sharing about how they related to the environment they lived in. Certain elements were observed with the researcher's constant visits to the study areas due to family ties. It led to the realisation that some data collection methods, namely hosting a focus group, would not yield positive results that the researcher could use to discuss the situation.

Potential participants were also observed through the researcher blending in with the community and asking meaningful but straightforward questions to get answers from people because of the ability to blend in well with the community aided by speaking the language spoken in the area, isiZulu. The questions asked revolved around the general attitudes towards meetings, the frequency of the community meetings and the rate at which people were willing to attend them. People quoted various reasons, but the reason that stood out the most to the researcher was the days/times of the meetings, venue(s), and availability (this related to lifestyle issues). The informal way these questions were asked enabled the researcher to get honest responses from the people as there was no taking of notes or the asking of confrontational questions that demanded thinking and reflection, which sometimes intimidates some people. The responses made the researcher aware of the people's general schedule, which

meant that using a focus group as a data collection method would be more suited if hosted at one of the community members' households.

4.7 Secondary Data Methods

Secondary data collection methods referred to collating different pre-existing data consulted and reviewed concerning the core study questions. The consulted documents were the weather maps, physical maps, Msunduzi Municipality development plans documents (SDF and IDP⁵), Soil morphology book, COGTA land allocation guideline(s) and *Google Earth* photographs.

4.7.1 Documents: Books, Municipal Document Plans and Pertinent Legislation(s)

The case study's rationale was formulated using a series of documents to inform the outcome/conclusion of the study. These documents formed part of the second data component of the study. Essential documents were the Msunduzi Municipal documents, namely the Spatial Development Framework, Msunduzi Integrated Development Plan(s) and the Local Area Plan of Vulindlela. These documents gave the background information about the development dynamics of the area in which the case study was based and the general plans of development from the perspective of Msunduzi Municipality.

4.7.2 Visual Documents: Maps and Aerial photographs

There are other sets of documents that presented the study area's natural and/physical attributes, and they were visual. This does not include the photographs collected during the fieldwork phase of the research but the maps of the area, getting the relevant shapefiles to produce a locality map. The South African Weather Services climate/weather maps were consulted to understand the study area's climatic status.

⁵ SDF is the Spatial Development Framework.
IDP is the Integrated Development Plan.

4.7.3 Pertinent Legislation(s)

The research aimed to understand the influences that result in the rapid densification in the peri-urban areas in a specific area of KwaZulu-Natal, Msunduzi Municipality. Peri-urban policy dynamics are dual; therefore, the most relevant legislation to the study consisted of legislation for both the Municipality and the Traditional Authority area. The use and interaction of the two ‘types’ of legislation can be seen in documents such as the Spatial Development Frameworks, the Vulindlela Local Area plans, and the Ingonyama Trust Act, 1994 (Act No. 108 of 1996).

4.8 Data Analysis

Data analysis was the phase of making sense of the data collected. Both the primary and secondary data were analysed against the main research question and objectives. The primary data analysis required that the researcher engages with the collected data before identifying the themes. The interviews were transcribed, and the outcomes of the sessions were coded into themes. The questionnaire responses were collated, the general patterns were identified, and the questions asked formed part of the themes. This approach enabled the consideration and identification of a common thread in responses from interviewees and responses to the questionnaire's open-ended questions. *MS Excel* was used to capture and analyse the questionnaire's empirical outcomes, and subsequently, themes were identified. The themes a. Theme 1 The pull factors of the Nadi (*eMbizane*) and Henley Dam areas, b. Theme 2 The socio-ecological relations; c. Theme 3 Observable land changes and d. Theme 4 Environmental impacts over time.

4.8 Summary

This chapter's purpose was to present the methods (methodology) used to collect the data that was needed to start answering the critical questions of the research considering the aims and objectives for the research. The researcher used both quantitative and qualitative methods in secondary form or collected (primary) by the researcher. The chapter further described how these methods were used to inform the research process.

Chapter 5: Review of the Data and Results of the Case Study

5.1 Introduction

The land-use change and its social and environmental impacts in the Nadi (*eMbizane*) and Henley Dam areas were intriguing. It first describes the biophysical characteristics of the peri-urban areas of Nadi (*eMbizane*) and Henley Dam, where the densification is occurring. It then analyses the governance arrangements that are potentially both enabling and constraining these changes. The social processes that drive the land-use change in the area are analysed, drawing on the data collected from residents living in the area. The biophysical context, governance and social processes of urbanisation frame the discussion. The impact of climate change is further exacerbating land-use change around Henley Dam.

5.2 The State of the (Natural) Environment in Nadi (*eMbizane*) and Henley Dam

Nadi (*eMbizane*) and Henley Dam have similar physical and natural characteristics, such as the soil type. However, they also have some natural characteristics, such as slope and vegetation cover, differentiating between them.

5.2.1 Geological Characteristics: Topography and Slope

The Nadi (*eMbizane*) area relief ranges from gentle slopes to relatively mountainous areas. The highest point is at 1100 meters above sea level. The Henley Dam area is relatively flat and has a lower gradient than the Nadi (*eMbizane*) area. In the central areas leading toward the Henley Dam, the topography is flat. In contrast, the surrounding areas range from 1020 metres to 1060 meters above sea level. They were not part of the study. The Henley Dam area is located at 980 - 1020 meters above sea level. The built-up areas are concentrated on the flat plateau. The stony rock ridge influences the settlement patterns on the eastern slope of the hill. The Nadi (*eMbizane*) area also consists of a steeper slope than 1:4, particularly the area that is still a

grassland on the Eastern-facing side. Nadi (*eMbizane*) is at the top of a hill at approximately 1055 meters above sea level. The locality of being at the top of the hill could suggest landscape stability if the slope were not interrupted; however, the increased development of houses on the sides of the hill could lead to an unstable slope.

5.2.2 Soil: Types(s) and Properties

The soil type in Nadi (*eMbizane*) and Henley Dam is the deep red colour, which is pale after being dug and dried out. This soil type is known as ‘*isibovu*’⁶ to the local people and is known for drying quickly. It is best seen when the soil is newly unearthed (*see Appendix 5*) before becoming dry or brittle. Humic soils are known for not retaining moisture for an extended period (Fey, 2010). The red soil becomes visible when the soil has been excavated beyond the topsoil layer, which has a distinct brown colour that suggests high organic matter present and above-average soil fertility that can support cultivation.

This soil type is most dominant in areas with rolling hills /moderately sloped with elevated plateaus that experience high rainfall accompanied by cool to moderate temperatures (Fey, 2010). The level at which the soil becomes visible, below the thin topsoil with a humus layer, asserts that the Nadi (*eMbizane*) area is part of the ‘thin families’ within the humic group (Fey, 2010). In the Henley Dam area, the soil is a pale red indicating that it is part of the Kranskop formation. The humic soil type complexity primarily depends on the vegetation cover, which plays a significant role in stabilising the soil, as weathering in this soil type is always active and ongoing.

Humic soils, whether from the thick or thin family, are very stable if there is vegetation biomass present (Fey, 2010), which helps curb the erosion of the new soil formed during the weathering

⁶ *Isibovu* is an isiZulu word used by the local people to describe and name the red soils in their lands. The word directly translates to ‘red’.

process. The previous land use, plantations, impacted the soil, particularly the amount of moisture held, meaning the soil could dry out excessively over time. The soil in the study areas is drying excessively. This gives rise to the heavy dust (*see Appendix 8*), which is becoming a challenge for the Henley Dam residents, particularly the households along the main access road. The effects can only worsen as the land-use changes to residential because of the constant removal of the top layers of soil as construction occurs. Rapid and unnatural changes in this soil type result in an expansion and contraction of the soil particles that increase the soil's shrinkage limit. The moisture leaves the group rapidly, making the soil more vulnerable to degradation and erosion.

5.2.3 The Biomes of Msunduzi Municipality: Vegetation Types and Threatened Ecosystems

Within Msunduzi Municipality, there are two main biomes: namely the Savanna and Grassland biomes. The Vulindlela area is mainly the Grassland biome with minor extensions of the Savanna. The study sites (as shown with circles on the biome map) fall entirely in the Grassland Biome (Henley Dam), while Nadi (*eMbizane*) is on the edge of both the grassland biome and the savanna biome. This would mean that the biodiversity found in these areas (before the transformation) is diverse. It is important to note that the biomes map does not consider the current land uses, which is why Henley Dam forms part of the grassland biome area despite being transformed to agriculture (plantations) for over three decades.

Within the biomes, the vegetation types differ. The vegetation types occurring are the Midlands Mist-belt Grassland and the *Ngongoni Veld* (Figure 5.1); it is only Nadi (*eMbizane*) where two vegetation types occur. This would explain the common occurrence of *Ngongoni Veld* in part of the area and why participants in the questionnaire spoke of the need to remove deeply rooted grasses to make way for their home to prepare the site for home development. With the growing

threats of climate change, land-use change, such as the changes this research examines, and the infestation of alien-invasive plants, the different vegetation types within these biomes are being threatened. These are grouped under the threatened vegetation types categories (Figure 5.3). The threatened vegetation types maps are represented along with the biomes to show the extent of the biome that is threatened; it could be categorised as an endangered vegetation type or critically endangered.

Both the study sites are in the Midlands Mist-belt Grassland vegetation zones (Figure 5.1). The Midland Mist-belt grassland is a threatened vegetation type that is endangered (SANBI, 2015) by activities such as rapid densification (Figure 5.2). The vegetation types do not follow 'lines' or 'delineations' in the natural environment, as shown in Figures 5.1 and 5.2. During the field observation, there were primarily patches of *Ngongoni* Veld within the Midlands Mist-belt Grassland. The development of residences in Nadi (*eMbizane*) leads to a high occurrence of species diversity loss. The Queen Elizabeth Nature Reserve is shown in Figure 5.2 -Threatened Ecosystems in Msunduzi Municipality- to show the stark contrast of the area under environmental protection and the areas listed as threatened.

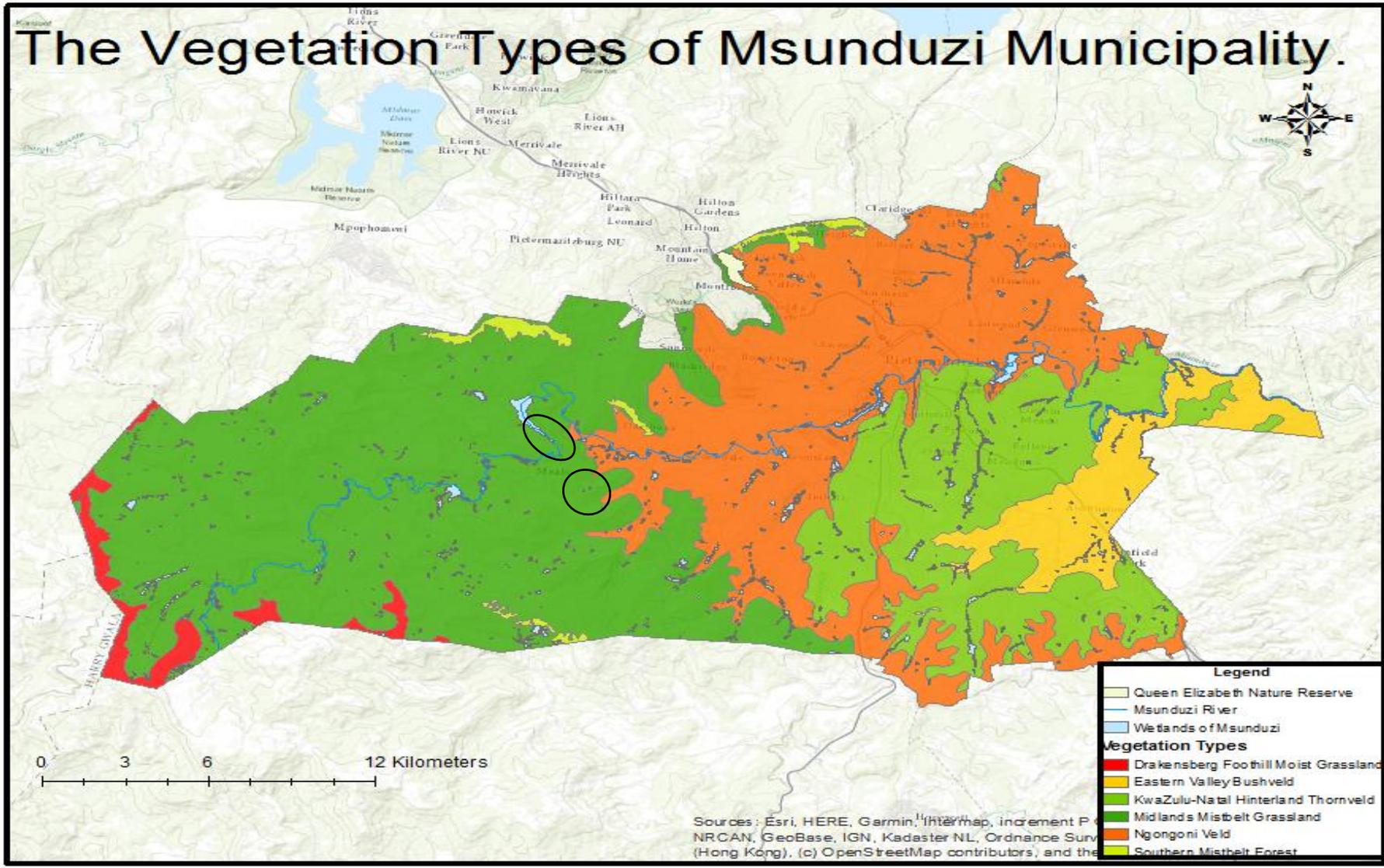


Figure 5. 1: The vegetation types found in Msunduzi Municipality.

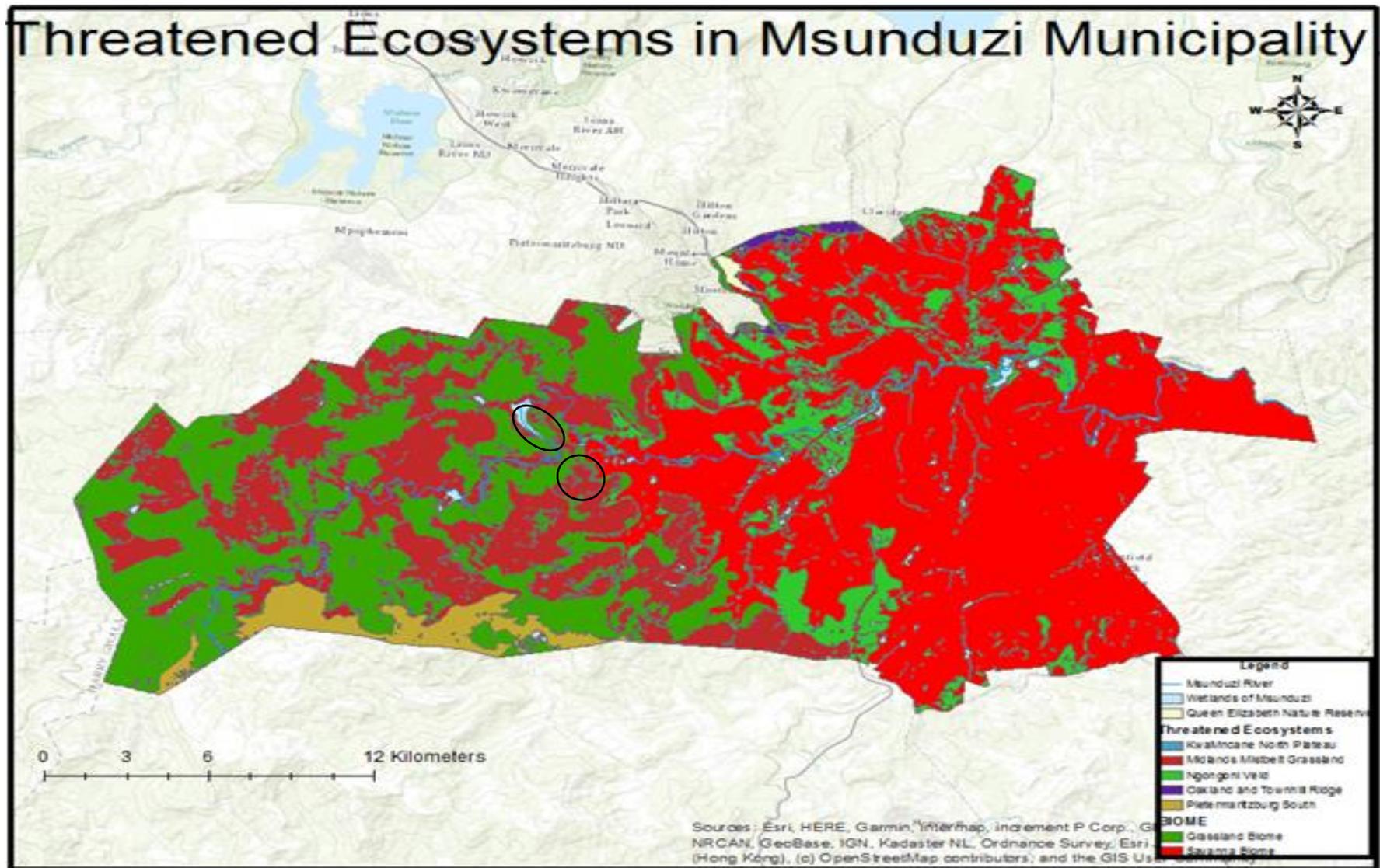


Figure 5. 2: The threatened vegetation types and biomes in Msunduzi Municipality.

5.2.4 Impacts on Natural Vegetation as a Result of Rapid Densification

The development of houses in Nadi (*eMbizane*) and Henley Dam has drastically changed the area's overall natural vegetation. The change harms the biodiversity (in the undisturbed grassland on the slope of Nadi (*eMbizane*) as the ecosystem's foundation is being interrupted. There were patches of undisturbed grasslands on Nadi (*eMbizane*) that survived around the Black wattle (*Acacia mearnsii*) plantation. The natural vegetation that is still left after the development has occurred is sparsely distributed around the houses and is mostly grass that is still part of the original grassland or has been planted.

Before the development of houses in Henley Dam, the land use was a Gum tree (*Eucalyptus*) plantation. This land-use (plantation) had a great demand for water which impacts negatively on soil moisture content. It would be expected that the presence of the plantations in the areas had an impact on the vegetation in the vicinity, such as making the environment 'ripe' for other non-indigenous species of vegetation to come into the area. However, further research needs to be conducted on the impact of previous land use and how this has already started land degradation or created a baseline of poor soil health. There is still a subtle presence of Spreading Three-Awn (*Aristida congesta barbicollis*) *ingongoni*, a tall-growing grass found in some grasslands. The common invasive species of plants present are the Bugweed shrub (*Solanum mauritianum*), sporadically spread Black wattle and Gum trees, and Lantana (*Lantana Camara*) that is most common in the Henley Dam area. The natural grassland found in the study area has deep-reaching roots that closely bind the soil together, lowering the chance of erosion and degradation (Jones, 1995; FAO, 1993).

5.3 The Governance of Peri-Urban Areas Surrounding Nadi (*eMbizane*) and Henley Dam

In South Africa, the peri-urban areas are the areas beyond the urban-suburban zone. It could be the informal residential areas outside the city as described by Torres (2007) or further away beyond the townships, such as in the case study location, Nadi (*eMbizane*) and Henley Dam. South African peri-urban areas are different because the development in these areas, such as Nadi (*eMbizane*) and Henley Dam, is informal and similar to the development of residences in the rural hinterland as described by Ravertz *et al.* (2013). However, the rate at which the development occurs is faster.

5.3.1 Leadership: Traditional Authority and Municipal Dual Governance

Within the Vulindlela Local Area, there are different traditional authorities. The study areas, Nadi (*eMbizane*) and Henley Dam are part of KwaMnyandu within the *INadi* Traditional Authority area (*Induna Nxumalo*, 10-11-2018). Gough & Yankson (2006) discussed how in certain countries such as Ghana and Zimbabwe, peri-urban land is most likely to be under customary rule. This is the case in Nadi (*eMbizane*) Henley Dam areas. There are two governance systems (Nyarko & Adu-Gyamfi, 2012) in practice in the area; there are the councillors and the traditional council leadership under *INKosi Zondi* (*Induna Nxumalo* 10-11-2018). *INKosi* has several *izinduna* that serve in the council. The portfolio description for *izinduna* is: placing people, following customary law(s), allocation of land for people from out of the community as community mediators and drafting letters to institutions such as banks in addition to having a seat in the Traditional Council (*Induna Nxumalo*, 10-11-2018).

Dual governance in Nadi (*eMbizane*) and Henley Dam seems to be a concept that exists in theory, as the general functions of governance are polarised. In practice, governance or inter-governance in the areas of Henley Dam and Nadi (*eMbizane*) contradict the assumption of

Holzinger *et al.* (2016), which states that governance is the organisation and rules that are in place which should ideally assist the decision-making process and regulate behaviour for the collective, which seems to be absent in the areas of interest in this research. There is no consultation about the land allocations between the councillors and *induna* (Councillor Zondi, 09-11-2018) as that mandate sits with the Traditional Council. The lack of unity within the dual governance structure in Nadi (*eMbizane*) and Henley Dam leads to a disjunct approach to governance, particularly land-use management.

The two groups of actors in the governance of Nadi (*eMbizane*) are charged with separate mandates related to land and its management. This alludes to what Allen (2003) discusses about overlapping institutions, particularly in African countries, where traditional authority and state law have different roles to play. The traditional council allocates land in the *Kwa Mnyandu* area within Vulindlela under the Ingonyama Trust Board overseen by different *inkosi*. The municipal counterpart's mandate is mainly land use management and service delivery (Sim *et al.*, 2018). The leaders in Henley Dam and Nadi (*eMbizane*), the ward councillors and the *induna* are overwhelmed by the rate at which the land-use change is occurring.

There is a constant emphasis on the lack of communication and working together between the municipal councillors and the local traditional council regarding matters of land allocation. This could translate directly to the increased land availability as allocation is up to the *induna's* discretion. There seems to be a trend showing no consultation with the land allocations guidelines that COGTA had put together to assist the *induna* with identifying areas of social and ecological importance, such as burial sites and rivers. Residential encroachment on steep slopes in Nadi (*eMbizane*) and near the Msunduzi River in Henley Dam serves as an example of how the land allocation guide's implementation and consultation are not practised. The 'miscommunication' directly affects issues like the carrying capacity of the land, natural

vegetation cover and, subsequently, service delivery in the areas of Nadi (*eMbizane*) and Henley Dam (Councillor Zondi, 09-11-18).

5.3.2 Land: The Process of Allocation and Acquisition

There has been a noticeable increase in people interested in acquiring land in traditional authority areas or *emakhaya*⁷. The Kwa Mnyandu area is experiencing a high percentage of growth/development, proving popular with people looking for land to build on (*Induna Nxumalo*, 10-11-2018). This is an example of diverse land tenure systems, particularly in countries with indigenous people on communal lands (Diaz-Chavez, 2006). The allocation and placing of people on the land are done after the individual or family approaches the *induna* to ask for any available land. Alternatively, people purchase land from individuals and then approach the *induna* to complete the process of being placed on the lands of *INkosi* by paying the placement fee followed by the formal placement ceremony (*Induna Nxumalo* 10-11-2018).

The access to land in Henley Dam and Nadi (*eMbizane*) has evolved and mainly becomes private. An increased number of people purchase directly from an individual or purchase from the *induna* who sells plots after subdividing the land. This would mean that the land allocation is now partially in the hands of *izinduna*, and they no longer influencing the allocation trends. One can say that since the emergence of the ‘private’ land market, the areas have densified rapidly, with more people being ‘allocated⁸’ land on dangerous plots, such as too close to the riverbank and on steeper slopes. This shows the importance of *izinduna* in these processes and the risk of privatising land allocation practices.

There are two ways of acquiring land in Nadi (*eMbizane*) and Henley Dam; by purchasing it from *induna* or purchasing from an individual. These methods require the *induna* to officially

⁷ An isiZulu word that directly translations into ‘home’, meaning ‘a place of belonging’. Its origins can be traced to the time of the existence of Kwa-Zulu.

⁸ Allocated is being loosely used in this context to refer only to the transfer of land from the seller to the buyer and does not include the formal traditional allocation that is overseen by *izinduna*.

place you as per the traditional council requirements when one has acquired land within the traditional authority area.

According to *Induna Nxumalo* (10-11-2018),

“...ideally, the individual comes to me and asks for land, and I will then identify a plot of land that can be allocated to you. Other times people buy from individuals and then come to me to pay the fee required to be placed on the land that belongs to *Inkosi*”.

This links directly to the issue of availability along with the access to land in the peri-urban areas. Once there has been an established land market, regulating the access and acquiring of land becomes difficult as the privatisation of land, where the transfer of deeds and ownership is not required, can go unnoticed within the regulatory system. Gough & Yankson (2006) present a case of land allocations in the Ghanaian peri-urban areas where land is planned through the county. This example's allocation of land differs entirely from Nadi's (eMbizane) norms and Henley Dam. In Nadi (*eMbizane*) and Henley Dam, “the councillors do not get consulted or involved in the allocation of land. That is only the *induna*” (Councillor Zondi, 09-11-18). In the Ghanaian example, there is an office for land allocations, and it is overseen by both the county officials and the traditional leaders. The land management practises example limits a situation where one management authority feels powerless and fosters cooperative leadership and governance.

5.3.3 Municipal Plans and Objectives for the Areas

One aspect currently not well captured in the Spatial Development Framework is the changing landscape of the peri-urban areas around the city. The plans do not reflect the change level that informality (Figure 5.3) brings into the city. The SDF, therefore, cannot quantify the ripple effects of the change in terms of environmental consequences such as land degradation. Secondly, the Vulindlela Local Area Plan Spatial Framework lays down the Vulindlela Local

area's plans. The areas experiencing a high increase in population and residential property density where Henley Dam is listed as one of those areas (Msunduzi Municipality 2016). The local area plan still shows the peri-urban areas as open spaces, whereas they are now under residential development through the traditional authority land allocation process. This shows the lack of cadastral information and data and the disjunct in transferring data from the traditional council to the municipality. The framework acknowledges the challenges on the rise in the Vulindlela Local Area, particularly in Henley Dam. Issues such as the changing population dynamics and the land allocation systems have led to establishing high-density residential areas with no control mechanisms (Msunduzi Municipality 2016). The plan acknowledges these challenges but does not as yet contain planning instruments to address these challenges.

The Spatial Development Framework of Msunduzi Municipality Framework has not yet been updated to include the increased residential development and density in Henley Dam and Nadi (*eMbizane*). The areas circled in black show the study areas and how they are still presented as open spaces (agricultural or otherwise), suggesting that the areas have not experienced any land-use change (transitioning from agriculture areas or plantation to a residential area). Nadi (*eMbizane*) is represented as grassland that features an opportunity for Msunduzi Municipality to include it as a Major Open Space (Figure 5.4).

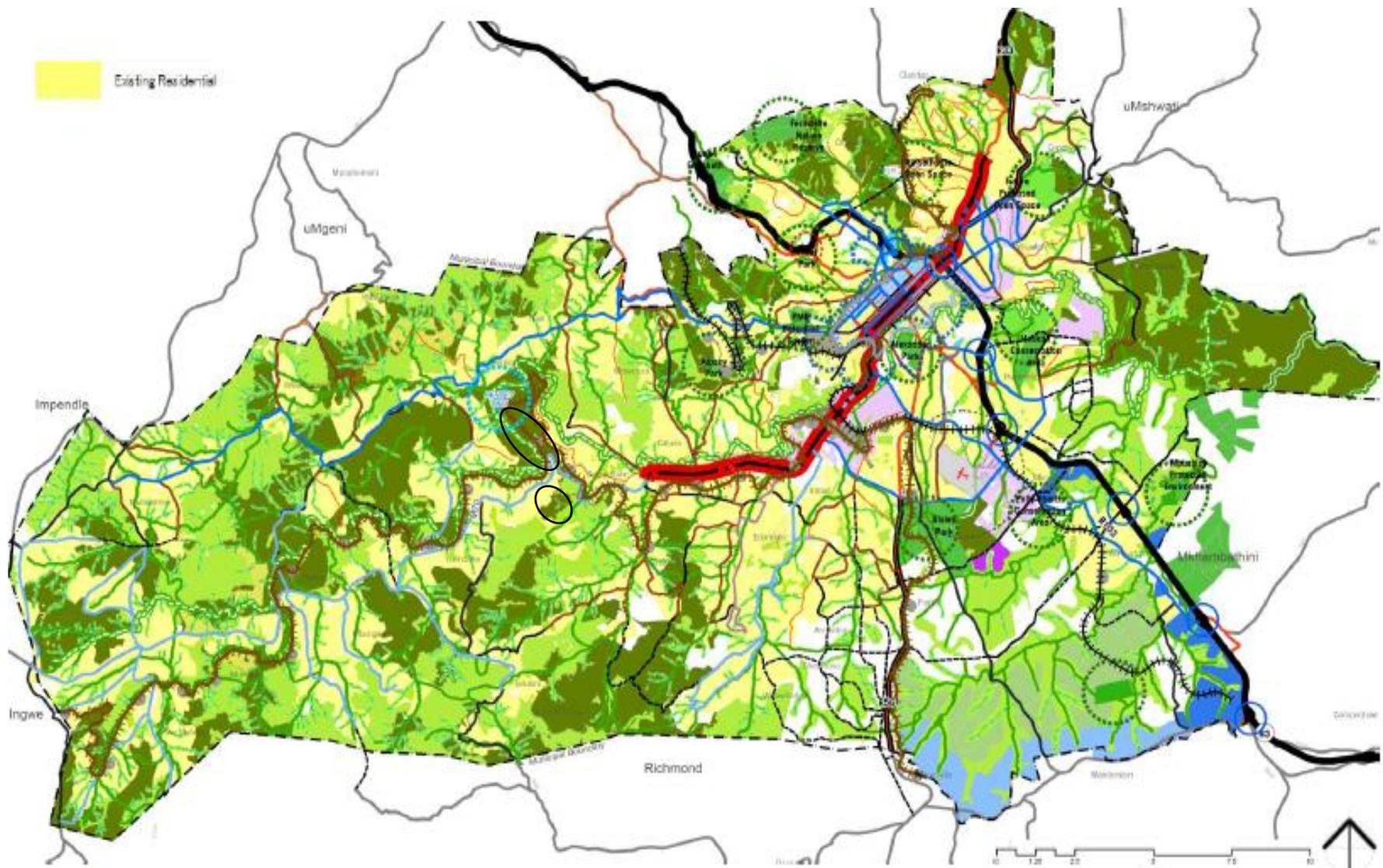


Figure 5. 3: The SDF showing existing residential neighbourhoods within the Municipal boundary 2015. (Source Msunduzi Municipality).

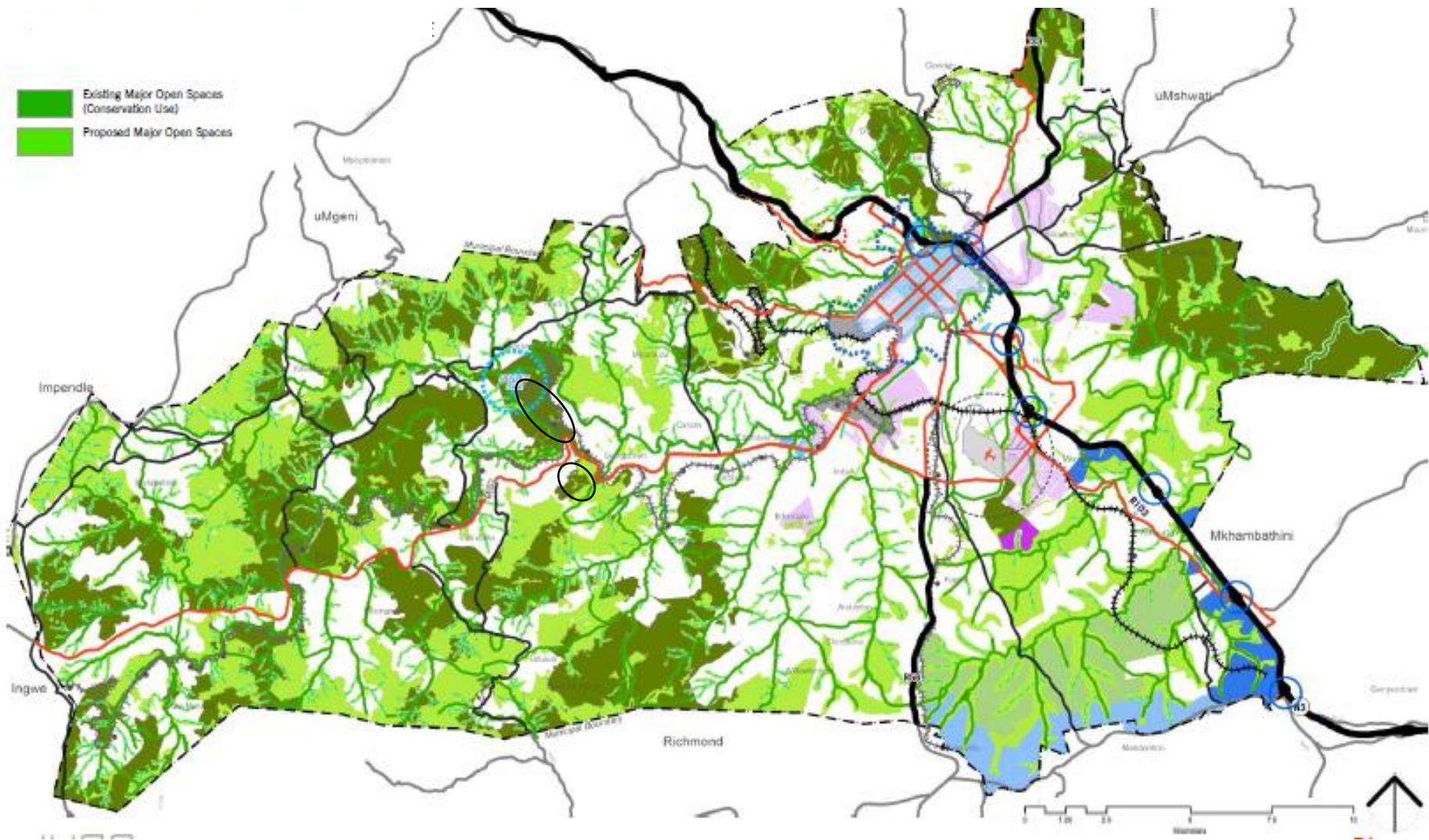


Figure 5. 4: The existing Major Open Spaces and Proposed Major Open Spaces for Msunduzi Municipality 2015. (Source Msunduzi Municipality).

5.4 Social Processes Driving the Land-use Change in Nadi (*eMbizane*) and Henley Dam

People's relations with the environment and values on the land impact how they see the land. The fundamental themes break down the overall understanding of the land access dynamics and views on the environment. These views may be personal or shared.

5.4.1 The Movement of People to the Peri-Urban Surrounds

The most prominent pull factor in the peri-urban areas of Henley Dam and Nadi (*eMbizane*) is affordability (Respondent: 05 10-11-2018; Respondent: 09 10-11-2018; Respondent: 18 15-11-2018; Respondent: 20 15-11-2018; Respondent: 24 16-11-2018; Respondent: 27 16-11-2018 & Respondent: 29 16-11-2018). It is observable that about 27% (overall) of the respondents to the questionnaire survey cited the affordable rates at which the land in these areas can be purchased. It is also very noticeable that affordability is most prevalent in the Henley Dam area, where the emerging lifestyle has been described as a duplication of the areas where the residents used to live, such as suburbs and townships. This portrays a picture of uniformity in the 'class' (middle class) of people choosing to buy land in Henley Dam and build houses there.

There were variations in other reasons that prompted the move to the peri-urban areas for Nadi (*eMbizane*) and Henley Dam areas. Figure 5.5 presents the pull factors that the people mentioned when asked about the reasons that led to them living here/what attracted them to Henley Dam and Nadi (*eMbizane*). The pull factors shown in Figure 5.5 below show the different values placed on the land as a resource and how the two communities interact and relate to the environment that chose to purchase land in the study area and settle on it. Living or building a home in the traditional authority areas (peri-urban) comes with the convenience of saving time and money. This is because various processes are skipped when buying land to

build in these areas. The need for approved plans and hiring specialists such as surveyors and engineers are redundant; therefore, people save time and money, which allows them to invest more in their homes. This means they can build the home they had dreamed of (Respondent: 17 14-11-2018; Respondent: 19 15-11-2018; Respondent: 25 16-11-2018). The risks to this practice are that these building regulations and norms are ignored until something happens to the structure (house), which can take many years to physically manifest for the people to see.

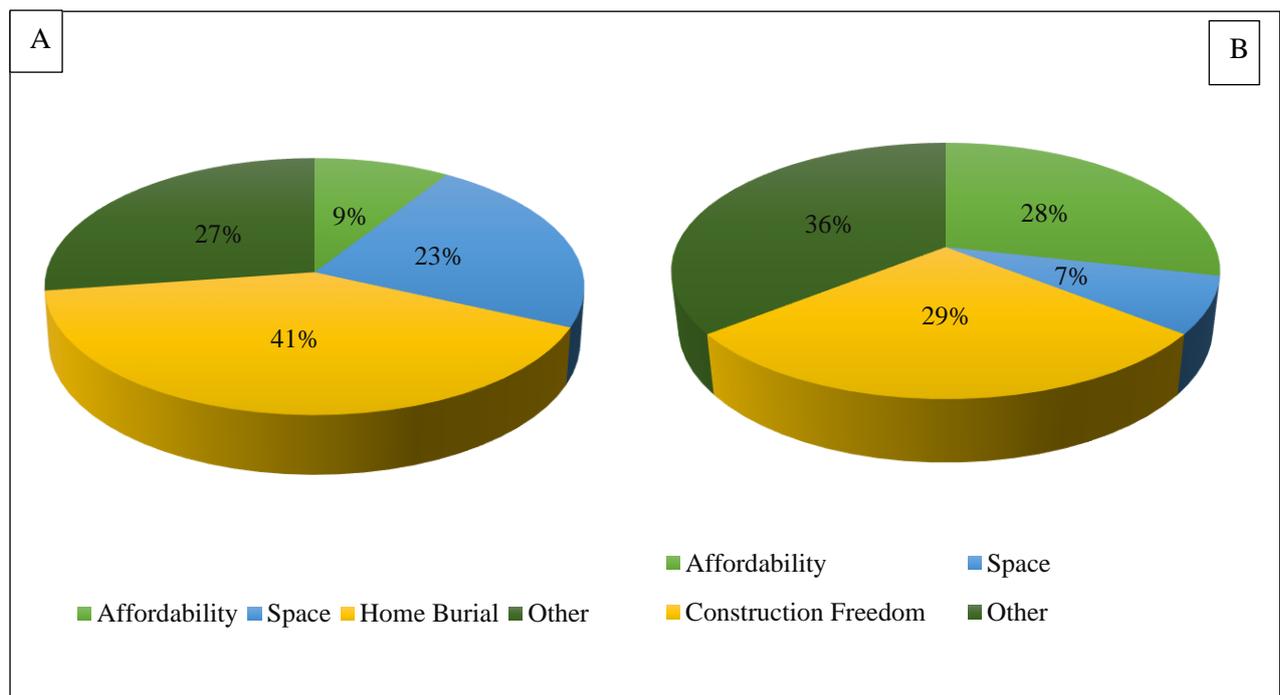


Figure 5. 5: The pull factors of Nadi (*eMbizane*) (A) and Henley Dam (B).

The issue of space is a recurring theme in both the Nadi (*eMbizane*) and Henley Dam areas, but the percentage of the respondents that cited ‘space’ as a pull factor differs by at least 16% (Figure 5.5) and that can be linked to the idea of a sense of space. The plots in the Henley Dam area are usually smaller in size. That can be linked to subdivisions of plots to sell privately. In the Nadi (*eMbizane*) area, subdivisions are generally not practised and purchasing a ‘double plot’ is often encouraged. The standard plot in the new area of *eMbizane* referred to as Nadi (*eMbizane*) in this study is 30m x 30m (Community Elder 11-11-18). A double plot means those dimensions are more significant and allow more space to build the desired structure or home.

The issue of home burials links closely with space, lifestyle and socio-ecological relations. Burials at home in the Henley Dam area are not routinely practised. This could result from the land ownership dynamics where Umgeni Water holds the title deed, which may deter people from practising home burials and the lifestyle led by the people in the area. People that are moving in are more urbanised. They have urban lifestyles that they are accustomed to, which is then replicated when they move to the area.

The transfer of lifestyles from urban areas to peri-urban and rural hinterland areas is linked to the types of houses built, the degree of environmental concern during/after construction, and the degree of construction freedom that comes with the change in 'neighbourhoods'. The number of years in which the two communities have been established differs slightly, and that shows in the percentage of people in these communities that have fully embraced living in Henley Dam and Nadi (*eMbizane*). Henley Dam is the area that has seen the most development (land-use change and transformation) in the last ten years, and that change directly affects the natural environment and, subsequently, the people in the long run.

When closely identifying the potential pull factors for the peri-urban areas, it is apparent and distinct that the housing status majorly influences the movement into the areas in South Africa. This alludes to access to the property market (includes land) and the costs attached to being part of that market; this speaks to the initial access and continued 'maintenance', particularly regarding municipal rates. The cost of living in peri-urban areas like Henley Dam, Nadi (*eMbizane*) and parts of eThekweni Municipality is reduced significantly by the provisioned free basic service such as water and not paying rates and taxes to the municipality (Sims *et al.*, 2018). In basic terms, peri-urban development and the process of sprawl that results in an expansion of residential areas that are unplanned into areas that have been zoned for other land-uses, such as agriculture, reflects Ravertz *et al.*'s. (2013) diagrammatic representation of why urban areas expand (*see Appendix 2*). In the context of Nadi (*eMbizane*) and Henley Dam, the

economy, infrastructure and housing are prominent and permeate through all the questionnaire responses.

Furthermore, there is a noticeable shift from the belief that people (particularly those of a particular economic class) are pushed towards the urban areas, are now pulling people towards the peri-urban or rural areas. In other words, a form of counter-movement to the traditional patterns of urbanisation. The distances travelled to the urban centres for services and work are increased. However, because of the improved infrastructure in terms of roads and continuously improving public transportation that Ravetez *et al.* (2013) speak of, moving outwards is easier. In short, what pushed people out of the areas (around Nadi (*eMbizane*) and Henley Dam as these are new areas) is now pulling them back into the area.

An additional pull factor to the peri-urban areas is having a second home that allows one to connect into the lifestyles offered in the peri-urban areas and connect into the urban lifestyle in the townships, suburbs and the inner city. The responses show a direct relationship that can be observed when looking at the years that the household has been present in the area and whether there is a second home elsewhere.

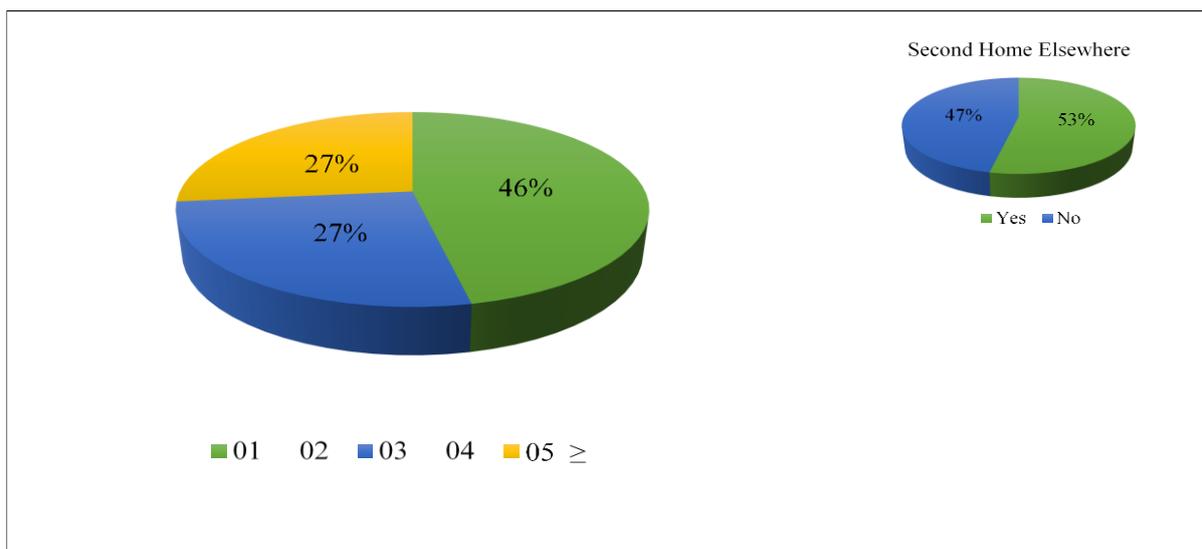


Figure 5. 6: The number of years living in Nadi (*eMbizane*) with an insert of the percentage of homesteads that have a second home elsewhere.

There is a variation in the development rate in the study areas; this also translates into the number of years that the homesteads have been there. The variation links to the direct relation observation mentioned above; a trend is observable that shows that in the Nadi (*eMbizane*) area (Figure 5.6), there is a higher prevalence of having a second home in central parts of Pietermaritzburg and the surrounding residential areas.

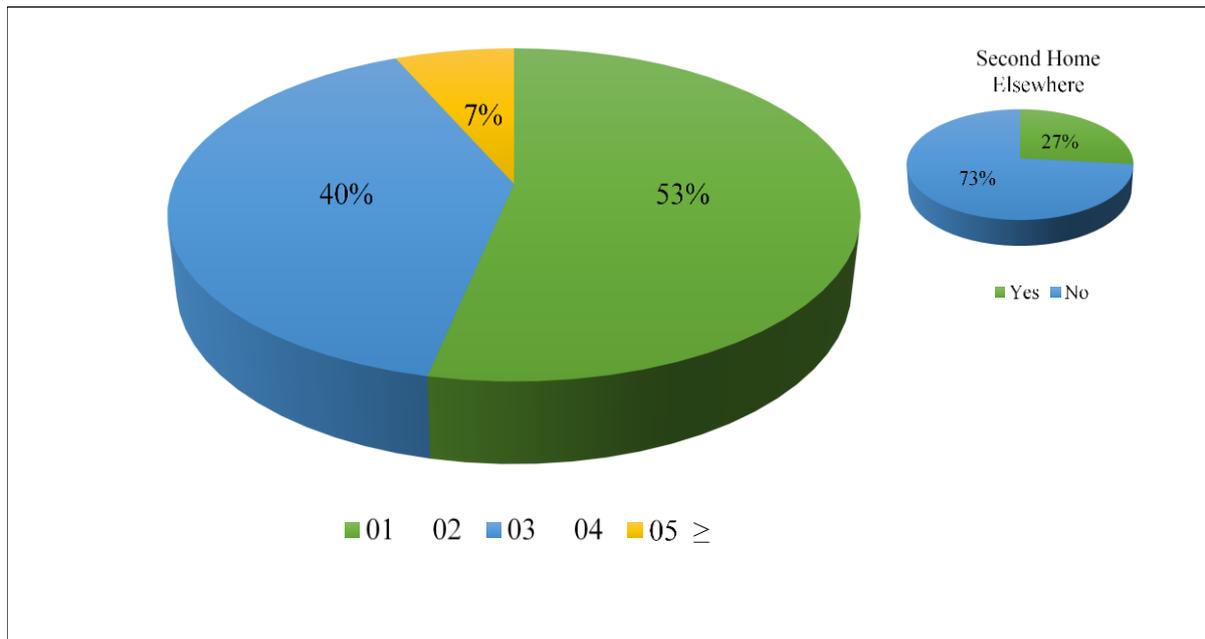


Figure 5. 7: The number of years living in Henley Dam with an insert of the percentage of households with a 2nd home elsewhere.

In contrast, only 27% of the respondents have a second home elsewhere in the Henley Dam area. Those are mainly the households that are partly still being constructed (Figure 5.7). This also alludes to how long the developments have been going on in Henley Dam. This has been since 2007, while in Nadi (*eMbizane*), the development of residences has been going on after 2010 with an increase in the development after 2014.

5.5 Social and Environmental Changes in Nadi (*eMbizane*) and Henley

Dam

The change observed in Henley Dam, and Nadi (*eMbizane*) sites are the land-use change. From predominantly agriculture, within the dispersed settlement patterns of a rural area, to highly dense (Henley Dam) residential areas, that have partially led to the cutting down of the Black Wattle plantation on the slopes and completely changed the land use (Henley Dam). The development of residences in Nadi (*eMbizane*) and Henley Dam change the land use in terms of what is observable or seen.

The way the plots are prepared for construction results in the land-use change pattern that is dangerous and not sustainable. This is because of the methods used to prepare the site and the extent of vegetation cover removal. In Nadi (*eMbizane*) and Henley Dam, the popular way to prepare a plot of land that has been allocated is the use of a Tractor Loader Backhoe (TLB) for deep excavation of the soil (Figure 5.8). This method's popularity is influenced and increased by the slope in these areas and the need to create a level plot that will support the development of a house.

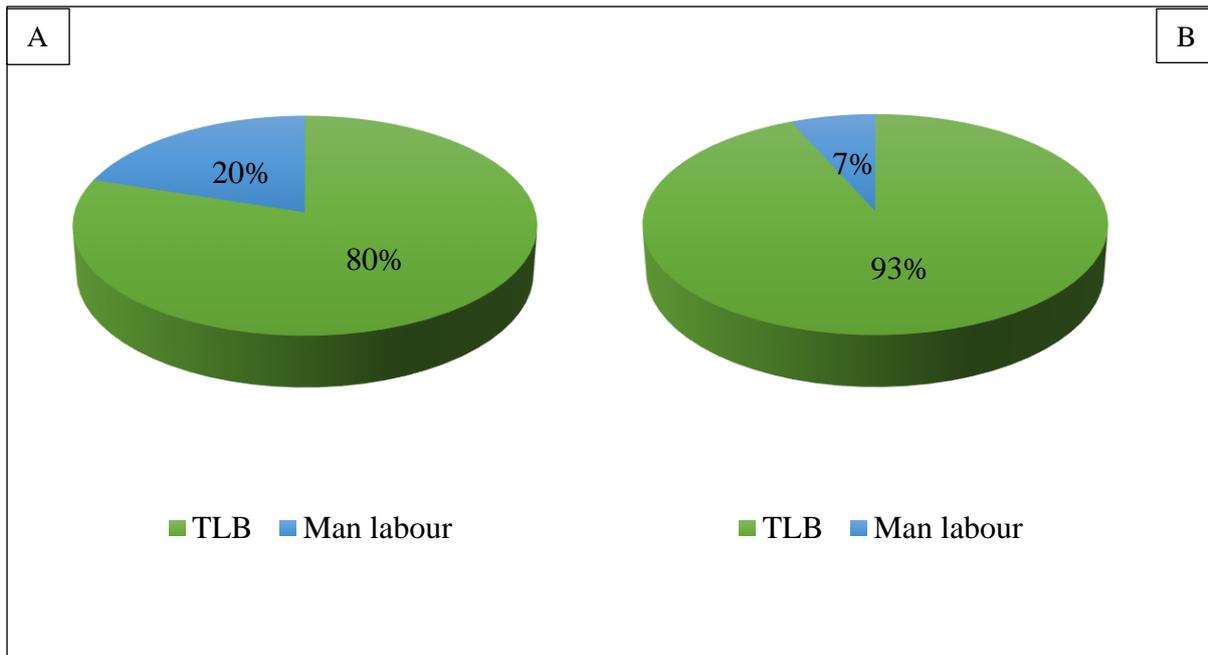


Figure 5. 8: The different methods of plot preparation techniques used in Nadi (*eMbizane*) (A) and Henley Dam (B).

Moreover, the representations above show households' results that utilised minimal excavation methods of plot preparation versus the deep excavation using a TLB. As shown in Figure 5.8, there is a vast variation of soil deposits that are produced or excavated during the different preparation processes. In Figure 5.9A, manual labour entails digging trenches where the house will be located, as depicted below. In contrast, in B, the site was formed using the TLB's deep excavation, which creates a cut and fill platform site. Vegetation cover removal occurs in both methods; however, the extent is different. That links directly to each plot preparation method's advantages and disadvantages and the statement made above about the danger and unsustainability of the building of houses based on the method used to prepare that slope.

There is a direct link that can be made to the potential for land degradation occurring. The first indicator would be the soil disturbance followed by slope disturbance. As the plots are being prepared, the slope is being cut, which lowers the slope integrity, leading to an increased chance of soil creep, the creation of rills, and ultimately slope collapse that is a danger to the people's lives.



Figure 5. 9: Two prepared plots in Nadi (*eMbizane*) where A is manual labour method and B used a TLB.

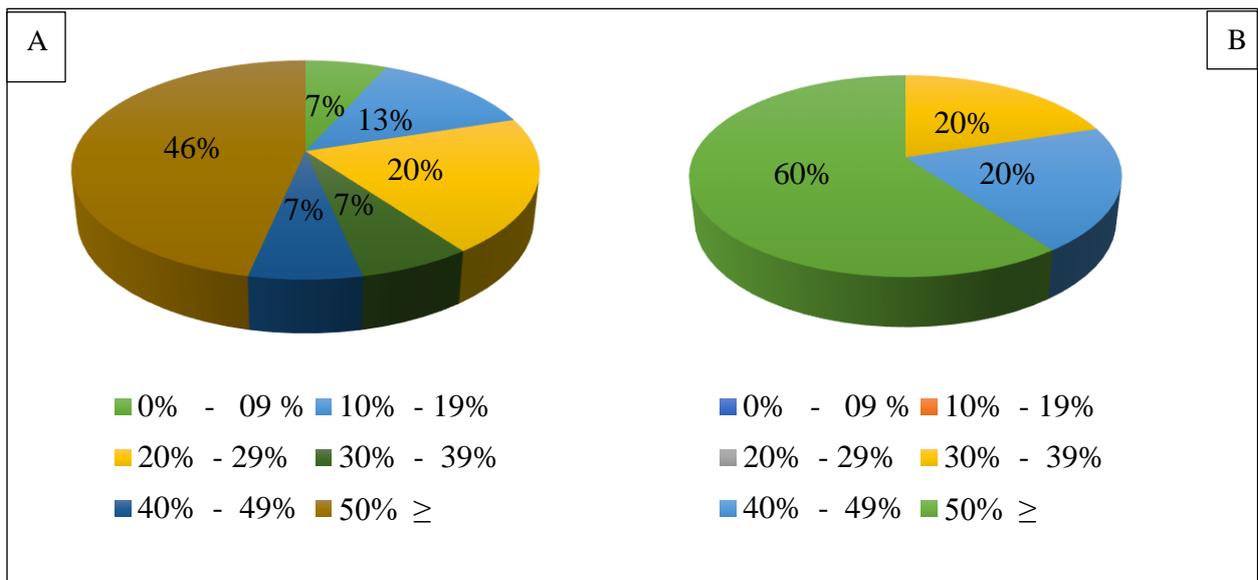


Figure 5. 10: The amount of vegetation removed during plot preparation phase at Nadi (*eMbizane*) (A) and Henley Dam (B).

The removal of vegetation is inevitable when development is occurring in an area. However, the extent of vegetation cover removed varies based on the preparation method, as discussed above. It can be concluded that the rate at which the vegetation cover is removed in both the study sites is high. In Henley Dam alone, 60% of the respondents said they had removed more than 50% of the vegetation they found on the plot. Nadi (*eMbizane*) follows closely with 46%

(Figure 5.10). The difference in the percentage where more than fifty per cent of the vegetation was removed can possibly be linked to Henley Dam's deep exaction method's popularity. Simultaneously, a substantial number of households still utilised the minimal excavation method using manual labour.

The environmental change seen in Henley Dam and Nadi (*eMbizane*) directly impacts the environment, translating into the environmental impact that can manifest presently or over time. Climate change increases this risk due to increased storm events that lead to rapid surface run-off—the rapid removal of the vegetation cover and the constant land disturbance makes the soil more susceptible to erosion and, subsequently, land degradation. The creation of bare surfaces directly affects and impacts the amount of surface runoff after a rainfall event. There has been a change in the type of vegetation cover found in the study areas. These vegetarian cover types seem to reflect the change in land use from open grassland and agriculture (plantations). The vegetation in the areas has become domesticated, impacting the infiltration rate into the soil because vegetation such as flower beds and vegetable gardens do not cover the soil completely. This adds to the risk of increased soil erosion and the manifestation of land degradation features such as gullies.

The rate of change in Henley Dam and Nadi (*eMbizane*) is closely related to the value that the people moving into these two areas place on the land they buy or get allocated. The land allocation is primarily informal and mainly not regulated by the municipality nor the traditional local authority of the *INadi* Tribal Authority. In Henley Dam, it is common for one person to purchase a more significant portion (compared to the other plots of land available in the area) to subdivide the plot in future and sell it to a willing buyer. This makes it harder for the government structures in the areas to start regulating, monitoring, and planning the rate at which the development of residential houses is happening. The rate of change in the land use

of the Henley Dam and Nadi (*eMbizane*) is primarily influenced by how an individual can access the land.

5.5.1 The Trend of Change and Densification

The change and development do not have a specific trend for Nadi (*eMbizane*) and Henley Dam. However, from the aerial photographs taken in 2006 until 2018 (*see Appendices 3 & 4*), one can see where and when the areas became popular to build a home in. In some cases, this is attributed to lifestyle and lifestyle preferences revealed in the questionnaires' responses. In the Henley Dam area, the people who lived the longest are closer to Henley Dam's main road. Those closest to the dam have lived there the shortest, at most three years. The households that are closer to the main road have been living in the area for 4 to 6 years. The environment in the Henley Dam area is entirely different from Nadi (*eMbizane*). In Nadi (*eMbizane*), the pattern followed a linear pattern. Each year the number of houses built in the area was constant and increased slowly along the access roads until 2014. The reason for this pattern is linked to the allocation of land as “the available plot is allocated to a family”.

The development in Nadi (*eMbizane*) and Henley Dam areas has resulted in the repetitive disturbance of the land and soil. This means that land degradation cause is direct (FAO, 1993) and land degradation forms that are visible and are manifesting are due to the activities or land uses that are local. The nature and rate of the development in these peri-urban areas have immediate impacts on the land and paves the way for more damaging impacts on the soil/or land in future (FAO, 1993). The indicators for damage to the soil and land have already started to show in the areas. These effects have unfortunately been thought to be dismissible by the residence and homestead owners. Certain land degradation features have begun to manifest and become prominent, particularly in Nadi(*eMbizane*) due to the area's raised (steep) slope and the growing need to have plots of land prepared for the house construction using the excavating

TLB method. This makes the land/or soil more vulnerable to erosion agents such as water, gravity and wind (McGregor & Thompson, 1995).

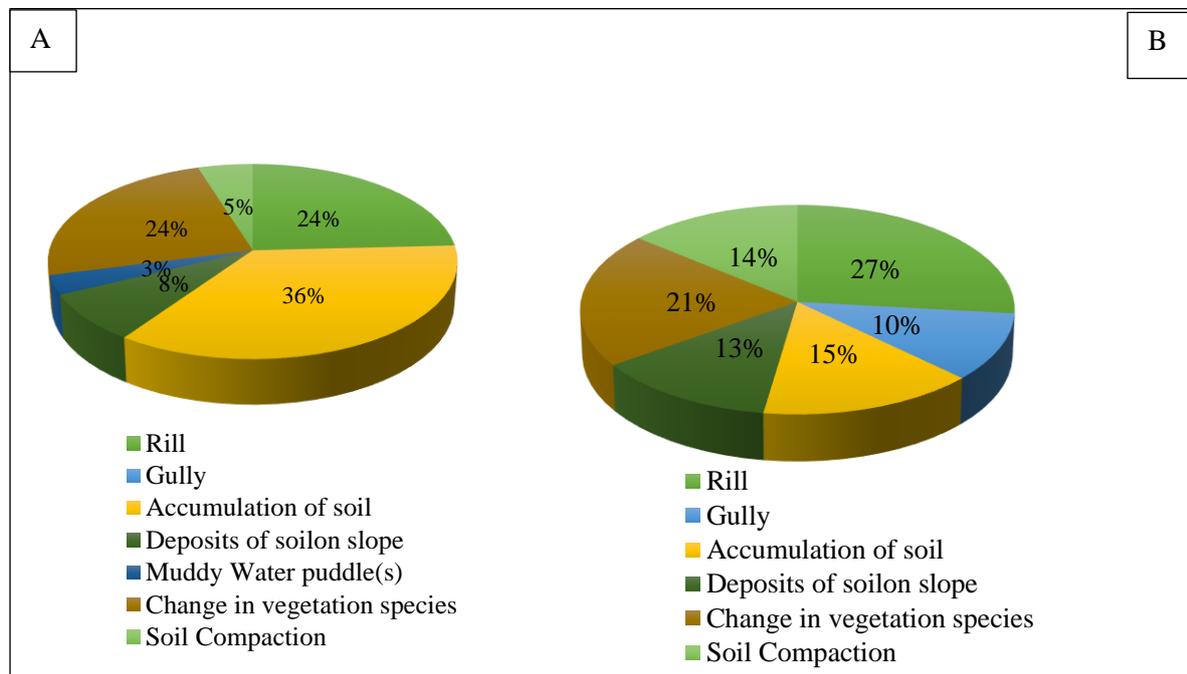


Figure 5. 11: The prominent land degradation features that were observed in Nadi (*eMbizane*) (A) and Henley Dam (B) areas.

As mentioned above, the areas' geological attributes play a significant role in how land degradation occurs, the rate and the types of land degradation features that are most prominent in the two areas. The trends in the types of environmental degradation forms that are visible in the study sites collaborate well to some extent, with a certain degree of variation, which is to be expected. In Nadi (*eMbizane*), soil accumulation is evident in the rapid movement of soil (Figure 5.11) because of the disturbances. That is an issue that some of the residents in the area have tried to respond to by building brick, stone or recycled-tire walls around the perimeter to hold the clumps of soil falling from the 'cut' (Respondent 09, 09-11-2018; Respondent 12, 10-11-2018; Respondent 15, 10-11-2018).



Figure 5. 12: Man-made interventions to hold the soil and prevent the down-slope movement of the soil. (Photograph: Cebolenkosi Zuma 2018).

There are various ways that people have tried to control soil movement from the fill slope, such as the example shown in Figure 5.12. Rocks collected during the building's excavation stage are used as wall retainers along with other household materials such as corrugated iron and poles. Some also attempt directing water around the house and away from the platform by digging furrows. This helps mitigate water impacts, especially after a heavy rainfall event (Respondent 02, 09-11-2018; Respondent 19, 15-11-2018). This reduces the impact of water on the soil and curbs the occurrence of soil erosion by water, as discussed by Liniger *et al.* (2013) and Nüsser & Grab (2002) when unpacking the types/causes of land degradation (through the active erosion agent).



Figure 5. 13: Rills and fledging gullies forming on the edge of a platform. (Photograph: Cebolenkosi Zuma).

The development of rills and gullies (Figure 5.13) allude to water channelisation as the surface flow increases. This increase can be due to the change in the climatic conditions, primarily rainfall frequency and intensity, or due to the increase of artificial and bare surfaces as homes are being built. Rapid deforestation and mass removal of vegetation cover is the primary trigger for the gradually increasing forms of land degradation that are becoming more prominent as time passes (FAO, 1993). The soil's overall permeability is further reduced (soil type naturally drains quickly) as the vegetation cover decreases. As discussed, vegetation's presence may increase infiltration rate as the surface-area increase allows for the water to go into the ground, thus increasing permeability, which lowers surface flow. An increased surface flow (FAO, 1993) in the Henley Dam area potentially leads to increased sediment load and through the suspension of load, the dam (Henley Dam) can silt up, which decreases the capacity of the dam leading to the potential of flooding (after rainfall event). This directly impacts the households built in the vicinity and low water levels to the river (Msunduzi River) going downstream.

There are very steep and deep cut-fill plots that make the land integrity weaker. The land and soil's resilience to eroding factors are significantly reduced in Henley Dam and Nadi

(*eMbizane*) (Jones, 1995). This increases the likelihood of slope failure and slope collapse, particularly when the soil becomes brittle or inundated. A number of the issues on land degradation in the areas of Henley Dam and Nadi (*eMbizane*) are linked to the change in land use which FAO (1993) highlights as a 'feature' or cause of land degradation and the change in land cover (vegetation cover which includes forests) as discussed by Jones (1995).

5.6 Emerging Socio-Ecological Relations in Nadi (*eMbizane*) and Henley Dam

The relations between the people (social aspect) and the environment are discussed as the socio-ecological relations. This aligns with the general definition of the environment, as highlighted by Nhamo & Iyango (2011). This theme seeks to bring out the biophysical aspect and the social situation (Nhamo & Iyango, 2011) to get a fuller socio-ecological perspective (the green and brown perspective). These are measured or described by using specific actions /or behaviours by the people towards the environment. Through action, negative or positive, the assumptions and conclusions are drawn to determine if the socio-ecological relationship is favourable or not. The socio-ecological relation is either low or high based on the individual and household actions and values placed on the natural environment, including land, plants and animals. Socio-ecological relation is also in ecosystem services, whether provisioning, regulating, supporting and cultural services (MEA 2005).

The socio-ecological relation of Nadi (*eMbizane*) is primarily linked to the reasons why people move into peri-urban areas (Figure 5.5), including the freedom of home burials. In many African cultures, particularly Southern Africa, there is great importance that is placed on the land, owning enough land that will accommodate the family burial sites. The issue of family burial sites falls into both the reason to move and is a cultural service that is offered by nature and the availability of land. This is likely to result in a conservative attitude towards the land. When the value of the land and environment in a household is high, the measures required to

reduce environmental degradation, including land degradation, are taken regularly. Home burials, space or land available to support smallholder farming where vegetable gardens can be started and livestock such as free-range chicken and goats can be kept (Respondent 11, 09-11-2018). This reveals the strong socio-ecological relations where people depend on ecosystem services and land to meet their social and economic needs.

The scale at which these household activities are carried out is primarily small. The organic waste is often reintroduced to the soil/land, which increases the amount of biomass grown in and around that homestead. This way, the homestead directly engages with the environment to reduce risks. Socio-ecological relations could be linked to the ‘reason to move’ into the area. However, they can also be understood separately based on individuals’ behaviour towards the environment and look at the social benefits for the people.

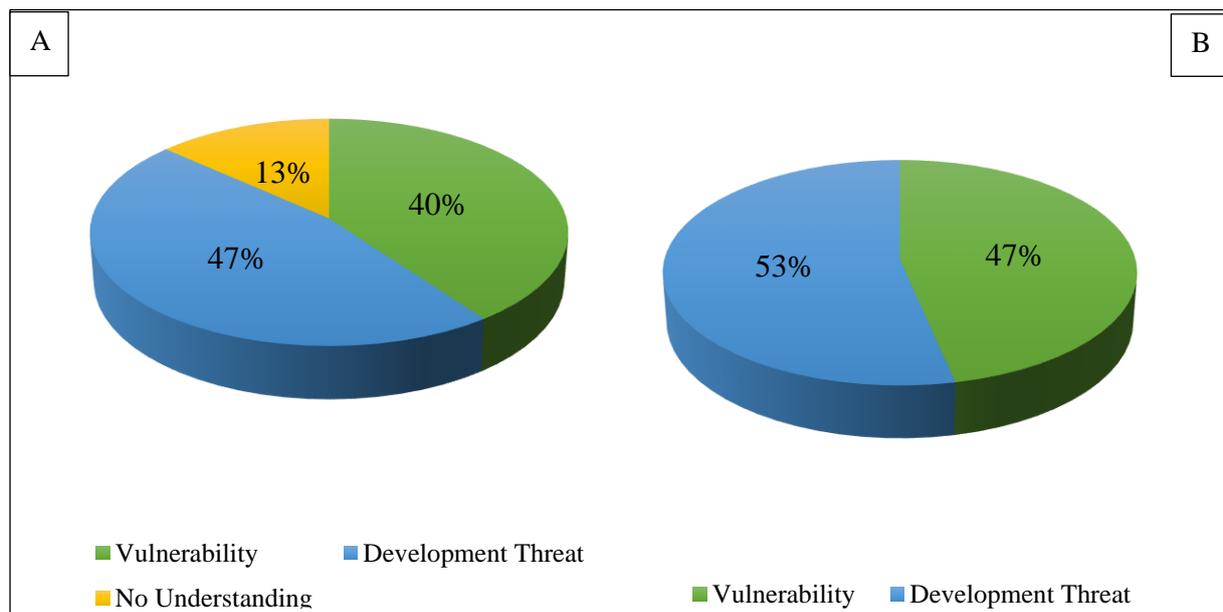


Figure 5. 14: How people understand environmental risks in Nadi (*eMbizane*) (A) and Henley Dam (B).

There are different understandings of environmental degradation, which links directly to the persons’ socio-ecological relations. Environmental risk is generally understood as an action that contributes to environmental degradation (Figure 5.14). The understanding is skewed toward the ‘causality effect’, which demonstrates the feedback loop in how the environmental

risks are perceived. This highlights and links to the green and brown perspective of defining the environment (Nhamo & Inyang, 2011). This could alter the status of the socio-ecological relations index overall. Most people understand environmental risk as caused by developments where building houses becomes a risk to the environment. Vulnerability is an additional understanding of what environmental risk is. This is when the environment is 'forced' to change by different factors, not limited only to the development of houses but also natural changes over time that may increase environmental risk.

5.7 Climate Change an Additional Burden and Loading on the Landscape

The rate of residential development in Nadi (*eMbizane*) and Henley Dam, notably in Henley Dam, has adverse effects on the environment and the ecosystem services provided by ecological infrastructure such as the grassland and the Msunduzi River.

5.7.1. The Immediate Effects of Rainfall⁹

Ecological infrastructure is vulnerable to change. The change is increased when climate change phenomena start to influence environmental change, both naturally occurring and human-induced environmental change.

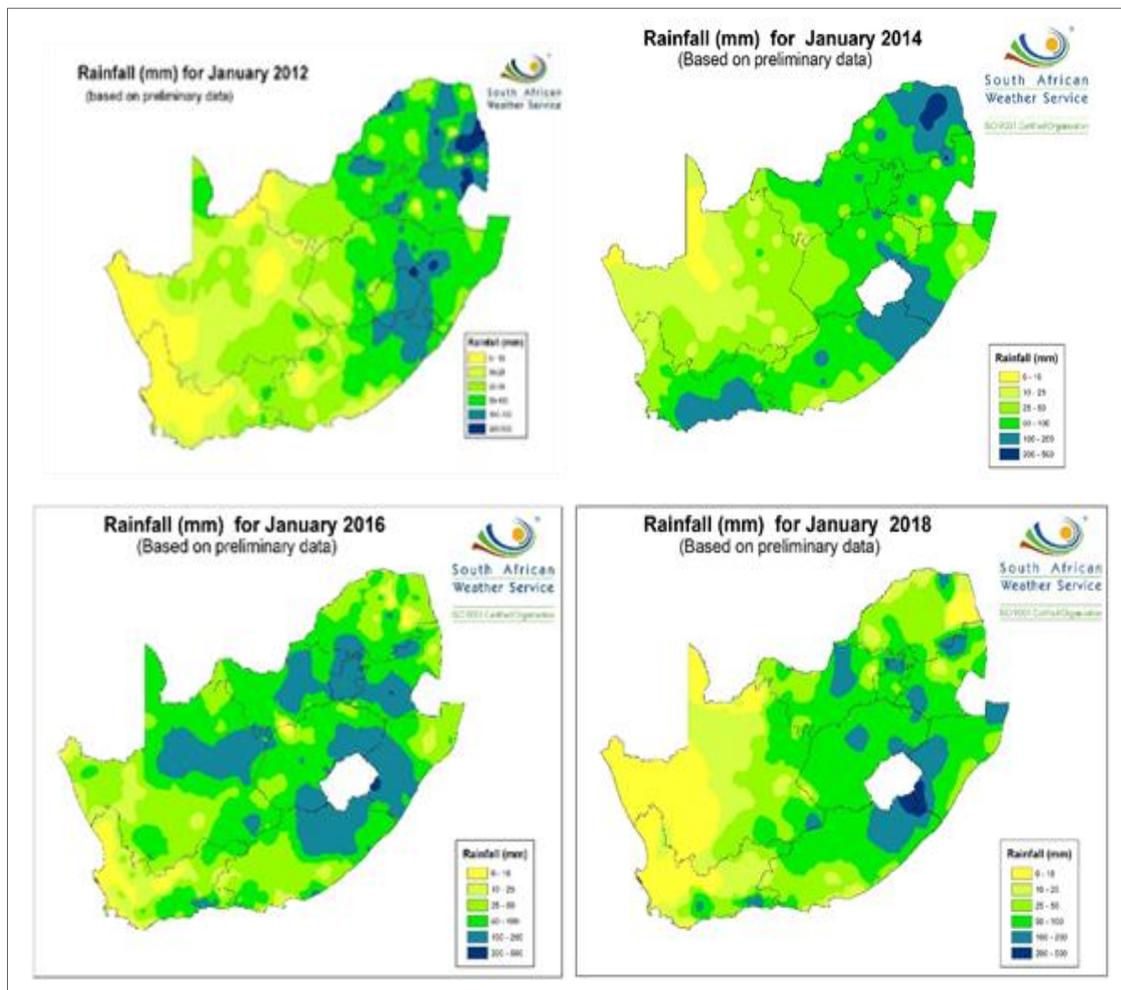


Figure 5. 15:South African rainfall maps for January 2012-2018. (Source: South African Weather Services).

⁹ As a variable of climate change.

Climate change affects weather patterns in changing weather patterns, fluctuating precipitation intensities, and increasing the frequency of storm events. Certain areas where the weather has experienced a shift become extreme in both drought and flooding events. There has been a noticeable increase in the rainfall for the area when looking at the rainfall maps over the six years from 2012 until the beginning of the rainy season in November, as shown in Figure 5.15.

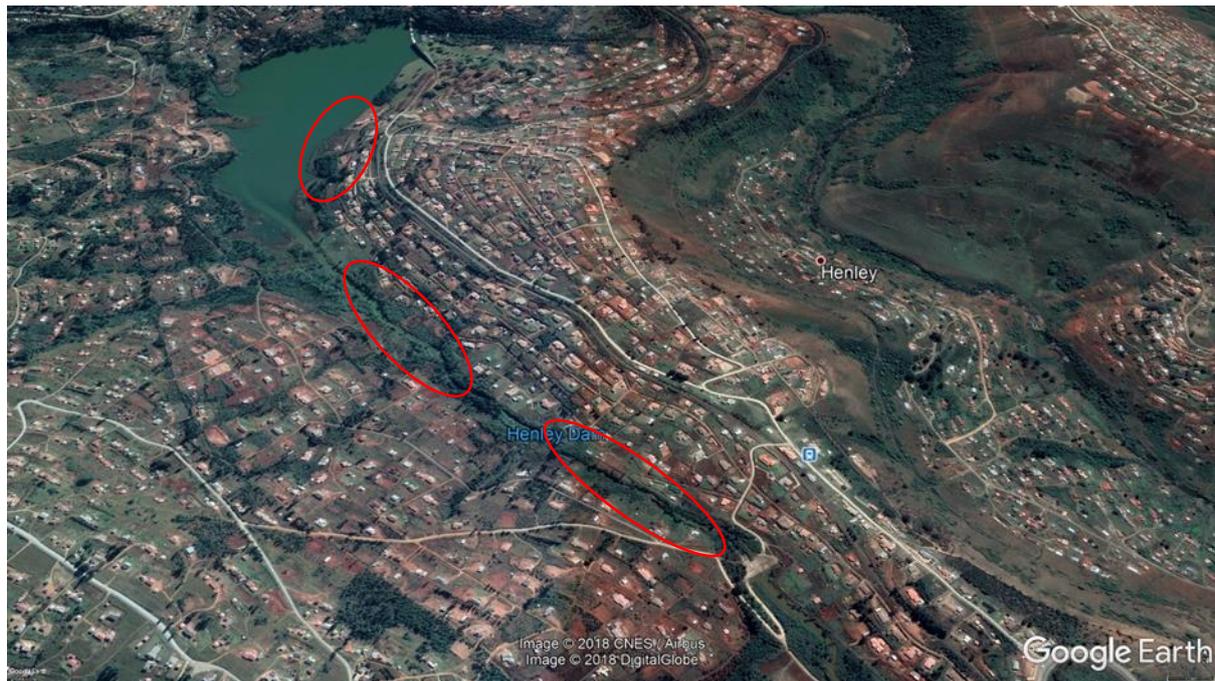


Figure 5. 16: The Henley Dam area in November 2018 as a fully developed neighbourhood with predictions of areas that are more likely to flood on the banks of the Msunduzi River. (Source: Google Earth 2018).

Furthermore, pressures of the development concerning the change in the environment of Nadi (*eMbizane*), and Henley Dam coupled together with the effects of climate change on the river system can have very negative consequences, especially for those living close to the river and near the ‘make-shift’ bridge (Figure 5.16). The risks of flooding in the area were already high, even when looking at the proximity of settlement to the river and given the areas rainfall patterns; now factoring in the effects of climate change that the SAWS maps in Figure 5.13 are showing, the risk of flooding is increased even more. A good example would be the eThekweni Municipality floods that occurred in April 2019. The South African National Space Agency

(SANSA) representation of flooding potential around the Henley Dam area at one meter and five meters assert that more than 15% of the houses in the area are likely to flood. Those fall into the area depicted by the circles in Figure 5.16. The drastic and rapid changes in density and rate of change in land use only increase these households' vulnerability and the area.

The risk of flooding in Nadi (*eMbizane*) is lower than that of Henley Dam because of the slope/height above sea-level. However, there is a risk associated with increased rainfall, namely, soil erosion and increased down-slope runoff. This is highly likely to trigger the slope's collapse should it become less stable/ or 'hollow' due to increased residential development. That has been evident in Umlazi and other parts of South Durban, where slope failure resulting in landslides and the collapse of houses has taken place because of increased rainfall, unstable soil or land and highly densified slopes (SABC NEWS, 2019). Nadi (*eMbizane*) sections most susceptible to natural disasters should include the 'stress' on the land increase, increasing the likelihood of slope failure and collapse, particularly areas that exhibit land degradation features such as gullies. Other vulnerable areas are those where there is soil creep, and soil erosion can potentially occur anywhere where platforms have been created using TLBs.

5.7.2 The Socio-Ecological Consequences of the Change

The people of Henley Dam frequently mentioned the dust problem and deforestation (Figure 5.15; *Appendix 8*). There is a concern that the freedom of acquiring land in the Nadi (*eMbizane*) and Henley Dam areas affects the environment currently and may become detrimental in the future. A respondent to the questionnaire survey (from the Nadi (*eMbizane*) area) mentioned that people have no regard for the environment regarding cutting down trees and clearing the grass. This is compounded by the practice of the community elder who sells land to the people; according to the respondent, he sells land inside the wattle forest, which means that to prepare a plot fully, one needs to clear out the forest litter, grass and trees completely. The forest might

not be as natural as it was (partially is) a man-planted forest of an invasive tree species, Wattle. However, the ground had enough mulching from the forest canopy, grass, and litter to prevent land degradation and soil movement.

When asked the question of whether people understood the environmental risks that can arise amid the rapid densification, the most prominent answer was no, which means that the goal for most of the residents is to build and build as fast as they can with the lowest cost. One survey suggested that people are aware. However, the goal to build the home they desire overrides the need for environmental and land degradation concerns.

Geotechnical Factors	Implications of Development
1. Risk of Flooding (inundation)	Development on a flood plain; 1 in 50years.
2. Slope Instability	Risk of soil creep, slumping or slide.
3. Active , Expansive or Swelling soil	Risks to the development increase as moisture fluctuates.
4. Erodible Soils	Development impacts on the sediment load.

Table 5. 1: Prominent Geotechnical issues in the Pietermaritzburg Area & the possible implication for developments. (Source: Adapted from Richards *et al.*, 2006).

The risk of flooding (in generic terms) is most susceptible in low-lying areas near a water body, particularly adjacent to the river and Henley Dam. These geotechnical pressures or factors presented in Table 5.1 actively summarise the risks that may manifest in the study areas based on geological characteristics, which entail soil, soil type and soil characteristics (Richards *et al.*, 2006; Fey, 2010). The soil type in the area dries rapidly, which means it can potentially lack the ability to absorb water, making it more likely for flooding and inundation and slope

instability due to highly erodible soils. This links to the land degradation forms observed in the areas during the visual assessment (Figure 5.11; see Appendices 13 & 14).

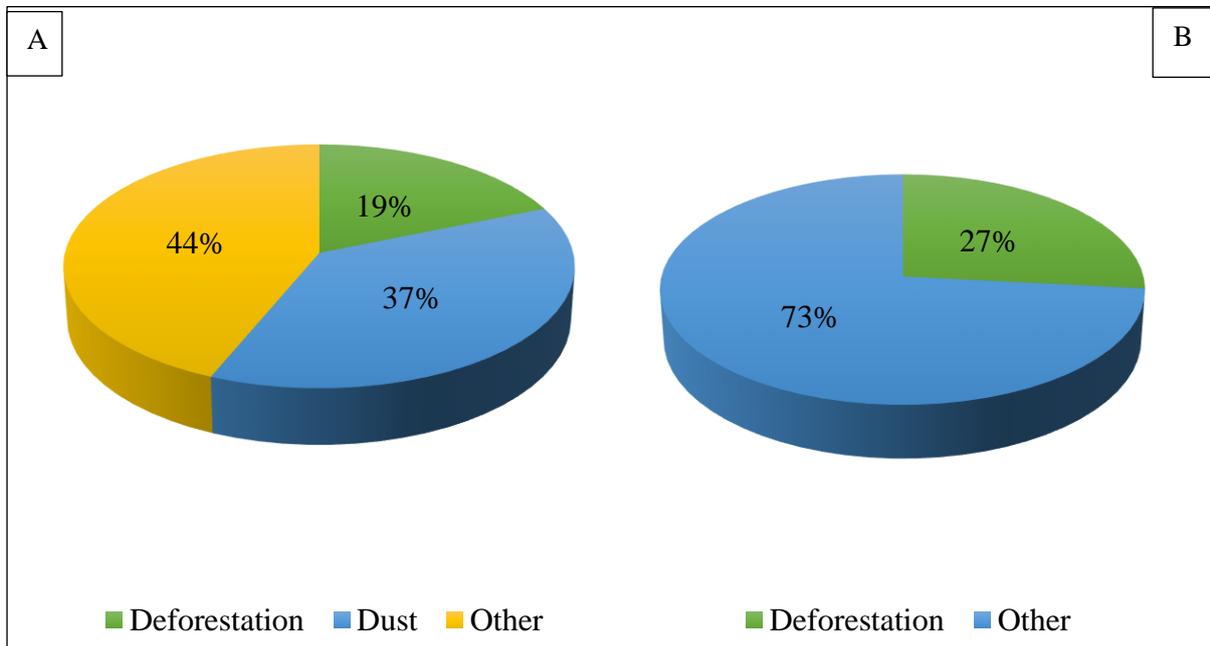


Figure 5. 17: The effects of environmental change in Henley Dam (A) and Nadi (*eMbizane*)(B).

The change seen in the environment is the increase of dust in Henley Dam (Figure 5.17), which has risen very quickly over the years. There has been an increase in deforestation to make way for building homes. Other changes that the residences have observed over time include deforestation and the removal of grasses which links directly to the increase in dust particles that are always in the air, particularly in the Henley Dam area. The increased dust particles in the air directly impact the lives of people because the air quality is decreased drastically (Figure 5.17); a respondent described the change in the environment by saying, “.... the dust is increased.... And the forest is almost completely gone” (Respondent 17, 14-11-2018).

5.8 Summary

The study aimed to link the environmental, social and physical environmental phenomena of land degradation. This was through obtaining peoples' understanding of the environment by looking at their relationship with the environment. The governance arrangements also seem to influence the trend that the housing developments are taking. The study's findings emphasised the need to consider the socio-ecological perspective when understanding issues that impact the environment and people. Environmental degradation influenced by human activities does not allow the ecosystems to recover, therefore lowering ecosystems' resilience, increasing the likelihood of land degradation. Over time, the degradation features that are starting to form in Henley Dam and Nadi (*eMbizane*) will become aggravated, and it will be harder to control or rehabilitate them.

Chapter 6 Recommendations and Conclusion

6.1 Introduction

The peri-urban areas are changing rapidly. This results from an increase in the demand for land and housing and the other socio-economic pressures in society. The rapid change in peri-urban areas challenges municipalities' spatial planning and increases environmental risks (locally and downstream). Governance structures and cooperative governance are at the core of limiting and controlling these areas' sporadic development. This chapter will evaluate the research findings and propose a set of recommendations for a way forward.

6.2 Evaluation

The study's main aim was to find out why there has been a steady increase in the development of houses in the peri-urban areas of Nadi (*eMbizane*) and Henley Dam, located on the outskirts of Pietermaritzburg, Msunduzi Municipality in KwaZulu-Natal, South Africa. The research focused on the nexus of rapid peri-urban densification, environmental change, land degradation and socio-ecological risk.

The study's first objective was to investigate the situation at Nadi (*eMbizane*) and Henley Dam regarding the rapid development of houses within Msunduzi Municipality. The factors that are driving the densification of these peri-urban areas were identified and outlined. The research established that the trend is influenced by affordability and availability of land and the choice of a peri-urban lifestyle, with all the benefits it offers. The change in land use has a linear development pattern.

The study's recurring background theme was the potential impacts of the change in land use on the environment, particularly land and soil erosion. This objective aimed to use *Google Earth* images and field observations to identify the impacts and effects of land-use changes on the

land. The responses to the questionnaire supplemented this. From the images, the issue of increased run-off because of the clearing of vegetation impacted the dam (Henley Dam), impacting the water levels in the Msunduzi River. There were instances whereby it was visible that the soil particles were being carried down into the river as the colour was visibly brown, which suggests sediment load (usually after a rainfall/storm event). The loss of open spaces and their associated ecosystem services also makes the two areas more susceptible to erosion and land degradation. The observable trends of densification in the areas of Henley Dam and Nadi (*eMbizane*) are different. As discussed in Chapter 5, the areas seem to be 'attractive' to different people. The push & pull factors impact the different trends that are observable from *Google Earth's* satellite imagery. This was substantiated from the evidence provided by household members that completed the questionnaires. In Henley Dam, the land development trend started off by following the road (meaning available infrastructure impacted the trend). Because of the emergence of the 'informal land market', subdivisions of land made the trend more sporadic, with no apparent pattern post-2014. Nadi (*eMbizane*) has a land development trend that mostly follows the availability of more suitable land for development as access to land is still largely 'controlled' and managed by the traditional authority.

From the images that were sourced from *GOOGLE Earth*, the topography of the study areas was analysed. The information from the images and the observation notes from the fieldwork phase enabled conclusions to be made about the vulnerability of the areas to further land degradation. The study revealed land degradation features that have already started to show. The Basic Visual Land Degradation Assessment was carried out to see whether there is already any land degradation. The data collected allowed for the identification of whether there is an excellent chance that the minor feature(s) could be aggravated. This was done by analysing the information and literature on the soil types present in the study site. These land degradation

features have already begun to manifest, and the landscape (slope and aspect) is therefore susceptible to further erosion and land degradation.

6.3 Recommendations

After the case study research had been completed, it seemed plausible to present some alternatives, changes, and recommendations that could help Nadi (*eMbizane*) and Henley Dam not get worse. The recommendations are mostly centred around the issues of governance and planning, which were the prominent issues during the study. They are vital in reducing the effects of change on the environment and possibly evading severe land degradation in the future. The recommendations presented below are recommended to be implemented for the areas where the case study research was carried out and in other peri-urban areas that are experiencing rapid land-use change and unplanned residential developments in South Africa.

6.3.1 Governance

The governance structures in the area are working in silos. Therefore, there is a need for the Department of Co-operative Governance & Traditional Affairs (COGTA) to engage with leaders that are part of the “dual governance” in the area to foster good governance, integration and cohesion that will benefit the people and the environment. This can also include formulating a law, customary or hybrid (include customary law and modern civic laws) that govern how the land can be acquired in the peri-urban areas. It is advisable to carefully control the transfer of land (private sales) between two individuals. One way of controlling that is through ensuring that when one wishes to sell the land, the *induna* should be made aware of this process and should be required to give his consent.

Furthermore, one area that seems to be lacking in understanding the different mandates of the municipal leadership (councillor) and the Traditional Council (*iNkosi, induna*). This presents an opportunity for COGTA and the municipality to have workshops and training with the

councillors that have Wards within the Ingonyama Trust area to understand the municipality's mandate to manage and control the land use within the municipal boundaries. This would help reduce the occurrence of informal land-use change and reduce the risks of land degradation occurrence. It would also be advisable to get both the Traditional Leadership and the Councillors in 'one-room' to revise the principles that 'guide' the allocation of land and how the two leadership forms can support each other.

6.3.2 Planning

The rapid densification of the area is the first indication that planning has not occurred. This presents a need for a monitoring mechanism for the rate of change, particularly the previously demarcated areas for other purposes. It would be advisable to have these records updated and revised annually. This will also help track the 'plans' as per the SDF and ensure that the Framework (SDF) and the Local Area Plans serve as guides. Understandably, there are capacity issues, but the appointment of a peri-urban land use manager (within the municipality) would make the tracking easier. The profile scope would also include working with the Traditional Authority and Ward Councillors on land use management (this fosters the practice of integrated land use management) and ensures all key stakeholders' participation in decision-making.

It has been evident that the environmental chapters and subsections in the municipal plans are a 'tick-box' whereas this can be used as a mechanism that can 'model' how fast the change through developments are steadily encroaching on the environmental plans and ecological zones or ecological infrastructure (areas of ecological significance). The formation of a Joint Task Team consisting of all the relevant stakeholders that will focus on issues of land-use change and environmental issues in the peri-urban and rural areas where change occurs at a high rate, with a particular focus on areas that are under dual leadership is critical.

6.3.3 Environmental Awareness

There is an opportunity for the governance structures in Nadi (*eMbizane*) and Henley Dam to work together on environmental awareness on the long-term effects of the rapid development of houses in the areas and sustainability. These environmental awareness campaigns could be in partnerships with other relevant stakeholders with interests in environmental awareness and ecosystems services and government departments such as the Departments of Co-operative Governance and Traditional Affairs (COGTA), Department of Environment Forestry and Fisheries and Department of Rural Development (Land Affairs Division). People moving into these areas need to understand the long-term effects of rapid land-use change. The leaders (*izinduna* and community elders) in the communities also need to be mindful of the value of ecosystems services and carrying capacity of the land when allocating sites to person. There is much value in raising awareness of how people prepare their plots and how they build to curb the risks associated with environmental degradation, such as land degradation.

6.4 Conclusion

Peri-urban development at a very high densification rate does have a relationship with land degradation, leading to environmental change. Uncontrolled and unplanned development leads to land degradation and increases environmental risk. The lack of planning and cohesive governance that is functional and efficient only aggravates the matter. The rapid densification in peri-urban areas, such as Nadi (*eMbizane*) and Henley Dam, shows that other underlying factors influence the movement of a particular urban class from urban areas to the peri-urban periphery. The relationship between people moving into an area rapidly and land degradation is best understood when considering the social reasons for the move and how the respondents see and relate to the environment (natural environment) they live in. The socio-ecological perspective of land-use change and the occurrence of land degradation provides a broader

understanding of land degradation potential in areas experiencing rapid change and development/densification.

The push and pull factors reveal that vulnerability to land degradation can only be studied using an environmental perspective. The social and governance dimensions are just as important to understand. Therefore, this research adopted a socio-ecological framing. The images, which show change over time, reveal how simple visual tools and instruments that are usually overlooked can be a viable source of information that allows visual interpretation of spatial information over time and makes it easier to follow trends. Understanding the social and governance arrangements in each context by interviewing people who live in the area and understanding their way of life and their choices are also critical in improving spatial and ecological planning and ensuring the sustainable development of peri-urban areas under dual governance systems.

References

- Adedeji, A., (1994). An Alternative for Africa. *Journal of Democracy*. 05 (14). p. 119 – 132.
- Allen, A., (2003). Environmental Planning and Management of The Peri-Urban Interface: Perspectives on an Emerging Field. *Environment and Urbanization*. 15(01), p. 135-148.
- Aspinall, R., (2008). Basic and Applied Land Use Science. In: Aspinall, J, and Hill, M (Eds.). *Land Use Change: Science, Policy and Management*. CRC Press, New York, p. 03 – 15.
- Aspinall, J, and Hill, M., (2010). Introduction. In: Aspinall, J, and Hill, M (Eds.). *Land Use Change: Science, Policy and Management*. CRC Press, New York, p. xvii-xxi
- Bai, Z., Dent, D., Olsson L, & Schaepman M. (2008). Proxy global assessment of land degradation. *Soil Use and Management*. 24 (1), p. 223-234.
- Barrow, C., (1995). *Developing the environment: Problems and management*. Longman Scientific & Technical, Essex
- Boon, R., Cockburn, J., Douwes, E., Govender, N., Ground, L., Mclean, C., Roberts, D., Rouget, M. & Slotow, R. (2016). Managing a threatened savanna ecosystem (KwaZulu-Natal Sandstone Sourveld) in an urban biodiversity hotspot: Durban, South Africa. *Bothalia*. 46(2), a2112. <http://dx.doi.org/10.4102/abc.v46i2.2112>
- Beinat, E and Nijkamp, P. (2010). Land-use management and the path towards sustainability. In: Beinart, E, and Nijkamp, P (Eds). *Multicriteria Analysis for Land-Use Management*. Kluwer Academic Publisher, Norwell, p. 01-16.
- Binns, T and Maconachie, R. (2006). Re-evaluating People-Environment Relationships at the Rural-Urban Interface: How Sustainable is the Peri-Urban Zone in Kano, Northern Nigeria. In: Simon, D.; Mc Gregor, D and Thompson, D. (Eds.). *The Peri-Urban Interface: Approaches to Sustainable Natural and Human Resource Use*. Earthscan, London. p. 211-228.
- Buttel, F., (2000). Ecological modernization as social theory. *Geoforum*. 31 (01). P. 57-65.
- Bryman, A., (2012). *Social Research Methods*. Oxford University Press, Oxford.

Cadman, M., Peterson, C., Drive, A., Sekhran, N., Maze, K and Munzhedzi, S. (2010). Biodiversity Conservation and sustainable development in South Africa. In: *Biodiversity for Development: South Africa's landscape approach to conserving biodiversity and promoting ecosystem resilience*. South African Biodiversity Institute, Pretoria. P. 22-45.

Centre for Conflict Management and Transformation. (2015). *Roles and Responsibilities in Rural Local Governance in Zimbabwe: Parallels, Overlaps, and Conflict*. Harare.

Centre for Law and Society. (2015). Land Rights under the Ingonyama Trust. Rural Women's Action Research Programme.

Chalise, D.; Kumar, L and Kristiansen, P. (2019). Land Degradation by Erosion in Nepal: A Review. *Soil Systems*. 3 (12). Online: doi:10.3390/soilsystems3010012

Chevallier, R., (2014). Emerging Insights into Governance and Sustainable Management of Africa's Natural Ecosystems. *SAIIA Policy Briefing*. Vol 95

Cobbinah, B and Amoako, C. (2014). Urban Sprawl and the Loss of Peri-urban land in Kumasi, Ghana. *International Journal of Social, Behavioural, Educational, Economic and Industrial Engineering*. 8 (01), p. 313 – 322.

Department of Environmental Affairs. (2016). Biodiversity and Ecosystem health (Chapter 7). *2nd South Africa Environmental Outlook: Report on the state of the environment*. Department of Environmental Affairs, Pretoria. p. 107-129

Department of Co-operative Governance and Traditional Affairs (KZN). (2016). Land Allocation and Land Management in TC Areas.

Doan, P, and Oduro, C., (2012). Patterns of Population Growth in Peri-Urban Accra, Ghana. *International Journal of Urban and Regional Research*. 36 (06), p. 1306 – 1325

Douglas, I. (2006). Peri-urban Ecosystems and Societies Transitional Zones and Contrasting Values. In: Simon, D.; Mc Gregor, D and Thompson, D. (Eds.). *The Peri-Urban Interface: Approaches to Sustainable Natural and Human Resource Use*. Earthscan, London. p 17- 29

Douglas, I. (2008). Environmental Change in Peri-Urban Areas and Human and Ecosystem Health. *Geography Compass*. 02 (04). p., 1095-1137.

Etter, A and McAlpine, C. (2008). Modelling Unplanned Land Cover Change across Scales: A Colombian Case Study. In: Aspinall, J, and Hill, M (Eds.). *Land Use Change: Science, Policy and Management*. CRC Press, New York, p.81 – 98.

Fair, T. (1982). *South Africa: Spatial Frameworks for Development*. Chapter One. Rustic Press, Cape. P. 1- 5.

FAO. (1993). *Land Degradation in South Asia: Its severity, causes, and effects upon the people*. Online: www.fao.org/docrep. Accessed: 30 August 2018.

Gargiulo, V., Sateriano, A., Di Bartolomei and Salvati, L. (2012). Urban Sprawl and the Environment. *Geography, Environment, and Sustainability*. 05(04). p. 46- 62

Gough, K, and Yankson, P., (2000). Land Markets in African Cities: The Case of Peri-urban Accra, Ghana. *Urban Studies*. 37 (13). p., 2485 – 2500.

Gough, K, and Yankson, P., (2006). Conflict and Cooperation in Environmental Management in Peri-Urban Accra, Ghana. In: Simon, D.; Mc Gregor, D and Thompson, D. (Eds.). *The Peri-Urban Interface: Approaches to Sustainable Natural and Human Resource Use*. Earthscan, London. p. 197-209.

Jewitt, G.P.W., Sutherland, C., Browne, M, Stuart-Hill, S., Risko, S., Martel, P., Taylor, J., and Varghese, M. (2020). Enhancing water security through restoration and maintenance of ecological infrastructure: Lessons from the uMngeni River Catchment, South Africa. Vol 1: Final Report. *Report Submitted to the Water Research Commission*. WRC Report No. TT 815/20.

Hill, M., (2008). Developing Spatially Dependent Procedures and Models for Multicriteria Decision Analysis: Pace, time and decision-making related to land-use change. In: Aspinall, J, and Hill, M (Eds.). *Land Use Change: Science, Policy and Management*. CRC Press, New York, p. 17 – 40

Hoffmann, T and Ashwell, A. (2001). *Nature Divided: Land degradation in South Africa*. University of Cape Town Press, Cape Town.

Holzinger, K., Kern, F and Kromery, D. (2016). The Dualism of Contemporary Traditional Governance and the State: Institutional Setups and Political Consequences. *Political Research Quarterly*. 69 (03). p. 469 - 481.

Hugo, L., (2004). *Environments Management: An ecological guide to sustainable living in Southern Africa*. Eco plan, Paarl

Ingonyama Trust Board. (2016). Annual Report for 2016 -2017. Online: <http://www.ingonyamatrust.org.za/download/ingonyama-trust-board-annual-report-for-the-year-ended-31-march-2017/>. Accessed:26 May 2018.

Jones, D., (1995). Environmental Change, Geomorphological Change, and Sustainability. In: McGregor, D and Thompson, D(Eds.). *Geomorphology and Land Management in a Changing Environment*. John Wiley & Sons. Sussex, p. 11 – 35.

Kates, R., (2011). What kind of a science is sustainability science? *PNAS*. Vol 108(49). P. 19449-19450. Online: <https://doi.org/10.1073/pnas.1116097108>

Kenward, R.; Whittingham, M.; Arampatzis, S.; Manos, B.; Hahn, T.; Terry, A.; Simoncini, R.; Alcorn, J.; Bastian, O.; Donlan.; Elowe, K.; Frazen, R.; Karacsonyi.; Manou, D.; Navodaru, Papadopoulou, O.; Papathanasiou, J.; von Raggamby, A.; Sharp, A.; Soderqvist, A.; Vavrova, L.; Aebischer, N.; Leader-Williams, N and Rutz, C. (2011). Identifying governance strategies that effectively support ecosystem services, resource sustainability, and biodiversity. *PNAS*. 108(13). p. 5308-5312

Kombe, W., (2003). Land-use Dynamics in Peri-Urban areas and their implications on urban growth and form: The case of Dar es Salaam, Tanzania. *Habitat International*. 29 (01), p. 113-135

Liniger, H.; van Lynden, G.; Nachtergaele, F.; Schwich, G and Biancalani, R. (2013). *Land Degradation Assessment in Drylands: Questionnaire for mapping land degradation and sustainable land management (QM Version 2)*. Food and Agriculture Organisation of the United Nations, Rome.

Mbatha, S and Ngcoya, M. (2019). Peri-urban land transactions: the new geographies and cultures of peri-urban land in eThekweni Municipality. *Transformation: Critical Perspectives on Southern Africa*, 99, pp. 1-36. Online: <https://doi.org/10.1353/trn.2019.0009> . Accessed: 17 December 2020.

Mbiba, B. and Huchzermeyer, M., (2002). Contentious development: peri-urban studies in sub-Saharan Africa. *Progress in Development Studies* 2 (02), p. 113–131.

McGregor, D and Thompson, D. (1995). Geomorphology and Land Management in a Changing Environment. In: McGregor, D and Thompson, D(Eds.). *Geomorphology and Land Management in a Changing Environment*. John Wiley & Sons. Sussex, p. 02 - 10.

McLafferty, S., (2015). Conducting Questionnaire Surveys. In: Clifford, N., Cope, M., Gillespie, T and French, S (Eds.). *Key Methods in Geography*. SAGE, London. p. 129-146.

Msunduzi Local Municipality. (2015). Msunduzi Municipality SDF Review: Final Report.

Online:

<http://www.msunduzi.gov.za/site/search/downloadencode/nbaaZaLEbNeqrYyx/index.pdf>

Msunduzi Local Municipality. (2016). Vulindlela Local Area Plan: Spatial Framework.

Online:

<http://www.msunduzi.gov.za/site/search/downloadencode/nbaqZqKebNeqrYyx/index.pdf>

Msunduzi Local Municipality. (2017). Draft 2017-2022 Integrated Development Plan. Online:

http://www.msunduzi.gov.za/site/search/downloadencode/Msunduzi_IDP_DRAFT_2017_2022.pdf

Millennium Ecosystem Assessment (Program). (2005). Ecosystems and human well-being. Washington, D.C: Island Press.

Nhamo, G and Inyang, E. (2011). *Frameworks and Tools for Environmental Management in Africa*. CODESRIA, Dakar.

Nüsser, M and Grab, S. (2002). Land degradation and Soil Erosion in the Eastern Highlands of Lesotho, Southern Africa. *Die Erde* 133, p 291-311.

Nyarko, J and Adu-Gyamfi, O. (2012). Managing Peri-Urban Land Development: Building on Pro-Poor Land Management Principles. *Pro-Poor Land Management*, 5673.

Oelofse, C.; Scott, D.; Oelofse, G and Houghton, J. (2006). Shifts within Ecological Modernization in South Africa: Deliberation, Innovation, and Institutional Opportunities. *Local Environment*. 11(01) p. 61-78.

Ravetz, J.; Fertner, C and Nielsen, T. (2013). The Dynamics of Peri-urbanization. In: Nilsson, K.; Pauleit, S.; Bell, S.; Aalbers, C, and Nielsen, S (Eds.). Peri-urban futures: Scenarios and models for land-use change in Europe. *Springer-Verlag Berlin Heidelberg*; pp 13-44.

Report of the High-Level Panel on the Assessment of Key Legislation and the Acceleration of the Fundamental Change. (2017). Online: https://www.parliament.gov.za/storage/app/media/Pages/2017/october/High_Level_Panel/HLP_Report/HLP_report.pdf. Accessed: Dec 2017

Richards, N., Botha, G., Schoeman, P., Clarke, B., Kota, M and Ngcobo, N. (2006). Engineering geological mapping in Pietermaritzburg, South Africa: Constraints on Development. *IAEG*. p. 01-11.

Scoones, I. (2007). Sustainability. *Development in Practice*. 17 (4-5). p. 589-595.

Sim, V.; Sutherland, C, and Scott, D. (2016). Pushing the Boundaries – Urban Edge Challenges in eThekweni Municipality. *South African Geographical Journal*. 98(01), p. 37-60.

Sims, V.; Sutherland, C.; Buthelezi, S and Khumalo, D. (2018). Possibilities for a Hybrid Approach to Planning and Governance at the Interface of the Administrative and Traditional Authority Systems in Durban. *Urban Forum* 29, (), p.351–368. Online: <https://doi.org/10.1007/s12132-018-9355-2>

Simon, D.; Mc Gregor, D and Thompson, D. (2006). Contemporary Perspectives on the Peri-urban Zones of Cities in Developing Areas. In: Simon, D.; Mc Gregor, D and Thompson, D. (Eds.). *The Peri-Urban Interface: Approaches to Sustainable Natural and Human Resource Use*. Earthscan, London. p 05-17.

Stocking, M., Murnaghan, N. (2002). *A Handbook for the Field Assessment of Land Degradation*. London: Routledge.

Sutherland, C., Sim, V., Buthelezi, S. & Khumalo, D. (2016). Social constructions of environmental services in a rapidly densifying peri-urban area under dual governance in Durban, South Africa. *Bothalia*. 46(2). a2128. <http://dx.doi.org/10.4102/abcv46i2.2128>

Sutherland, C. and Mazeka, B. (2019) Ecosystem services in South Africa. In Knight, J. and Rogerson, C. (eds) *The Geography of South Africa, World Regional Geography Book Series*, Nature New York: Springer.

Taylor, L., (2016). Case Study Methodology. In: Clifford, N., Cope, M., Gillespie, T and French, S (Eds.). *Key Methods in Geography*. SAGE, London. p. 592 -596.

Torres, H. (2007). Social and Environmental aspects of peri-urban growth in Latin American megacities. *Paper presented at United Nations Expert Group Meeting on Population Distribution, Urbanization, Internal Migration and Development*, New York, 21–23 January.

Torres, H., (2011). *Environmental Implications of Peri-urban Sprawl and the Urbanization of secondary cities in Latin America*. Inter-American Development Bank; Technical Notes. No. IDB-TN-237.

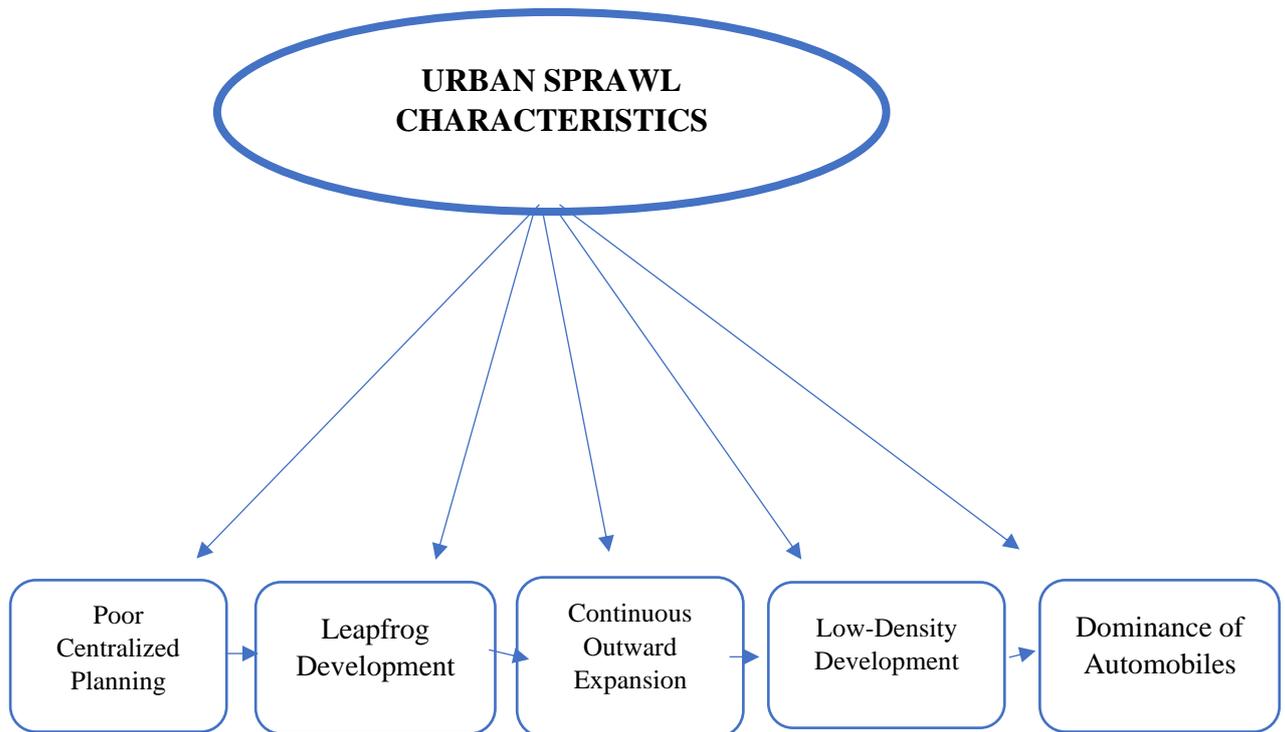
Turner, D., (2007). Soils of The Shale of The Pietermaritzburg Formation, Ecca Group in Kwazulu-Natal. Chapter 15. University of Pretoria

United Nations Commission on Sciences and Technology for Development. (1997). *On Solid Ground: Science, Technology and Integrated Land Management*. International Development Research Centre & United Nations Commission on Sciences and Technology for Development, Geneva.

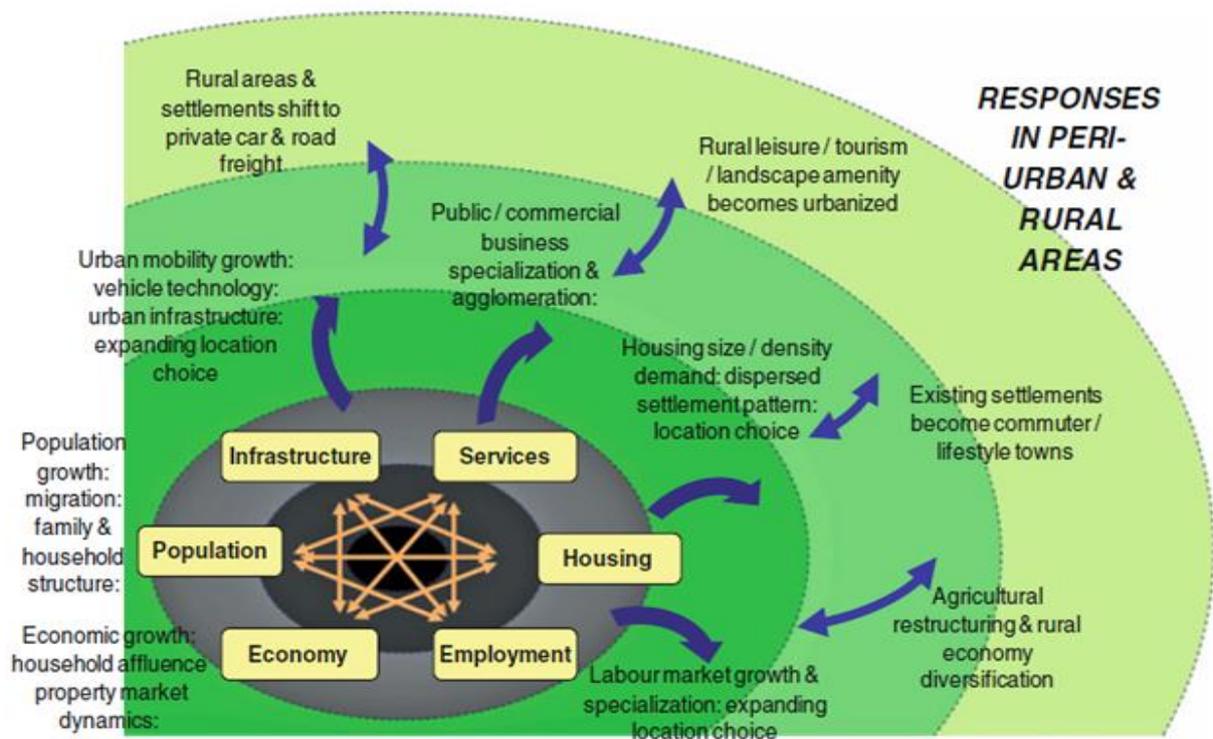
UNEP. (1992). Desertification, land degradation[definitions]. *Desertification Control Bulletin* 21.

Xulu, S., (2014). *Land degradation and settlement intensification in Umhlathuze Municipality*. MSC Thesis. Stellenbosch University. Online: <http://hdl.handle.net/10019.1/86208>. (Accessed: 28 June 2016)

Appendices



Appendix 1: Major characteristics of urban sprawl. (Source: Adapted from Cobbinah & Amoako 2014).



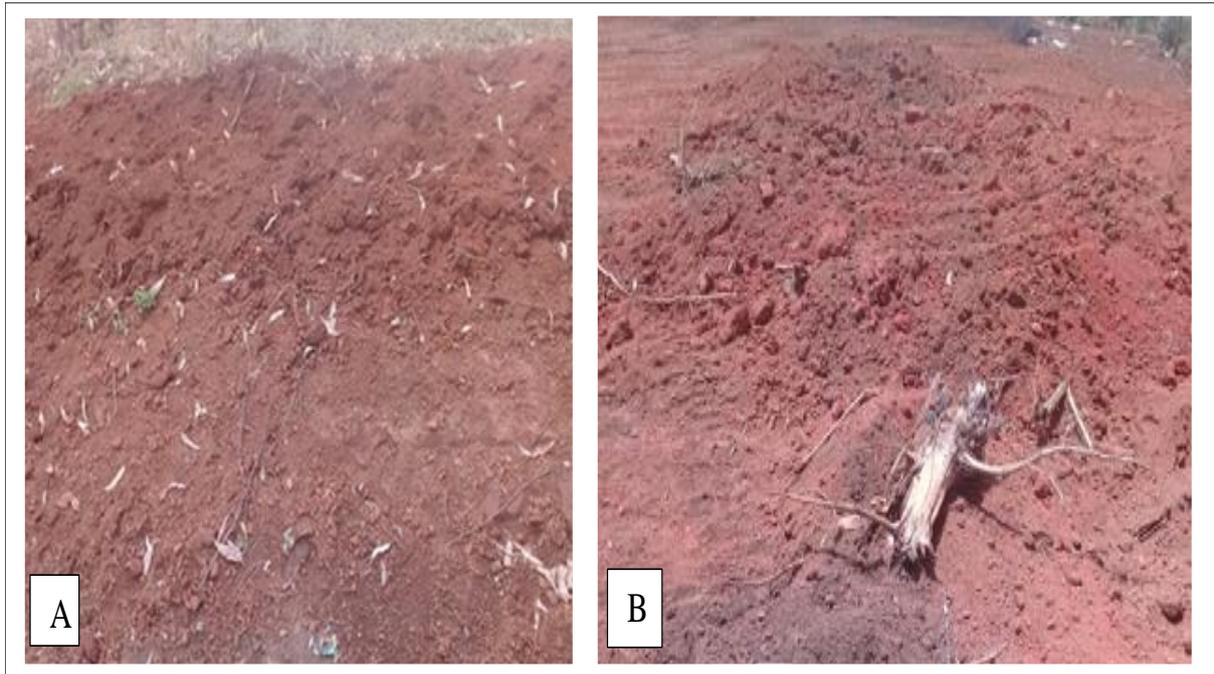
Appendix 2: Factors that influence urban expansion and the responses in the peri-urban and rural areas. (Source: Ravetz et al. 2013).



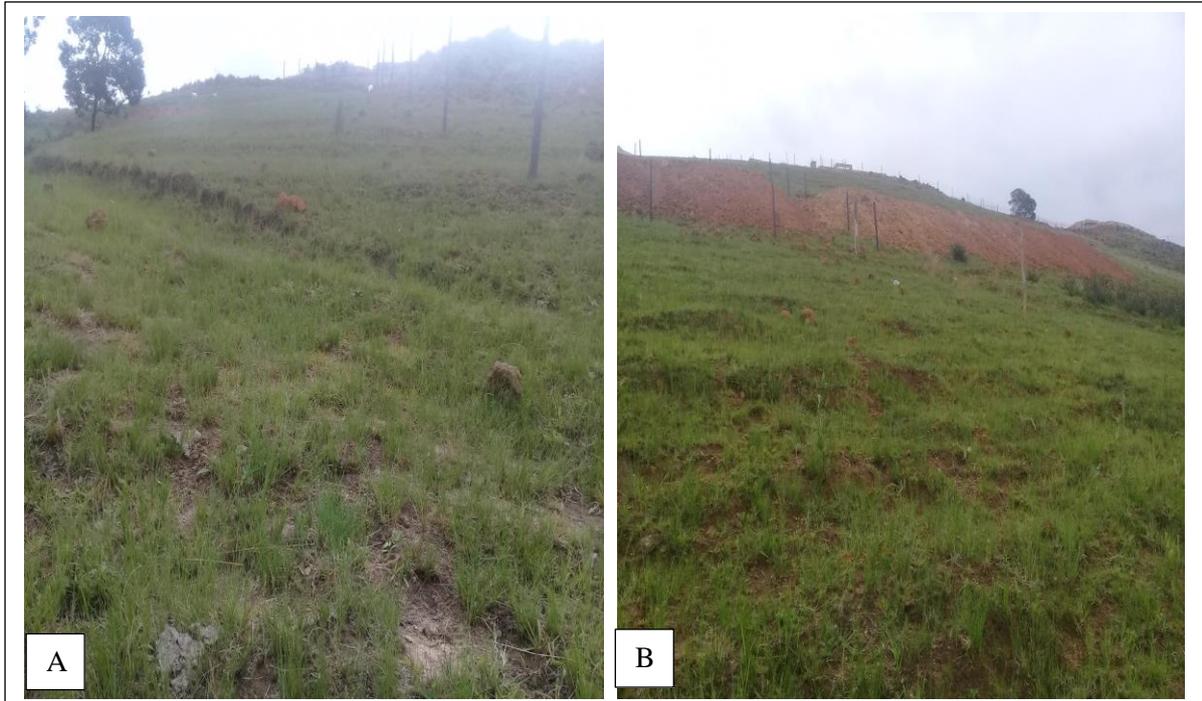
Appendix 3: The Henley Dam area in 2006, 2010, 2014 and 2018 (clockwise) at different levels of development. (Source Google Earth 2018).



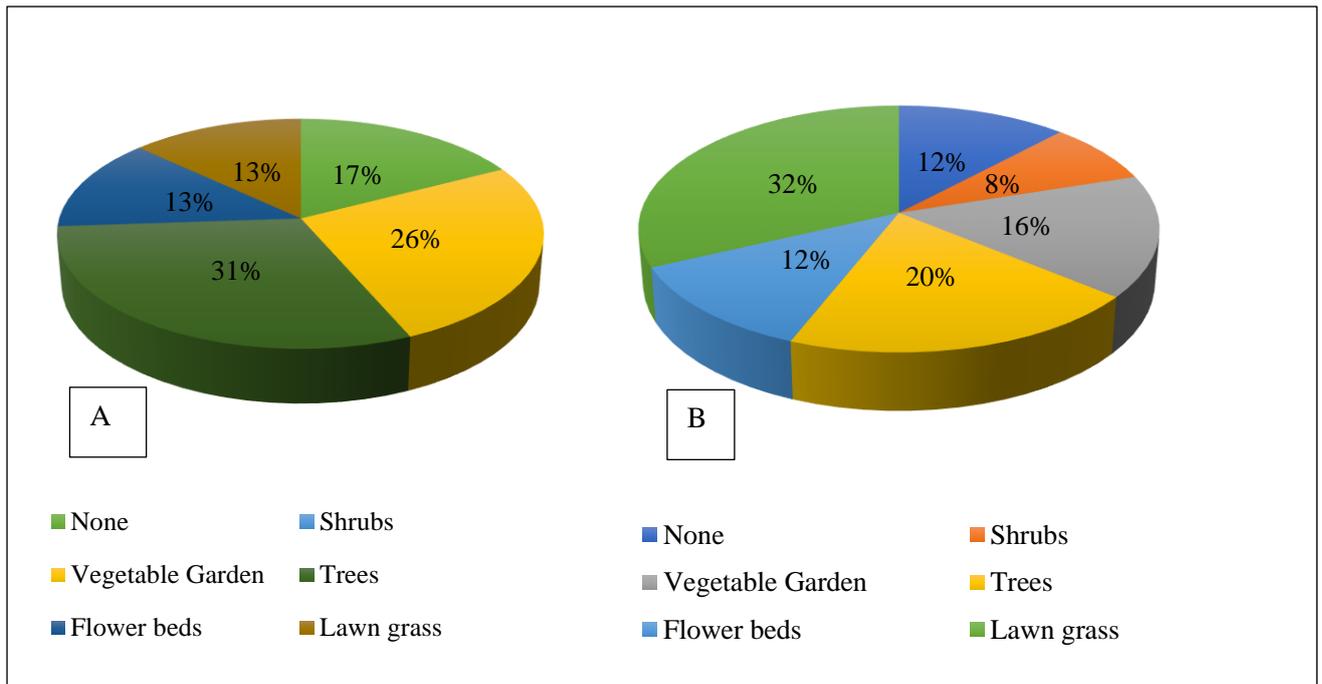
Appendix 4: The Nadi (*eMbizane*) area in 2006, 2010, 2014 and 2018 (clockwise) at different levels of development. (Source Google Earth 2018).



Appendix 5: (A and B): Plot preparation on two sites in Nadi (*eMbizane*) and Henley Dam visible red soil. (Photographs by Cebolenkosi Zuma 2018).



Appendix 6: The grassland on the slope of Nadi (*eMbizane*) where A shows the grassland with an old platform clearing and B is the opposite side of the hill with a newly prepared cut-and-fill platform. (Photograph: Cebolenkosi Zuma 2018).



Appendix 7: (A and B): The current vegetation cover in (A) Nadi (*eMbizane*) and (B) Henley Dam.



Appendix 8: Increase dust seen on the grass along the gravel road in Henley Dam. (Photograph: Cebolenkosi Zuma 2018).

Housing Densification and Land Degradation

1. What attracted you to come live in this area?

2. Do you have a second home elsewhere?

If Yes, where?

3. Do you own this land?

If yes, continue to next question

No, skip next question

4. How is the land attained?

5. How long have you lived in the areas?

1-2 years	
3-4 years	
5 years >	

6. Is the area densifying rapidly?

If yes continue to next question

No skip next question

7. Do you think it is sustainable?

8. How do you conceive/relate to your surrounding environment?

(land, forest and grassland)

9.

! Observe the way the foundation is prepared for:

a. Cut & fill

b. Removal of vegetation/biomass with minimal excavation

i. Why did you prefer doing a **cut & fill** excavation style when preparing for your foundation?

ii. Is the fill stable?

iii. Do you have any concerns about the fill-in terms of the soil and land when developing or building your home?

iv. a. How much vegetation cover did you remove preparing your plot?

0 – 10%	
10 - 20%	
20 – 30%	
30 – 40%	
40 – 50%	
50 >	

b. Were there any trees on your plot?

If yes (next question)

No, (skip next question)

c. How did you remove the trees?

d. Did you plant any trees or vegetation on your plot?

! Observe the way the foundation is prepared for:

- a. Cut & fill
- b. Removal of vegetation/biomass with minimal excavation**

i. Why did you prefer the minimal excavation plot preparation method?

ii. What are the advantages and disadvantages of using this method?

Advantages	Disadvantages

iii. a. How much vegetation cover did you remove preparing your plot?

0 – 10%	
10 - 20%	
20 – 30%	
30 – 40%	
40 – 50%	
50 >	

b. Were there any trees/vegetation cover on your plot?

If yes (next question)

No, (skip next question)

c. How did you remove these trees?

d. Did you plant any trees or vegetation?

10. What do you understand about land degradation?

11. What forms of land degradation have you observed on your plot & surrounding area?

12. What have you done on your plot to reduce the occurrence of land degradation?

Appendix 9: Questionnaire Survey.

Appendix 10: Interview Schedule 1 (Community *Induna*).

1. What is the structure or set up of the governance in Vulindlela Local Area?
 - 1 Which ward are you responsible for and which areas fall into your jurisdiction as *Induna*?
 - 2 What role(s) do you play in the community and which governance duties are you responsible for?
 - 3 During the allocation of land, what role do you play? How do you undergo the process of to new people and others who could come from the community?
 - 4 What is your take on the changing dynamics in terms of the increased population of the area, especially Henley Dam and parts of Nadi (*eMbizane*)?
 - 5 Can you please shed light on the process of accruing land in this area?
 - 6 How does the *Induna* and the Traditional Council decide on sites that can be allocated to people and those that cannot be allocated to people?
 - 7 What sort of guidelines do you consult and/or use when allocating land to people?
 - 8 Have you had situations where there is a request from an individual who wants to use land for other purposes not related to building of residences? (If yes)
 - 8.1 How did you approach that request?
 - 9 Can you please explain the relationship that the Traditional Council has with the Ingonyama Trust in matters of site allocations and the submission of allocated sites receipts to the Trust?
- 10 How do you perceive the natural environment that you live in with the community?

Appendix 11: Interview Schedule 2 (Community/Ward Councillor).

- 1 What is the structure or set up of the governance in Vulindlela Local Area?
- 2 Which ward are you responsible for and which areas fall into your jurisdiction as Councillor?
- 3 What role(s) do you play in the community and which governance duties are you responsible for?
- 4 During the allocation of land, what role do you play? Are you involved in the process of land allocation to new people and others who could come from the community?
- 5 What is your take on the changing dynamics of the area, especially Henley Dam and parts of Nadi?
- 6 Can you please shed light on the process of accruing land in this area?
- 7 How does the *Induna* and the Traditional Council decide on sites that can be allocated to people and those that cannot be allocated to people?
- 8 How do you perceive the natural environment that you live in with the community?

Appendix 12: Interview Schedule 3 (Community Elder).

- 1 What is your role as an Elder in this community, especially the new area?
- 2 How does a person go about attaining land in this area?
- 3 How does the Traditional Authority of INadi come into the process of land?
- 4 To whom does the decision fall to when it comes to deciding which plot can be assigned to an individual or family?
- 5 Do you think that the people are aware of the dangers of building homes/houses on very steep slopes such as the plots on the NNE direction on the mountain?
- 6 The planning of the new area in terms of road access is impeccable, who can one credit for this work?
- 7 The sites seem to be generally the same size with a few that are double the size, how did this come about?
- 8 What sort of guidelines do you consult and/or use when allocating land to people? (Bonus if admits to being part of allocating land)
- 9 The area seems to have densified rapidly since people started to move in. How do you think this affects the land and natural vegetation?
- 10 Have you had situations where there is a request from an individual who wants to use land for other purposes not related to building of residences? (If yes))
- 11 How did you approach that request?
- 12 Do you think that the area is at risk of land degradation?

Visual Indicators of Land Degradation (Mbizane) __/__/2018

Visual Indicator(s)	Tally
Rill	
Gully	
Accumulation of Soil	
Deposits of Soil on slope	
Muddy water/mudflows	
Changes in Vegetation species	
Soil compaction	
Increased crusting & run-off	
Decrease in ants/earthworms	

Appendix 13: Visual Indicators of Land Degradation (Source: *adapted from Stocking & Murnaghan 2002*) (1).

Visual Indicators of Land Degradation (Henley) __/__/2018

Visual Indicator(s)	Tally
Rill	
Gully	
Accumulation of Soil	
Deposits of Soil on slope	
Muddy water/mudflows	
Changes in Vegetation species	
Soil compaction	
Increased crusting & run-off	
Decrease in ants/earthworms	

Appendix 14: Visual Indicators of Land Degradation (Source: *adapted from Stocking & Murnaghan 2002*) (2).