A critical examination of the relationship between urban greenness and sustainable development of urban spaces in UMhlathuze, Kwa-Zulu Natal, South Africa

By

Fidelis Chihambakwe

Submitted in fulfilment of the academic requirements for the degree of Masters of Science (Dissertation) in the

Faculty of Science

University of the Witwatersrand

Johannesburg

Supervisor: Prof Jasper Knight

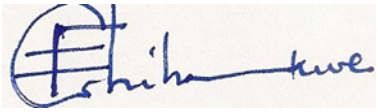
Faculty of Science: School of Geography and Environmental Studies

May 2016

Declaration

I, the undersigned, hereby declare that the work contained in this dissertation is my own work and that all sources I have used have been indicated and acknowledged by complete reference. This work has not previously been submitted at any university for a degree.

Fidelis Chihambakwe (849075) **DATE**: 22 May 2016



(Signature)

Acknowledgements

I wish to sincerely thank my supervisor, Prof Jasper Knight for his diligence, support, thoroughness, encouragement, imparted knowledge and useful suggestions throughout my study period. Thank you very much for this academic transformation. In addition I would like to extend my thanks and appreciation to:

- UMhlathuze municipality staff for their assistance with maps and additional information on the city's urban greening.
- My friend Admire Chibisa and his family for the motivation and inspiration they gave me throughout my studies.
- My wife Thabani and our daughter Joyful, for all their invigorating support throughout my study period.
- The Almighty God for the guidance and renewed strength to continue studying.

Abstract

Globally, urban areas are the fastest growing land cover with significant numbers of people residing within these urban spaces. The continuous growth and expansion of urban settlements continue to exert unprecedented negative pressure on the natural environment, and green spaces are increasingly disappearing. In most intermediate and secondary cities of developing countries, loss of urban green spaces is partly due to the knowledge gap in urban planning as well as the lack of comprehensive assessment of the challenges and factors contributing to the deteriorations of urban spaces in these cities.

In any given urban environment, green spaces of all types are acknowledged for creating valuable economic, social and environmental services. Urban green spaces are fast becoming means to sustainable development due to their extensive multifunctional roles and benefits to different users. This research focusses on critically assessing the relationship that exists between urban greenness and sustainable development in the city of UMhlathuze, KZN, South Africa. It also explores how urban greening is increasingly tied to urban planning and the challenges that urban greening faces in the context of rapidly increasing urbanisation. Results of this study show that there is increasing need to improve green spaces especially for low income groups who cannot afford to travel out of town to experience natural environments. Urban development therefore calls for stakeholders to follow the principles of sustainable development with reference to ecological systems in urban areas, including community green spaces, gardens, biodiversity, native species and urban green infrastructure. If urban greening is properly planned and integrated into urban development and planning policies, it can brings economic, social and environmental benefits to developing world cities.

TABLE OF CONTENTS

Page

CHAPTER 1: INTRODUCTION 1

1.1 Introduction 1
1.2 Research statement 7
1.3 Motivation 8
1.4 Research questions 10
1.5 Aims 11
1.6 Objectives 11
1.7 Study area 12

CHAPTER 2: LITERATURE REVIEW 19

2.1 Introduction 19
2.2 History of urban greening 19
2.3 Functions of Urban Green Spaces 22
2.3.1 Introduction 22
2.3.2 Public health benefits of Urban Green Spaces 23
2.3.3 Ecological benefits of Urban Green Spaces 25
2.3.4 Economic and aesthetic functions of urban green spaces 26
2.4 Sustainable Development 28
2.4.1 The concept of sustainable development 28
2.4.2 The concept of equity in sustainable development 34
2.4.3 The strength of sustainable development 35
2.4.4 Environmental Sustainability 36
2.4.5 Government role in sustainable development 39
2.4.6 The role of the stakeholders in urban greening and sustainable development 43
2.5 Urban Planning 44
2.5.1 Introduction 44
2.5.2 Planning for sustainable development 45
2.5.3 Relationship between legislation, plans and budgets in Urban Greening 48
2.6 Challenges of Urban Green Spaces in Africa 50
2.6.1 Socio-Economic and Demographic factors 50
2.6.2 Environmental Injustice in access to Urban Green Space 53
2.7 Examples of green place practice 54
2.8 Conclusion 62

CHAPTER 3: METHODOLOGY 64

3.1 Introduction 64

3.2 Research design 64
3.3 Methodological steps 65
3.4 Observations, Photographing and Map analysis....67
3.5 Analysing observational data 72
3.6 Map analysis 73
3.6.1 Introduction 73
3.6.2 Analysis of maps and photograph data 75
3.7 Conducting interviews....76
3.7.1 Introduction 76
3.7.2 Analysing data from interviews 77
3.8 Questionnaires for city residents....78
3.8.1 Introduction 78
3.8.2 Open-ended questions....80
3.8.3 Close ended questions....81
3.8.4 Analysis of questionnaire data....83
3.9 Document review 84
3.9.1 Introduction 84
3.9.2 Criterion used to select these documents 85
3.9.3 Advantages of document review 86
3.9.4 Disadvantages of document review....87
3.9.5 Analysing data from documents 87
3.9.6 Methodological reflections 88
3.9.7 Conclusion....89

CHAPTER 4: RESULTS 90
4.1 Introduction 90
4.2 Results of Document review 90
4.2.1 Introduction 90
4.2.2 Role of planning in urban greening and sustainable development....92
4.2.3 Awareness of urban greening 99
4.2.4 Greenness projects and achievements....100
4.2.5 Policy making for sustainable development....106
4.2.6 Challenges of urban greenness 109
4.3 Interview results....116
4.3.1 Introduction 116
4.3.2 Use of environmental law and policies in urban greening and sustainable development....118
4.3.3 Challenges faced in urban greening....118
4.3.4 Levels of urban greening, comparing old and new greening activities 120
4.3.5 Relationship between social, economic and environmental Development in the city....124

4.3.6 Future plans to enhance urban greening 126
4.4 Results from Field observations and Map analysis 129
4.4.1 Introduction 129
4.4.2 Vegetation along streets and in the open spaces 131
4.4.3 Maintenance of urban vegetation 142
4.4.4 Evidence of tree planting 143
4.4.5 Urban farming 148
4.4.6 Presence of parks and open spaces 149
4.4.7 Nature of recreation and development in the suburbs 152
4.4.8 Connection between discussed themes above 154
4.5 Map Analysis 155
4.5.1 Vegetation mapping and urban planning 155
4.5.2 Urban expansion 157
4.5.3 Newly planned and re-planned areas 160
4.6 Results of Questionnaires 163
4.6.1 Introduction 163
4.6.2 Growth and expansion of the city 164
4.6.3 Public awareness of urban greening 167
4.6.4 Different levels and measures of greening 173
4.6.5 Proximity to green spaces and frequency of visits to such spaces 178
4.6.6 Role of residents and municipality in urban greening 184
4.6.7 Link between urban greening and social and economic development 184
4.6.8 Summary 190

CHAPTER 5: DISCUSSION 191
5.1 Introduction 191
5.2 Effects of urbanisation on urban greening 191
5.3 Use of policies and Environmental law in urban greening 195
5.4 Relationship between urban greening and socio-economic development 198
5.5 Role of planning in urban greening and sustainable development 204
5.6 Levels of greening, awareness and success of urban greening 210
5.7 Challenges of urban greenness and sustainable development 220
5.8 What is different about this study 225
5.9 How Literature review and Methodology used in this study influence the findings and analysis of results 226
5.10 Conclusions 227

CHAPTER 6: CONCLUSIONS 229
6.1 Introduction 229
6.2 Recommendations 229
6.3 Alignment of this research with other existing studies 231

6.4 Wider context of urban greening..... 233

CHAPTER 7: GREENING RECOMMENDATIONS..... 235
7.1 Greening recommendations..... 235
7.2 Areas of further research..... 240

LIST OF FIGURES

Figure 1.1: The interconnections in sustainable development 2
Figure 1.2: Relationship between urban greenness and sustainable development. 5
Figure 1.3 a): UMhlathuze Municipality and specific areas used for data Collection 15/16
Figure 1.3 b): Geo technical constraints in UMhlathuze 17/18
Figure 2.1: Villa degli Armeni, Asolo, Italy 21
Figure 2.2: The tripartite contributions of urban green spaces 23
Figure 2.3: The meaning of sustainable development 29
Figure 2.4a: A systems Approach to sustainability 33
Figure 2.4b: The Three Pillars of Sustainability 36
Figure 2.5: The garden city according to Ebenezer Howard 55
Figure 2.6 a): An attempt at a garden city: Zlin in Czech Republic 56
Figure 2.6 b): Svit in Slovakia 56
Figure 2.6 c): Park median in Avenida Amsterdam 57
Figure 2.7: Joan Miró Park in Barcelona 58
Figure 2.8: Hangzhou, China 58
Figure 2.9: The urban forest canopy of Sacramento, CA 59
Figure 3.1: Key colours for vegetation mapping along streets and roads 70
Figure 3.2: City of UMhlathuze showing the 5 study areas 82
Figure 4.1: Photograph showing proposed revitalisation plan of Empangeni CBD with greening 94
Figure 4.2 a): Possible nature reserve sites in the city of UMhlathuze 97
Figure 4.2 b): Expansion and improvement of Alkantstrand beach using grass and trees 101
Figure 4.3: Proposed Expansion area between Vulindlela and Esikhawini suburbs 114
Figure 4.4: Proposed expansion areas (purple) south east of Richards Bay Expanding into conservation areas (light green) 115
Figure 4.5: Proposed section of Complex parks that will deal with recreational needs 126
Figure 4.6: A section of the proposed Complex parks that will focus on ecological conservation and biodiversity plus more recreation 127
Figure 4.7: A summarised photograph of the beneficiaries of the proposed new Complex Parks 127
Figure 4.8: A diagrammatic sketch of the proposed Complex Park showing its greenness features 128
Figure 4.9: Map of UMhlathuze showing study 130/31
Figure 4.10a: Density of trees along roads in Central Park Empangeni 134
Figure 4.10b: Street trees and canopies along Segar road in Empangeni Central suburb 135
Figure 4.10c: Old trees along Paul Avenue in Empangeni Central Park suburb... 136

Figure 4.10d: Density of trees along selected roads in Empangeni CBD 137
Figure 4.10 e): Density of trees along selected streets in Esikhawini H2 138
Figure 4.10f: Density of trees along selected streets in Richards Bay CBD 139
Figure 4.11a: Dense trees in St Catherine High School in Empangeni Suburb visible from the street 140
Figure 4.11b: Young and sparse trees planted around Old Mill High school in Central Park suburb 141
Figure 4.11c: A Street with grass patches and few shrubs in ESikhaleni 141
Figure 4.11d: Well-maintained or pruned trees in Empangeni CBD 142
Figure 4.12a: Newly planted trees along Biyela Street in Empangeni CBD 143
Figure 4.12b: Newly planted trees in front of the Empangeni municipal library . 144
Figure 4.13: Aerial photograph showing vegetation in Esikhawini along roads and in yards 145
Figure 4.14a: Richards Bay CBD showing trees planted in parking areas and surrounding green spaces 146
Figure 4.14b: Car park in Richards Bay dotted with trees 146
Figure 4.14c: Car park in the Empangeni city centre lined with trees 147
Figure 4.14d: Open spaces in Richards Bay around the Civic Centre 147
Figure 4.15a: Farming in open spaces of the Esikhawini H2 residential area 148
Figure 4.15b: Unprotected open space near Ikhandlela High School being used for farming in ESikhaleni 149
Figure 4.16 a: An open space in Empangeni suburb with thick bushes 150
Figure 4.16b: An open space in Esikhawini with wild grass, sparse trees and illegal dumping 151
Figure 4.16c: An open space in Empangeni with children's swing 151
Figure 4.17: A photograph of a street map of ESikhaleni showing planned Numerous open spaces 152
Figure 4.18: A view into the Empangeni private Golf course 153
Figure 4.19: An SDF map of UMhlathuze showing different land zones and Nature reserve areas 155
Figure 4.20 Settlements expanding in new areas in unplanned areas around Esikhawini 157
Figure 4.21: Thick forest being cleared in Birdswoods due land claims and informal settlement 158
Figure 4.22: Changes in greening levels in UMhlathuze Sports Complex 159
Figure 4.23: Connected greenbelts or open spaces in Esikhawini Low income residential area 160
Figure 4.24a: Unplanned map of Mzingazi showing the current picture of the area today 161
Figure 4.24b: Planned map of Mzingazi not yet implemented 161
Figure 4.25: Newly planned areas around Hill view (Empangeni) expanding into surrounding farming land 162

Figure 4.26: Planned area in Richards Bay where development of buildings has not yet started 163
Figure 4.27: Question A1: In which residential area do you live in currently (%). 164
Figure 4.28: Question B 3: Has your residential area expanded in the last 10 years 165
Figure 4.29: Question B 4: how has residential expansion affected natural Vegetation in the area 165
Figure 4.30: Question B10: Is your area under threat from the growth of informal (squatter) settlements 166
Figure 4.31: Description of threat from squatter settlements growth 167
Figure 4.32: Question B11: Does the municipality or Department of parks carry out any green space or vegetation protection awareness programs in the media, in schools or in your area 168
Figure 4.33: Question B12: If yes describe the awareness program you have seen or heard 169
Figure 4.34: Question B14: Do you think your suburb or city of UMhlathuze need more trees or green spaces 170
Figure 4.35: Question B20: If the municipality is going to come up with a policy that says each family should at least plant one tree or fruit tree in their yard or around their area, would you support it 170
Figure 4.36: Question A6: Do you make use of a flower or vegetable garden or open green space with trees (fruit trees) 174
Figure 4.37: Question A5: Which of the following types of ownership applies to you 174
Figure 4.38: Question B8: How would you describe the street trees in your residential area or suburb and along roads 175
Figure 4.39: Measures taken by the municipality to preserve natural vegetation 176
Figure 4.40: Measures that need to be done to preserve natural vegetation 177
Figure 4.41: Measures for ensuring development and green areas to work together 178
Figure 4.42: Question 8b): Choose the type of park or recreational area nearest to your place of residence 179
Figure 4.43: Question B9 a):) If you sometimes visit a nearby park/playground or open green space how accessible is it from your place of residence and how often do you or your family members visit this park 179
Figure 4.44: Question B9 b): Driving time to get to park/open green space 180
Figure 4.45: Question B9 c): Walking time to get to park/open green space 181
Figure 4.46: Question B 16 a): Do you have pets that need to be walked around 181
Figure 4.47: Question B 16 b): If you have pets how often do you walk your pet around 182
Figure 4.48: Question B18 a): How often do you take children out to parks or

sports fields 183
Figure 4.49: Question B 9: Do you think the local residents and municipality are doing enough to plant more trees, grass, flowers and agricultural crops around your area or in your suburb 184
Figure 4.50: Question B19: Whether the competition for economic development and environmental development was fair 185
Figure 4.51: Question B1: Are the roads, telephone lines, tapped water and other infrastructure services like parks and outdoor recreational areas well developed and available in your area 187
Figure 4.52: Question B 2: If no which services are lacking or poorly developed In your area 187
Figure 4.53: Question B13: Which of the following land uses do you think should be given priority on available open land in your town 188
Figure 4.54: Question B18 c): Do you think having more green spaces around you or in a town can improve people's quality of life 189
Figure 5.1: Model demonstrating the balanced relationship of sustainable development elements 201
Figure 5.2: The triangle of conflicting goals for planning 205

LIST OF TABLES

Table 1.1 Age structure of the city....12
Table 1.2 main Economic sectors and their percentage contribution in the city ...13
Table 3.1: Street tree densities on selected roads and distances....70
Table 3.2: Pre-set code list for data analysis....72
Table 3.3: Sampled Documents for data analysed....85
Table 4.1: Sampled Documents examined in this study....91
Table 4.2: Land Uses in UMhlathuze Municipal Area....105
Table 4.3: Land use zones and their sizes related to ecological conservation and use....106
Table 4.4: Results from Infill Investigation showing land to expropriated into proposed expansions....111
Table 4.5: Showing proposed expansion areas in different suburbs of the city ..112
Table 4.6: Anticipated land usages in Expansion Areas....113
Table 4.7: Street tree densities (trees/100m) of selected roads or streets in the study area....133
Table 4.8: Reason for the need of more trees or green spaces in the suburbs or city....171
Table 4.9: Reason for not wanting more trees or green spaces in the suburbs or city....172
Table 4.10: Reason for wanting or not wanting a park nearby....173
Table 4.11: Question 6b): Specify the type of garden used....175
Table 4.12: Question 18 b): Reason for the indicated frequency of taking out children to parks or sport fields....183
Table 4.13: Question B 15: What needs to be done to strengthen economic development and environmental development....186
Table 4.14: Question B 18 b): Reasons on whether having more green spaces around could improve people's lives....189

REFERNCES 241

APPENDICES 262
Appendix A1: Interviews Transcripts Department of City Development and Planning 262
Appendix A2: Interview Questions: Department of City Development and Planning 264
Appendix A3: Interview sample: Community Service Department and Department of Parks and Recreation 265
Appendix A4: Interview Sample questions: Department Infrastructure and Technical Services with Mr Naido 269
Appendix A5: North Myrtle Beach Park and Sports Complex in South Carolina. 270
Appendix A6: Questionnaire for residents 271
Appendix B 1: Map of Empangeni Environment 276
Appendix B2: Map of Empangeni Open spaces 277
Appendix B3: Street Map of Empangeni Town 278
Appendix C1: Map of Richards Bay Open Spaces 279
Appendix C2: Map of Richards Bay Environment 280
Appendix C3: Street Map of Richards Bay 281
Appendix D1: Map of Esikhawini H & J Open Spaces 282
Appendix D2: Wetland Map of Esikhawini 283
Appendix D3: Street Map of Esikhawini H1 and 2 284
Appendix E1: Wetland and Open Space Map of Mzingazi 285
Appendix E2: Proposed Plan for Mzingazi 286
Appendix F: Approval Letter from the UMhlathuze municipality 287

ABBREVIATIONS USED

DCD	Department of City Development
DERM	Department of Environmental and Recreational Management
DITS	Department of Infrastructure and Technical services
E.P/PM	Environmental Planning/ Project Manager
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESMP	Environmental Services Management Policy
ESMP	Environmental Services Management Plan
IDP	Integrated Development Plan
LUS	Land Use System
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
SDF	Spatial Development Framework (Key component of IDP)
SEA	Strategic Environmental Assessment
UNCED	United Nations Conference on Environment and Development
WMP	Wetland Management Plan

CHAPTER 1: INTRODUCTION

1.1 Introduction

Urban Greening can be generally defined as the combined process of growing, conserving and management of different types of vegetation in different areas of the city for social, economic and environmental benefits (Byrne and Sipe, 2014). Urban greening can be synonymously used with the term urban greenspace also considered as a combination of a many green areas in a city, (Roy et al., 2010). These include all types of playing fields, court yards, resident's gardens, wild vegetation, cemeteries, green roofs, vacant lots, nature conservation sites and areas offering different recreational activities, (Harnik, 2010). Most green areas are made up of vegetated public and private spaces, (URGE Team, 2004).

Recent studies refer to this concept as Green Urbanism, also defined as a practice of creating beneficial human and physical environments (Isaac, 2013). This concept is aimed at creating green areas with more long lasting economic, social and environmental benefits so as to improve the lifestyles of urban communities and create cities that have functional ecological systems (Troy et al., 2007). Urban green spaces are widely becoming popular in the world of increased congestion, pollution and climate change, as they supply many ecological services crucial for combating urban ills and improving the health of people living in cities (Byrne et al., 2014). Urban greening traverses many disciplines and brings together specialist from different fields like architecture, engineering, urban planning, environmental management, economic specialists and many others (Mazza, 2010).

Sustainable Development on the other hand, refers to economic growth that is carried out without the depletion of natural resources (Wolch et al., 2014) and without preventing meeting of future needs by generations to come (Institute for International Urban Development (IIUD), 2012; Mensah, 2014). It is therefore the expansion of economic opportunities to all while remaining within the physical bounds of what can be maintained indefinitely (Atiqul, 2011). Sustainable development combines the interrelationship between people, nature and wealth (IIUD, 2012); while on the other hand it supports policies that help to meet these important elements of the environment (Troy et al., 2007). This means that a program that has been enacted sustainably has its attention on meeting human and environmental needs (Atiqul, 2011). Sustainable development can be regarded as a platform that can be used to bring together socio-economic and ecological processes that can ensure a better urban environment as illustrated in Figure 1.1 (IIUD, 2012).

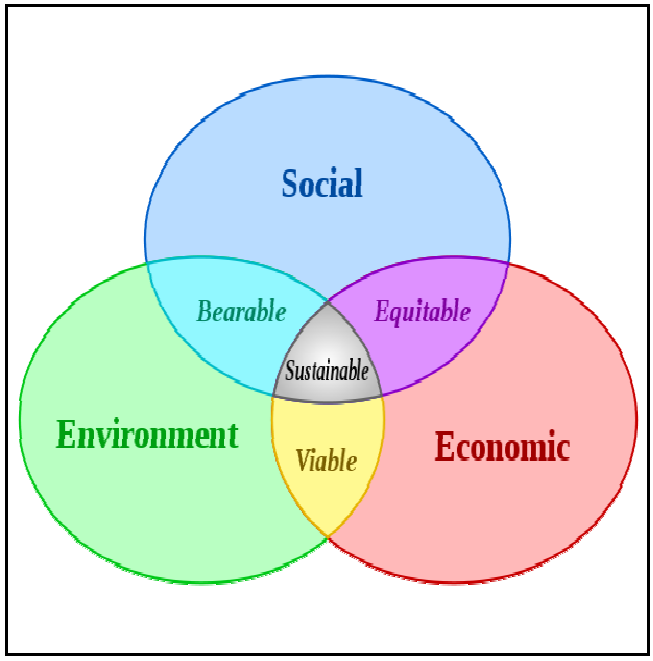


Figure 1.1: The interconnections in sustainable development (Institute for International Urban Development (IIUD), 2012)

Though the concept of sustainable development has been covered and defined by various international conventions, some schools of thought believe that more discussions are needed to accommodate cites experiencing this development in different ways (Isaac, 2013). It can be noted that despite the level of development a country may reach, several countries still experience inadequate sustainable development programs (Atiqul, 2011; IIUD, 2012). In this regard urban green spaces are becoming critically important in improving urban environments to accommodate the rapidly increasing urban population (Byrne et al., 2010). It can be argued that instead of a "one size fits all" definition more focus should be directed towards the achievement of spatial and unique benefits for people and ecological systems in specific urban areas (Sauri et al. 2009; Isaac, 2013). In this way sustainable development can be tailor made for different cities and bring about improving health living standards for different cities as opposed to a blanket definition where other cities' development endeavours are left out.

In the past, sustainable development used to focus mainly on ensuring conservation and improvement of degraded ecosystems as a result of increased social, economic and demographic urban growth (Jennifer et al., 2014). However this understanding has many loopholes and is counterproductive as it omits social and economic needs of people. In White's (2008) view, the growing significance of human poverty is the motivation behind the continuing need for the expansion of economic and social opportunities. In short, sustainable development has improved from focussing on environmental conservation, but now covers several related environmental aspects capable of bringing improved quality of life for urban communities (Atiqul, 2011). In South Africa the government is increasingly recognising that sustainable development is a crucial link to various elements of the economy and is working towards policy frameworks that promote this relationship of social, economic and environmental aspects of the economy (NFSD, 2008). In this regard sustainable

development can be considered as the expansion of economic benefits to all while remaining in the physical bounds of what can be maintained indefinitely (White, 2008).

As the world continuously experience problems related to unsustainable development practices, urban areas are aligning their developments to meet sustainable living standards, planting and growing street trees, increasing the number private and public open spaces with vegetation in urban areas. Many scholars believe that most cities in developing countries have taken more time to discover the need to transform themselves to sustainable urban greening than those in developed countries (Andersson, 2006; Mazza, 2010). However, it should be noted that cities in developing countries are more concerned with issues of poverty alleviation, increasing unemployment, starvation and shortage of basic services instead of addressing both environmental and socio economic challenges of sustainable development, hence urban greening has not been comprehensively integrated in urban development (Donaldson-Selby et al., 2007). Basic needs issues for developing countries rarely includes improvement in urban ecology hence it has been side-lined in many cases. Many proponents of sustainable development agree that sustainable development should focus on fostering effective measures that can lower levels of poverty while promoting environmental protection and economic growth (Shah, 2011).

In the 1960s and 1970s, the concept of sustainable development was considered to be a response to environmental degradation of green areas caused by industrial development as a result of population and economic growth (White, 2008). This version of sustainable development has now been fused with social and economic development elements in order to create urban areas that continue to function in the future with less environmental degradation. Greening urban areas and sustainable

development have a strong link between urban developments and influence each other as shown in Figure 1.2.

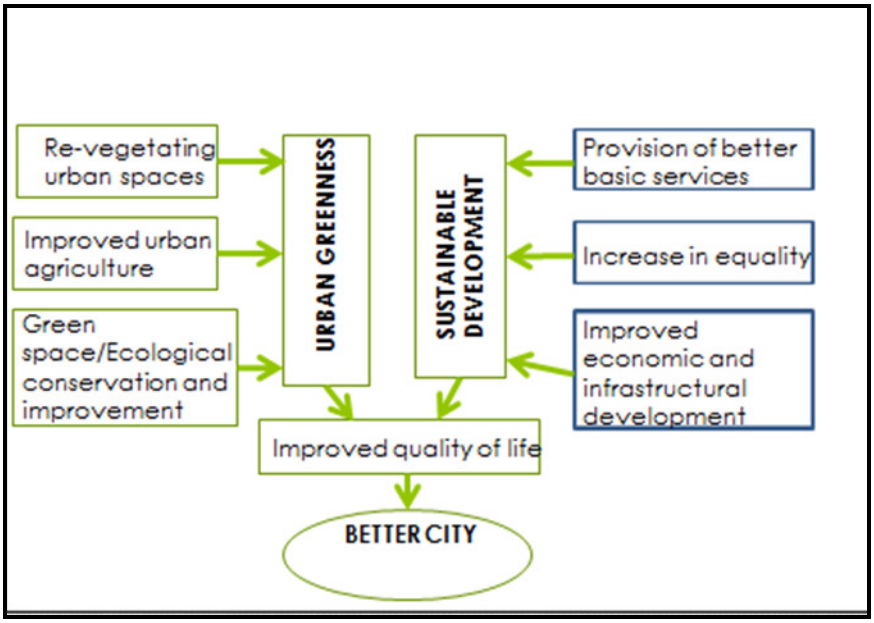


Figure 1.2: Relationship between urban greenness and sustainable development.

Sustainable development has improved from a sole environmental focus to the provision of social equity and economic prosperity in cities (Zhao, 2010). Commitment to eliminate poverty and provide better jobs and services must be accepted as a priority (NFSD, 2011), while simultaneously working on reducing wastefulness and ecological damage as shown by the complementary relationship in Figure 1.1 and 1.2. However the biggest challenge is that economic development and urban greening are mostly at loggerheads in many municipalities of developing cities with the environment being the biggest loser resulting in environmental degradation instead of enhancement (Zhao, 2010). Urban growth and sustainable development should prioritize sustainable economic and social processes like walking to nearby work places, cycling, creating more green jobs, creating more parks, increasing accessibility of recreational activities in city parks, planting more street trees and use of public transport to minimise car trips and congestion (NFSD, 2011). This should be fused together with ecological conservation and improvement to maximise

ecological benefits and sustainability (White, 2008). It is this relationship between sustainable development and greenness in most developing cities that is seriously being compromised by rapid urbanization, driving such cities into unsustainable future (Isaacs, 2013). Any economic prosperity and poverty alleviation programs or service provision that neglects and destroys urban greenness does not constitute sustainable development as these two are linked in many ways and need to complement each other (White, 2008).

Growing urban areas symbolises economic growth and prosperity (Mensah, 2014) and as many governments continue to channel large chunks of their national budgets into industrialisation, transport infrastructure, housing and provision of services, environments, like open green areas are encroached and degraded, bringing ecological development and economic development into conflict (Nicholson, 2000). As many cities experience unprecedented growth, resulting in environmental degradation, many policy makers are compelled to concentrate on the potential of urban trees and urban green spaces in mitigating the harm caused by economic development (Young, 2010, Young; 2011). This has consequently resulted in the loss of open spaces and urban agricultural land due to urban sprawl, reducing the economic and ecological advantages provided by these green areas in the city (Sauri et al., 2009). Despite the success of many recent studies in stressing the significance of ecological systems in human wellbeing, the threat of destruction of ecological space continues to grow as many cities face problems of waste management, urban sprawl, deteriorating air quality and access to green areas (Young, 2011).

This research is an attempt to investigate the urban challenges and barriers existing in intermediate cities that are strongly influenced by urban development policies and

planning policy on one side while on the other side it focusses on challenges to development, management and protection of urban green spaces. For urban greening to meet the objectives of sustainable development, municipal authorities or local government should craft policies and strategies that should safeguard the future of green spaces, improve the quality of urban services like air, transport and water, and make urban areas more attractive to investors while enhancing the wellbeing of local people (Troy et al., 2007). Flexible planning considers social, demographic and bio-physical characteristics of areas, in which green space is planned (Byrne et al., 2010). In other words, green spaces should be provided to meet social and ecological needs of a city. This is one of the biggest challenges facing many countries like South Africa, where the recently experienced political change that has brought capital and economic interests into the forefront of development priorities (Mentis, 2010). Through better spatial planning, cities can minimise urban land use footprints and enable ecological conservation and improvements to be part of the foundation of city development (Henderson, 2013). Sustainable development therefore requires many functions of urban greenness like heat absorption, purification of air and aesthetic value in promoting urban living standards without degrading urban ecology.

1.2 Research Statement

The main focus in this study was on investigating the barriers that exist in terms of urban development policies, planning policy on one hand and challenges to development, management and protection of green spaces on the other hand. To do this, the investigation examined the quantity and quality of street trees and green spaces respectively in the city of UMhlathuze to try and discover if greening policies and planning procedures are translated into the increased and improvement of urban green spaces. Appropriate planning takes into consideration the physical

needs of an area versus its growth rate needs. Policies should be constantly updated to promote provision of ecological related service. The reason why more should be done to improve ecological infrastructure is because ecosystem services are regarded as the foundation of sustainable development and without them food, shelter and healthy living will be difficult to meet. Intermediate cities of the developing world need to increase knowledge and awareness of the value of ecological services among people in order to achieve more sustainable progress (Troy et al., 2007). If ecological asserts are depleted, the ability of ecosystems to provide services will diminish. What therefore must be sustained is the potential for generations to meet their needs through ecosystem services as the key functions that underpin the potential for well-being.

1.3 Motivation

Ensuring of environmental sustainability and growth continues to increase today as it becomes a crucial tool to assess and monitor the interaction between man and the environment in different parts of any given urban (Teriman, 2015). Such an assessment generates important information or data that can be used to evaluate the performance a city's environmental, social and economic policies. This research also sought to collect and provide valuable information that can be used by planning departments and policy developers in South Africa and explored the importance of urban greenness and how it impacts on sustainable development.

In many countries, biodiversity is historically conceived as a luxury peripheral to developmental objectives (Byrne et al., 2010). South Africa is a biodiverse country, but this fact has not historically translated into national planning, i.e. planning which caters for all socio-economic and environmental activities in all urban areas in the country. In this kind of planning government programmes require national co-ordination and integration in both policy development and implementation (National Treasury, 2010). In recent years environmental concerns have now been co-opted

into major planning policies, although poverty and job creation remain government priorities (NFSD, 2011). The South African government, according to Donaldson-Selby et al., (2007) has committed itself to becoming more environmentally sustainable in its new National Development Plan Policy (NDP) from 2000 to 2011. According to the National Development Plan, all development issues need to be dealt with in a manner that improves environmental sustainability and the ability of the human and socio-economic fields to effectively respond to the challenge of climate change while working to improve quality of life (NFSD, 2011). However this shift has experienced many challenges and slow responses from many stakeholders as cities attempt to improve their level of greenness. Most small cities lack the financial resources coupled with less political support in campaigning and implementing greenness plans and policies (Mensah, 2014). If cities are to become more livable and ecologically viable over longer periods, they need alternative approaches to green space provision. This research reviewed some of the latest findings from green space research and discussed more flexible modes of green space delivery (Roy, 2012).

With the world's population surging towards a seventy-five percent urban population by 2050 (Byrne, 2013), urban planners, municipal managers, ecologists, healthy professional and ordinary citizens in developing countries like South Africa are becoming increasingly alarmed by the rapid increase in urban environmental challenges. These include increasing pollution, loss of biodiversity, deteriorating physical health, food shortage, and shortage of water and a reduction of green space (Young, 2011). Cities are therefore under pressure to protect and improve their green spaces (Byrne, 2013). This research is an attempt to explore how small cities like UMhlathuze (South Africa) are managing their green spaces and evaluate the challenges they face as they implement sustainable development measures.

Urban green spaces are considered as a crucial environmental assert in many parts of the world, but statistics in Africa reveal that there is rapid and continuous degradation and reduction of the number and sizes of these spaces (Mensah, 2014). Another contributor to urban green space decline in Africa is less focus of research studies on urban green spaces, especially the challenges affecting the relationship between greenness and sustainable development. Much of the studies are dominated by European examples with fewer studies on upcoming economies in Africa like South Africa (Mensah, 2014). Several green space studies in South Africa concentrates mostly on such spaces in big cities like Johannesburg, Cape Town and Durban with less attention on small cities like UMhlathuze. It is against this background research that seeks to provide a micro study on the relationship between sustainable development and greenness in small cities of South Africa. This attempt will simplify the efforts of municipalities, policy makers and other stakeholders working on developing and improving greenness and sustainable development for them to be aware of the challenges obstructing the success of developing open spaces that can bring about sustainable development in South Africa.

1.4 Research Questions

This research addresses the following research questions were formulated:

1. Is there a relationship between urban greenness and sustainable development in the city of UMhlathuze?

2. To what extent is urban greening implicit and explicit to urban planning in the city of UMhlathuze?

3. What are the barriers and challenges facing development, management and protection of urban green spaces in the city of UMhlathuze?

4. To what extent are there interactions between residents and green spaces in the city of UMhlathuze?

1.5 Aims

To address the above motivational needs of this research, the following aims and objectives provide a framework for literature review and data collection of this research. The following are the aims of this research.

1. To assess and evaluate the relationship between urban greenness and sustainable development and the extent to which urban greening is implicit and explicit to urban planning in UMhlathuze.
2. To investigate and assess the levels and challenges of urban greenness in the context of rapid urban growth and expansion in the city of UMhlathuze.

1.6 Objectives

In order to address the aims of this research, the following objectives were formulated:

1. To study and analyse new and old policy documents and written records of past and future development plans of the city to address the needs of aim 1, To compare levels of greenness in different residential areas to address aim this will help to assess how city planning has helped to improve city greenness and quality of life for city residents. This objective will also help to investigate and assess the different levels of greenness that exist in commercial and residential zones of a city so as to enable comparison between different zones and suburbs of the city.

2. To observe and count street tress to help assessing the levels of greenness and to investigate the challenges hindering development and improvement of green areas to address the needs of aim 2.

3. To establish the various benefits of greenness in urban development and identify different socio-economic activities impacting on the growth of urban greenness. This will address the needs of aim 2.

1.7 Study Area

UMhlathuze is located on the north eastern coast of KwaZulu Natal province in South Africa, 180 km north east of Durban (Statistics South Africa, 2011) and is the third biggest municipality in the province. It covers an area of approximately 795 km^2 (Statistics South Africa, 2011) and encompasses the towns of Empangeni and Richards Bay and residential areas of Meerensee, Central Park suburbs, Esikhawini, Ngwelezane, eNseleni, Mzingazi, Madlazini and Vulindlela and also areas under Traditional chiefs Zungu, Khoza, Mbuyazi, Dube and Mkhwanazi as shown in Figure 1.3. Rapid urban growth has seen the population of the city rising from 289 189 in 2001 to 334 459 in 2011 with a population growth rate of about 1.47% (Census, 2011). Its age structure is dominated by the working class population (see Table 1.1).

Table 1.1 Age structure of the city (Statistics South Africa, 2011)

Population characteristic	**Percentage of the total population**
Population under 15	29.30
Population 15 to 64	67.50
Population over 65	3.20
Total population	**334 459**

The city has many human and natural wetlands and other water features which include lakes like Lake Nhlabane, Mzingazi, Cubhu and Nsezi (Census, 2011). Its tourism attraction is boosted by its 45km coastal plain with 80% of it still in its natural condition. Tourism is also favourable in the city because of its rich biodiversity, international acclaimed game reserves, spectacular wetlands, many outdoor sporting activities, cultural heritage sites, subtropical climate and endless beaches (Local Government Handbook, 2014). Economically the city has been boosted by its newly established Industrial Development Zone (IDZ), which continues to attract more business investments into the city. UMhlathuze has been positioned by the State as one of the country's development nodes with its deep water port and airport being influential in ensuring spatial development in many parts of the municipality. Its main economic sectors are summarised in the table below.

Table 1.2 Main Economic sectors and their percentage contribution to the city (Local Government Handbook, 2014)

ECONOMIC SECTORS	**PERCENTAGE CONTRIBUTION**
Manufacturing	45
Mining and Quarrying	11.6
Financial, Real estate and Business	10.7
Community, Social and Personal services	10.4
Transport and Communication	9.1
Trade	6.3
Agriculture, Forestry and Fishing	3.2

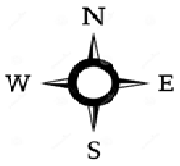
It is home to many political parties like the African National Congress, Democratic Alliance, Inkata Freedom Party, National Freedom Party and others.

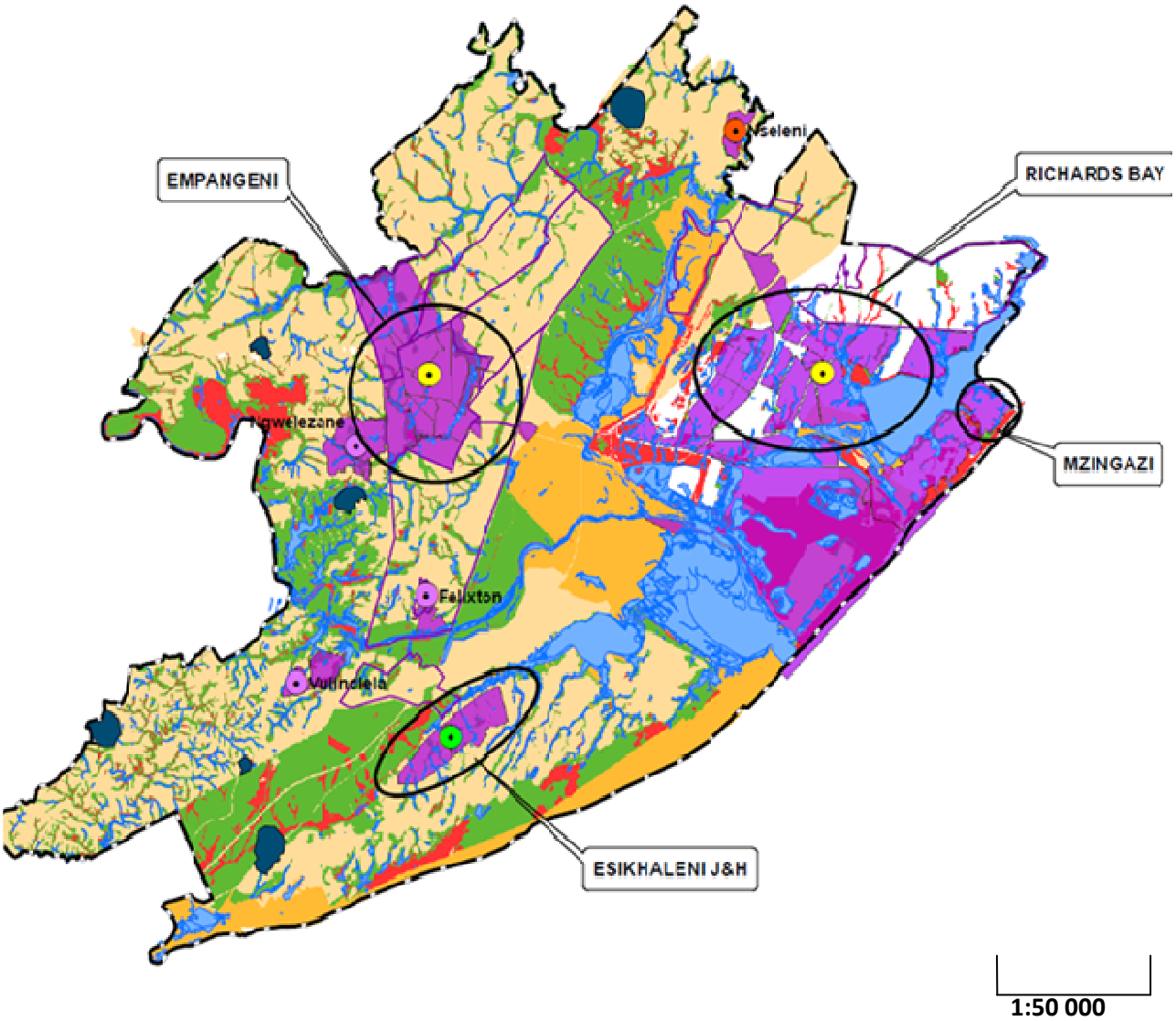
Primarily this investigation focused on the city of UMhlathuze but more attention in terms of data collection and surveys focussed on the built up areas that mainly characterise this city that is the Central Business Districts (CBDs) of Richards Bay and

Empangeni. Further surveys were done in Mzingazi as a new residential area where the city is visibly growing and expanding, ESikhaleni is an established high density suburb that gives an insight on greening and sustainability matters from low to middle income resident's perspective. Central Park on the other hand represents the higher income residential area while Mzingazi represent a mixture of rural and urban suburb. Within these areas, research also focused on greening and sustainable development in the built up areas, residential areas, peri-urban areas, open spaces and parks. The selected areas formed a true representation of the city. The map below shows the city of UMhlathuze and the marked areas which will be targeted for data collection.



UMhlathuze municipality (red) in KwaZulu Natal Province(cream) in SA





Key

NODES	ESMP Draft	LANDUSES

	Area of focus in the city		Buffer linkage		Wetlands
	Emerging Primary Node		Conservation		Formalised area
	Primary Node		Developable land		Future expansion area
	Secondary Node		Nature Reserve		Municipality boundary
	Tertiary Node				Rural Nodes 2013

Figure1.3 (a): UMhlathuze Municipality in Kwa-Zulu Natal in South Africa and specific areas used for data collection (UMhlathuze Municipality, 2011/2012 Annual Report)

AREAS OF FOCUS IN THE CITY

Richards Bay CBD

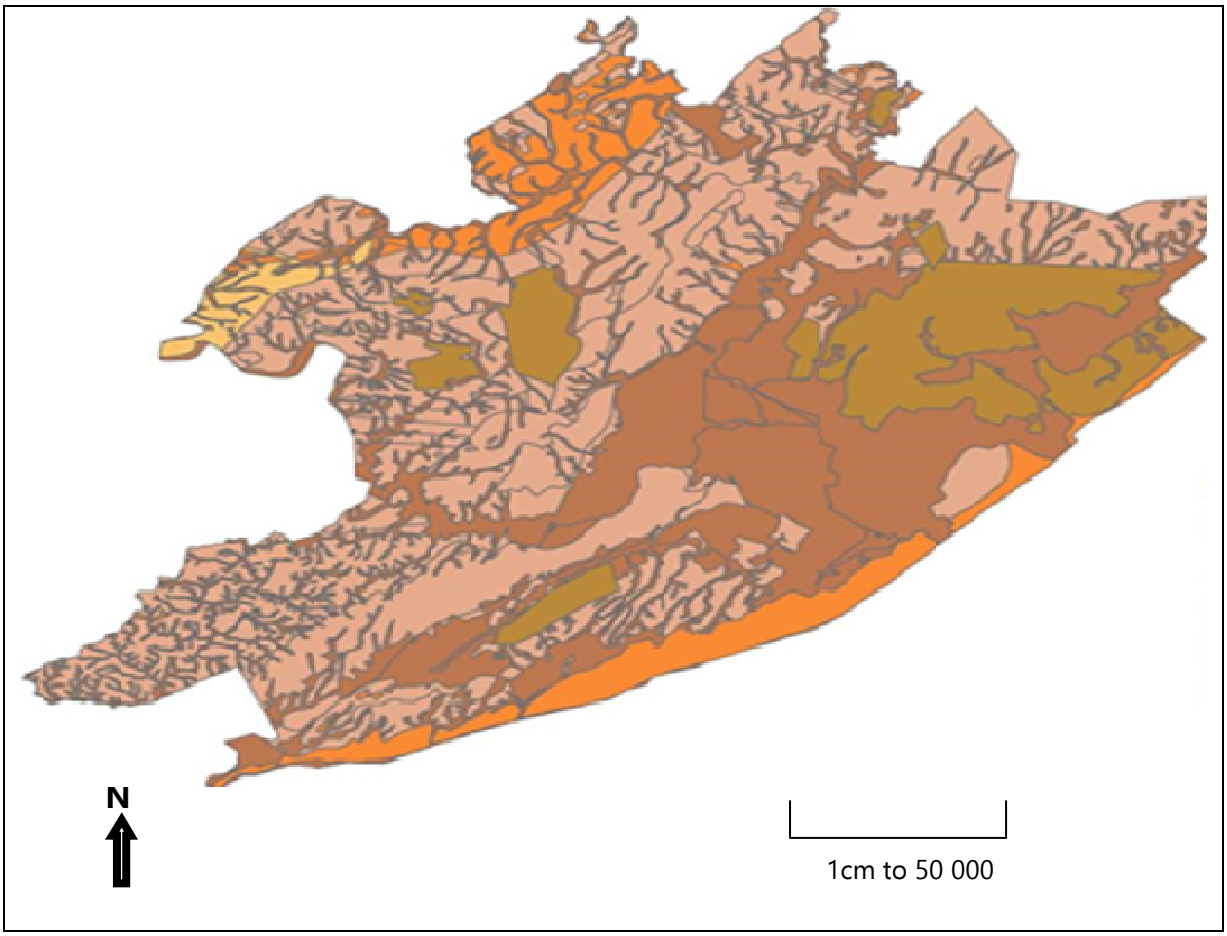
Empangeni CBD and Central park suburb (low density suburb)

Mzingazi low income residential area (High density suburb)

Esikhawini residential area (H1&2) – High density suburb

Geomorphologically the landscape of the city of UMhlathuze is a low lying area bordered by the Indian ocean, coastline and a high inland relief, showing a history of erosion and sedimentation (Spatial Development Framework Review, 2014/2015).These past geomorphological processes have created a landscape that supporting dense and diverse flora and fauna species that have contributed to the development of scenic sites in the area. However, the existence of a low Indian ocean, coastal plain increases the risk of flooding and climate change in the area, therefore ecological conservation and effective decision making are critical area in the development planning of the city.

In terms of biodiversity the municipality lies within the Maputaland-Pondoland-Albany biodiversity hot spot, regarded as one of the richest floral region in Africa (Spatial Development Framework Review, 2014/2015). This region contains about 80% of South Africa's remaining forests (Spatial Development Framework Review, 2014/2015). The area covered by this municipality supports about 174 Red data species and is ranked among the highest in South Africa given its smaller size (UMhlathuze annual report, 2012/2013). This large composition of Red Data Species is one of the driving forces behind sustainable greening and high emphasis on ecological conservation of indigenous species in the province (Spatial Development Framework Review, 2014/2015).



Key

Development Constraints	
	Developable with minor constraints
	Developable with costly constraints
	Developed
	No development Recommended
	No Restriction on Development

Figure 1.3 (b): Geo technical constraints in UMhlathuze (Spatial Development Framework Review, 2014/2015 page 48).

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The promotion of better standards of living in urban areas in South Africa is one of the challenges facing cities, particularly after the social and economic developments that these areas have been experiencing in the last decades. Green areas like parks, recreational facilities and agricultural land in cities are and can be used as fundamental tools for building a long term of environmental sustainability, which is a critical resource in raising the standard of living in towns and cities (Atiqul, 2011). Urban green spaces are continuously becoming critical in improving the environmental, social and economic status of any given city in terms of both quality and quantity of green open spaces. These aspects are now the centre of prime concern for planners and city administrators (Gupta et al., 2012) as they show tolerance and awareness of nature in urban areas. More research is therefore needed to discuss and characterize the spread and availability of these spaces in urban areas (Tang et al., 2014) aimed at enabling cities to assess their levels of greenness and management of green spaces. This section reviews the relationship between urban greenness and sustainable development of different literature, and assesses many other related issues of sustainability and the significance of urban green spaces from different perspectives. Views of different scholars will be used to analyse and assess the role of different green areas in uplifting urban lifestyles.

2.2 HISTORY OF URBAN GREENING

The history of urban green spaces can be traced back to many countries particularly in Europe. Despite the broad origins of urban green spaces, a brief description of the history of urban green spaces is given in this part to help assess the role of urban greening in sustainable development in urban areas. The past offers useful insights into the nature of socio-ecological interactions under diverse conditions, and

elucidates the implication of the decisions made in the past, the present and the future development of urban areas (Costanza et al., 2007). The idea of urban greening is regarded by some schools of thought as being as old as the cities themselves (Greenhalgh and Warpole, 1996) and starting with the Hanging Gardens of Babylon, the ancient marshes of London up to the scenic gardens of Vienna and Paris. Garden cities in Britain (London) can be traced as far back as the early 20th century (Massey, 1999).

The emergence of villas (Figure 2.1) and their associated gardens in Italy marked the increased use of trees as part of recreation, farming and urban beautification (Lawrence, 2006). In the late 16th century walled towns and cities started introducing trees on wall tops and buildings for defensive purposes, but soon these trees lined spaces were now being used for walks (Massey, 1999). In the Netherlands, ideas of planting trees following canals began to infiltrate into towns but this time trees were mostly planted along roads (Jackson, 2007). Such a need and importance of trees in cities continued to grow and by the early 17th century trees were now protected by municipal ordinances in Amsterdam (Lawrence, 2006; Jackson, 2007). All these developments, including the need for leisure and recreational activities around public and private areas continued to push the growth and importance of green spaces in urban areas of many parts of Europe in the 17th century (Lawrence, 2006).



Figure 2.1: Villa degli Armeni, Asolo, Italy (Jackson, 2007)

The commencement of the Enlightenment age in the 18th century was accompanied by rapid population growth in urban areas which caused the emerging of different types of social, economic and environmental conflicts which negatively affected the growth of urban green spaces and their access by urban residents (Lawrence, 2006). Finally green spaces emerged started to emerge in many countries as private and public gardens (public parks). Public parks came into existence around the Victorian era in Britain when what began as land of the social elite eventually became a desirable space for common men (Morphet, 1989). Around the same time with the Victorian era, many big cities like New York began preserving natural urban areas like Central Park, while the Olmstead period marked the intense introduction of parks in urban areas in the United States (Massey, 1999). In Britain, urban greening found its way into cities as green squares surrounded housing complexes of crowded residential areas as a way of improving people's health (Greenhalgh and Warpole, 1996), as for densely settled Victorian cities, green were strongly regarded as a way of improving health of people especially from high air pollution of the industrial revolution (Morphet, 1989). Socially advocates of green spaces in urban areas

believed that such spaces would provide amenity, lower levels of crime and offer children recreational areas as opposed to the dangers of inner city environments (Greenhalgh and Warpole, 1996). In addition roads, pavements and walkways in Britain were increasingly lined up with trees and flowers, culminating in the opening of different types of parks (Jackson, 2013).

The early 20th century saw the growth of the concept of green spaces or parks in town was boosted by Ebenezer Howard's town planning ideas demonstrated by his idea of garden cities meant to improve the attractiveness of new towns using well designed green spaces, (Masseyet al., 1999). The 1930s and 1940s were more concerned about the life of young people and concentrated more on recreation and sports grounds as urban open spaces. This resulted in the increase in quantity of open spaces but reduced the quality of open spaces (Greenhalgh and Warpole, 1996).

Green spaces have been critical areas of both socio-economic and cultural lifestyles during the early years of civilisation to today. A historical analysis of the origins of urban green spaces offers useful insights into the nature of social, economic and ecological interactions taking part in urban greening, which enable improved decision making about the future of urban greening to be made (Massey et al., 1999).

2.3 FUNCTIONS OF GREEN SPACES

2.3.1 Introduction

The role and use of urban open spaces are mostly underrated while its ability to improve quality of life and sustainable development is not always fully realized. These spaces serve complex functions in urban ecosystem (Feng et al., 2005) by

providing significant social, cultural, economic and ecological processes that shape both sustainable development and protection of the environment, (Haq, 2011). They can act as long term tools for planning for environmental protection and upgrading of urban living standards by providing various amenities and recreational facilities (Haq, 2011). See Figure 2.2.

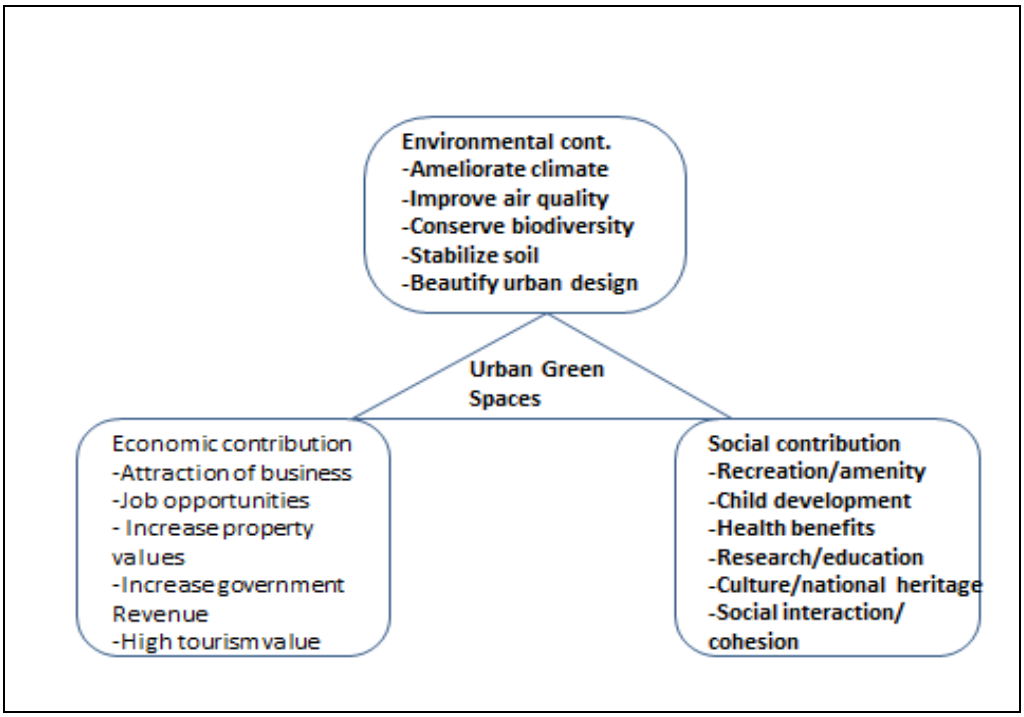


Figure 2.2: The tripartite contributions of urban green spaces (Mensah, 2014)

2.3.2 Public Health Benefits of Urban Green Space

Parks and green spaces boost human health and wellbeing in ways that supports urban revitalisation and quality of life for all (Wolf, 2014). Apart from beautification of surrounding areas, parks and open spaces are widely appreciated for their connection to better health. Studies have shown that there is a strong positive association between natural environments and mental health (Seeland et al., 2009). In the same way, constant contact with green spaces in urban areas improves people's fighting chance against many diseases and depressions (Maheswaran, 2010). In

addition green spaces are purported by Kemp et al., (2005) to the improvement of the human mind and overall body health. Reports of increased life expectancy of the old as a result of living in and green spaces have been noted by many researchers (Takano et al., 2002) due to the increase in physical activities. Other studies have also reported that there is a strong relationship between improved life expectancy and high greenness urban environment as opposed to built-up environments (Morris, 2003; Maheswaran, 2010). All these benefits are all linked to the clean, fresh air generated by these green spaces. It is widely accepted green spaces offer relaxing and revitalising opportunities of urban populations, which are conducive to mental wellbeing (Bratman, et al. 2012). However a lot of controversy has been raised concerning the green spaces contribution to increased life expectancy for people living in greened areas, therefore in some urban locations greening is not highly prioritised and not a necessity (Takano et al., 2002).

Contact with the natural environment (green spaces) has been proved to promote psychological restoration, improved mood and reduced stress and anxiety (Wolf, 2014). In support of this, a study of health patterns in the Netherlands discovered that there is a close relationship between people's view of health and the availability of urban green spaces (Morris, 2003). With these health benefits one can wonder why this benefit is not being enjoyed by many people in cities. Awareness of these ecological benefits remains very low to many urban residents of developing countries. Municipalities have less contact time with communities to raise such awareness due to financial challenges and lack of prioritisation of environmental education in residential areas (Mentis, 2010). In the past, parks, green spaces and trees were mainly regarded as elements of beautification projects, but today they are profoundly regarded as important sources of positive human health and well-being (Wolf, 2014).

2.3.3 Ecological benefits of urban green spaces

Governments at all levels are just realizing the value brought by trees and other different types of urban spaces (Hirokawa, 2010). Research has now shown that in addition to the aesthetic benefits of trees and green spaces, productive management of the urban tree canopy cover results in air quality improvements and can help local governments in meeting federal clean air standards (Williams, 2000; Hirokawa, 2010). Availability of clean air is highly important to many local governments, but is still a big challenge many cities are failing to provide for the betterment of urban life. Urban trees are capable of removing these pollutants at less or no cost, which explains why urban greening is becoming a critical urban tool in sustainable development (Hirokawa, 2010).

The challenge of heat islands in urban area causes the rise in temperatures of these areas by approximately 5°C (Bolund and Sven, 1999) and adequate forests and green spaces in around urban areas can help to mitigate this situation (Haq, 2011). The increase in motor vehicles in urban areas has increased the levels of noise and air pollution, generating large volumes greenhouse gases like carbon monoxide and carbon dioxide with a high toxicity for both plants and human environments, (Sorensen et al., 1997). Urban vegetation can absorb many pollutants and lower the levels of urban pollution, but the big question is how many trees are needed to obtain this quality. Bolund and Sven (1999) noted that about 85% of the pollution in a park can be absorbed by vegetation to create clean air. In overcrowded cities, urban green spaces, especially urban trees can strongly lower noise levels, but affected by the quantity of vegetation and how far the trees are located away from the source of noise pollution by blocking its transmission. Huang et al., (2009) concur with the above ecological benefits and assert that big economies like China must intensify urban expansion that incorporates more green spaces as an additional

function of lowering carbon dioxide levels. Protection of open spaces and maintenance of the natural ecological network is therefore vital for environmental sustainability in cities.

2.3.4 Economic and Aesthetic functions of urban green spaces

With the increase in built up areas, many urban areas have lost their natural beauty in the form of vegetation, however the situation becomes different with the intensification of urban greening. Urban open spaces are the best option of incorporating the ecological environment into towns and cities (Roy et al., 2010). In addition, they help to soften the harsh concrete texture of most urban areas to liveable and attractive environments, (Williams, 2000). This has resulted in green spaces being preferred more by property developers because of their many economic and aesthetic functions.

Use of vegetation to cool buildings and reduce energy costs is regarded by many urban planners as a cost effective measure of cooling buildings while greening urban buildings (Atiqul, 2011). The financial benefit of urban trees or urban forest is rarely calculated in many countries, yet this contribution is worth millions of dollars (Wolf, 2014). In the view of the Canadian Parks, Forestry and Recreation Press (2013), ecological benefits of urban trees, including temperature moderation was valued at approximately $28 million in a year in the city of Toronto. Such a value excludes benefits related to physical and mental health brought by trees. Greening urban buildings by enveloping them with layers of plants (green walls) has many advantages (Perini et al., 2013) that range from reducing pollution, absorbing heat to reducing noise pollution. Provision of shade and improvement in air circulation all provides cooling effects. This can be supported by a research done in Chicago, which discovered that an increased tree density of about 10% lowers energy used to heat

and cool the town by between 5 to 10 (Sorensen et al., 1997). Due to these benefits architects in European and North American cities are focusing more on rooftop gardens as a way of improving environmental integrity, biodiversity and sustainable development (Johnston and Newton, 2004).

When urban greening is fully implemented, it can increasingly raise property values by between 5 to 15% (Feng et al., 2005; Haq, 2011) as the attractiveness and recreational facilities become readily available. Research from several cities has indicated that urban properties in the vicinity of strong green and prestigious recreational areas experience a rise in property values (Byrne and Sipe, 2010). Urban areas with vegetated recreational facilities are associated with high levels of outdoor recreational activities with many urban people (Kemp et al., 2005) and open spaces in residential areas are associated with healthier patterns of children's outdoor activities like sports and recreation (Haq, 2011).

According to Sorensen et al., (1999), beautifying urban sites of Kuala Lumpur (Malaysia) and Singapore contributed to the large scale attraction of foreign investment which brought huge economic growth. This means green spaces can have both economic and aesthetic benefits which, when effectively implemented can increase quality of life, economic margins and promote sustainable development (Williams, 2000). Urban ecosystems provide aesthetic and recreational services capable of improving people's quality of life without compromising meeting the needs of future generations (Aldous, 2006).

While urban green space strategies can provide a vital ecological function that can address environmental justice problems, improve quality of life and increase

aesthetic attractiveness (Wolch et al., 2014), they can also increase housing costs and property values. In the long run this can lead to gentrification (Wolch et al., 2010) causing the displacement of poor residents whose lives greening aims to improve. It is therefore a challenge to urban planners and policy makers to come up with greening strategies that can protect environmental sustainability and social values of all people (Mentis, 2010; Shanahan et al., 2014). This is not always the case in low income groups who are in the majority in growing cities, and who are more concerned with economic and sustenance problems which to them are more urgent than health issues (Mentis, 2010; Shanahan et al., 2014). The growing concern of the deterioration of nature and the need for leisure activities in supportive green environments is believed to be a concern mainly for affluent groups and those with environmental awareness (Smetana et al., 2014).

2.4 SUSTAINABLE DEVELOPMENT

2.4.1 The concept of sustainable development

Economic development on its own cannot achieve sustainable development (Jim, 2012). It can only bring sustainable development when it is well planned with local and environmental concerns so as to create jobs and improve quality of life (Lewis, 2008). This is a big challenge to many countries and cities which bring this research to the big question of what is sustainable development. The Brundtland Commission defined sustainable development as an improvement that meets both current and future generation needs (Institute for Sustainable Development, (ISD) 2010). In support of this definition the National Environmental Management Act of South Africa regards it as an the integration of environmental, economic and social factors with urban planning and policing in order to satisfy present and future generations developmental needs (Government Gazette, 2005). All these definitions can be summed up in the illustrations shown in Figure 2.3.

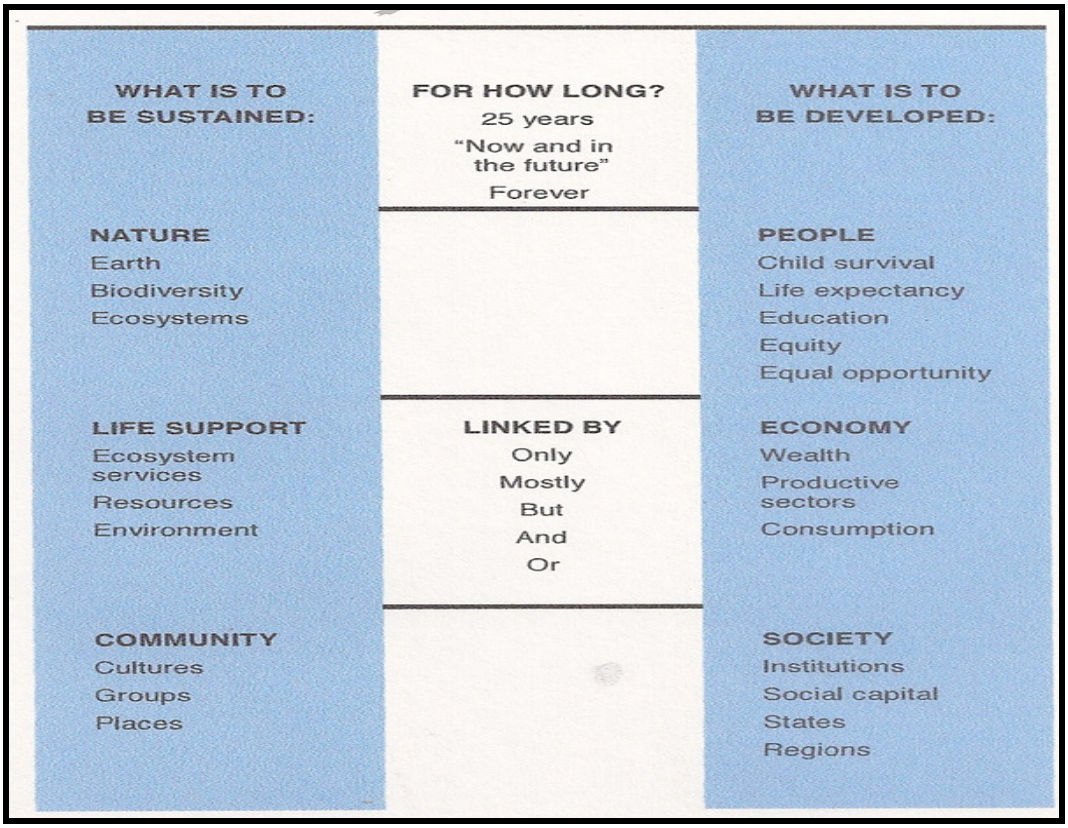


Figure 2.3: The meaning of sustainable development (SOURCE: U.S. National Research Council, Policy Division, and Board on Sustainable Development, Our Common Journey: A Transition toward Sustainability (Washington, DC: National Academy Press, 1999).

What is to be sustained is nature, life support systems and community while developing people, economy and society (Kates et al., 2005). Urban greening as a form of nature conservation should not be valued as intrinsic asserts but as a utility that brings social, ecological and economic benefits. In a South African context

> "sustainable development implies the selection and implementation of a development option, which allows for appropriate and justifiable social and economic goals to be achieved, based on the meeting of basic needs and equity, without compromising the natural system on which it is based," (Department of Environmental Affairs, 2014 ; 8).

Such a definition is meant to address sustainable development in a holistic way and stresses that environmental planning and implementation should be backed by the

economic policies of the respective city and country (Williams, 2000). South Africa considers urban greening as new path capable of addressing many economic, environmental and social issues of urban populations and urban ecosystem (Mentis, 2010).

Unsustainable development practices continue to increase due to lack of political entry points of sustainable development in national governments and private enterprises. As a result of the limited implementation of sustainable development,

> "… Climate change has become the de facto proxy for implementation of the sustainable development agenda; but the framework of the climate change negotiations are not always the appropriate forum for broader strategic discussions of sustainable development" (ISD, 2010: 2).

All these paradigms accept that sustainable development involves the combination of the three related pillars i.e. environmental preservation, economic growth and social development (Kates et al., 2005).

Over the past two decades, sustainable development has mostly been strongly regarded as environmental conservation with less attention on other pillars limiting its effectiveness and integration with most sectors of the economy. In many countries the effectiveness of sustainable development has also been limited by the current orientation of development as purely economic growth (ISD, 2010). This approach has been commonly applied in developed countries in achieving high levels of economic improvements and many developing countries are following the same direction which compromises the quality and quantity of natural resources threatening biodiversity and natural environments (Kates et al., 2005; ISD, 2010). Developed countries possess the capacity and resources to practice sustainable

development policies through political involvement and engagement of the public which are still low. This slowness of change in developed countries is made worse by developing countries which are also following the same economic development model (ISD, 2010: 2). Significant change in natural resource uses in developed countries in order to expect changes in developing countries tuned to economic development practices. More and better greening methods capable of improving greening dialogue and cooperation with all countries of the world are required (ISD, 2010).

In many European and North American cities sustainable development is not only desirable but necessary (Walliser et al., 2012) to ensure that the present and future needs of urban residents are safeguarded and promoted. Massey et al. (1999) agree that for cities to achieve sustainable development it is necessary to avoid the social, economic and ecological challenges that threaten human health as a result of depletion of resources caused by pollution and rapid urbanisation. Urban planning has a role to play in promoting changes that will solve the above problems and also help to bring about changes in urban forms to achieve more sustainable relationship between ecological improvements and different land uses (Hinchcliffe, 1999). A sustainable city is therefore one that is able to cope with conflicting interests like poverty, need for economic development, ecological conservation and urban expansion (Boone, 2004). This means that, the relationship between environmental movements and city planners should be prioritized and strengthened to ensure that ecological issues gain a prominent place on the urban agenda. Campbell (1996) also agrees that planners will therefore be advantaged from combining social theories and environmental procedures with various skills and techniques to address environmental conflicts and injustices.

The idea of sustainable development emerged from old criticisms and limited results of post-world war 2 model of development where economic growth was prioritized ahead of other elements of the economy like the environment (Gardiol, 2009). In contrast to this sustainable development through urban greening can last forever with effective results as it incorporates economic, social and environmental elements (Williams, 2000). This kind of development therefore needs private sector, government and general public support and commitment in order to increase the effectiveness of such benefits (Mentis, 2010). Sustainable development of urban areas and their green spaces have therefore become crucial in today's world due to the pressure and rapid growth of urban populations (Aksoy, 2011). Sustainable development in many countries was a reaction to environmental, social and economic concerns on suitable strategies capable of improving people's quality of life in urban areas

In developing countries, economic development in cities is highly prioritized more than its environmental counterpart, leaving environmentalists to believe in worsening environmental degradation and a decrease in urban green spaces as well as other thing such as declining air quality (Mentis, 2010). Some Environmentalists believe that a growth in the economy can promote both rural and urban people to press for improved lives and environments (Gan et al., 2014). This generally implies that as economic growth increases, better living environments, green spaces will also increase, contributing to better quality of life. In Mentis' view (2010), this is difficult to achieve in countries with high economic inequalities where the poor people are believed not to afford strict environmental standards because, it is argued that this will constrain economic growth and deny poor people basic needs and a better life (Mentis, 2010). This view is not favourable for sustainable development because if the standard of safety, health and environmental management are low, the poor will

suffer the most because they are vulnerable and have limited capacity to face the consequences of the negative effects of economic development alone (Aksoy, 2011).

Sustainable development will soon become a priority in many parts of the world as a development framework that integrates environmental, social and economic aspects of the economy (Kitchener and March, 2011). All these elements are related to each other through different regulatory frameworks that provide a link between them (Department of Environmental Affairs, 2014), as displayed in figure 2.3. This type of integration is rarely found in small cities, as local authorities are more focussed on economic development as a way of meeting people's socio-economic needs, and this has serious environmental consequences especially for future generations as economic development on its own cannot bring sustainable development (Mentis, 2010). It contributes to environmental degradation through the excessive use of non-renewable resources. Although the term sustainable development is widely used by many government departments and municipalities, its achievement is very slow, although achieving it is a gradual process (Kitchener and March, 2011).

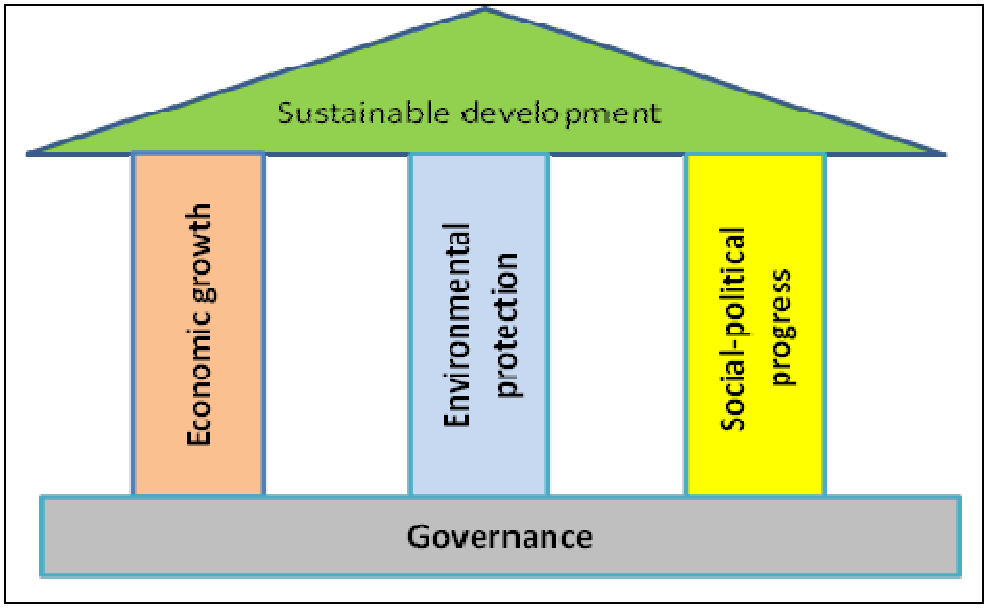


Figure 2.4 (a): A systems Approach to sustainability

Sustainable development, according figure 2.4a) means making sure that the four systems of development represented should be continuously compatible with each other through greening efforts (Department of Environmental Affairs, 2014). To achieve this, urban planning need to be done and used to maintain a strong relationship between the systems in figure 2.4a). Without adequate planning, management and investment, urban growth and expansion may fail to generate the much needed jobs, resulting in more inequalities, exclusion of many local groups and protests for services (Massey et al., 1999), while on the other hand cities become vulnerable to climate change and other environmental changes due uncontrolled degradation caused by poor planning (Naess, 2000). This is the reason why many cities of the world are moving away from simple urban development, preferring sustainable development which attempts to balance the social, economic and environmental components of development (Spangenberg, 2004; Smith et al., 2014).

2.4.2 The concept of equity in sustainable development

One of the central principles of sustainable development is equity. Sustainable development means there should be equity in communities where there is a minimum level of income and environmental quality below which nobody falls, and where everyone should have equal access to community resources with no individual or groups being left to bear greater environmental burden than the rest. Exercising equity means there must be fairness, not necessarily equality and entitlement to an acceptable quality and standard of living (Bede, 2000). The concept of equity is derived from the concept of social justice (Beder, 2000). Under this concept, it widely agreed that certain services should be made available to all people in order for sustainability to be regarded as a success. It is therefore the role of policies in municipalities and national governments to impartial, fair and just towards achieving sustainable development (Falk et al., 1993).

In most cities, environmental inequalities are common, with poorer members of communities are being exposed to environmental problems than the richer. Affluent members of communities have the advantage to choose where to live and are capable of financing environmental improvements and upgrades to enable them to live in better and safe environments. In addition, affluent residents have better access to better education, financial resources and decision making structures which puts them in a better position to fight the imposition of environmental damaging agents like polluting industries and mines (Beder, 2000). Many governments, especially those in the developing world have and are still adopting sustainable development policies that reinforce existing inequalities. Provision of green and recreational services still remain unbalanced across residential suburbs and continues to be influenced by the legacies of pre-independence policies which tend to remove decision making power from some sections of the neighbourhood, leaving them to bear more than their fair share of environmental burdens (Beder, 2000).

2.4.3 The strength of Sustainable Development

Environmental degradation in present decades has arisen from unsustainable of consumption of environmental resources. It is against this backdrop that this subsection looks at the strength of sustainable development. The principle of sustainable development has been used as a guiding principle in the administration of municipalities, such as research on ways of reducing pollution while increasing urban greening for example, research shows that trees can boost air quality through the filtration of pollution particulates (BRIDGE, 2011). Removal of pollution can therefore be boosted by planting trees (urban greening) in the most polluted areas. Environmental sustainability therefore forms one of the pillars of sustainable development.

Sustainable development has been pursued at numerous levels, resulting in a variety of positive improvements both in the human and natural world. Some of these achievements include the increased creation of green job opportunities, reduced net loss of biodiversity, better building designs, improved working conditions and widening the choice of high quality homes. However these plans and policies must be applicable to local circumstances and people (Naess, 2000).

2.4.4 Environmental Sustainability and Urban greening

The meaning of Environmental Sustainability is deeply rooted in Morelli's concept of the three pillars of sustainability shown in Figure 2.4b).

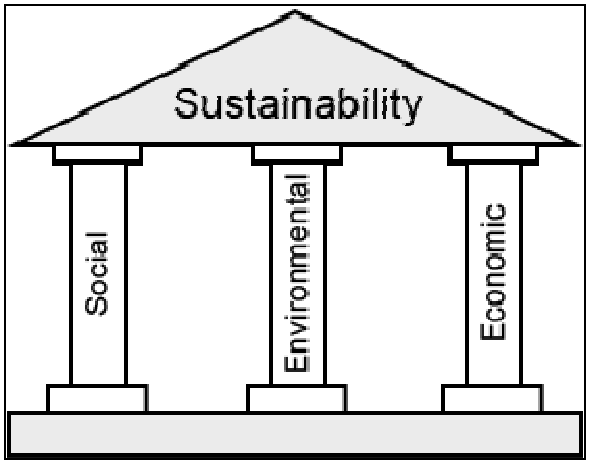


Figure 2.4 (b): The Three Pillars of Sustainability (Morelli, 2011)

According to the above concept of complete sustainability problem to be solved, all three pillars of sustainability must be sustainable (Morelli, 2011). Of the three pillars, environmental sustainability is regarded as the most important one and if it is not promoted, the other pillars cannot be made stronger because they are dependent on the greater system of the environment in which they exist (Haq, 2011). Whether one considers sustainability to exist as an aggregate of the development pillars in Figure

2.4b). One of the important functions is to ensure that people have clean air, water and productive land (Mapes and Wolch, 2011). This brings this discussion to urban greening as a principle that can be used to achieve Environmental Sustainability.

Environmental sustainability focusses on promoting the availability of resources and services for both current and future needs without jeopardising the environmental elements that provide these services. Williams (2000) defines environmental sustainability as a combination of ideas and activities aimed at long term environmental conservation of human and natural resources. This involves reducing air pollution and lowering negative human effects on urban ecology. This call for all urban environmental stakeholders to make informed and sustainable decisions that can lower negative impacts on the environment like urban vegetation (Haq, 2011; Teriman, 2013). All this can be achieved by the successful implementation of techniques that protect and improve the environmental ecosystems and enriching people's lives, all these are part of urban greening (Williams, 2000). Urban greening can be a means to achieve environmental sustainability as it puts more emphasis on sustainable human settlements based on ecological balance, preservation and restoration of green open spaces in urban areas (Morelli, 2011).

Environmental sustainability can help both private sector and government departments' focus beyond short term environmental gains in favour of long term environmental practices that can contribute to a better human and natural environment (Newman and Jennings, 2008). For much of the past, most urban activities and businesses like manufacturing, power generation and food processing have paid less attention to their negative effects on the environment and many of these organisations are responsible for various levels of pollution as some of them still continue practicing unsustainable activities (Hough, 2004; Teriman, 2013). To

combat this degradation and help to achieve environmental sustainability management, planning, redesigning and implementing better urban policies that can enhance green spaces are key steps that can help to integrate and incorporate sustainable environments into sustainable development (Hough, 2004). In short, quality of life in urban areas is based on the quantity and quality of green spaces accessible to people.

Urban agriculture is another form of urban greening that is fast gaining prominence in urban areas due to its social, economic and environmental benefits (Morelli, 2011). Accessible food is regarded as a basic need and sustainable food production systems that protect the environment can support local urban economies and empower people through self-help projects which in the long run can promote and improve quality of life especial financial and nutritional needs (Williams, 2000). The following examples are manifestations of how urban agriculture as a form of urban greening can bring both socio-economic and environmental sustainability.

The emergency of agriculture in the inner city of Birmingham, where there were high levels of unemployment in the 1980s and 1990s resulted in hundreds of people being involved in agricultural projects (Massey, 1999). Derelict gardens were transformed and valuable urban crops were cultivated by residents. Many African cities have been affected by the changing levels of tolerance towards urban agriculture. The city of Harare in Zimbabwe has experienced increased agricultural activities in the 1990s due to many reasons (Wheeler, 2004). The rapid increase in urban farming has resulted from the large growth in urban population since independence in 1980 (Mudimu, 1996 quoted in Massey, 1999), the worsening economic conditions and the rise in commodity prices like food. Many families have turned to urban cultivation as an alternative source of food and income generation.

In Maseru the capital city of Lesotho the local government has supported keeping of dairy cows, maize cultivation, and vegetable and fruit production as a way of promoting urban agriculture (Mbiba, 1994, in Massey, 1999).

The cases of Birmingham, Harare and Maseru provide signs that urban agriculture can play a progressive role in urban greening. Although urban agriculture is not restricted to the urban poor it is the most economically vulnerable residents who will engage in urban farming (Mbiba, 1994 in Massey 1999). Apart from the social and economic benefits of urban agriculture, many environmental benefits can be realized in the long run like controlled soil erosion and preservation of soil fertility (Milburn, 2009). What municipalities and local governments need is to carefully include agriculture in urban planning, and support it as another way of increasing participation and sustainability projects in cities(Mbiba, 1994 in Massey 1999) . City authorities also need to work harder in educating urban residents against the general distaste towards rural land uses like farming in urban areas (Milburn, 2009). Redefinition of what it means to be urban that include recognition of city natures may help to produce more sustainable forms of urban living and building better cities to live in (Massey, 1999).

2.4.5 Government role in sustainable development and urban greening

When pursuing both sustainable development and management of open spaces governments and municipalities should develop databases for both the city and country at large of areas of possible greening and prioritise their greening based on their ecological and economic values (Jim, 2004). The importance of such a database is to develop a management plan that can safeguard urban spaces from encroachment and competition from various urban land uses while conserving

ecosystem resources like plants, water, animals, air and physical landforms and landscapes. Management plans to facilitate these greening programs should be put in place at an early stage of urban planning and designing in order to have full and long term control of management and preservation of the respective green spaces Jim (2004).

Government and municipalities can also contribute towards greening in a big way by maximising the environmental, ecological and socio-economic benefits of urban greening through bold and decisive revamping of all old thinking and practices that do not yield sustainable development (Jim, 2004). They can persuade decision makers to adopt an integrated approach to urban greening while providing plantable sites, maintenance and management of open green spaces. Achieving sustainable development through urban greening calls for a combined effort to pull all stakeholders like the private sector, government departments and the public to work towards sustainable communities (Williams, 2000).

The planning and management of urban spaces can be enforced by a city's by-laws, however the problem in many cases lies with political leaders who fail to impartially enforce these laws to promote sustainable practices like the ecological greening of urban spaces (Mentis, 2010). The state, through its various political portfolios must take the mandate of ensuring and enforcing regulatory frameworks towards more effective greening and planning to ensure improvement of living standards in the long run (Massey and Hinchliffe, 1999). In agreement, Quintas and Curado (2007) also discovered that through supportive policies, planning and by-laws, vegetation density can steadily increase in cities as present vegetation is protected while more green spaces are developed. They also believe that political leaders can rally behind "one fruit tree per home" policy or planting of fruit trees around the city. Fruit trees

can economically and environmentally assist the whole town at large with food, money and ecological benefits (Quintas and Curado, 2007). Many cities in developed countries like in Toronto, Canada, have better green canopies around cities all because of political will and enforcement of by-laws by national government, local governments, environmental pressure groups and other stakeholders (Parks, Forestry and Recreation Press, 2013). Whenever there is a lack of political will, it is difficult to progress because legislation enforcement is heavily dependent on political persuasion and this relationship is paramount to urban greenness and sustainable development (Jim, 2004).

In Toronto the local government recognised the critical role of urban forestry and its crucial benefits. This has resulted in the implementation of urban policies and by-laws aimed at enhancing urban greening (Parks, Forestry and Recreation Press, 2013). By July 2004 the favourable by-laws and policies helped the city of Toronto to increase its tree canopy cover across the city by approximately 30% to 40% from 2000 to 2004, resulting in the maximization of potential ecological, social and economic benefits which are all pillars of sustainable development (Parks, Forestry and Recreation Press, 2013).

The Parks, Forestry and Recreation Press (2013) also reiterates that success of Toronto's Strategic Forest management plan was due to inclusivity in decision making by many city stakeholders as quoted below.

> "The long term vision for the urban forest and strategic goals of this plan were developed in consultation with City staff from various divisions, external stakeholders and the community" (Parks, Forestry and Recreation Press, 2013:45).

Local government and municipalities can be regarded as key players in availing planning, upgrading and investing in urban infrastructure system that includes green spaces and this role extends over selection of infrastructure projects and is capable of bringing greener urban centres (Merk et al., 2012). Their leadership also spans over much investment mechanism selected to finance and upgrade city structures because they are in control of large physical and financial resources and are capable of enhancing development of green spaces (Satterthwaite 2002; Merk et al., 2012). Governments are better at institutionalising sustainability than any other sector, which makes them better partners who bring invaluable benefits and are keen to see how partnerships can improve sustainable development projects (Satterthwaite, 2002).

Finance from the public sector is not enough to stimulate all greening needs, there for private sector investments in urban greening and sustainable development should be seriously mobilised to bridge the funding gap between the municipalities and public (Williams, 2000). However for such partnership with the private sector to be successful, attractive conditions for private sector investment must be made available. The next section looks at this private sector role together with that of other stakeholders in urban greening and sustainable development (Satterthwaite 2002).

2.4.6 The role of the stakeholders in urban greening and sustainable development

Recent years have seen the achievement of urban environmental management through stakeholder participation. This includes private sector businesses, NGOs, environmental pressure groups, civic organisations, the public, scientific and engineering communities (Haq, 2011). Collaboration with stakeholders provides greater synergy (Merk et al., 2012) as this is more than information exchange or combined policing and planning. NGOs are effective agents for building public awareness and participation in the implementation of greening projects as well as voicing local concerns. They have got the capacity to mobilize planting of trees and the development of other urban green spaces. The biggest challenge in involving NGOs according to Williams (2000) is on how to make environmental NGOs primarily focussing on natural resource preservation and global issues to broaden their focus to protection and development of urban ecology for both environmental and socio-economic upliftment of urban spaces.

The Scientific and Engineering community are participating in environmental research aimed at transmitting appropriate information to all stakeholders (Spangenberg, 2004; Merk et al., 2014). Research discovers new ideas, results of projects and helps to link up all new information on greening from different parts of the world through different publication platforms. Apart from the Science and Engineering community news, media reporting on negative environmental activities are also critical to stakeholders in urban greening (Spangenberg, 2004). Their full collaboration will help to communicate and broadcast different greening activities while facilitating public awareness and participation in such sustainable development projects (Merk et al., 2012). Combining all these different stakeholder roles can strongly shape urban greening into a successful process of achieving sustainable

development. Policy makers, Urban planners and city development agencies should implement and support planning and construction techniques that favour pollution reduction and strives to improve urban greening through increasing city green spaces as a way of achieving a balance between the built environment and ecological systems (Merk et al., 2012).

2.5 URBAN PLANNING

2.5.1 Introduction

The transition to green cities should be reinforced with sustainable focussed planning and backed by management practices that promote the linking and connection of different green spaces. According to Byrne (2012) outdated standards are no longer suitable for planning urban green spaces and instead of "one size fits all" prescription plan; green planners need ingenuity, creativity, adaptability and willingness to experiment. Use of integrated planning ensures that planning process in each department take into account planning in other departments to ensure sustainable development (Kemp et al., 2004). Prioritizing and building quality urban infrastructure can be one way of promoting sustainable green cities.

The planning decisions made in different departments are aligned with achieving the agreed goals can bring long lasting benefits. For example, decisions made by the planning department can on one hand affect land use functions of home owners, retail sectors and the community at large. This therefore calls for integrated planning and designing of urban spaces of all related departments and functions (Merk et al., 2012). Similarly, urban service like health services, schools, recreational parks and many others can effectively contribute to development when planned together with the urban transport systems and other public land uses. It is these integrated

planning solutions that are capable of ensuring long term advantages of sustainable development. In support of the above view, concur that integrated planning solutions can achieve long term, strategic, multi-sector and multi-disciplinary approach to decision making for urban planning, investment and development (Kemp et al. 2004) .

2.5.2 Planning for sustainable development and urban greening

Urban planning is regarded as a central pillar of decision making and management of urban programs. Urban planning aims to improve the welfare of urban communities by balancing the conflicting needs of accommodation, industrialisation, urban farming, recreation, transport infrastructure and environmental needs. Effective planning is capable of ensuring an attractive, convenient, healthy, and efficient environment for the present and future needs. This is why planning is central to sustainable development and urban greening (Cilliers et al., 2014). Planning is at the centre of urban regeneration, especially when considering the competing views of businesses and local communities (Campbell, 1996). Planning refers to the process of ensuring that different forms of development in cities are sustainable (Ahern, 2013) and is all balanced preserving and improving the environment. However, it is more disturbing to note that in many cities planning is more aligned with economic and political issues, causing more neglect in improving the ecological facilities in the city (Merk et al., 2012). Without vibrant and functional green spaces most cities will experience deterioration in quality due to problems of air, water, land and noise pollution which lowers the living standards of urban areas especially those of low income groups (Branas et al., 2011).

Urban Planning has an important role in forming the framework of urban sustainable development by strengthening socio-economic, cultural and environmental qualities

of urban areas (Grimm et al. 2008). Contemporary scholars advocate for rational urban planning (Teriman, 2015) in an attempt to align urban planning with the needs of sustainable development. Planning of this nature constitutes four essential steps: (i) analysing the situation, (ii) establishing goals, (iii) formulating possible courses of action, and (iv) comparing and evaluating consequences of the actions (Schonwandt, 2008). According to proponents of this method, this process can be highly successful if it is linked to an environmental review process (Teriman, 2015). However this process's biggest criticism is that, in practice, such review process either has not been put into use at all or not yielded much positive impact slowing sustainable development (Schonwandt, 2008). Furthermore, in the sustainable urban development discourse rational urban planning is criticized for failing to generate realistic plans for sustainable futures, including procedures to take urban ecosystems into consideration during the planning stages (Vasishth, 2008). Schonwandt (2008) purports that this type of urban planning will fail to bring sustainable development in urban areas if it continues to lack public dialogue and failing to integrate social and environmental needs into its planning process.

In today's world quality urban areas are those with health and functional green spaces as evidence of effective planning and environmental management (Aksoy, 2011). Urban green spaces are increasingly offering mitigation for nonpoint source pollution, due to the manner in which trees capture and filter storm water before it becomes a pollution problem (Jim, 2004; Hirokawa, 2010). Urban forests are therefore gaining more prominence in urban sustainable development process as a tool in climate change strategies due to the ability of trees to capture air pollution (Hirokawa, 2010). Urban greening in sustainable development adds positive features like trees and green spaces to reduce the scarcity of healthy environments. Planning in its various forms can integrate the different forms of urban greening into

development processes of cities to help improve people's lives and the environment (Lewis, 2008).

Planning has no limits and can still be done on already planned and built up urban areas, but only as a measure to enhance sustainable methods and improve quality of life (Massey et al., 1999). In the United Kingdom, the influence of planning may be illustrated by urban containment through the use of greenbelts, new towns, parks, industrial estates, pedestrianized streets, redevelopment of older areas and neighbourhood planning (Massey et al., 1999). Re-planning or urban renewal can help in designers to redesign and re-plan urban areas so as to align them with environmental friendly (Hirokawa, 2010). Re-planning urban areas can help rationalizing land uses which are not compatible with their surrounding (Lewis, 2008). Urban planning can help old and new urban areas to cope with the pressure of rapid population increase and rapid urban expansion to promote socio-economic and environmental elements of urban areas (Aksoy, 2011)

Many cities in Africa are subjected to the insufficient operation of urban planning regulations where most planning regulations are dysfunctional (Mensah, 2014). A good example is the Ghanaian and Malawian us of the old 1945 and 48 Town planning acts respectively (Awuah et al., 2010). In Lusaka, Zambia, there has been over reliance of the 1968 master plan (Mpofu, 2013). All these old planning systems are not compatible with present development needs and will not assist urban greening as they have lost touch with new developments (Mensah, 2014). Proper and efficient urban planning of open spaces in African cities has been weakened by limited institutional backings like low levels of financing, limited staff competencies in environmental issues, less transparency, corrupt leadership, and long processes of bureaucracies, political meddling and misappropriation of funds (Mpofu, 2013).

Planning should be adapted to the cities involved and should be able to address critical development and greening needs to help improve quality of life which is central in sustainable development (Lewis, 2008). In support of planning that prioritize green spaces Gairola and Noresah (2010) agree that despite shortfalls in urban planning relating to open green spaces, there is a growing recognition that sustainable forms of development like urban green spaces are not merely desirable but are necessary (Williams, 2000).

Planning for sustainability should take into account the interrelationships between the physical and social components of change (Wheeler, 2004). It must emphasise taking action to avoid costly damage to urban green spaces in future (Williams, 2000). In short, planning should not be a collection of plans and designs, but should be an integration of all social-economic and environmental elements or principles of urban areas or cities which can sustain environmental continuity and improve the lifestyles of urban populations (Massey et al., 1999; Zhou and Wang, 2011).

2.5.3 Relationship between legislation, plans and budgets in urban greening

Plans, budgets and legislation should be interrelated to improve operational effectiveness and ensure that key objectives and priorities for urban greening are budgeted for to ensure their achievement (National Treasury, 2010). However in many cases that involve urban greening this interrelationship is never achieved because of tensions between budgeting and planning which reduce desired levels of integration. Budgets focus on a short term period (a financial year) while planning focuses on a longer period (Five year plan) (Berke et al., 2006). Given South Africa's development challenges, a long term planning period is needed to address historical

inequalities in environmental and ecological benefits, but these cannot be sufficiently addressed by the yearly financial budgets (South African National Treasury, 2010).

South Africa's constitution is the highest law in the country and provision of all basic needs, protection of the environment and improvement in quality of life should be offered or conducted in compliance with the constitution (National Treasury, 2010). Court rulings and upholding the environmental law should be respected and upheld irrespective of its impact on business operations as this is in compliance with the national constitution of South Africa. Monitoring can ensure protection of green spaces against encroaching urban land uses. According to South Africa's National Treasury (2010) most urban green spaces have been seriously degraded due undermining of policies, Acts and legal rulings. If sustainable development is to be achieved through urban greening, legal bindings on urban green spaces should be complied with. Conservation of urban green spaces is also promoted by a city's by-laws (South African National Treasury, 2010).

In compliance with the constitution of South Africa, municipalities operate with by-laws to guide them and enforce environmental management and conservation of green spaces and provision of services to residents. By-laws entail and enforce different local government requirements and legislation on all public and private facilities like open spaces, cemeteries, culture and recreational service Mazza, 2010). These need to be fully enforced in urban areas if sustainable development is not to be compromised. Ecological conservation and improvement has been on the receiving end due to economic development, but all this can change if political leaders fight to enforce the city by-laws without any partiality (Mazza, 2010). Most African cities are riddled by constant squabbling between politicians, stakeholders and municipal authorities instead of enforcing laws (Mentis, 2010).

2.6 CHALLENGES OF URBAN GREEN SPACES IN AFRICA

2.6.1 Socio-Economic and Demographic Factors

As rapid urban growth and expansion continue to threaten sustainable development, there are many factors that continue to perpetuate degradation of urban places and weaken appropriate and preventative ecological measures (Williams, 2000). Some of these factors are lack of public and political awareness of environmental threats and the importance of green spaces, lack of effective public education and participation in matters of urban greening and inadequate governance. Williams (2000) concurs with Kemp et al., (2005) that inadequate governance is a serious threat to the implementation of greening policies and development of urban green spaces. This inadequacy includes weak institutional capacity, weak coordination; shortage of public accountability, unimplemented regulatory policies, and insufficient qualified environmental personnel (Williams, 2000; Jim, 2012). Byrne and Sipe (2010) suggested various ways by which local governments can improve their operational processes to increase urban greening and improve sustainable development. Government need to seek a win-win situation between environmental and economic goals in order to promote both sectors of the economy (Jim, 2012. In addition, government should involve NGOs and the general public in safeguarding and implementation of environmental programmes like developing urban green spaces (Williams, 2000).

Rapid urbanization has caused many environmental impacts which have reduced green spaces in urban areas, the utilization of infill areas is regarded as the biggest cause of the loss of urban green spaces (Gan et al., 2014), in a related case to this, research figure in some US cities between 2003 and 2009 discovered these

experienced a rapid growth in population densities, culminating in more pressure on development and the environment (Nowak and Greenfield, 2012). With human beings about to become predominantly urban species, the big question is whether cities can ever be sustainable? (Seymour, 2012) In addition to rapid population growth in urban areas, increased development pressure from manufacturing, construction, residential and commercial sectors result in the continuous fragmentation of urban green spaces (Gan et al., 2014), and loss of soil to support city vegetation and farming (Quintas and Curado, 2007; Parks, Forestry and Recreation Press, 2013).

Unlike the declining trend reported in this section the percentage of green spaces in a town or city may increase as a result of growing urbanization (Gan et al., 2014). In In some Chinese cities, green areas have gradually increased in the past two decades (Zhao et al., 2013) as a result of urbanisation and increased implementation of greening policies. This therefore concurs with Mentis' (2010) view that as the town and economy grow, people of all levels demand better living environments, further promoting sustainable development and construction of more urban green spaces. However Milburn (2009) sees the balancing of urbanization impacts and sustaining urban green spaces as the most challenging conditions in sustainable urban developments. Continued conflict relationships between urban utilities and growing service needs of towns and cities contribute in reduction of land sizes available for increasing urban vegetation like trees while on the other hand the increase in concrete covered surfaces will continuously reduce permeability and ground water that sustain the growth of urban vegetation (Gan et al., 2014).

All towns have by-laws that govern the administration and implementation of projects, however institutional failures (Kronenberg, 2014), like local government and

social empowerment failures, have reduced the effectiveness of some by-laws. Insufficient funding, poor maintenance of urban trees and green open spaces have contributed to low levels of greening in some towns in developing countries (Anderson et al., 2014). Conservation and improvement of green spaces have also failed due to social empowerment failures (Bentsen et al., 2010) like lack of mobilisation related to low levels of appreciation of the importance of green spaces (Kronenberg, 2014). While it is important to raise awareness of the benefits that urban green spaces provides, there is need for broad institutional reforms in order to implement critical policies that promote sustainable development.

Urban green spaces with good connectivity forming a green network permeating the city constitute the best mark of a naturalistic design, making it easier to create areas with a rich biodiversity (Jim, 2012). Many urban green spaces are not connected to one another and are easily threatened and overwhelmed by other urban land uses dominating in those areas. The same view is shared by Varese and Bertelli (2001) who are of the opinion that the failure of greening policies in several cities of developing countries is a result of urban greening concepts being merely regarded as offering a green portion isolated from other green spaces of the natural environment. As a result, those who work tirelessly to conserve, develop and improve urban green spaces are frustrated due to lack of progress (Kronenberg, 2014). In addition, Varese and Bertelli (2001: 14) go on to say, "Unlike the traditional urban planning which used the instrument of green belts as static borders used to limit city growth, the green network of today shows a lack of versatility in linking up different ecological elements of a city". If well connected, green spaces provide good quality view in the design of such networks and result in the increased attractiveness of respective urban areas (Anderson et al., 2014).

2.6.2 Environmental Injustice in Urban Green Spaces

Having looked at how both health and recreational benefits are linked to different ecological areas, this section now focuses on whether access to urban green space is fairly or unfairly spread for the benefit of all residents of these urban areas. Although agreement exists among scholars on different ways of measuring people's access to green and recreational areas, most studies have used Geographical Information systems (GIS) to measure this accessibility (Wolch et al., 2014). Metrics of this measurement included the presence versus absence of a park or recreational area near a home and density of facilities (Sister et al., 2010; Wolch et al., 2014). The challenge of this method is that GIS cannot describe the function of a green space which may discourage use of green space in a particular area.

According to Sister et al., (2010) in the research on use of parks in urban areas in Baltimore, park congestion was low in low income neighbourhoods. This can be attributed to socio-economic factors influencing people's recreational attitudes. Other studies also discovered residents of low income suburbs are more likely to have low levels of open space activities and as a result, they continue to be served by less better recreational facilities. In high income residential areas the picture is different as accessibility to better urban green facilities continues to increase. Such disparities can be used to explain the common cross-cultural and socioeconomic variations in the use of different green spaces common in many towns and cities (Morris, 2003; Maheswaran, 2010).

In addition, parks have different sizes, qualities, facilities and differ in terms of recreational programmes. Local people may also have different safety perceptions about certain green areas like parks in an area affecting the use and benefits that are

to be obtained from such ecological facilities (Wolch et al., 2014). Regardless of all these challenges Sister et al., (2010) concur with Wolch et al., (2014) that continued environmental injustice in the provision of urban green spaces among ethnic and low income groups continue to worsen as compared to more affluent areas. This can be attributed to socio-spatial determinants (travelling distance and park features) (Brownlow, 2006). If given green space is considered as unsafe or as a known spot for another community group, it may not be used by other groups, especially in cities with a legacy of racial segregation (Sister et al., 2010).

2.7 EXAMPLES OF GREEN SPACE PRACTICE

Cities can be viewed as ecological entities whose relationship with nature is scarcely perceived as urban residents seem to be cut off from their natural surroundings, yet it is the interrelationship between cities, society and the natural environment that determine their sustainability (Massey and Pryke, 1999). This view is supported by various frameworks such as that of Ebenezer Howard in his theory of "the three magnets" (Figure 2.5) (Massey and Pryke, 1999), the Green City model by Le Corbusier, the Ecotopia by Ernest Callenbach, the Smart Growth by Litman, the biophilic cities by Beatley, and Green Urbanism model by Walls.

In Howard's time the massive industrialisation and rural to urban migration in London during the 19 th Century was highly unsustainable. The solution was simple – reintegrate people with the countryside, hence Howard combined together the two magnets (Town and Country) and came up with the third magnet which he called, The Town-Country Magnet where human society and the scenic attraction of nature are meant to co-exist. Howard therefore tried to combine what he saw as the advantages of the urban and the rural areas in a new sustainable form of a city and he called this the garden city as shown in Figure 2.5 (Massey and Pryke, 1999).

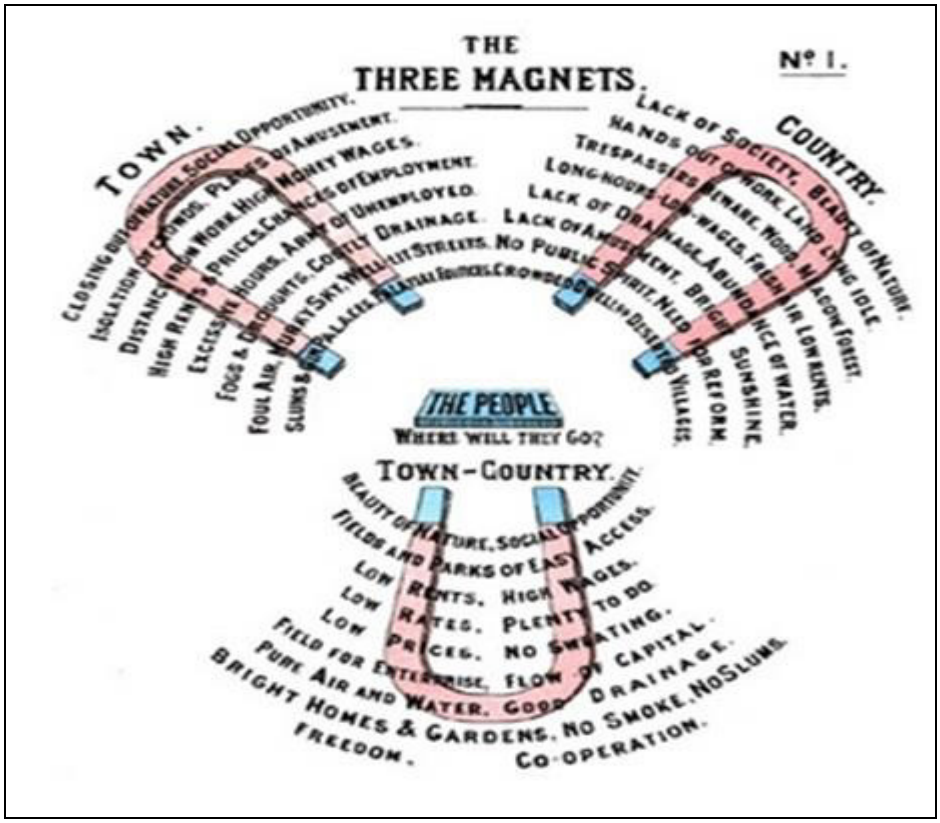


Figure 2.5: The garden city, according to Ebenezer Howard (Massey et al., 1999)

Many urban green plans today were inspired by this concept of the garden city (Massey et al., 1999). In past urban planning, trees lining the roads have always been regarded as an important beautification aspect aimed at softening and increasing the beauty of an area (Varese and Bertelli, 2001). Street trees or urban forests from Howard's time come with many social and environmental benefits that transform city areas into quality environments. The municipality of Zlin (Czech Republic) is one good example where the city takes more care of the present green spaces and keeps them as nice as possible while creating new places planted with greenery (Aganivanshi, 2014;Landscape, Mexico, Urban Design,2015) as shown in figure 2.6a. In addition, figures 2.6a, b and c below clearly show park islands and dense street trees in the city centre as influences of Ebenezer Howard's ideas of a garden city and the essential decorative element of street trees.



Figure 2.6 a): An attempt at a garden city: Zlin in Czech Republic (https://en.wikipedia.org/wiki/Garden_city_movement)



Figure 2.6b): Svit in Slovakia - originally in 1934 planned as a combination of an industrial and garden city (https://en.wikipedia.org/wiki/Svit).



Figure 2.6 c): Park median in Avenida Amsterdam, the "grand avenue" of the Mexico City, designed in 1926 and inspired in part by Howard's Garden City (https://pricetags.wordpress.com/2015/01/14/mexico-enero-5/).

In Barcelona the Joan Miro Park features a wide variety of green spaces from neighbourhood plazas to large metropolitan parks. This park is famous for its sustainable design principles such as a water sensitive design with a variety of active recreational uses with large parts of the park planted with native vegetation (Byrne, 2012).

		
Wireless facilities, Joan Miró park, Barcelona	Café/Bar, Joan Miró park, Barcelona	Dog exercise area, Joan Miró park, Barcelona

Figure 2.7: Joan Miró Park in Barcelona (http://www.barcelona.cat/)

In China's Hangzhou the local officials started a program of city wide greening and ecological greening focusing on once neglected and forgotten spaces such as a street verges freeway, railway corridors and abandoned canals as a way of revitalizing the city through urban greening. Such projects have made China one of the world leaders in remodelling urban green spaces (Byrne, 2012).

	
A street in a new university sector of the city, Hangzhou, China	Freeway greening, Hangzhou, China

Figure 2.8: Hangzhou, China (http://www.citinature.org/city).

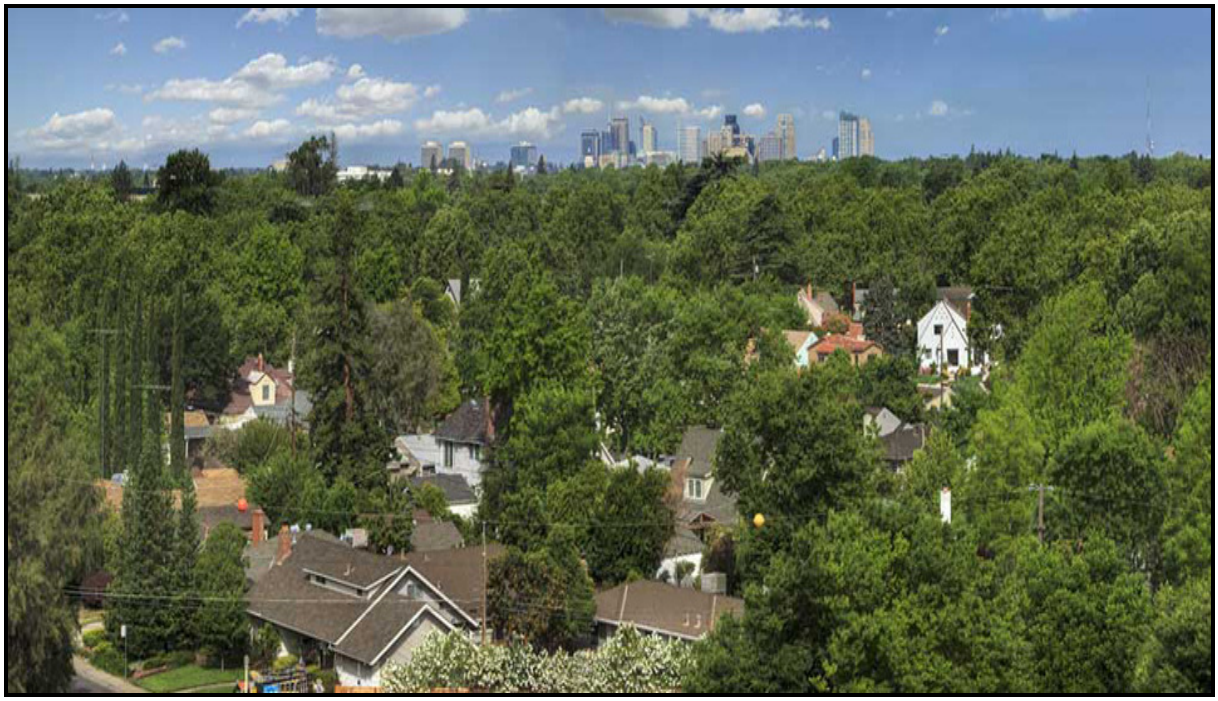


Figure 2.9: The urban forest canopy of Sacramento, CA (USA) (http://scenariojournal.com/article/how-many-trees-are-enough/)

Ernest Callenbach (1975) captures the environmental concerns of today through a story which explores an ecologically sound and sustainable society. The Ecotopia story emphasise the importance of oneness with nature as emphasised in this research that cities should increase the integration of green spaces into their infrastructure as a conservation measure and a way to provide environmental services.

The theme of environmental conservation and sustainable development is also shared by Litman in his concept of Smart Growth (Litman, 2015). Smart Growth can be explained as a way of building urban and rural communities through convenient housing, promoting transportation choices near workplaces, shops and schools, and preserving open space, farmland, natural beauty and critical environmental areas (McConnell and Walls, 2005). Smart Growth ideas have become the springboard for

better growth policies in an attempt to promote protection of open spaces and revitalizing neighbourhoods into livable communities (Litman, 2015). It means that, how a community or town develops has direct and indirect effects on the environment; hence the need to ensure that development should be sustainable.

According to the US Environmental Protection Agency (EPA, 2006), Smart Growth policies are capable of bringing compact, mixed and accessible development while promoting better transport systems that ensures more economic savings. Smart Growth can also lead to development that is resource efficient, affordable, and socially equitable. This research stresses that urban greening driven by the collaboration of the community and stakeholders (EDRG, 2007). Urban planning that lacks urban greening has led to increased impervious surfaces that provide less environmental benefits which have increasing storm water management costs and urban heat island problems. Urban planning supported by appropriate architectural designs that encompass rooftop gardens, street trees and pervious pavements can slowly reduce any environmental damage. Smart growth also favours compact housing which reduces land consumption and promotes preservation of urban open spaces (Arrington 2008; EPA 2006).

Timothy Beatley with his concept of Biophilic city (Lehmann, 2010), provides a strong framework from which this research draws more conceptual links in furthering the quest for cities to be green and sustainable. As urbanization increases, more people are in need of urban nature on a daily basis and this is what the Biophilic city framework advocates for. Biophilic cities are cities that contain abundant nature (Lehmann, 2010) and strive to preserve, conserve and improve nature in urban settings. The Biophilic concept stresses the need for the development of deep connections and contact between people and nature. According to Beatley

(Lehmann, 2010), the concept of Biophilic cities differs from sustainable cities in that Biophilic cities are natureful cities in which nature is put at the core of planning and design can also encourage people to take an active participation in interacting and caring for urban nature.

Urban problems such as urban heat island, flooding, flooding and pollution can be addressed by making cities natureful through tree planting, urban forests, constructing green parks and rooftop gardens. In a green city, there are open spaces in the form of parks and urban forest, but from a biophilic city perspective nature does not have to be compartmentalized into separate blocks but should bring nature into every aspect of the town such as trees along suburbs and streets.

The Green City Model by Le Corbusier in 1920 (Bahatt, 2008), was developed as a way to reform polluted industrial cities of the 1930s (Bahatt, 2008) through the construction of high rising building towers in a park where workers could live above the streets but surrounded by green spaces at a faraway distance from the polluting industries. Green belts in and around the city were meant to contain and control the growth of the city and improve the spatial quality of neighbourhoods (Bahatt, 2008). This work has become the cornerstone of many planners and architects of today and has a strong bearing on this research through emphasizing the use of green spaces around land use zones like residential areas. Le Corbusier adopted the green features as strategic elements of urban models and he saw nature as a tool to reshape the urban environment and improve the living conditions of people in the neighbourhood. This theme is strongly embedded in the current research as the inclusion of nature into the city is viewed as a lasting solution to many problems. However it should be noted that Le Corbusier was attempting to solve overcrowding

and urban pollution problems, hence unlike his predecessor Howard he opted to build up vertically instead of building out.

The Green Urbanism Model by Walls in the 1990s (Beatley, 2000), is a recent framework that emerged as a need to promote compact energy efficient urban development and a zero waste design (Beatley, 2000). The main aim was to bring transformation and the re-engineering and regeneration of post-industrial city centres. Green Urbanism is a conceptual model for zero-emission and zero-waste urban design, which arose in the 1990s, promoting compact, energy-efficient urban development, seeking to transform and re-engineer existing city districts and regenerate the post-industrial city centre (Usama, 2013). The current research also draws a number of parallel and complementary themes from the vision of Green Urbanism, which includes programs, policies and creative ideas for urban renewal and environmental sustainability (Beatley, 2000). The model strives to encourage the development of socially and environmentally sustainable cities which are a crucial aim of the current research.

These are a number of theoretical concepts for looking at the relationship of urban planning to greenness and environmental issues. There is more emphasis on preserving nature and improving ecosystems that are found in growing urban areas in order to ensure sustainable development from an environmental perspective.

2.8 Conclusions

Different scholars referred to in this chapter share many agreements on the value and importance of open urban spaces in fulfilling many urban functions that enhance people's quality of life and guides cities in attaining sustainable development. Due to

rapid global population increases, urban green spaces are becoming critically important in reducing environmental degradation in cities (Byrne, 2010) while improving the aesthetic and scenic functions of urban areas. To achieve these benefits, outdated standards are no longer needed for planning green spaces, hence green space planners need more ingenuity, creativity and willingness to experiment with new standards if they are to help create green areas capable of adapting to changing social and ecological conditions of the modern city (Byrne, 2010). More collaboration between local government, community groups, urban planners, ecologists and other willing stakeholders is very critical in advancing urban green strategies that can improve quality of life and health without environmental equity and social justice in urban areas (Wolch et al., 2014)..

Discussions in Chapters 1 and 2 have given a contextual background and insight into important aspects of urban greenness and sustainable development in cities. This review has laid the foundation for the investigation and data collection of the relationship between urban greenness and sustainable development of urban spaces in UMhlathuze which is the main thrust of Chapter 3, which includes a discussion of the methods used to collect the data.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This section of the research discusses the different methods that were used for gathering data in the study area, focussing on the relationship between greenness and sustainable development in urban areas. It also gives an explanation of the processes used to generate data and the effectiveness of the tools used to gather the data and address the research aims and objectives. The aim is to critically examine if sustainable development and ecological development are complementary in city development. Data collection will only be done from a selected sample of subjects or study areas due to limited time and financial resources. The methods that are used to collect data for this research include:

i) Counting of street trees, survey of vegetation in open green spaces conservation areas, parks and analysis of maps and photographs of street vegetation.
ii) Interviews municipal officials
iii) Document review of city policies, publications and annual reports.
iv) Questionnaires of local residents

3.2 Research Design

The design for this research was a case study. The choice of this design was influenced by the researcher's need to carry out an in depth study of urban greenness and sustainable development in developing world medium sized city. It was through a case study design that the broad area of urban greening and sustainable development could be narrowed down into a small topic that could be easily researched with stipulated time frames. Given the complexity of urban

greening and sustainable development in the developing world context it was then decided that a case study will allow data to be gathered through a variety of means or data sources like interviews, documents review, questionnaires and surveys. The field of urban greening and sustainable development is a dynamic field that is constantly changing, therefore the researcher opted for a case study design because of its flexibility that would accommodate new changes and results and still allow the research to take new directions.

3.3 Methodological Steps

After the approval of the topic the following methodology were taken before data could be collected.

- A visit to the Head Office of the UMhlathuze Municipality was undertaken to meet the Heads of Departments working with or closely with environmental management.
- The following personnel and their departments were then selected as these were regarded as key informants in key decision positions and worked in fields close and directly linked to the research topic:

DCD – Department of City Development: Brenda Strachan

DITS – Department of Infrastructure and Technical services: Mr Naidoo

EPD/PM – Environmental Planning Department/ Project Manager: Sharin Govender

DERM - Department of Environmental and Recreational Management: Ernst van Biljon

- These Heads of Department were then chosen as subjects for interviews because of their full and comprehensive knowledge of their respective department's operations and their in-depth knowledge on urban greening and sustainable development.

- From the discussion with the Heads of Departments, the researcher was able to get the municipal website where most documents related to environmental management and greening were found, for example reports, schedules, magazines, photographs and others.

- Hard copies available were then physically obtained from these respective offices. Documents addressing related themes of the research topic like environmental management, urban greening, urban development, urban growth and expansion and urban planning and policing were collected for document review. Dates of publication were also considered and documents published from 2000 onwards were considered to explore the different trends of urban development and greenness.

- Street maps and photographs of the city were then obtained from the Department of Planning. These were used to delineate the area to be covered under Observations, Photographing and Map analysis.

After the municipality visit, the researcher then of documents and articles available on the internet searching several databases and websites for articles and documents related to the topic. Articles and documents with matching words and themes were selected as being relevant to the topic and were set aside for Document review together with documents from the municipality website and hard copies obtained from the Heads of Departments.

With study area demarcated, interview subjects having been identified, areas to serve questionnaires were selected as residential and commercial areas in the city. Random sampling methods were used to select questionnaire respondents in different residential areas. This was then followed by the drafting of questionnaires and interviews, which was followed by setting up appointments for interviews. The

following section looks at how each data collection tool was prepared and administered and also its strength and weaknesses in this research.

3.4 Observations, Photographing and Map analysis

The Observation method is considered as an effective method of data collection (Leedy and Ormrod, 2001). Systematic noting and recording method involves an orderly observation and recording of events, objects and behaviours, detailed field notes and photographs describing what has been observed during field studies and observations. This method is regarded as a reliable way of extracting field data (Mouton, 2011). Non-participant observation will be used to study behaviour that occurs naturally in natural contexts of the city. The basis of this method was to assess street tree densities and tree management activities in an attempt to evaluate the level of greenness and ecological development in the city. In support of this idea city administrators, especially in North America and Europe have started to conduct extensive inventories of their tree stocks not only in the streets, but also in parks (Martin et al., 2011) with an aim of establishing a tree data base and critical information on vegetation needs and management in cities. In 1996 New York City residents came together to count the street trees in the city and creating a baseline inventory of the city's street trees (Keller and Konijnendijk, 2012). In 2005 to 2006 a street tree census was carried out again in New York City by volunteers recording information such as numbers, sizes, species, location and condition of trees (New York City Department of Parks & Recreation, 2007). Volunteers moved from one street to another equipped with maps, clip boards, tape measures and tree identification keys.

In this research the main objective was to identify through observation the quantity, density and availability of street trees in the city of UMhlathuze. This information can

then be compiled into a database using the New York methodology and can assist local government authorities and municipalities have a general understanding of tree stocks (Ostberg, 2013). This information is vital for planning and monitoring of urban forests, and to help quantify the values and services offered by street trees (Keller and Konijnendijk, 2012). Forests inventories in urban areas can assist in deciding, identification of areas with and without tree density, species types, identification of trees affected by urban developments and surveying the diversity and age of city trees (Ostberg, 2013).

Observation in this research involved the counting of street trees in both commercial centres and residential areas of the specified study area. Streets on base maps were visited and marked on to the base map of streets to avoid leaving out some streets and repeating the count in the same streets. This involved walking up and down the streets on foot physically counting street trees and observed open spaces and other aspects of greenness in the area. This made it possible to construct maps showing levels of greenness in the area and see if this environmental pillar of development is being addressed to ensure increased ecological functions and better urban living standards. Only trees of approximately one and a half metres and above were counted is this was considered to be the height when trees are considered to be safe from physical harm associated with young trees. Shrubs were left out because their clustering in thickets made it difficult to count them although they can be regarded as part of trees. To include these, the research also observed and photographed the area covered by hedge, shrubs and grass along the streets since they also constitute urban greening. Observation also included taking photographs showing the nature and density of vegetation along streets to help compare greenness levels in the different suburbs and also to help in data analysis (Gan et al., 2014). This observation was done in summer from October 2014 to February 2015 when most vegetation was in the natural green state to ensure easy observations.

Apart from physical counting of street trees, the researcher also recorded and investigated:

1) Streets where trees have been recently planted and the success rate of such projects by counting the surviving trees were compared with municipal records of trees and shrubs planted in that section. .
2) The length of the street which was measured from the base maps or google maps.
3) Streets with more potential space for vegetation growth and streets or roads where trees can no longer be planted. This was achieved by observing areas covered in concrete and buildings and those covered in grass and trees and recording this on base maps.
4) Open spaces that are neglected and can accommodate more urban vegetation and recreational activities. These were physically counted and recorded on base maps during observation sessions.

Road distances were measured from current google maps and density were calculated by dividing the number of trees counted along a section of a road by the distance of this road stretch to give the answer in trees per 100 metres. The selected roads, their lengths, tree densities and colour of density were tabulated like Table 3.1. To record the above characteristics blank base maps with street names were used for recording and different colours were used for recording different greenness features as shown in Figure 3.1.

Table 3.1: Street tree densities of selected roads and distances

ROAD MEASURED	FROM	TO	DISTANCE (m)	No. of trees	Density (No. of tree/100m)	Density colour

11 and more trees per 100m	dense	
7 to 10 trees per 100m	medium density	
3 to 6 trees per 100 m	Sparse	
0 to 2 trees per 100 m	almost empty	

Figure 3.1: Key colours for vegetation mapping along streets and roads.

Apart from recording the number of trees on either side of the road or street and those inside yards that can be seen from the streets, field notes were compiled after each counting session.

Field observations was carried out in specified areas of the city which includes the CBD of Richards Bay and Empangeni, southern part of Central Park suburb, Esikhawini suburb (H 1 suburb) and half of the Mzingazi residential area (see Figure 1.3a). These areas were selected as they are the main residential and commercial centres of the city and exhibit both old and new greenness characteristics of the city. Before going into the field a survey list with different vegetation characteristics was prepared to guide observations and to ensure uniformity in data collection in all areas selected:

- Identifying whether parks have green lawns and trees and how accessible are these open spaces to the public.
- Does the area have private or public parks, what types of trees are there (indigenous or exotic)?

- How big are they and their density? (Density of trees will be recorded as high, medium or low densities which will be determined by counting the number of trees per area e.g. number of trees per 100 m).
- What social and economic activities are taking place in the area and what is their effect on open land and vegetation, do these activities make use of ecosystem services?
- What type of green infrastructure do people in the area have like fruit and vegetable gardens, flower and grass gardens, orchards, veranda plants etc? (Google maps of the area will be used to have a close overview of the area and then compare them with what will be observed from street level).
- Are there any community or municipality projects on vegetation growing taking place in the vicinity?
- Are there any urban problems visible in the area like traffic congestion, any form of pollution or unavailability of certain basic services like schools and clinics?

These questions or research guidelines were necessary to determine the nature of different aspects of vegetation and development activities in the area, so as to establish the relationship between greenness and socio-economic developments. All this information enabled the researcher to produce maps of greenness in the visited areas.

There are many advantages of the observation method, but most importantly data obtained is regarded as processed, tried, tested and useful (Mouton, 2011). However, problems of greenness vary with time, season in a year. Dense or thick vegetation along roads is normally considered a serious pruning problem and a crime, promoting aspect in the rainy season when all vegetation bloom and recuperates from more rainfall, but in winter this is a less challenge as vegetation loses its thickness due shading of the leaves. It therefore requires the observer to be trained

so as to be very skilful and efficient in observing time related problems of urban greenness. Also, vegetation density observed today may not be the same after a month, especially in fast growing urban areas due to constant pruning and maintenance which may be done after the observation.

3.5 Analysing observation data

A coding system was used on the descriptive field notes compiled during field observations. A pre-set code list of about 27 codes was used on these field notes (see Table 3.2). The process uses different words, numbers or symbols to represent each respective data category in order to give meaning to pieces of information from field notes to make more sense of this data and discover patterns that would be difficult to detect by reading alone. This pre-set code list was designed using the research aims, objectives, research rationale and the literature reviewed.

Table 3.2: Pre-set code list for data analysis

INITIAL CODING	
1. Improved recreational projects	1. Threats of urban expansion
3.Tree planting monitoring	2. Greening projects
5. Economic issues	3. Budgeting for arboriculture
7. Political intervention	4. Horticultural projects
9. Influence of policies	5. Future plans on urban greenness
11. Awareness of urban greening	6. Involvement of local communities in urban greening
13. Physical challenges	7. Vegetation integration into city planning
15. Benefits of open green spaces	8. Media use to increase awareness
17. Level of greenness	9. Involvement of schools
19. Availability of basic services	10. Role of the private sector
21. Quality of life	11. Development priorities of the city
23. Sustainable development in the city	12. Influence of regulatory bodies
25. Urban planning and preplanning	13. Influence of planning
27. Ecological conservation	

The above table gives some of the groups or categories into which different themes of observational information can fall into. Before grouping the information the codes above were combined into broad categories to minimise repetition and from these combined categories of different themes. These codes assisted the beginning of placing observation data into groups as shown in Table 3.2 that are constantly repeated and will be grouped together into larger themes.

3.6 Map analysis

3.6.1 Introduction

Map analysis was chosen in this research because of its various advantages. Maps store a lot of data and provide useful ways of displaying different types of open spaces, ecological infrastructure and different types of development in a given urban area. Maps can show old and new boundaries of land use zones and show different activities in different colours. This is crucial in addressing the aims of this research, which focusses on the extent to which urban greening is implicit or explicit in urban planning and further investigate the different levels and extent of greenness that exists in different urban land use zones. Maps are also good for analysis, especially when examining the relationship between two elements (i.e. urban greenness and development) through the use of GIS in order to compare changes in greenness and development within a given period of time (i.e. between 2000 and 2014).

Most of the maps were obtained from the municipal's Department of Environmental Planning in both hard and soft copies (see Appendix B1 to E2). All maps were recently published in 2014 and show all current changes in city vegetation, open spaces, expansion areas and new commercial and residential developments in UMhlathuze. In addition, specific thematic maps were printed directly from the

department's map resource centre to aid analysis of street maps. After a series of consultation with the Mapping Department an agreement on the different map themes and areas to be covered was reached and the first batch of maps were printed which included the following:

Street maps of:

1) Empangeni CBD
2) Richards Bay CBD
3) ESikhaleni High density suburb
4) Mzingazi High density suburb
5) Central park Low density suburb

These maps were meant to guide all the different types of data gathering and survey in the study area including mapping of street trees and open spaces. Apart from the street maps the second collection also contained the following thematic maps:

1) Open spaces map on all the areas of the survey
2) Private and public park maps of the selected areas above
3) All green spaces area maps in the areas to be surveyed
4) Wetland and sensitive areas map of the study area.
5) Environmental map of the city showing vegetation buffer linkages, Conservation areas, developable areas and Nature Reserves
6) Google maps showing street vegetation of the study area.
7) Maps showing aerial coverage of the City of UMhlathuze like the aerial coverage in 2000 and 2013/2014

The case of Mzingazi is different from other parts of the study area. The area has been recently absorbed by the municipality, but its leadership is still under the traditional chief. No street map is available and there are no properly planned streets as the area is still in the process of developing into a suburb. The area is undergoing re-planning hence a planning map was obtained. Mzingazi is an example of mixed high density and informal settlements with affluent properties scattered around the area. Green spaces and open spaces have been seriously encroached by urban sprawl, especially by informal houses. The area originated as an agri-village where people were allocated big yards to practice farming or gardening, but due to pressure for residential land and the complex combined administration of the area by a municipality and a traditional chief many green spaces and open spaces have vanished. There are no parks and recreational ground due rapid urban growth in the area. This map shows how the municipality has re-planned the area to try and save the environmental resources of the area and also to bring in better services like schools, shops, parks, removing people from sensitive or flooding areas while saving natural vegetation and wetland ecosystems in this area. All these maps were used to assess the level of urban greenness and sustainable development in UMhlathuze.

3.6.2 Analysis of maps and photograph data

Maps and photographs of the city's green spaces, especially trees, grass and shrub covered areas were collected in preparation for analysis. This was done between December 2014 and April 2015. Thematic maps of vegetation or green spaces were compared to settlement maps in order to assess the relationship between development and greenness in the city. During analysis, observations were made on availability of green spaces and their distribution in the city. Type of trees and their nature were also noted from photographs. Recurring themes on greenness aspects

like Maps provide useful ways of displaying information in a meaningful way and act as a means of storing data. Maps and photographs are also good in measuring the amount of change of land use through time.

3.7 Conducting interviews

3.7.1 Introduction

Planting of trees and maintenance of trees and green spaces in municipality areas of South Africa is the duty of municipal and local government authorities (Anderson and Elmqvist, 2012). It is therefore important to collect and assess their ideas and plans in order to understand the state of greening and the future plans in store for cities especially the concept of street trees and green spaces. Interviews can be used to extract more information on the plans and programs lined up by these officials. The crucial objective of the interviews in this research was to gain first-hand information about the link between urban greenness and sustainable development in the city of UMhlathuze. Municipal departments with activities closely linked to the aims and objectives of the research topic were first identified. In each department the Head of Department was chosen for interviews, but in some cases the Head was allowed to prescribe an official or a sub branch directly related to the research aim. Different viewpoints from different Heads of Departments in the municipality were then compared with policy views from the documents during data analysis. Interview data was crucially important in showing the extent to which the city treats the issues of sustainable development and urban greenness, and what priorities they are setting. Semi structured interviews (Appendices A1 to A4) were conducted. Interviews focussed more on assessing the relationship of urban greenness and sustainable development in the city. The represantativity of the respondents could not be ensured as it was dependent upon their willingness and availability to engage in the interviews.

The following departments were selected for these interviews:

i) Department City Development
ii) Environmental Planning in City Development (Project manager)
iii) Department Community Services
iv) Department Infrastructure and Technical Services

These departments and their respective heads were selected because they are key informants in key decision making positions and have knowledge of the functioning of their respective departments.

Interview questions were set and prepared in advance and were emailed to respondents in advance to allow them to familiarize with the questions so as to elicit accurate relevant responses, and to minimise time losses. Interview sessions were recorded and transcribed to allow data analysis and assessment. During the interviews the semi structured questions will enable enabled the interviewer to be flexible by asking extra questions to gain more information on related subject matters. The other advantage of these interviews is that responses to the questions will be able to be clarified and expanded during the interview. Information from semi structured interviews will assist in gathering not only answers but explained reasons of these answers of different questions. When interviews are combined with observations, they allow the researcher to understand the importance of ecological activities to residents of the city. However, one big disadvantage of such interviews is that they are time consuming, especially when it comes to securing interviews with high ranking officials who are not always available, and transcribing is time consuming.

3.7.2 Analysing data from interviews

Transcription analysis was mainly done using the open coding system which uses themes from interview samples to confirm and certify emerging themes and

categories (Burnard et al., 2008). Recorded interview sessions were transcribed and summarized in brief notes, noting all elements described in the transcripts. All these phrases or themes were compiled into a refined list where duplicates were removed. Using the system of initial coding framework, all themes or phrases were put into categories based on their theme. After compiling a list of theme categories, the next step of the research was to further look for overlapping or similar categories and further refined them by grouping them together. The shortened list of theme categories was then used to analyse and divide up interview responses (Burnard et al., 2008).

Each category was then assigned a different colour where data themes were underlined or shaded. Finally all data sections with the same marking colour were put together and each category was given a labelled divide. This organised data set was then used to write a report of the findings. Since interpreting interview findings was subjective, there was need for this data to be validated by a third part or the respondent of the interview. This will not be done in this research due to time constraints, however the supervisors of the research will be free to comment and suggest changes (Burnard et al., 2008).

3.8 Questionnaires for city residents

3.8.1 Introduction

A questionnaire (Appendix A6) was structured to elicit honest responses due to part of its close ended format structure. The questions were phrased in a way that provide insight on the importance of urban greenness and how it can enhance urban living standards and help to bring sustainable development in cities. Each question was discussed in chapter 4 to give a broader insight on how the questionnaire was structured and how the questions relate to the aims and objectives of this research.

This further facilitated evaluation on how the local residents responded to greenness and sustainable development issues and what they have done and are prepared to do to increase chances of sustainable development in the city. The questionnaire survey was conducted over a period of about 5 months (from November 2014 to March 2015) in the Two CBDs and three suburbs of different socio-economic status. The study areas were Empangeni central suburb; Empangeni CBD, Richards Bay CBD, ESikhaleni (H1and 2) and Mzingazi (see Figure 1.3 a). The three suburbs are reflective of the different levels of environmental and economic development, while they also show the influence of socio-economic status on issues of service provision, recreation, street vegetation and nature of open spaces and parks in the city. Random sampling was used to select respondents of questionnaires. This process targeted residents in the stated suburbs and commercial areas residing in the city of UMhlathuze for more than one year. This was meant to interact with residents who could have had time to carry out any significant greening or notice several environmental development needs and achievements made in their area.

Limited time and research capacity resulted in a sample of 150 residents being targeted for questionnaire survey.. A Stratified sampling method was used and respondents from the five study zones were randomly selected from all suburbs as per availability, willingness to answer questions and meeting other stipulated requirements. Most questions had a familiar nature with a pre-selection list of possible answers so that respondents will not have to ponder about the situation of service delivery and nature of their service delivery, nature of their parks and open spaces and challenges of urban growth especially on ecological development. Open ended questions also allowed an in-depth clarification and addition of more information to certain questions. The questionnaire was successfully subjected to an approval process by the Ethics Committee of the University of Witwatersrand.

Distribution and collection of questionnaires was personally done by the principal researcher hence no training and explanation of instructions was necessary. The contact details of the researcher were written on all questionnaires in case some respondents had queries on the research topic or with answering questions.

Questionnaires were numbered for easy recording and collection before being distributed to residents to answer and return them through various distribution points like schools, churches, supermarkets and municipality offices, and respondents were given a period of 4 to 5 weeks to complete and return the questionnaire. Some questionnaires were emailed to respondents who chose to have them emailed to them, but the completed ones were physically picked up. Ideally the questionnaire was to be answered by the head of the house unit, whether renting or owning the unit, but where not possible other members of the household unit can answer it. All residents, including foreign nationals will be allowed to take part in this survey as long they had lived in that respective area for not less than a year. The questionnaire was made up of open-ended and close ended questions.

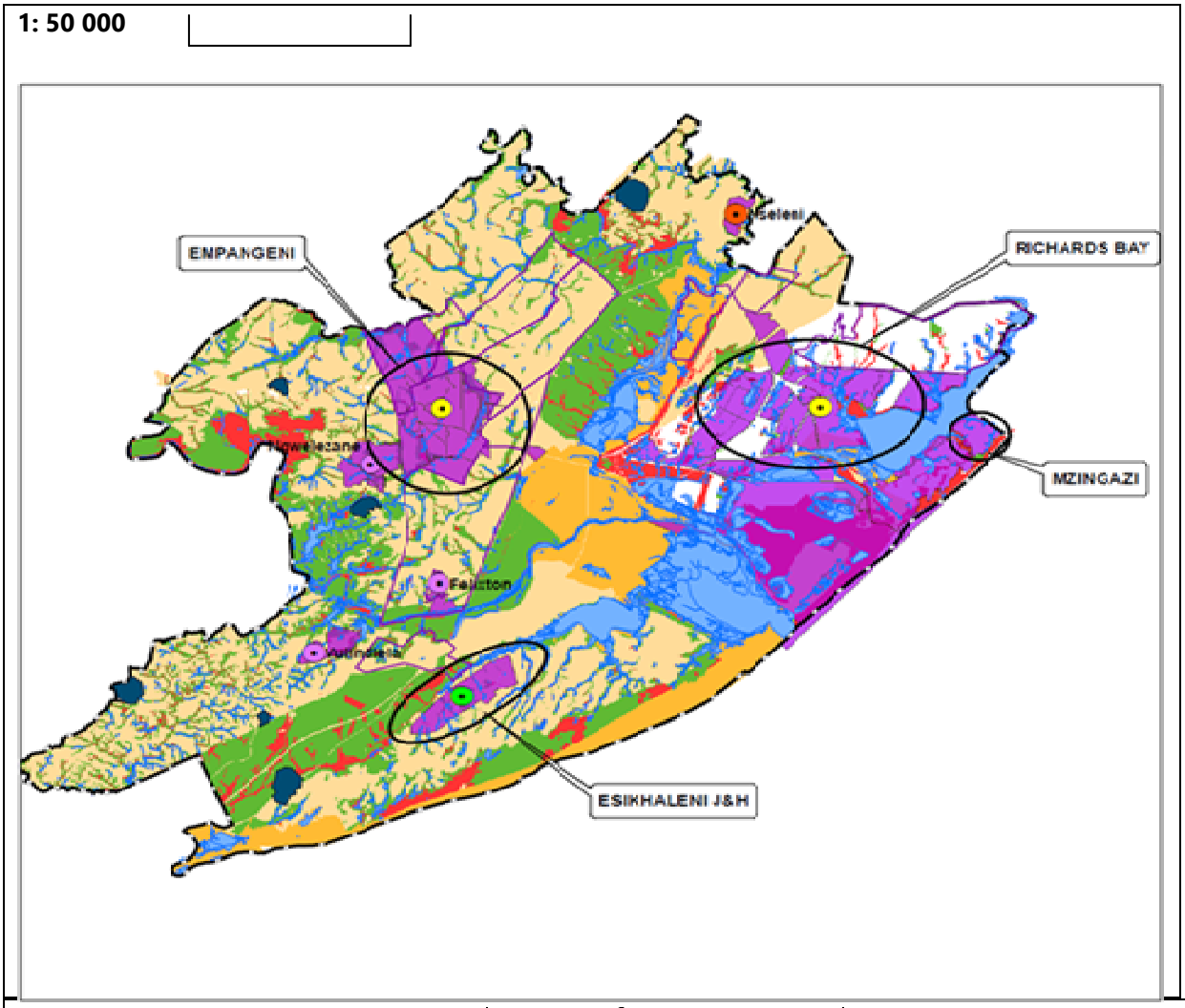
3.8.2 Open-ended questions

These questions allowed the respondents to express their views freely about the subject matter and such questions gave the researcher an insight into the important opinions of residents on the topic. However, the weakness of open ended questions was their inability to use statistical assessments in order to make conclusive decisions. Coding of responses was used to analyse these responses.

3.8.3 Close ended questions

These were used to obtain background information on where people lived, how long they have lived there, their type of house ownership and the availability of green spaces, parks and vegetation, any new socio-economic developments in their area and environmental challenges they notice in their area. Such questions were meant to address the needs of the objectives of this research. The advantage of closed-ended questions was that they enabled the quantifying of data, but to effectively do this the researcher should have had a clear picture and understanding of his topic at hand and how the questions to be answered address the research questions.

To get a good understanding of the different greenness aspects and sustainable development trends in the study area a brief description of each of the 2 CBDs and 3 suburbs at their current status was given. The two CBDs and three suburbs selected differed in terms of physical characteristics, population composition and size. Empangeni CBD is the oldest, but less expanding while Richards Bay CBD is new, and expanding due to its close proximity to the sea and harbour. The Central Park suburb is dominated by the high affluent class with people of European origins forming the majority followed by Africans, Indians and lastly, people of mixed colour. Esikhawini is a predominantly African residential township suburb with approximately a quarter of the people showing high affluence and the rest are middle income residents. Mzingazi is a low income residential suburb with a mixture of formal and informal houses due to high population growth as more people migrate into the suburb from surrounding rural areas.



NODES		ESMP Draft		LANDUSES	
	Area of focus in the city		Buffer linkage		Wetlands
	Emerging Primary Node		Conservation		Formalised area
	Primary Node		Developable land		Future expansion area
	Secondary Node		Nature Reserve		Municipality boundary
	Tertiary Node				Rural Nodes 2013

Figure 3.2: City of UMhlathuze showing the 5 study areas.

Esikhawini was established in 1976 as a Black Township, consisting of middle income residents (SA Statistics, 2011). The H suburb, according to SA Statistics (2011) has a size of about 0.06 km and a population size of about 579 000 people and a density

of about 9541.82 people per km. The suburb is surrounded by an ever growing belt of informal settlements which falls in the jurisdiction of traditional chiefs. The area has a number of wetland areas running across the suburb.

Central Park suburb is located strongly in the southern part of Empangeni CBD. It is considered to be an affluent area and has citizens of all race groups. Historically, it was considered as a predominantly white area characterized by massive gardens and an abundance of trees. Mzingazi was established as a garden village to accommodate locals who had been displaced by the establishment of the new town of Richards Bay. Since the new residents were now coming back from surrounding rural areas like Mtubatuba with a rural background, a garden village was the most appropriate type of suburb. Mzingazi is predominantly a suburb for Africans of mixed low income and a few of middle income residents (SA Statistics, 2011). The suburb is under the administration of the traditional chief, but receives all its services from the municipality of UMhlathuze. The big garden plots have been subdivided and sold to the ever increasing incoming rural and urban population in need of houses; hence the suburb has within its boundaries a hive of informal and formal activities.

3.8.4 Analysis of questionnaire data

The SPSS package was used to analyse the questionnaire survey outcomes which were further subjected to multivariate statistical testing to validate the results. The advantage of using the SPSS package was that it quickened and simplified data analysis as the method is designed to statistically analyse data using a variety of graphs, tables and charts.

3.9 Document review

3.9.1 Introduction

Document review according to Mouton (2011) is a way of collecting data by reviewing documents available on the subject. In addition, Bowen (2009) reiterates that it is a process of evaluating documents to develop empirical knowledge and understanding. Objectivity and sensitivity should be highly observed and remain balanced. Such documents may be internal or external to the city of UMhlathuze and may be hard copies or in electronic form. This research made use of various city documents which were obtained from the municipality's website while others were emailed from departments where interviews were conducted (see Table 3.3). The criteria used to select these documents were based on the appropriateness of a document to the research topic. Documents with themes focussing on urban greening and development, sustainable development, environmental management and planning and many others were selected. Other documents selected were also recommended by the Heads of departments during interviews. Among the documents were newsletters published by the municipality on the city's achievements in areas related to this topic like tree planting in the city, service delivery, promotion of tourism and environmental improvements and annual reports and different policies. The aim of reviewing these documents was to generate broad themes that were used in coding the data for analysis and supplementing data from interviews, observations and questionnaires. Selection of these documents was mainly done using the information needs of the research topic based on the aims and objectives of the topic. The following documents were selected and the empty column was to be filled by data selected from the respective document. The selected topics were selected through scanning and skimming of the documents before comprehensive reading could be done (see table 3.3).

Table 3.3: Sampled documents for data to be analysed

Document Selected	Selected topics for analysis
City of UMhlathuze Annual Review 2004/05 (Building a strong foundation for a sustainable future)	
City of UMhlathuze Annual Review 2005/06	
UMhlathuze Municipality Draft 2010/2011: Integrated Development Plan(IDP)	
UMhlathuze annual report: 2012/13	
City of UMhlathuze Annual: Draft Scheme 2013	
UMhlathuze annual report (Gearing for economic growth): 2012/2013	
TRP 449 N RTP 169 Institutional Document	
UMhlathuze wami – December 2014	
UMhlathuze wami – February 2015	

3.9.2 Criterion used to select these documents

The municipal website has many reports, policies and publication; hence the researcher had to use some criteria in order to select the relevant documents. The following criteria were then used:

a) Availability – these documents were easy to access from the municipality website and from different concerned municipal departments where interviews were conducted. All documents were obtained as soft or electronic copies.

b) Relevant to research aims and objectives – This was one of the major criteria used to select documents for review as it addressed the aims and objectives of this research.

c) Ability to complement or clarify some interview questions and field observations.

d) There was also a time period or currency to consider and documents from 2000 to the present day were considered.

However, it was noted that document review should be triangulated with other qualitative research methods to strengthen the resulting data and themes of the research (Labuschagne, 2003).

3.9.3 Advantages of document review

In many cases information needed to complete an assessment may have been collected for other purposes in the municipality for generating different reports and publications. Ministries, NGOs, Government agencies and consultants usually produce valuable reports that can be used to supplement data collection. This was one of the reasons why document review was used as a data collection tool. One key advantage of conducting document research is that, it gives the researcher access to information that would be difficult to access. Document information is more reliable due to various levels of verification that are involved in its approval and publication. In addition, this information helps to provide useful background data on the city as it is grounded in local settings. In addition, data collection over a longer period is made possible and larger data samples can be obtained more than that collected from questionnaires and interviews. Reports, policies and publications of the municipality are based on high quality or large probability samples making it possible to generalise this data to a larger population.

3.9.4 Disadvantages of document review

It is difficult for the researcher to control the quality of data collected. Information on accessibility of parks to residents and level of awareness of local communities on the importance of a green city was very limited while access to some content was limited. For example, content from the documents on the proposed plan of "Revitalisation of Empangeni CBD" could not be accessed as the report was still new and was being finalised before implementation could commence. Issues like access to open spaces and awareness on the importance of greening can change many times before the respective documents are analysed. Due to the wide coverage of documents, information contained in them could not provide insight into participants' personal thinking. Data from municipal documents like reports and publications were restricted to what already exists on the ground, hence new data or new developments are not accounted for.

Government documents were not designed with this research in mind so sifting through the large material is time consuming and frustrating as some of the information on specific areas and population of interest was not available. Even the standard way of collecting data keeps changing, so there may be information that will not be available for one period of time and not another, creating gaps in data. When considering the strengths and cost saving advantages of data analysis, it can be stated that, this method has more advantages than its limitations in this research study.

3.9.5 Analysing data from documents

Like other analytical methods in qualitative research, analysis of documents data should be rigorously done in order to obtain better meanings that promote

understanding and gathering of empirical (Bowen, 2009). When analysing this data the following steps should be seriously considered i.e. identifying and finding relevant documents and Data synthesis and appraisal. The researcher read through all selected documents and identified the most important themes and arguments that contributed to better understanding and discussion of the research topic.

Such an exercise can assist the researcher to gather important quotations and passages that can help to formulate major themes of the research (Labuschagne, 2003). The coding system that was used in the interview data analysis was also be applied to the selected documents. Information from documents was organised into categories related to aims and objectives of this research. The coding system was determined by data characteristics to explore themes critical to the research (Bowen, 2009).

3.9.6 Methodological Reflections

The four data collection methods used in this research greatly helped in collecting data for the project. Interviews were more productive in generating useful and up to date information. They targeted key personnel who are knowledgeable in the various functions of their departments. They were easy to administer and through recording and transcribing data was easily collected. The only drawback was it took time to find the officials in their offices on scheduled days. Transcribing the data was time consuming but was very educative and helped to start the process of analysis. Questionnaires were meant to target more people, but due time constraint the target group was reduced. The method of administering was inefficient as people had no time to fill in the questionnaires and return them on the spot. This method was changed and respondents were given more time to complete at home. Though collecting them took time it was worth the time as turnover was high.

Map analysis and observations were very effective as they were directed and controlled by the researcher. All areas of importance were visited so these methods were very flexible, which helped the researcher to work effectively and cover more areas. One weakness in the counting of street trees was the problem of counting shrubs due to their clustered nature. However most of the uncounted vegetation was catered for in some of the photographs taken during this field survey. Weather constraints like high temperatures and rainfall made it difficult for the survey to be carried within the prescribed period of 3 months. The method was very educative, easy to work with and helped to discover individual and group efforts in greening throughout the town.

Documents were the least useful in data analysis as they did not address some of the themes of the research. They were also prepared by people and institutions with different goals and purpose to that of this research. It was therefore necessary to carefully assess this data, especially when there was a direct comparison of this secondary data and primary data. At the end this process was time consuming and taxing.

3.9.7 Conclusion

This chapter discussed the study design and data generation tools and why they were suitable in this study. It also gave an explanation of the processes used to generate data and the effectiveness of the tools in relation to the research aims and objectives. A brief description of how the data was analysed was given and chapter 4 presented and analysed this data.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter is divided into subsections where the quantitative and qualitative results are presented. Quantitative data were obtained from questionnaires while qualitative data were collected from interviews, documents, observations and map analysis. After this presentation of results, the analysis of results will follow in chapter 5 where questionnaires were analysed according to the quantitative social science statistics package called SPSS. Interviews, Documents and Observations were analysed through coding and thematic identification which was aided by triangulation of results from the other respective data collection methods.

4.2 Results of Document review

4.2.1 Introduction

Document review is review of a collection of documents with relevant information that helps to build comprehensive knowledge of a research area. It is therefore a process of evaluating documents to develop empirical knowledge and understanding (Bowen, 2009). This sub section presents the document results by describing the several coded themes and describing how they are related to each other in the field of urban greening and sustainable development. Table 4.1 gives a summary of the documents that were selected and the relevant sections in these documents that were considered for analysis.

Table 4.1: Sampled Documents examined in this study

Abbreviation	Document Selected	Data analysed
UAR04/05	City of UMhlathuze Annual Review 2004/05 (Building a strong foundation for a sustainable future)	- City of UMhlathuze at a Glance page 3 - Parks, Sport and Recreation page 26 - Integrated Development Planning pages 36 & 37
UAR05/06	City of UMhlathuze Annual Review 2005/06	- Vision statement pages 1&2 - Planning and sustainable development. Pages 36 - 40
UMD10/11	UMhlathuze Municipality Draft 2010/2011: Integrated Development Plan(IDP)	- The Natural Environment pages 32,33,23,10 - DEVELOPMENT STRATEGIES pages 49, 55, 71
UADS13	City of UMhlathuze Annual: Draft Scheme 2013	- RESTRICTION ON ENVIRONMENTALLY SENSITIVE AREAS pages. 150, 170 - ADDITIONAL PROVISIONS APPLICABLE TO PRIVATE OPEN SPACES pages 182
UAR12/13	UMhlathuze annual report (Gearing for economic growth): 2012/2013	- Environmental Services pages 28, 125 - Integrated Development Planning (IDP) page 28
TRP449	TRP 449 N RTP 169 Institutional Document	- STRATEGIC ENVIRONMENTAL ASSESSMENT page 4
UWA14	UMhlathuze wami – April 2014	- Alkantstrand Beach facelift gets underway
UWF15	UMhlathuze wami – February 2015	- Exciting new retail development underway in CBD page 5
UWA15	UMhlathuze wami – April 2015	- City cashes in at the Greenest Municipality Awards page 1 - Highlights of the Operating Expenditure Budget 2015/2016. Page 7
GEG11/12	Gearing for Economic Growth – Annual Report 2011/2012	- Environmental Services pages 125, 126
USDF14/15	UMhlathuze Municipality Spatial Development Framework Review 2014/2015 FINAL DRAFT 30 JUNE 2014	- Informal Settlement Upgrade 67-69 - PLANNING FOR FUTURE SPATIAL DEVELOPMENT 90 -112

To avoid repetition the abbreviations in the first column of Table 4.1 will be used to refer to these various documents. The results of these documents are presented under the following themes.

1. Role of planning in urban greening and sustainable development
2. Awareness of urban greening,
3. Greenness projects and Achievements,
4. Policy making for sustainable development,
5. Challenges of urban greenness.

4.2.2 Role of planning in urban greening and sustainable development

The main focus of planning is to ensure that all stakeholders of urban development have access to relevant and up to date information to prepare them to implement policies and achieve the vision and greening targets of the city. UAR04/05, UAR05/06, UMD10/11, UAR12/13 and UADS13 puts strong emphasis on the mission of the city as an overall planning guideline that binds different planning activities in the city. UAR05/06 and UAR12/13 also stress that the importance of the city's vision is a guideline to all planning procedures in the city. The following is the mission and vision statements of the city highlighted in all these documents.

> "The City of UMhlathuze, as a port city, will offer improved quality of life for all its citizens through sustainable development. It will be a renowned centre for trade, tourism and nature-lovers, coastal recreation, commerce, industry, forestry and agriculture."
>
> (City of UMhlathuze Annual Review 2004/05, page 3)

> "It is a progressive municipality dedicated towards achieving a successful balance and synergy between industry, its rich environmental assets and the community"
>
> (City of UMhlathuze Annual Review 2005/06, page 2)

The above statements also highlight the city's intention to bring equity in its sustainable development quest by balancing out the different environmental activities that are important in the city. What remains to be seen is whether these environmental services can be balanced among the city neighbourhoods and its people.

A growing city requires constant environmental planning in order to refocus development work and align it with environmental changes. This needs to be done without undermining the relationship that exist between natural systems and human systems in order to satisfy both present and future economic, social and environmental needs. To achieve this, the USDF14/15 reports that the ESMP was adopted by UMhlathuze municipal as a broader planning tool to guide spatial development with an aim of safeguarding environmental services. Through this plan, areas providing environmental services have been identified and these include Nature reserves (areas of high biodiversity), Conservation zones (wetlands and forests), open space linkages and areas already developed but with more significance to environmental development. All these areas are part of green space in a town which are vital in increasing urban greenness and can therefore be employed here to improve living standards and the general wellbeing of the city through providing ecological services.

Functional planning should be implemented to influence results and improve current and future situations. In agreement with this thinking, UWF15 outlines that in 2010 the city's plan to revitalise the Central Business District (CBD) was approved by the Provincial Department overseeing development needs in the province. This includes renewal of the CBD through improving roads, transport facilities; buildings and refurbishing the streets and open space in an attempt to improve the commercial attractiveness of the city (see Figure 4.1). Greening in this case becomes a strategy to bring development in the city that satisfies the current needs and also ensure that future generations will be able to meet their needs as urban greening can be renewable and long lasting.

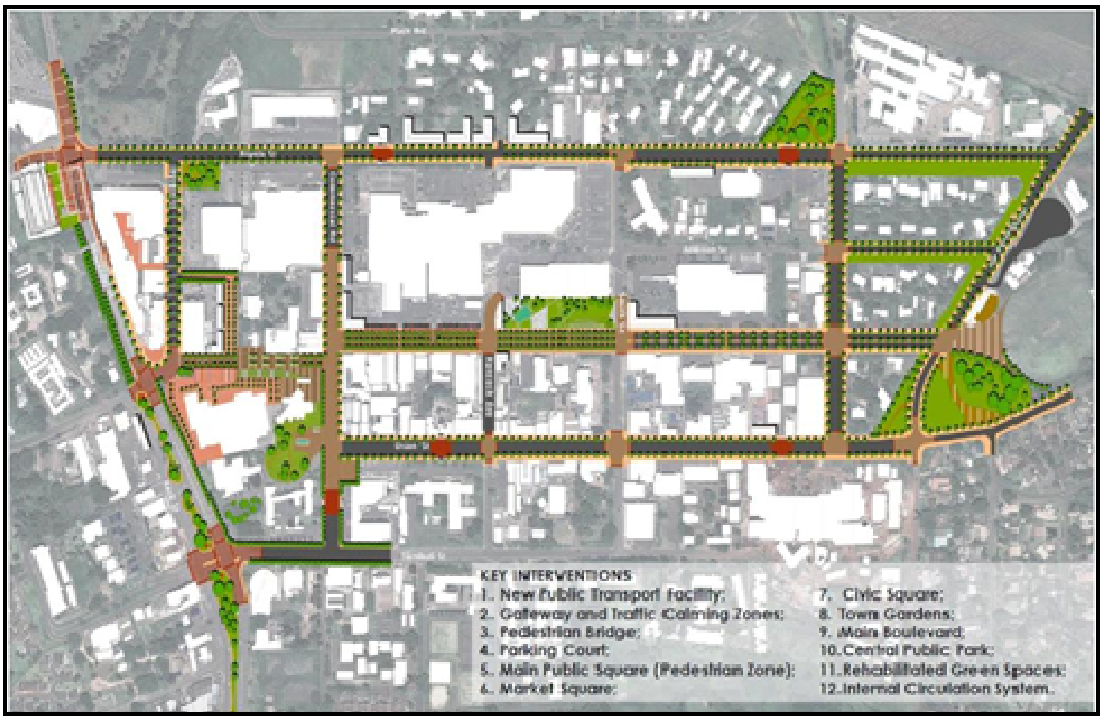


Figure 4.1: Photograph showing proposed revitalisation plan of the Empangeni CBD with greening (UMhlathuze Municipality, SDF Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 81).

UWA15 also notes that the planning of the Empangeni CBD Revitalisation Plan was finalised in 2013 and awaits implementation by the various stakeholders like municipalities, the public, private sector and other Government department.. Such

cooperation is crucial in implementing plans and ensuring improved greenness and sustainable development, especially when national government and private sector buy into ideas of local municipalities. In agreement with this, UAR05/06 describes that the city has tried to improve urban greening in its new plans by incorporating ecological infrastructure like street trees. In another dimension that seeks to increase urban greening and ecological benefits, UADS13 cites that UMhlathuze proposed to turn the city into a biosphere and maintain its diverse natural environment. To accomplish this, the Department of Planning and Sustainable Development has been liaising with Ezemvelo KZN Wildlife (an environmental protection group in the area) in an attempt to reduce development activities that are encroaching and reducing biodiversity in UMhlathuze municipality. This has culminated in the drawing of a Conservation Plan in 2005/2006 to show and mark areas that need protection priority due to their ecological composition. Already, about 75% of biodiversity in UMhlathuze municipality has already been altered by various social and economic activities, while the 25% that remain covered by natural vegetation is regarded as a critical resource of the city in providing ecological benefits. In this plan unaltered natural vegetation cover will be conserved as nature reserves. The following areas according to UADS13 have been identified as possible nature reserve sites, but most of them are located in rural parts of the city (see Figure 4.2 a):

i. Forest land around Lake Cubhu;

ii. The Mhlathuze Estuary;

iii. Land found around Lake Nsese;

iv. Land around Lake Mzingazi;

v. Thulazihleka Pan;

vi. Special areas in the Richards Bay Harbour;

vii. The corridor of land linking Lake Nsese and the Mhlathuze Estuary;

viii. Lakes Mangeza, Niwe and Mpangeni; and

ix. Sensitive areas in the Madlebe and Khoza traditional areas.

The attempt to conserve the remaining unaltered natural vegetation in the city can be regarded as a sustainable development move as this focuses on preserving green infrastructure that will further create better ecological services and improve people's lives.

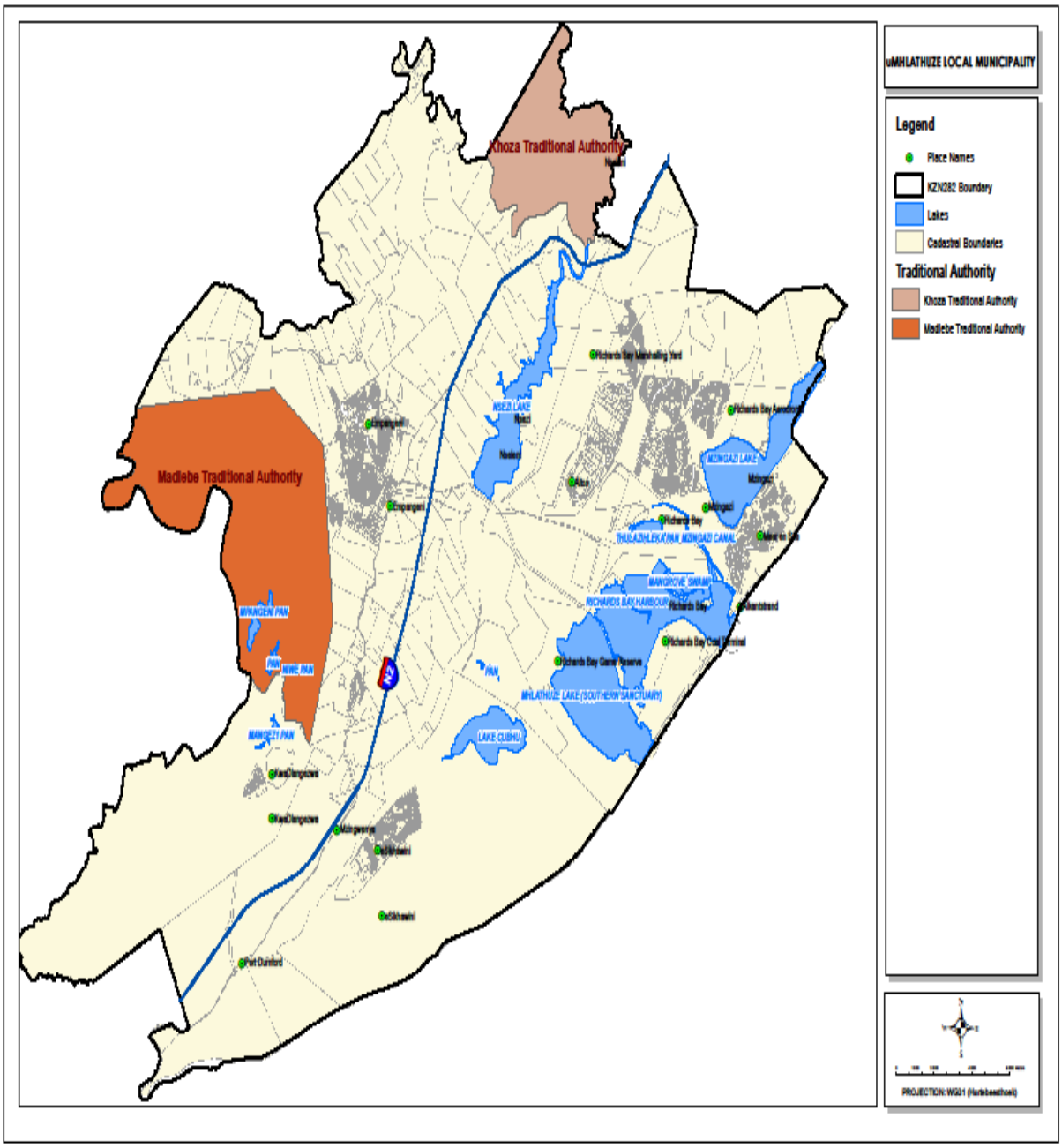


Figure 4.2 a): Possible nature reserve sites in the city of UMhlathuze

UAR12/13 emphasizes that implementing a biosphere plan in the city will bring many ecological advantages, including promoting a rich biodiversity, improving the aesthetic appeal of recreational, and open space areas. Developing a biosphere approach requires environmental planning to guide implementation and increasing the planting of trees and shrubs in many open spaces to offset vegetation lost to

different forms of social and economic developments. In line with promoting biosphere development, a Conservation/Biodiversity Plan was drafted. UAR 12/13 describes the development of an ESMP as a way to provide specific guidelines regarding future city developments in order to safeguard the supply of environmental goods and services. The benefits of using the ESMP are also emphasized in UADS13 which insists that such a plan and policy can promote sustainable development by safeguarding the green spaces of the city by prohibiting or restricting the destruction of environmentally sensitive areas identified in terms of the aforementioned plan.

Sustainable development involves environmental planning for the future and GEG11/12 documents that future plans of the city include expansion of existing urban centres and growth of new nodes and corridors especially along highways like the N2, R34, and R102. As nodes and corridors expand they start moving towards each other, filling most of the land between them. This means more vegetated areas will be lost to these new developments despite all the planning process. As the city increases its development it will have less and less green covered spaces than before. Planting more trees in these expanding areas can partly alleviate the ecological decline associated with this urban expansion. USDF14/15 insists that if the city is to maintain its rich ecological biodiversity, more green spaces like open spaces, buffer linkages and complex parks need to be included in future plans. In addition to this USDF14/15 and UAR12/13 note that future planning can increase efficiency in the use of land because land continues to be a scarce and valuable resource and its efficient use need to be facilitated by promoting land use concentration. This involves promoting infill development in appropriate locations with consideration of social and environmental effects on the environment. USDF14/15 also emphasizes that these proposed developments within nodes and corridors should allow the natural flow of fauna and small organisms between different urban green spaces.

This calls for a close monitoring, development and conservation of agricultural resources and ensure viable agricultural production. UAR12/13 further stresses that future plans of a city should strive to ensure sustainable development by not spreading development into areas of environmental significance and negatively impacting on existing services.

4.2.3 Awareness of urban greening

Most of the city's annual reports highlight that awareness campaigns on tree planting and greening of the city are being carried out annually during the Arbor week. According to UAR04/05, the City Council of UMhlathuze was awarded for its greening attempts in the 2005 Arbor City Award entered by almost all provincial municipalities. This achievement serves as a sign of the city's willingness to implement sustainable development through urban greening, which involves the planting of street vegetation with indigenous vegetation with the aim of increasing the ecological advantages and soften the urban landscape and making it more friendly to people. UMD10/11 highlights that in the same year of 2005; more than 1000 trees were planted in different parts of the city. UADS13 also noted that in 2013 the Arbor week was again commented as a success in the city for its ability to raise awareness and bring different players together for the common purpose of increasing the city's greenery. Greening the city through vegetation requires the involvement of many stakeholders across the city if awareness is to be promoted. To this effect, UAR12/13 and UADS13 observed that the city is involved in school awareness campaigns on urban tree planting and the benefits of having vegetation in urban environments. Both documents also agree that leadership is needed in order to increase awareness of the ecological advantages from urban trees.

Educating residents and increasing their awareness needs to be an ongoing process in the city. The UAR12/13 document also reports that environmental education and awareness will be offered on regular or monthly basis in the monthly city newsletter (UMhlathuze Wami). This move has been termed an "Environmental Watchdog" aimed at running environmental themes once every two months. In addition UAR12/13 reports that the Environmental Planning website for the city is operating under the Department of Integrated Development Planning and Environmental Planning where readers can get updates and new stories on Environmental and other related issues in the municipality. These flexible media platforms allow the city to reach the people with environmental news and awareness programs.

4.2.4 Greenness projects and achievements

Urban greening for sustainable development can also be undertaken as a tourism initiative that seeks to develop and improve economic and environmental infrastructure of the city. According to USDF14/15, UMhlathuze municipality in 2009 developed a tourism strategy as an initiative of improving the tourism system in the city in line with sustainable development needs. The strategy takes cognisance of areas of natural beauty and ecological advantages with many opportunities for tourism and other types of development. This framework is guided by different principles listed below.

i. Future developments should avoid developing in areas of environmental significance. However if the proposed development in these areas cannot be avoided, proposals should be accompanied by clear mitigation measures.
ii. All new development projects adjoining areas of ecological advantages should incorporate vegetation buffer zones to help protect ecological elements and minimise land use conflicts.

In line with the city's progress in promoting tourism and recreation using areas of ecological advantages, UWA14 reports that in 2014 Alkantstrand Beach received a facelift that includes greening the area. Alien vegetation was cleared in the new expansion areas and in their place minor earthworks were carried out as well as using natural material like vegetation to soften the landscape (see Figure 4.2 b). This move goes on to strengthen the view that there is a strong relationship between sustainable development and urban greening. Longevity in development can be put in place through various greening projects like eco-tourism projects mentioned above.



Figure 4.2 b) Expansion and improvement of Alkantstrand beach using grass and trees (UMhlathuze Wami February 2014, page 4)

The city has an ongoing tree planting project which is an indication of the authority's efforts to increase vegetation in the city. UAR12/13 reports that local indigenous trees have been planted along major roads, sensitive areas and in open space (800 to

1200) in 2012 and 2013. Despite this progress, UAR12/13 highlights that the city has experienced a big challenge in maintaining urban vegetation as it continues to receive complaints regarding trees which offer thieves hideouts and cover to carry out anti-social activities. However each issue is assessed and dealt with accordingly, with pruning and trenching being other alternative solutions before a tree is completely removed. In addition to planting indigenous and exotic trees along roads and open spaces, UAR12/13 notes that fruit trees have also been planted in newly constructed residential areas like UMhlathuze village. This initiative is coordinated by the Environmental Affairs section of Department of Economic Development, Tourism and Environmental Affairs, which sees the planting of mango, avocado, litchi, pear and orange trees around residential areas. Although this is an annual event during the Arbor week, UWA14 emphasizes that this can increase economic and environmental benefits like provision of fruits, selling of these fruits, reducing soil erosion, urban heat island effects and bring many other ecological benefits.

Urban greening can also be achieved through the removal of alien plants that threaten the survival of indigenous plants and water sources. UAR 12/13, UADS13 and UMD10/11 report on the successful removal of alien plants with the assistance of the KZN Department of Agriculture and Environmental Affairs funding the project. The above documents also report that about R15 million was invested in maintaining the vegetation land amounting to 1 281 hectares and from July 2011 to June 2012 a total of about 4 113 hectares was cleared of invasive and alien plants. UMD10/11 notes that alien vegetation provides ecological services in the same way as indigenous vegetation, but some species consume excessive amounts of water, hence the strategy to remove them.

Understanding of the value of urban greenness and sustainable development can be promoted in different ways. In line with this belief, UAR04/05 describes that in 2004/2005 the city launched a recycling initiative that included raising greenness awareness, education and economic empowerment of community members. This involved the revamping of the old Alton landfill area and was replaced with a fenced recycling area at an estimated cost of two million Rands. As a sustainable way beneficiaries received training in horticulture to enable them to run the project successfully. The same document believes that economic incentives for urban greening can achieve lasting results; therefore cash from recycling waste is now used to run vegetable gardens in a sustainable way.

Holding greening competitions and awards is also an indication of successful achievements of the city in its greening efforts. UWA15 reported that UMhlathuze municipality came second in the 4th Greenest Municipality Competition Awards in Tzaneen in January 2015. The aim of this competition, according to the Department of Environmental Affairs is to raise awareness on issues around environmental protection, social upliftment and economic growth in urban communities. The competition is also an incentive to local municipalities to improve people's lives by keeping their environment clean through management of waste. This competition also accommodates developments within the greening movement and has allowed for the incorporation of other elements like energy conservation, waste management, tree planting and beautification, public participation and community empowerment.

Through the Environmental Services Management Policy (ESMP) and Environmental Management Plans (EMP), the city of UMhlathuze aims to increase the ecological advantages of environmental services. According to UAR04/05 environmental services like reduced air pollution, flood attenuation, reduced soil erosion and many

others, enormously contributed to the economic improvement in the city. As a result of following regulations and using compliance tools like EMPs. UAR04/05 emphasizes that, like construction activities, waste removal, water provision services, and environmental services should also be given high priority in decision making. Among some of the environmental goods and services from the green open spaces are urban climate control, reduction in runoff and erosion and increasing biodiversity services. The report estimates that the total cost of ecological related benefits are estimated at a value of about R1.7 billion per annum. An attempt to improve and increase environmental benefits in the city can also be regarded is a sound sustainable move as it strives to meet present and future needs which also includes environmental needs.

Complying with regulatory policies is good for urban greenness, but the UAR 2012/13 reports that this can attain successful results when complemented with ecosystem assessments. In UMhlathuze this enabled a study of ecosystem changes in order to determine the impacts of these changes on human well-being. The results of these studies provide decision-makers with management and response options. Related to this, the Department of City Development in UMhlathuze has carried out Geotechnical studies and flood risks of most wetlands in the municipality in an attempt to guide new developments. These results are very crucial in controlling ecological effects of new developments like township growth to ensure the best practice development standards and in a way militate against environmental problems like flooding of properties especially in the suburbs like Esikhawini, Mzingazi and Madlazini. Implementation of this assessment's results will strongly help to protect sensitive ecological ecosystems within flood lines while improving people's lives as they are moved away from areas vulnerable to flooding. In the long run, wetlands are preserved while residents are taken to new and better sites.

Success in urban greening can also be seen by analysing the overall land used by the city for various ecological functions compared to other land use zones. UMD10/11 sums up these land use zones according to their sizes in hectares and total percentage of the city land. Table 4.2 helps to shade light on how far the city has gone to conserve and promote ecology in the city.

Table 4.2: Land Uses in UMhlathuze Municipal Area (Source: 2007 Status Quo Report)

LAND USE	**HECTARES**	**% TOTAL**
Airport	126.83	0.54
Biosphere	233.87	1.00
Business	587.47	2.49
Education	156.24	0.67
Existing & future residential	6 156.24	26.53
Industrial	1 951.87	8.41
Mining	519.31	2.24
MOSS (Flowerless green plants)	5 075.34	21.871
Port	1 527.88	6.58
Quarry	58.10	0.25
Bird sanctuary	1 262.14	5.44
Recreational areas	1 371 .50	5.91
Transportation	1 970.45	8.49
Water Body	2 217,13	9.55
TOTAL	**23 214.33**	**100.00**

From this table, total land use of ecologically related land uses shaded in grey amounts to 34% of total land use in the city (see Table 4.3). According to UMD10/11, all the land uses in Table 4.3 promote vegetation and greenness of the city in one way or the other, but overally they all function to improve air quality, reduce storm

water problems, and absorb heat, noise attenuation, positive climate enhancement, improved recreation, increases aesthetic values and many others.

Table 4.3: Land use zones and their sizes related to ecological conservation and use.

LAND USE	HECTARES	% TOTAL
Biosphere	233.87	1.00
Moss (Flowerless green plants)	5 075.34	21.871
Bird sanctuary	1 262. 14	5.44
Recreational areas	1 371. 50	5.91
TOTAL	**7 942.85**	**34.221**

4.2.5 Policy making for sustainable development

Annual reports and newsletter of the City of UMhlathuze covers city policies in detail. These policies are meant to assist in assessment, management and monitoring environmental effects and guide the city's vision and mission and ensure the achievement of sustainable development. The Strategic Environmental Assessment policy (SEA) according to TRP449 is being used by the city in decision making on development projects impacting positively on the city environment through mitigation measures. UMD10/11 agree with this view and reports that protecting open spaces, ecosystems and tress have also increased in importance in the city, especially as a result of using such policies like SEA in planning as quoted below:

> "The protection of sensitive areas is an essential intervention as part of the Strategic Development Rationale. The SEA makes specific proposals in this regard and the extension of the Metropolitan Open Space System to the entire City of UMhlathuze area is required" (UMhlathuze Municipality Draft 2010/2011: Integrated Development Plan (IDP) page 55).

Both UMD10/11 and TRP449 agree that through the use of SEA open green spaces can be conserved with its deserving priority instead of developing left over land. Unplanned and fragmented open spaces are a result of apportioning leftover land for open space and green spaces with no linkages can hardly survive the encroachment from other land use zones. UAR 05/06 reports that the city has also used other policies to complement the work of SEA. The Strategic Catchment Assessment (SCA) and the Environmental Services Management Policy (ESMP) assist in safeguarding environmental services delivered by the natural resources like green spaces and trees in different areas of the municipality. ESMPs are broadly meant to ensure a better understanding and implementation of development activities that are highly likely to negatively affect environmental services.

UAR05/06, UMD10/11 and UAR12/13 all reports on the growing positive use of Environmental Management Plan (EMPs) in conserving and drawing mitigation measures to maintain urban vegetation, especially when dealing with more intense development projects in sensitive areas that clears land and reduce biodiversity. UMD10/11 emphasize that green spaces help to breathe fresh air in the city and provide sustainable ecological benefits to city residents, especially in fast growing cities like UMhlathuze. According to UAR05/06 EMPs can be an effective countermeasure to the threat caused by rapid urban expansion in the city. In addition UMD 10/11 sites the following as crucial benefits that a city can have when using EMPs:

- Show the area or land likely to experience development pressure and how this can be eased.
- Promote environmental sustainability of the area of study through mitigation measures.

- Ensure conservation of high potential agricultural land.
- Identify city areas where specific land uses can be promoted or discouraged for both economic and environmental benefits.
- Identify areas of infrastructure requirements as a way of attracting more and better services in city areas.

Regulation of environmental activities and enforcement of compliance of legislation can ensure development that promotes accumulation of ecological benefits instead of their reduction in favour of economic development. Policies can be used to uplift the once under rated element of environmental greening and equate its contribution to sustainable development with social and economic development elements.

EMP according to TRP449 are regarded as a pillar of the city's Integrated Development Plan (IDP) as it strongly helps to ensure that necessary measures are identified and implemented in order to protect urban ecology and also comply with environmental legislation. This according to the UAR 05/06 is sustainable development and ensures improvement in quality of environment which promote better life quality and conservation of resources like open spaces. Environmental policies can be effectively used to protect open spaces in a city. UMD10/11 also outlines that the use of SEA in planning has also increased in the city especially in protecting sensitive areas. SEA has made specific proposals to extend the aerial coverage of open green spaces of the city.

USDF14/15 emphasizes that this is also another form of urban greening as plants provide ecological benefits like cleaning the air besides providing economic. The document also notes that although the responsibility of food security does not lie with the municipality, UMhlathuze has assessed its urban farming needs and the

need to reduce food shortages through the establishment of food production partnerships with the communities. All this is part of urban farming, which forms part of urban greening contributing to ecological benefits.

Sustainable development, according to USDF14/15 includes environmental priorities to manage ecological resources like soil, plants, water and air sustainably through environmental planning. Environmental prioritisation according to USDF 14/15 help to ensure protection of habitats and maintain environmental asserts through environmental management, compliance tools such as specific EIAs, EMF, and Environmental Frameworks of the Spatial Development Framework.

4.2.6 Challenges of urban greenness

Urban greenness is one way of achieving sustainable development in growing cities and is one process of what is increasingly being viewed as a critical tool for society's wellbeing. Progress in this field continues to face many challenges in the city of UMhlathuze. UAR12/13 reports that increasing crime and illegal waste dumping have been associated with areas of thick vegetation cover in the suburbs, and many residents around the city have complained about it and demanded the clearance of these trees. This has resulted in a number of tree clearance activities in areas near residential areas as a last resort of crime prevention and inability to keep up with vegetation maintenance in some parts of the city. This document emphasizes that the city faces a huge challenge to keep up with residential requests to provide them with safe and clean environments given the increase in illegal dumbing and high cost of maintaining urban trees.

Another setback to the successful utilisation of vegetation in the city, according to UAR 04/05 is illegal dumping and vandalism in unoccupied areas and open spaces

like parks and reserved areas and also the increased vandalism of green spaces infrastructure negatively affects the recreational interaction between parks and residents aided by green spaces. This setback slows down the efforts of the municipality to build, improve and balance ecological systems with other city activities. In addition the report documents that newly planted trees are unceremoniously trampled, while illegal dumping has increased in open spaces reducing their function of attracting residence for recreation. Foot paths and illegal roads and parking spaces continue to grow in open spaces interfering with the upkeep of vegetation and its aesthetic appeal. According to UMD10/11, this is a result of negligence and lack of social and environmental responsibility among residents and calls for more awareness programs and commitment by residents to protect their green spaces, parks and trees to be intensified in the city. UAR04/05 adds that in 2004 and 2005 vandalism and theft of trees were also cited as other challenges to urban greening in the city.

The city of UMhlathuze according to USDF14/15 has many informal settlements situated in land owned by traditional authorities and attempts to manage or prevent degradation of vegetation and the environment is proving to be difficult as rural land is owned by traditional leaders who are chiefs in this case. These traditional areas are becoming more densely settled due to the close proximity to the city core areas. This has resulted in unplanned and uncontrolled settlements in these informal areas, leaving many people living below flood lines with some settling in areas reserved for open spaces. Examples of such informal settlements include Mzingwenya Informal settlement, Nseleni Informal Settlement, Mzingazi Informal settlement, Mandlazini-Airport Buffer Strip Informal settlement, University of Zululand Informal settlement, Mzingazi and Mandlazini Agri-Villages. According to FAO (1997), current land resources throughout the world are clearly under stress due to increased degradation. This view is shared by USDF14/15 which stresses that rural system of

managing and controlling land degradation is now lagging behind because changing social, economic and environmental needs of the people and cannot promote sustainable processes like urban greening. This according to TRP449 is worsened by insufficient management and technology needed to replace the traditional systems of land management.

Residential land use is by far the biggest threat to open spaces, wetlands, agricultural land and open infill areas. UWA14 and UAR05/06 reports that, results from the investigation done in 2007 showed that a total of about 6 970 hectares could be taken from public open spaces and large undeveloped portions for residential purposes as shown by the breakdown in Table 4.4.

Table 4.4: Results from Infill Investigation showing land to be expropriated into proposed expansions (UMhlathuze Municipality, Spatial Development Framework Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 106).

	Open space land to be used for development density of 20 units per hectare	**Open space land to be used for development density of 30 units per hectare**
Arboretum	1000	1500
Birdswoods	614	921
Wildenweide/Veldenvlei	18	27
(SR 2)	190	285
(GR 2)	58	87
Brackenham	28	42
(GR 1)	26	39
Meerensee	392	588
(SR 2)	16	24
(GR 1)	28	42
Empangeni	276	414
(SR 1)	30	45
(SR 2)	20	40
(GR 2)	172	258
Total	2 868	4 302
Total for all areas		**6 970**

The need for more land and its related resources from different urban land use zones has resulted in declining crop production, dwindling urban forests and degradation of land related resources. USDF14/15 insists that the shortage of suitably located land for development to cater for increasing population is one big challenge that continues to affect the city. This has forced the city to consider housing people in its reserved and infill areas causing severe loss of more green spaces and natural vegetation. Expansion areas in Table 4.5 are planned to take place in the following areas where most of these areas are sensitive and contain many green spaces of the city. Out of a total of 8214.30 hectares of expansion land 568.43 hectares will be used for public or private open spaces (see Table 4.6). Despite this figure being bigger than other land use zones it is a fact that the greenness of the city will be reduced to accommodate new development needs of the city.

Table 4.5: Showing proposed expansion areas in different suburbs of the city (UMhlathuze Municipality, SDF Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 70)

EXPANSION AREAS	**LOCATION**	**PROJECT TYPE**
Area A	ESikhaleni-Vulindlela Corridor	Mixed Residential
Area B	Felixton	Mixed Residential
Area D	Empangeni	High Density
Area E	Empangeni	Mixed Residential
Area F	Richards Bay-Birdswoods-Mandlazini & Veldenvlei	Mixed Residential
Area G	Nseleni Interchange	
Area H	Empangeni (Water-stone)	Mixed Residential

Table 4.6: Anticipated land usages in Expansion Areas (UMhlathuze Municipality, SDF Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 101)

Zoning	Hectares
Commercial	119.93
Industrial	1782.50
General Residential	121.57
Special Residential	1573.86
Intermediate Residential	16.43
Public/Private Open Spaces	568.43
Transportation Infrastructure	32.86
Undetermined	17.25
Social	563.50
Other Zonings	3418.46
Total	8214.30

Most of these proposed expansion areas cover conservation areas which may result in massive loss of biodiversity as the city expand into these areas (see Figure 4.3 and 4.4). The following maps indicate the proposed plans to expand residential areas into farming land and open spaces in the peri urban areas of ESikhaleni/ Vulindlela nodes and Richards Bay respectively.

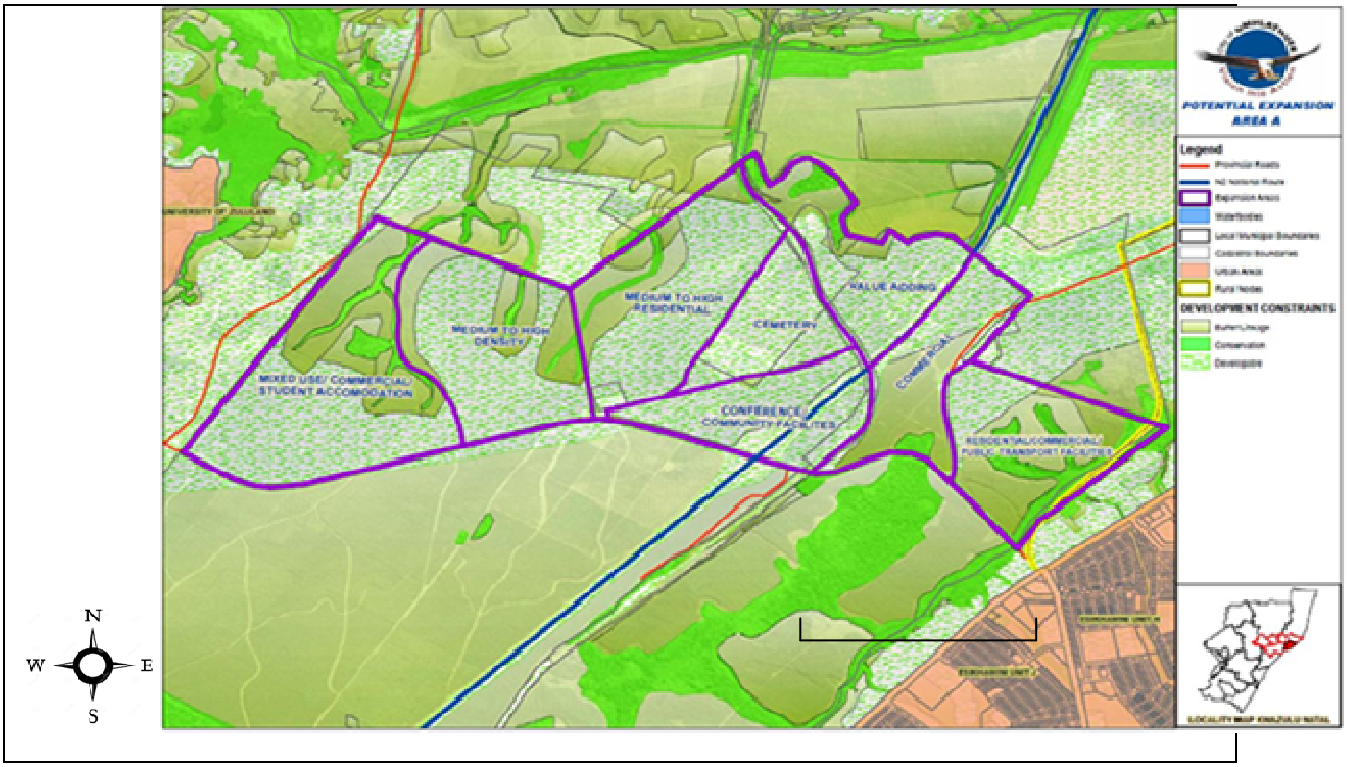


Figure 4.3: Proposed Expansion area between Vulindlela and ESikhaleni suburbs (UMhlathuze Municipality, SDF Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 102).

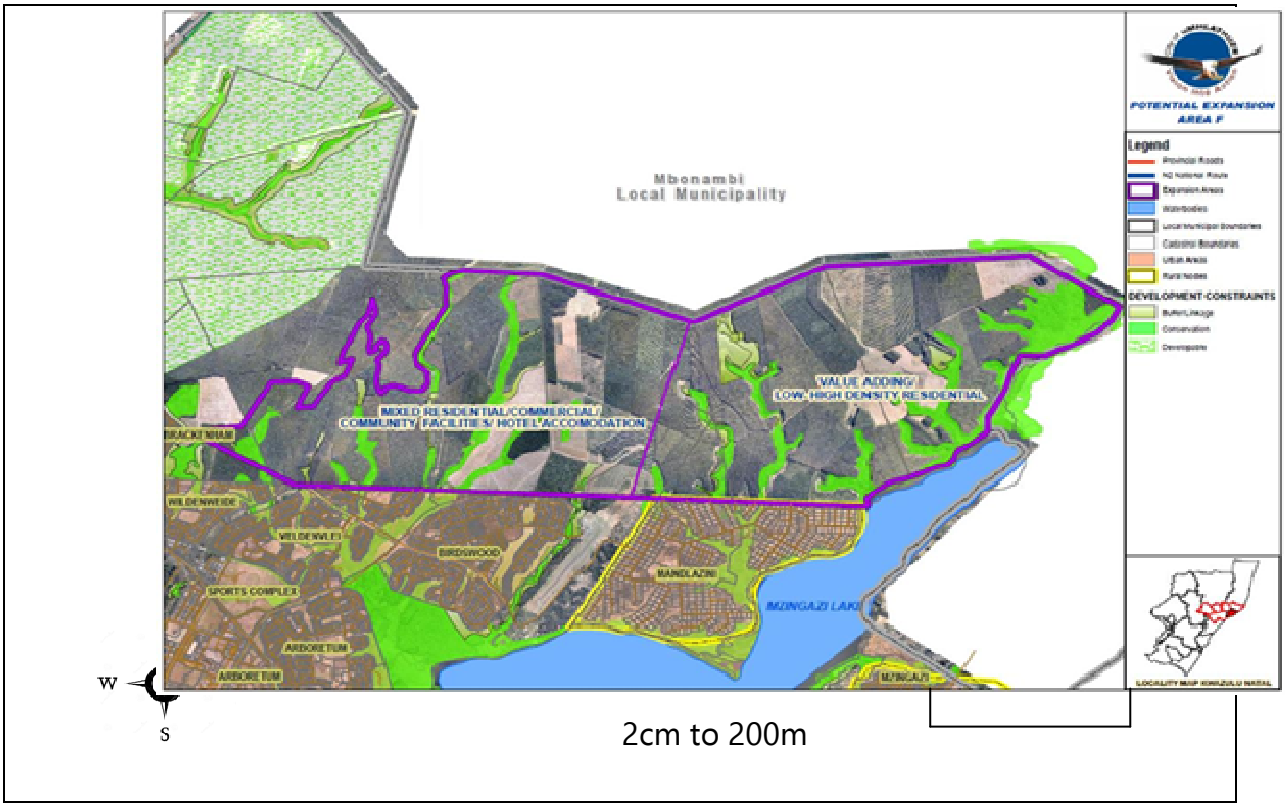


Figure 4.4: Proposed expansion areas (purple) south east of Richards Bay expanding into conservation areas (light green) (UMhlathuze Municipality, SDF Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 105).

A number of open spaces in the municipal area have been settled in an informal manner. No formal approval of building plans and appropriate zoning resulting in service provision in such areas not being planned for. This view is supported by GEG11/12 which stress that unplanned settlements like informal houses continue to threaten urban forests and conservation of open spaces in the peri urban. GEG11/12 and USDF14/15 all agree that the inadequate income of the population in informal settlements, their need for houses and lack of sustainable housing programs are encouraging occupation of land meant for green ecology like reserved parks, school sites, substations and public open spaces. All this according to the two documents stated above causes result in deterioration of green spaces, including areas of cultivation in the municipality area.

USDF14/15 emphasizes that very little of UMhlathuze's area would be available for future development and the option available is to obtain land from agricultural land uses. This poses conflict between proposed expansion areas and the department of agriculture on land acquisition. As a result of this scarcity the city is now opting to use its reserved infill areas for both residential and commercial purposes in Richards Bay and Empangeni in 2007. These are the areas that are part of open spaces with both natural and exotic vegetation and their expropriation means vegetation and ecological processes of urban greening will be gradual lost to the city.

4.3 Interview results

4.3.1 Introduction

Four interview sessions were conducted with HODs of municipal departments which deal with issues related to urban greening and sustainable development. Questions were different for each department except for Department of City Development and Environmental Planning where the HOD and Project Manager were interviewed in the same department. The results were obtained from transcribed audio recordings.

To avoid repetition the abbreviations given below will be used when referring to each respective department in the UMhlathuze municipality.

DCD – Department of City Development Brenda Strachan

DITS – Department of Infrastructure and Technical services Mr Naidoo

EPD/PM – Environmental Planning Department/ Project Manager Sharin Govender

DERM - Department of Environmental and Recreational Management Ernst van Biljon

All departments strongly agreed that they are using Environmental Law in one way or the other in their different activities. Environmental law in this case is an umbrella term combining the application regulations, statutes and all forms of laws to control and model human effects on the environment like urban vegetation. The DITS uses NEMA and Environmental Management Plans (EMPs) as the underlying legislation in all its road construction activities. The reason behind is that these tools stipulate low damage to existing vegetation and if there is any damage to vegetation it has to be reinstated to its original condition. The DCD and EPD/PM uses a number of policies, regulations, plans and statutes that are all derived from NEMA and the constitution of South Africa. Among these are:

1. Strategic Environmental Assessment
2. ESMP- Environmental Services Management Plan
3. EMP- Environmental Management Plan
4. ESMP - Environmental Services Management Policy
5. EIA – Environmental Impact Assessment
6. WMP - Wetland Management Plan
7. City Bylaws

4.3.2 Use of environmental law and policies in urban greening and sustainable development

The DERM works with the city bylaws and all its environmental dealings are dependent on NEMA pronouncements. Service providers and contractors to this department are expected to carry out EIAs and submit their EMPs. All departments are in agreement that environmental law offers coordinated environmental control and management by using suitable and progressive principles on decision making issues that concerns the environment. In short, the South African Constitution and NEMA provide the underlying framework for environmental law in UMhlathuze. On the issue of any policy obstacles that reduce the efficiency and effectiveness of departments, the EPD/PM highlighted that the legislature governing wetland protection was a challenge as it is undermined in many cases in favour of economic growth in the city, leading to more destruction of urban green spaces. A number of wetlands had been sacrificed for economic gains. The DCD cited that the long protocols and bureaucracy that are followed in complying with some environmental laws were too slow which frustrate most people and investors. At times, responses to EMPs and EIAs may come too late when the environment has already been affected by new developments.

4.3.3 Challenges faced in urban greening

All the departments face many challenges in trying to promote urban greening and sustainable development. One of the main challenges is insufficient funding to projects. In the DITS the biggest challenge is lack of sufficient funds to build new roads and rehabilitating existing roads with more vegetation. In the DERM many activities cannot be performed due to shortage of money needed to plant more trees, maintain trees, parks and open spaces, build more parks and provide functional recreational activities in these parks. In EPD/PM and DCD, financial

limitations make it difficult for them to hire more environmental assessors, specialist surveyors and procure new infrastructure needed for planning and implementing new planning developments. Other challenges include uncontrolled settlements in peri urban areas or Amakhosi areas, which at times take place in areas already planned. Because such settlements are backed by traditional leaders it is difficult to remove these people, thereby slowing planning progress and exposing urban green areas to more degradation. Apart from bureaucracy causing delays in the implementation of environmental plans, politicians at times disagree with environmental considerations on issues of protecting and conserving green spaces and wetlands in the city, in favour of populist ideas of increased development. Land claims by rural groups in conserved municipal land in Mzingazi and Birdswoods has caused destruction of urban forest and emergence of informal settlements in such areas.

Regarding challenges hindering urban greening and sustainable development, the DERM expressed concern about the increase in vandalism of urban parks, trees and recreational infrastructure. Communities want some dense street and park trees to be cut to reduce crime and illegal dumping. Newly planted trees at times are stolen while park infrastructure like taps, benches, swings, toilet seats and many others are stolen. Replacing them mean delaying other projects. According to the DITS, not all planted trees along roads are good, as some cause traffic obstruction while others with aggressive roots damage roads. DITS and DERM also highlighted that some streets have little or no vegetation not because the municipality does not want to plant more trees but that trees can obstruct vehicle movement. Trees with spreading roots damage the roads and negatively interfere with underground infrastructure like electricity cables, water pipes, sewer pipes and drains. This explains why narrower streets are without vegetation in low income areas like ESikhaleni.

4.3.4 Levels of urban greening, comparing old and new greening activities

On comparison part before 2000 and present of urban planning and urban greening, DCD noted that current environmental legislation is stricter than in the past. More environmental needs are considered in all fields of city development before new developments are instituted in industrial, commercial and residential areas. EMD/PM also agrees that current environmental policies are more supportive to environmental conservation and improvements than in the past although progress in their implementation is slow. Policies in the past were selective in terms of managing environments and open spaces in different parts of the city, resulting in high income areas having more green areas with most streets lined with trees than in low income areas. However DERM emphasises that past and present policies are almost the same, although some laws and policies have been improved such as the EIA. The two departments concur that use of improved policies and legislation will cost the city many business opportunities as many investors are deterred by strict environmental policies. On the effectiveness of policies in bringing better development, DERM is of the opinion that city policies are reviewed annually and are improved or new ones adopted that are applicable to the current situation. In the past, people might have had access to open spaces but today with the emergence of urban agriculture legislation has to be adjusted to the changing needs of people. The same department highlighted that there is a need for constant consultation with local communities when changing policies to enhance their participation in greening projects and obtain their input on economic development projects.

On issues relating to the development of more parks and open spaces to improve ecological benefits and improve recreation and increase aesthetic value of the city, both DCD and EPD/PM view greening as an essential part of city development which

should be promoted through planning of new parks and open spaces DERM partly agrees with this and notes that, as more people migrate into the city, more open spaces will be utilised, and green spaces in the periphery of the city will be constantly encroached by expanding land uses, especially residential. From a planning perspective, open spaces are being created in the new suburbs, but most of this land today is being utilised for uses which may not be good for ecological conservation. DERM also emphasizes that the need for parks and open spaces in a city depends on the basic services that a community needs, before providing recreational facilities. Prioritising urban greening in neighbourhoods that are in need of basic services like water, roads and farming land instead of green spaces can cause repercussions. This is the case in lower income suburbs where most of the recreational infrastructure is vandalised and stolen. People may therefore choose to have basic services rather than having playgrounds and parks. Because of such views, few people are making use of parks in lower income suburbs. DERM believe that more radical changes and social transformations are needed to bring more people into these parks to enjoy and spent their time there. This may also include revamping old recreational areas to provide combined or complex recreational parks which the municipality is planning for.

As a city grows, more open spaces and sensitive environments are pressurized by the increasing demand for more land for infrastructure, houses, industries and commercial facilities. DCD and EPD/PM believe that the city of UMhlathuze's open spaces, especially on the periphery are constantly under pressure from commercial, industrial and residential development needs. In addition to the need for land, Richards Airport is being upgraded, the port is being expanded, and the Industrial Development Zone (IDZ) is growing as more industries locate in the city. Low income residential areas are being developed (e.g. UMhlathuze village, Madlazini, Mzingazi), and uncontrolled settlements in areas owned and controlled by traditional chiefs

have encroached into wetlands, flood lines and land reserved for open spaces and recreation. On the other hand, EPD/PM stresses that the growing city is under constant development pressure from local government in terms of the need for more land for economic development. With all these land uses claiming more and more unused land, the DCD and EPD/PM agree that there is a need for more parks and vegetation buffer zones to be prioritised and developed in new areas of city expansion, to save vegetation and promote greenness. DERM reiterated that development of parks may also mean the development of basic services in an area including facilities like water, toilets, dustbins and lighting, which can aid the development of an area and improve access to resources. DITS also consider ecological improvement as an essential part of sustainable development, but notes that to bring development like roads to link these parks with where people live, some vegetation will be lost; hence absolute protection of any environment may be difficult especially when trying to improve people's wellbeing.

All interviewed department officials agree that all private sector stakeholders play a big role to play in sustainable development and urban greening. DITS is of the opinion that private sector helps several departments mostly when it suits them or benefits their business. This to them is not sustainable development, as enormous private sector input is a need in urban greening and sustainable development. According to the DCD and EPD/PM, the private sector contribution to urban greenness and sustainable development is not only monetary but can be technical, educational and at times through compliance. They both agree that the private investors to the city have shown a positive awareness of environmental procedures and their response has been positive, although a few disregard environmental compliance tools. All departments agreed that public-private partnerships should be prioritized so as to help the city respond positively and effectively to urban challenges and the world's sustainable development. The challenge to all

departments is to accommodate economic, social and environmental needs in a city with more environmentally sensitive areas. The DERM noted that donations to plant trees have come from the private sector and at times private businesses approach the department requesting to plant trees in front and around their business properties. In such cases the municipality advises them on the type of trees that can be planted in their areas. However DCD agrees with DITS that it is more on their terms than what the departments and communities need most. They both emphasized that there is need to put in place innovative financing tools for local authorities.

The most visible sign of urban greening has planted trees, shrubs and grass in open spaces, parks and along roads. DERM described its arboriculture success through planting trees in schools during the "arbour week", raising awareness on the importance of trees. Although this is helpful in greening the city, it is not enough since few schools and communities are targeted in that week. One of the challenges of the scale of this program is the limited funds available to buy more trees and hire more workers to plant and maintain these trees. DERM would want to plant about 1000 trees a year or more, but the expenses and difficulties in maintaining them to survive is one of their biggest challenges, one that the private sector has failed to completely rescue the department from. While roads could be vegetated with trees during such programs, DITS stated that the "conventional guidelines for transport safety regard trees as roadside fixed objects that constitute driving hazards", as a result of planning and designing of urban developments should prioritize tree planting as a way to improve and soften the appearance of urban roads. Therefore, it is not just a case of planting trees along any road, but it depends on whether the right type of vegetation is planted in terms of the size of the tree and its root structures. Road Islands can be planted with large trees which are appropriate or suitable, but at times grass and short shrubs are appropriate. The bottom line is that

the root structure becomes very critical in terms of effects on underground infrastructure like water, sewage and electricity cables as well as disturbing the road itself with overgrowing roots.

Apart from urban greening in the form of vegetation in parks, open spaces and along roads, DERM also pointed out that some forms of urban greening were linked to the different needs of people in an attempt to improve socio-economic needs. Open spaces in Esikhawini, Ngwelezane and Nseleni are being used for farming by low income groups to supplement their food and income. Although not planned for, this has helped to keep these areas green and ensuring generation of ecological benefits. Recreation, conservation and aesthetic were reasons behind such open spaces being developed, but these have not been fully utilised, hence DERM believe that farming in cities should be promoted and supported as a form of urban greening, especially in low income neighbourhoods.

4.3.5 Relationship between social, economic and environmental development in the city

The interviews also focussed on the relationship between Economic, Environmental and Social development in the city. Results from the four interviews widely reveal that there is no proportional balance between Economic, Environmental and Social growth in the city, as the balance is tilted towards economic development. Both DCD and DERM agree that economic development is still a dominant priority in the city as the political leadership believe that the city has more economic advantages capable of attracting more business into the city. As levels of unemployment and poverty rise in the city, economic development is seen as a strategy to reduce all these social and economic ills. Economic growth widens the tax base of the city which enables it to carry out other social and environmental developments to improve quality of life.

EPD/PM noted that environmental development is taking place in the city but, when it comes to designing and maintenance of green spaces, the city is still lagging behind. The same view is shared by EPD/PM who emphasized that the city is far from reaching a point of social and ecological radical shift where social and ecological matters take precedence in development priorities. All departments also agreed that although there is no balance between Economic, Environmental and Social development, there is a strong relation between urban greenness and sustainable development, as shown by all environmental planning, arboriculture and attempts to comply with environmental regulations. DERM emphasised that the city is in an economic take off stage of development and what is sustainable development today might not be sustainable development tomorrow, making it difficult to stick to established concepts of sustainable development.

As viewed by DCD, as cities become larger and more complex, trees may exist in them through careful designing, poor design or by accident. For this to take place both EPD/PM and DERM emphasize that careful and successful planning for managing urban vegetation is needed. DCD has re-planned Mzingazi, Madlazini and other areas in traditional chiefs' area with the aim of saving urban vegetation, sensitive urban ecosystems and to improve people's living conditions. Although planning is not for DCD, only DERM indicated that there was very little planning in their department on where to plant trees, so trees are planted simply where spaces are available. This is in contrast with DIT which cited that planting of trees along roads depends on the width of the street and underground infrastructure like sewer pipes, water pipes and electricity cables. This means planting trees along roads requires planning in conjunction with other land uses. DERM also emphasised that over the last decade the continuing development of cities has become linked to much greater emphasis on urban vegetation, successful management of vegetation in urban ecosystems and a demand for better and functional recreational facilities in

urban areas. To achieve this DCD, emphasizes that all communities should be involved in all initial planning procedures. In support of this, DERM also suggest that new ways to incorporate the highly versatile urban forest resource into the urban way of life will undoubtedly benefit the lives of residents.

4.3.6 Future plans to enhance urban greening

DERM went further to highlight and describe some the plans that the city has proposed to improve parks, farming and recreation which directly contribute to urban greening and sustainable development. The new plan by the city is to bring in a new form of parks called "complex parks" that will offer a variety of functions in one location. Figure 4.5 to 4.8 are imaginary sketches of complex park plans being considered by the city. Green spaces, social recreational areas and economic facilities are all available in one secure environment.



Figure 4.5: Proposed section of Complex parks that will deal with recreational needs (Department of Environmental and Recreational Management proposed plans)



Figure 4.6: A section of the proposed Complex parks that will focus on ecological conservation and biodiversity plus more recreation (Department of Environmental and Recreational Management proposed plans)

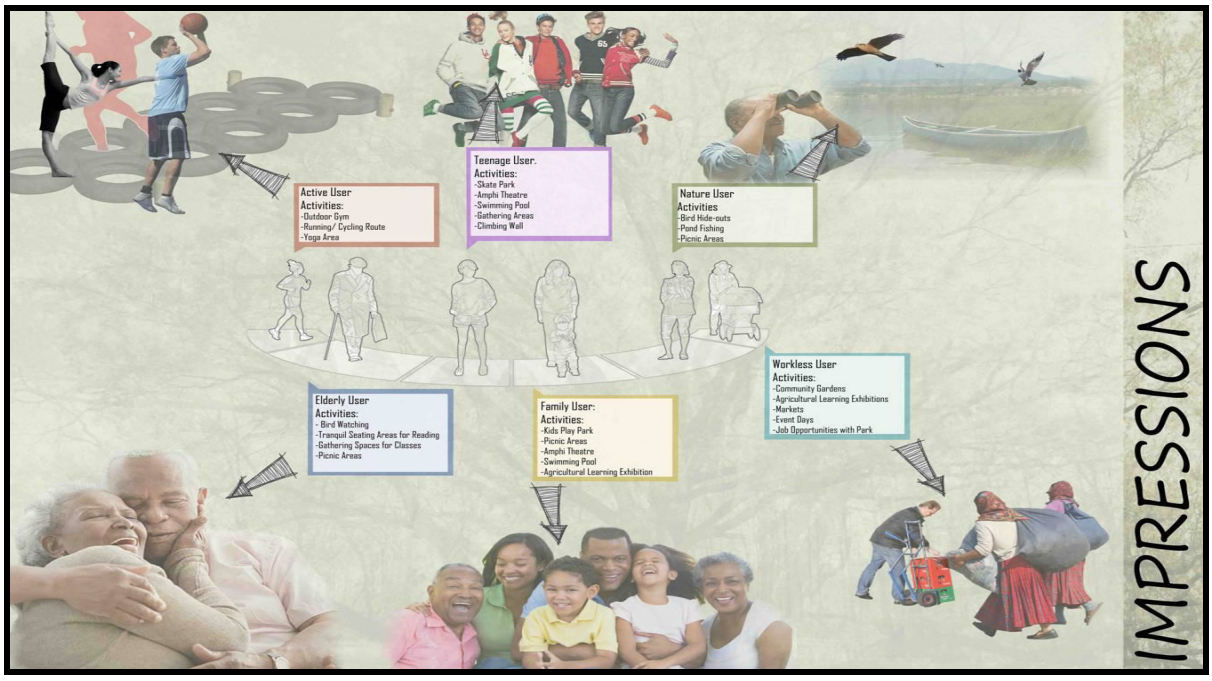


Figure 4.7: A summarised photograph of the beneficiaries of the proposed new Complex Parks (Department of Environmental and Recreational Management proposed plans)



Figure 4.8: A diagrammatic sketch of the proposed Complex Park showing its greenness features (Department of Environmental and Recreational Management proposed plans).

New Complex Parks will cater for a range of community users including the elderly, families, teenagers, regular park visitors and unemployed people. Due to unemployment and poverty, hence such complex parks will maintain community gardens on site, currently used to grow maize and also adding herb boxes and learning exhibitions regarding healthy living through growing organic produce. This is a presumably for local community needs as well, with benefits of urban greenness being complemented by economic and recreational activities, meant to improve people's living standards. UMhlathuze is well known for its ecological diversity; hence ecology in the new planned complex parks is of high importance. Such parks will have numerous cited advantages like:

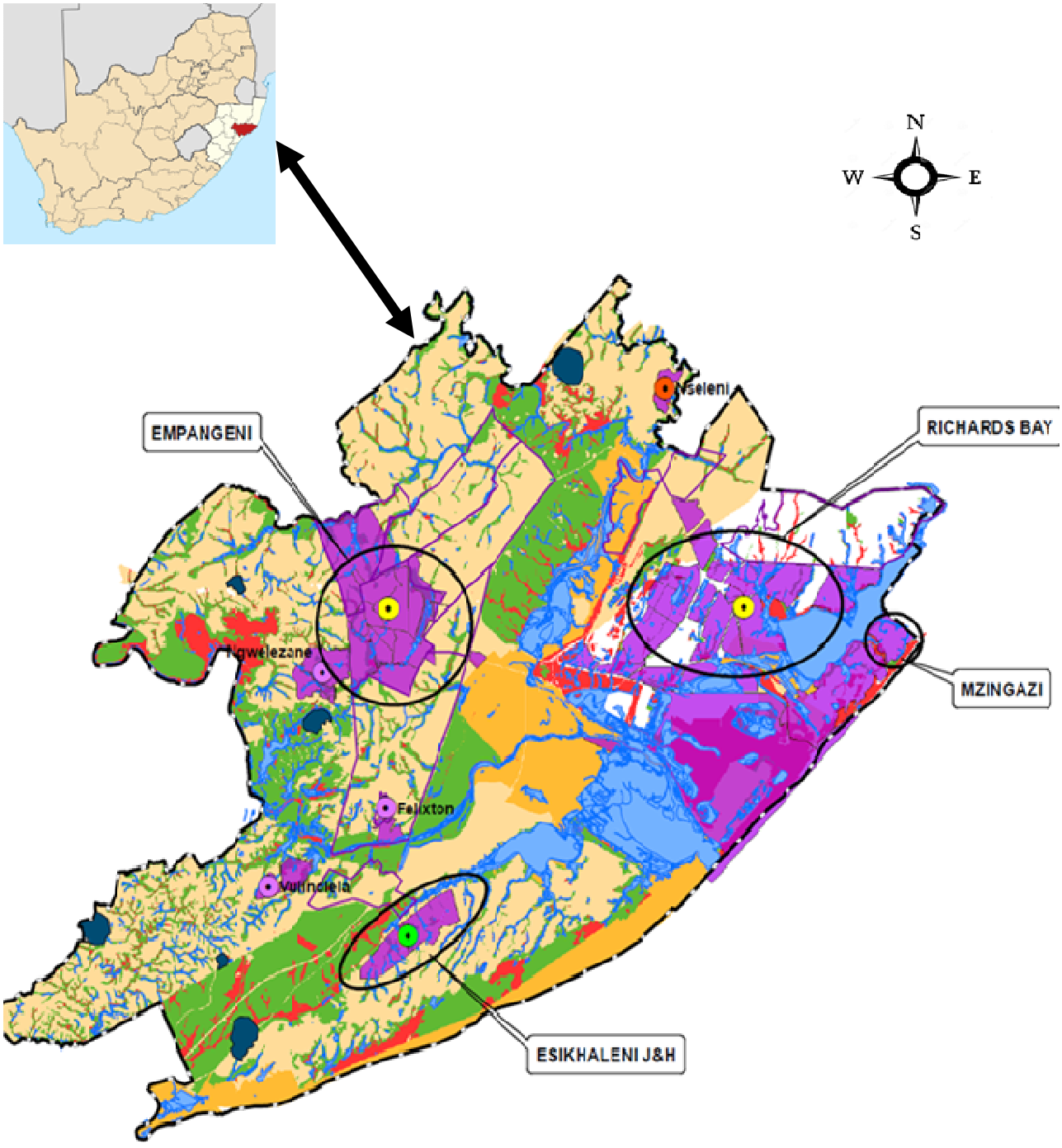
- Universal accessibility,
- A place that can be used in a number of ways (robustness)

- An area responding and reinforcing locally distinctive patterns of development,
- A place of safety and security to visitors,
- An inclusive area for different sections of the society (both young and old),
- A place of vitality and viability with thriving complementary uses,
- An area of urban greenness.

4.4 RESULTS FROM FIELD OBSERVATIONS AND MAP ANALYSIS

4.4.1 Introduction

Field observations were carried out in the Empangeni CBD, Richards Bay CBD, Central Park suburb, Esikhawini (H1&2) suburb and Mzingazi suburb is shown in Figure 4.9, but Map analysis covered the whole city including areas not labelled on the map in Figure 4.9.


N
W
E
S
EMPANGENI
RICHARDS BAY
MZINGAZI
ESIKHALENI J&H
Felixton
Vulindlela
1:50 000

Key

NODES		ESMP Draft		LANDUSES	
	Area of focus in the city		Buffer linkage		Wetlands
	Emerging Primary Node		Conservation		Formalised area
	Primary Node		Developable land		Future expansion area
	Secondary Node		Nature Reserve		Municipality boundary
	Tertiary Node				Rural Nodes 2013

Figure 4.9: Map of the city of UMhlathuze showing study area (UMhlathuze Municipality, Spatial Development Framework Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 10).

Field observations included counting of street trees along main roads in CBDs, high income and low income residential areas to assist evaluation of the levels and extent of urban greening, while map analysis involved scrutinizing and comparing different thematic maps to understand the nature of urban greening and sustainable development in the city. Results will be in descriptive format, sketch maps and photographs that will assist in comparing the level of urban greening in different land use zones of the city and nature and availability of open spaces, recreational activities associated with ecological infrastructure and other forms of economic development. Overall results will be compared to results of other research tools to develop common themes for discussion. The results will be presented under the following themes:

1. Vegetation found along the roads and green spaces
2. Maintenance of urban vegetation
3. Evidence of tree planting

4. Urban farming

5. Presence of parks and open spaces

6. Nature of recreation and development in the suburbs.

4.4.2 Vegetation along streets and in the open spaces

A ground survey focussed on street trees, shrubs, grass and trees in yards that can be seen from the street and the nature of vegetation in open spaces. Counting of street trees vegetation was carried out in selected areas of Empangeni CBD, Richards Bay CBD, Central Park and Esikhawini. How mapping of the densities was limited to a few streets of each area to give a picture of the density of trees along the roads of each respective area. Table 4.7 shows the selected roads, the distance surveyed and number of trees per 100 metres per given area.

Table 4.7: Street tree densities (trees/100m) of selected roads or streets in the study area

	ROAD MEASURED	FROM	TO	DISTANCE (m)	No. of trees	Density (No. of tree/100m)	Density colour
CENTRAL PARK	R 34	Biyela street	Five ways robots	23.8	550	13.47978033	
	Paul Avenue	R34 or 5 ways Mall robots	Thrush Road	20.03	270	9.209486166	
	Louise Botha Avenue	Paul Avenue	Standish Lester road	25.3	233	14.63486024	
	Flamingo Avenue	Louise Botha Avenue	Partridge Road	6.833	100	17.5231086	
	Eggless Drive	Eland Crescent	Gazelle Place	4.5654	80	25.48095299	
	Kudu street	Paul Avenue	Louise Botha Avenue	4.7094	120	7.693964854	
	Armstrong Road	Paul Avenue	To where it ends	9.7479	75	12.66381411	
	Sable Road	Kudu street	Grysbok Road	5.2117	66	8.4375	
	Moberly Avenue	Pasteur Road	Thrush Road	12.8	108	5.014130732	
	Pasteur Road	Union Street	Thrush Road	6.5814	33	12.97297297	
	Pearce Crescent	Turnbull street	Turnbull street	11.1	144	9.784172662	
EMPANGENI CBD	Biyela Street	R 34	Mtubatuba Road	13.9	136	6.06327858	
	Addison Street	Smith Street	Mtubatuba Road	5.4426	33	4.244604317	
	Maxwell Street	Loftheim Road	Mtubatuba Road	13.9	59	5.096774194	
	Union Street	Commercial Road	Railway line	15.5	79	15.42329825	
	Turnbull Street	Commercial Road	Hospital Road	7.7156	119	2.255947498	
	Commercial Road	Biyela Street	Turnbull Street	4.876	11	3.706067656	
	Smith Road	Biyela Street	Turnbull Street	4.8569	18	2.095238095	
	Mtubatuba/Hospital	start	Paul Avenue	10.5	22	12.33766234	
RICHARDS BAY CBD	Bullion Boulevard	Guldengracht Road	North Central Arterial	15.4	190	5.168467426	
	North Central Arterial	Bullion Boulevard	East Central Arterial	8.1262	42	1.308411215	
	East Central Arterial	North Central Arterial	Guldengracht Road	10.7	14	5.15061881	
	Guldengracht Road	East Central Arterial	Bullion Boulevard	6.7953	35	4.799112164	
	Mark Strasse Street	East Central Arterial	Bullion Boulevard	6.6679	32	6.05294547	
	Kruger Rand Road	Lira Link	Bullion Boulevard	5.6171	34	6.060170301	
	Lira Link	Premium Promenade	end	9.7357	59	1.05764146	
	Premium Promenade	North Central Arterial	end	4.7275	5	3.483835006	
	Calypso Cove	East Central Arterial	Kruger Rand Road	4.3056	15	6.714855631	
	Barbados Bay/ Penny Ln	Mark Strasse Street	Grenada Grove	5.0634	34	3.507794526	
	Metica Moon/Shilling Swing/Grenada Grove	Barbados Bay/ Penny Ln	Calypso Cove	9.6927	34	5.434782609	
ESIKHAWINI H2	Mdoni Road	Mdlebe Mpuma East	Mdlebe Ntshona West	13.8	75	1.079136691	
	Mdlebe Mpuma East	Mdoni Road	Ntokozweni robots	13.9	15	0.416666667	
	Mdlebe Ntshona West	Mdoni Road	ESikhaleni complex	19.2	8	2.770711065	
	Mgugude Road	The whole of it		7.9402	22	7.612557094	
	Inhlolamvula Road	The whole of it		2.7586	21	3.925557161	
	Intokozo Road	The whole of it		5.6043	22	4.82766692	
	Thokozani Road	The whole of it		6.8356	33	2.273896861	
	Mkhanyakhude Road	The whole of it		8.3557	19	2.635658915	
	Uzavalo Road	The whole of it		12.9	34	2.314814815	
	Mthengulu Road	The whole of it		10.8	25	2.486788934	
	Umnyezane Road	The whole of it		9.651	24	3.619047619	
	Msenge Road	The whole of it		10.5	38		

KEY		
11 and above trees per 100m - dense		
7 to 10 trees per 100m - medium density		
3 to 6 trees per 100 m - sparse		
0 to 2 trees per 100 m - almost empty		

The street survey revealed that most streets in Empangeni Central Park suburbs are lined with old trees roughly ranging from medium to dense distribution. In some streets like Segar road enveloping canopies were observed as evidence of old grown trees. The survey also revealed that few streets have sparse trees, but there are no streets without trees in Central Park (see Figure 4.10 a) and b).

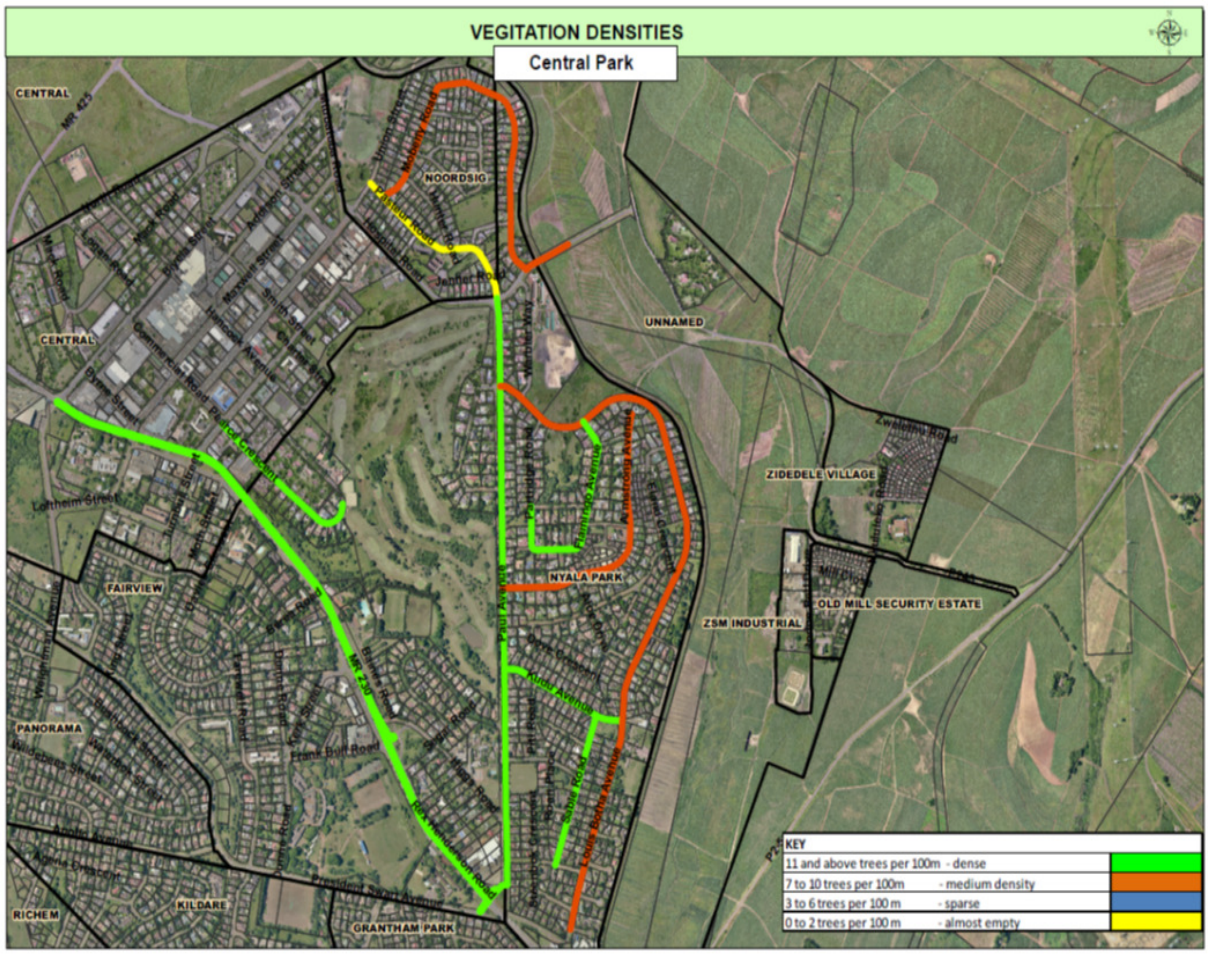


Figure 4.10 a): Density of trees along selected roads in Central Park, Empangeni (Field based, 2015)



Figure 4.10 (b): Street trees and canopies along Segar road in Empangeni Central Suburb (Photo: Field based, 2015).

Bigger or wider streets also have open spaces covered by well-maintained grass and shrubs on either side of the road. Most of the trees observed are exotic trees of about 7 to 20 metres with an approximate age of more than 20 years shown by their large enveloping canopies while less young or small trees (less than 10 years old and from 1 to 5 metres) are found along the roads Paul avenue as shown in the photographs below (Figure 4.10 c).



Figure 4.10 (c): Old trees along Paul Avenue in Empangeni Central Park suburb (Photo: Field based, 2015).

In the CBDs streets have sparse exotic trees, but their density increase towards the suburbs, especially in Empangeni where the CBD is surrounded by a high income residential area like the high density of trees along Turnbull road separating Empangeni CBD from Central Park suburb (see Figure 10 d). The CBD of Empangeni has sparse trees along streets; hence more trees are needed along sidewalks and adjacent open spaces to improve the greenness in the CBD.

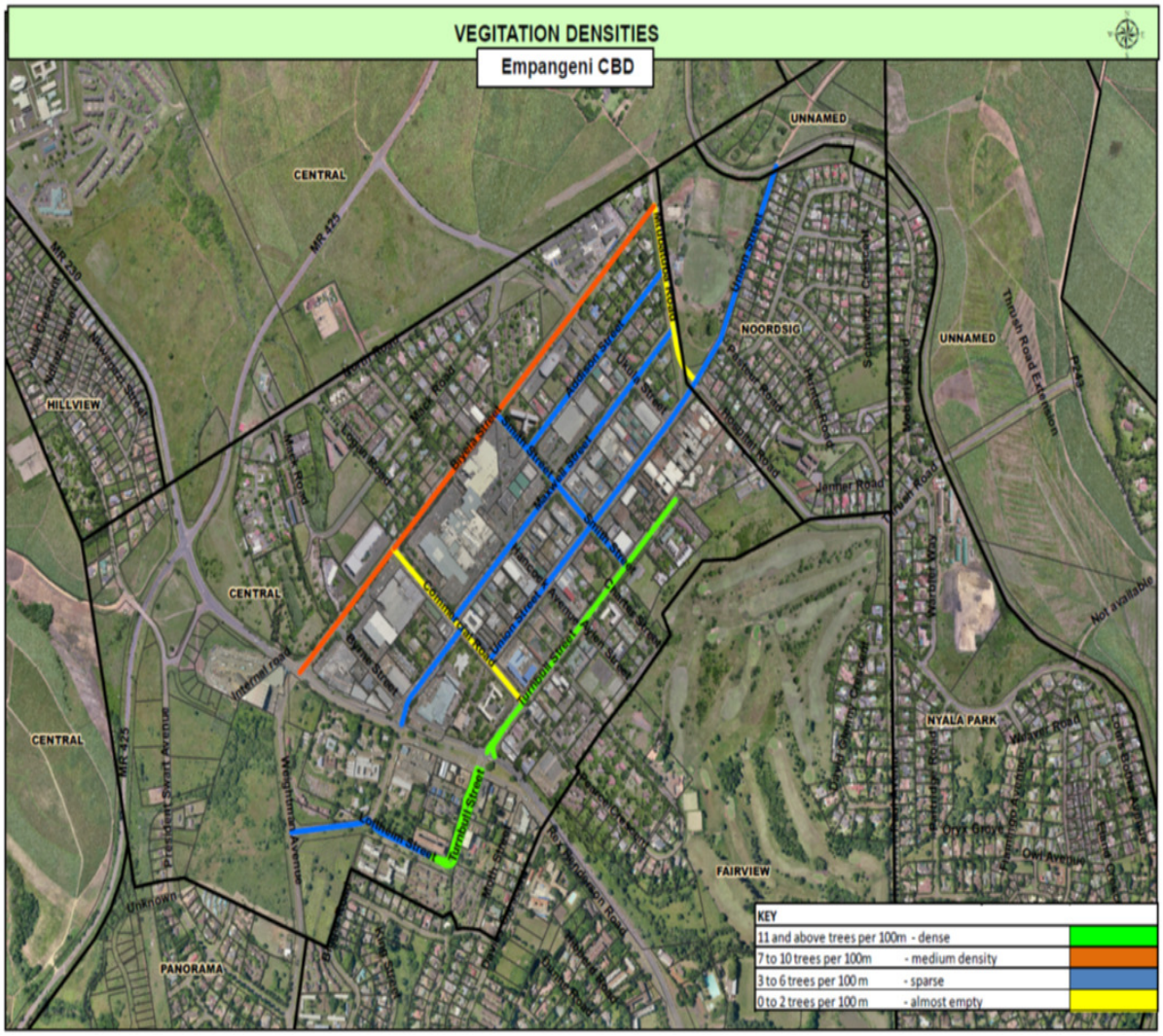


Figure 4.10 d): Density of trees along selected roads in Empangeni CBD (Field based, 2015)

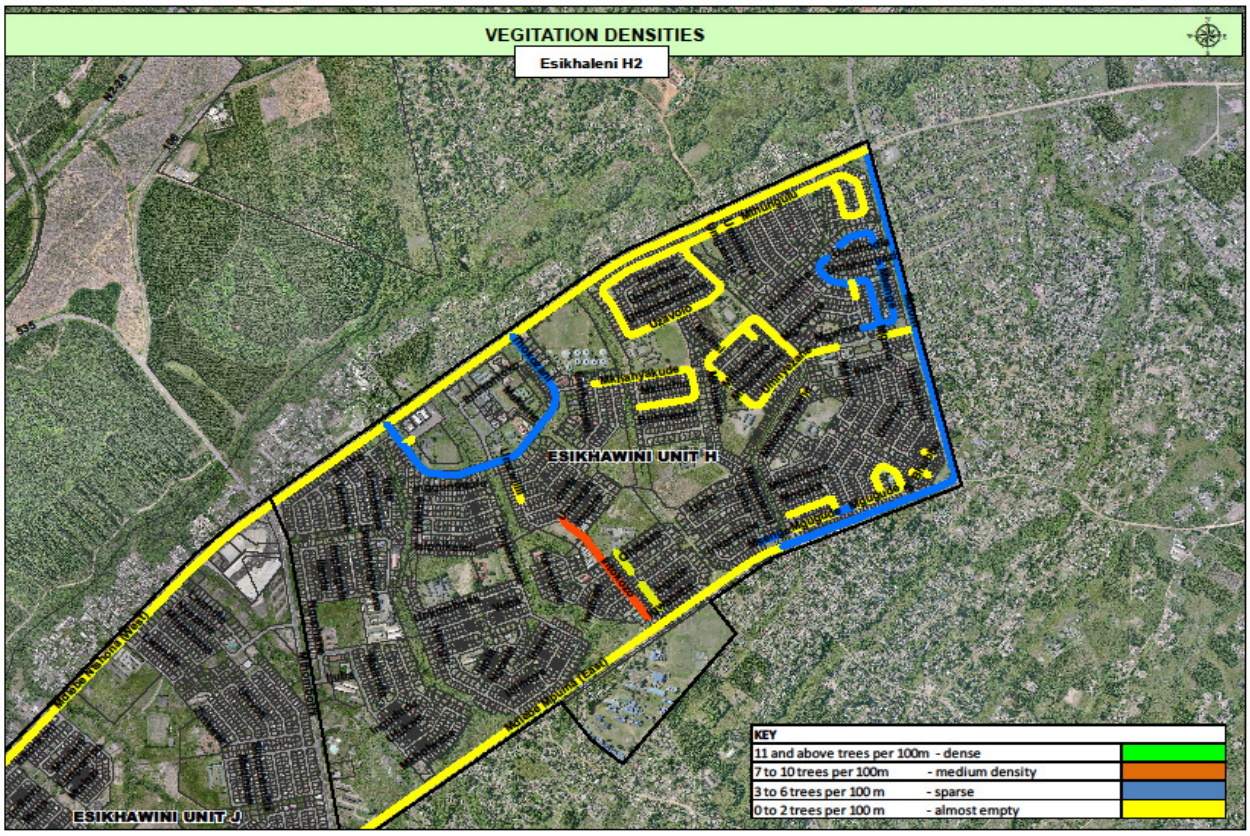


Figure 4.10 e): Density of trees along selected streets in Esikhawini H2 (Field based, 2015)

In Esikhawini and Mzingazi (Low income suburbs), streets are almost empty in terms of trees along streets, but most streets have maintained grass patches in ESikhaleni. The few trees visible along roads are either exotic trees planted by house owners or wild indigenous trees that have grown there on their own and were preserved during road and house constructions. The sparse vegetation in Figure 10 (e) is an indication of limited tree planting along roads of low income suburbs. Most trees and shrubs observed and counted in Central Park (see Figure 10 a), Empangeni CBD and Richards Bay CBD are exotic and of different species due to the municipality and individual efforts to plant trees and shrubs along roads and outside yards. However, along main roads or bigger roads there is uniformity in tree species which indicate a coordinated effort of greening by the municipality and Department of roads e.g.

along Paul Avenue (see Figure 4.10 b), R34, Louise Botha Avenue and Bullion Boulevard.

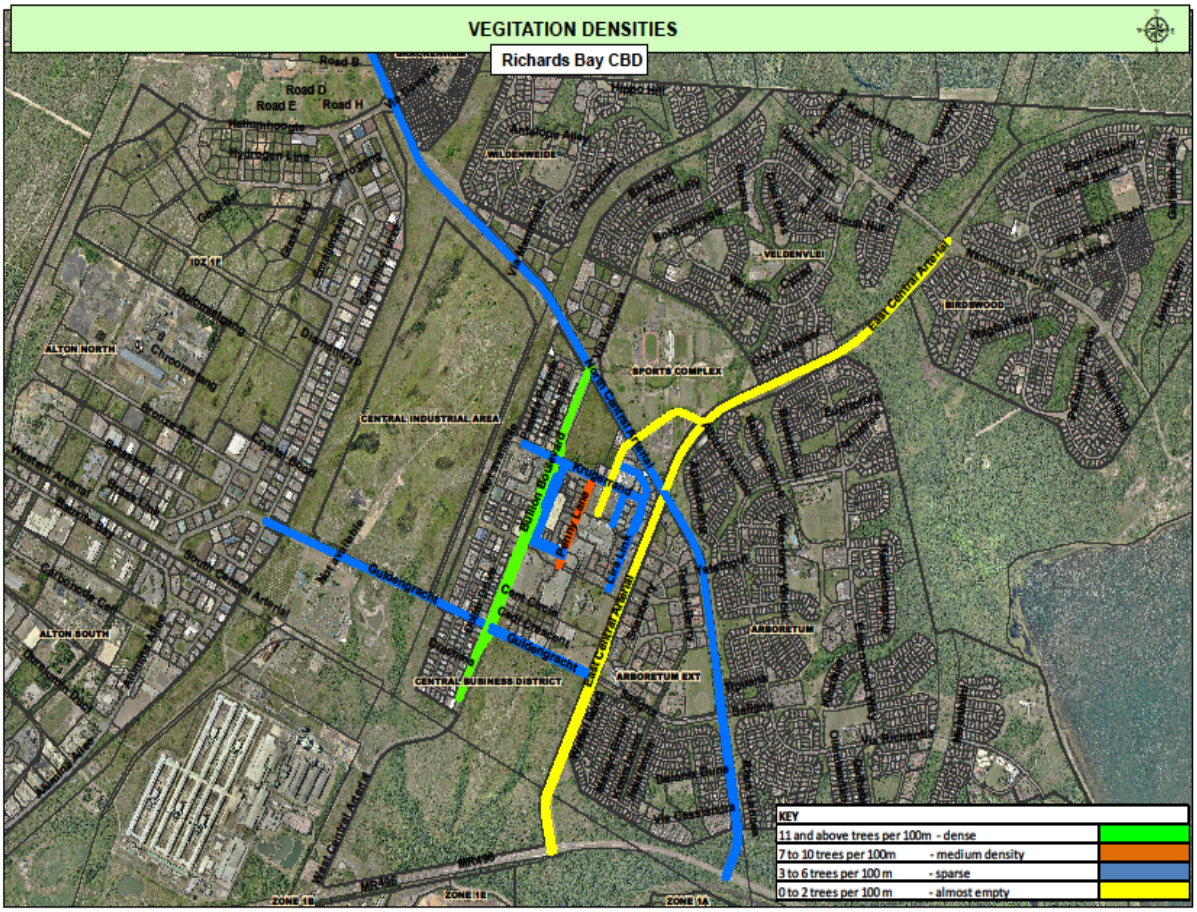


Figure 4.10 (f): Density of trees along selected streets in Richards Bay CBD (Field based, 2015)

Like in Empangeni CBD, Richards Bay CBD is also characterised by sparse vegetation consisting mainly of young trees (5 to 14 years). The existence of such densities is an indicator that greening is being practiced in this area, although more trees are still needed in the CBD (see Figure 10 f). In Esikhawini and Mzingazi, more open spaces are not well maintained and have sparse trees and uncut wild grass with dense vegetation being found along rivers and wetland areas. Most schools, churches and public areas have sparse to dense vegetation in all areas surveyed. Big tree canopies inside and outside the school property were observed around St. Catherine,

Empangeni High, Empangeni Preparatory and Empangeni Christian while less trees were observed around Old Mill High School and most of these are young trees. In ESikhaleni most streets have grass patches with very few shrubs and trees (see Figure 4.11 a, b and c). In low income areas urbanisation is rapidly taking place on the outskirts of these areas. The objective of equity in sustainable development is defeated as more people lose out on ecological services in these areas.



Figure 4.11(a): Dense trees in St Catherine High School in Central Park suburb of Empangeni, visible from the street (Photo: Field based, 2015).



Figure 4.11 (b): Young and sparse trees planted around Old Mill High school in Central Park suburb (Photo: Field based, 2015).



Figure 4.11 (c): A street with grass patches and few shrubs in ESikhaleni (Photo: Field based, 2015).

4.4.3 Maintenance of urban vegetation

Open spaces and parks in low income suburbs has unmaintained vegetation characterised by tall wild grass, wild un-pruned trees and thick shrubs. In the CBDs most trees are well maintained by pruning (see Figure 4.11 d), while in High Income suburbs like Empangeni Central Park grass in open spaces and along roads is well maintained. Open spaces and parks with trees have dense vegetation with unpruned trees. Along the streets where young trees have been planted some of these have died and have not been replaced, which signifies lack of maintenance and monitoring of newly planted trees. In the CBD of Empangeni stumps of old cut trees are visible, but have not been replaced. In all CBDs street trees are well maintained (pruned) but in residential areas there is less pruning of trees. In Mzingazi sparse trees are haphazardly found along gravel road tracks with very little grass found along such roads. Open spaces are difficult to see as most of them have been illegally occupied due to lack of planning. Most of the trees visible are indigenous wild trees and fruit trees near people's houses. In ESikhaleni open spaces have thick overgrown grass while trees, shrubs and grass along wetlands and rivers are dense and rough.



Figure 4.11 (d): Well-maintained or pruned trees in Empangeni CBD (Photo: Field based, 2015).

4.4.4 Evidence of tree planting

There is evidence of tree planting along roads by the municipality and residents in the CBD areas and Central park suburb. Roads like Bullion Boulevard; Central East Arterial (Richards Bay), Biyela Street (see Figure 4.12 a), R34, commercial street (Empangeni) are lined up with young trees that have been recently planted (See Figure 4.12 a).



Figure 4.12 (a): Newly planted trees along Biyela Street in Empangeni CBD (Photo: Field based, 2015).

Car parks and public areas in the CBD areas and commercial shopping areas have young planted trees evenly spaced. Most visited churches, municipal grounds and schools also have planted many young trees around their yards signifying a continued process of arboriculture (See Figure 4.12 b). Planting of trees in affluent areas is evidence that greening is very vital in urban areas where problems of pollution and other forms of degradation are common. It can be noted that greening

urban neighbourhoods is one of the less costly ways of bringing development and improving the quality of life in these urban environments.



Figure 4.12 (b): Newly planted trees in front of the Empangeni municipal library (Photo: Field based, 2015).

In Esikhawini and Mzingazi there are no signs or evidence of recent tree planting, however incoming roads like John Ross Highway (Mzingazi) and Mdoni road (Esikhawini) are characterised by broken tree lines while roads in the suburbs are almost empty except for wild trees and a few planted young and old exotic trees. There are more fruit trees in residential properties of all suburbs visible from the streets and a few found outside properties on street walk ways. In the open spaces of the above areas there are no signs of tree planting at all. In short, there is no evidence of recent coordinated tree planting as evidenced by the absence of young trees of uniform species in low income residential areas, despite roads having more open spaces that can accommodate vegetation except in CBD areas. Grass patches

along roads of the CBDs, Central Park and ESikhaleni, while in rural parts of the city, grass is unmaintained.



Figure 4.13: Aerial photograph showing vegetation in Esikhawini along roads and in yards (City of UMhlathuze Annual Review 2004/05, page 3)

Most streets shown in Figure 4.13 are almost empty in terms of street trees, however the vegetation seen in the area are trees in yards which consist of many fruit trees especially mangoes, guava and avocado. Streets are generally narrow with most sidewalks dominated by grass, few shrubs, few flowers and some sections with vegetable gardens. Richards Bay consists of more open spaces as a new town that benefited from planning. Car parks around malls in Richards Bay have been planted with young trees while open spaces around the CBD have maintained grass cover and a few trees (see Figure 4.14 a, b, c).



Figure 4.14 (a): Richards Bay CBD is showing trees planted in parking areas and surrounding green spaces (City of UMhlathuze Annual Review 2004/05, page 38)



Figure 4.14 (b): Car park in Richards Bay dotted with trees (Photo: Fidelis Chihambakwe 2014/15).



Figure 4.14 (c): Car park in the Empangeni city centre lined with trees (Photo: Field based, 2015).



Figure 4.14 (d) Open spaces in Richards Bay around the Civic Centre (City of UMhlathuze Annual Review 2004/05, page 20)

4.4.5 Urban farming

In the low income suburbs of Esikhawini and Mzingazi most open spaces, park areas and roadside walks are under crop cultivation and gardening. Crops like vegetables, maize, sweat potatoes, Bananas, groundnuts, Madhumbe and vegetables are being grown to supplement family incomes and provide fresh family food (see Figure 4.15a and b).



Figure 4.15 (a): Farming in open spaces of the Esikhawini H2 residential area (Photo: Field based, 2015).



Figure 4.15 (b): Unprotected open space near Ikhandlela High School being used for farming in Esikhawini (Notice that the fenced school open space is unaffected but not maintained: Photo: Field based, 2015).

Farming in open spaces and wetlands appears to be on the increase in low income residential areas especially in the summer season. Most people involved are elderly women using simple tools. Big trees in these areas are not cleared, but grass and shrubs are completely removed. Urban farming for the sake of protecting urban soils and reducing different forms of pollution can be regarded as sustainable development as it means that people are living within the means of their natural resources.

4.4.6 Presence of parks and open spaces

Green filled public areas located nearby or in a walkable distance from where people live should be a strong point of all new urban plans especially for densely settled

suburbs. Due to the health benefit of green spaces combined efforts of city planners, engineers and environmentalist should be undertaken in order to improve quality of life in these suburbs. All surveyed areas have public parks and open spaces that within walkable distance from people's houses. However, in Mzingazi and ESikhaleni it is difficult to differentiate parks from open spaces as most are occupied or cultivated and most lack recreation infrastructure (see Figure 4.15 (a) and (b) and 4.16b). Central Park has a private golf course where vegetation density is thick and well maintained (see Figure 4.18). In addition Central park residential suburb has many public open spaces both forested and grassed (see Figure 4.16 a). Some of these open spaces have been converted into parks mostly for young children through the installation of children's playing infrastructure (see Figure 4.16 c). ESikhaleni has more open spaces due to the presence of many rivers and areas below flood lines. Almost all visited public parks have broken/ vandalised recreational facilities while others do not have recreational facilities. Park attendance on all days of the week was very poor except for a few parents and kids from close by areas.



Figure 4.16 (a): An open space in Empangeni suburb with thick bushes (Photo: Field based, 2015).



Figure 4.16 (b): An open space in Esikhawini with wild grass, sparse trees and illegal dumping (Photo: Field based, 2015).



Figure 4.16 (c): An open space in Empangeni with children's swing (Photo: Field based, 2015).

Most open ground in Esikhawini suburb is found in and around Public places like Schools, Vocational training centres, Department of Education offices and Municipal offices as shown in Figure 4.16 b and 4.17).

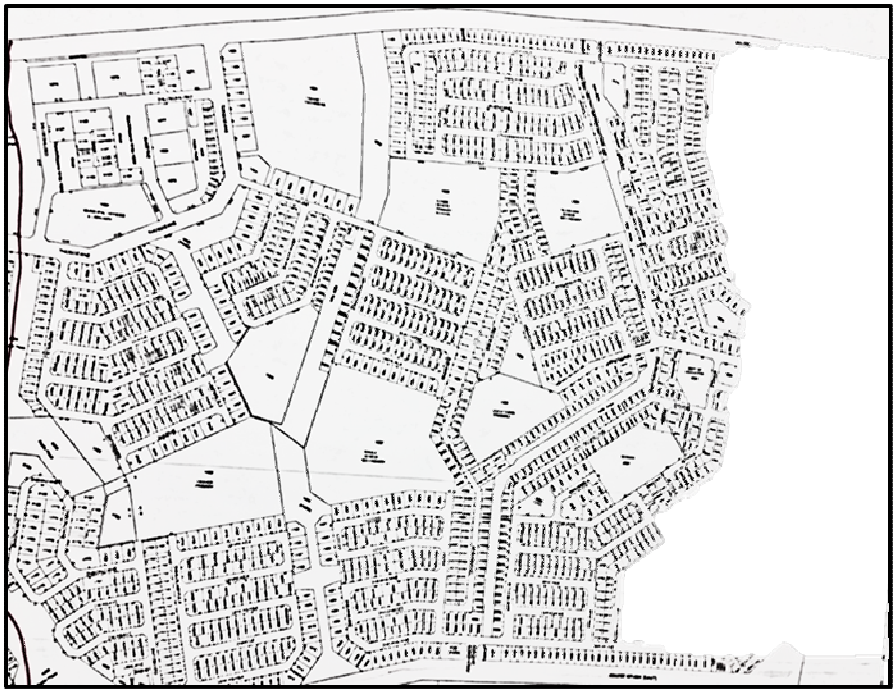


Figure 4.17: A photograph of a street map of ESikhaleni showing planned numerous open spaces (City of UMhlathuze planning maps 2014)

4.4.7 Nature of recreation and development in the suburbs

Most visible public infrastructure like roads, street lights, shopping centres, schools, clinics and sporting facilities are well developed in almost all visited areas except in Mzingazi. Visible infrastructure like roads and houses in Mzingazi are in a bad state with unplanned gravel roads, no street lights, no proper planned streets and no street names with informal houses visible in the backyards of unfenced properties. Recreational areas are in the form of makeshift soccer playgrounds, open spaces are disjointed except along roads. Rural land uses like rearing cattle is also visible in this area because of its rural and urban mix. The above picture is completely different in formal areas like Empangeni, Richards Bay and other formal suburbs. Erico park sports complex in Empangeni with its soccer, volleyball, and hockey and balling fields has well maintained facilities dominated by maintained grass cover, shrubs and trees. The same characteristics are found in the UMhlathuze Sports complex while suburbs

like Empangeni Central Park and Meerensee have private golf courses with well-developed green spaces (see Figure 4.18).

Attendance in sports fields of Erico Sports complex in Empangeni and UMhlathuze Sports complex is very high. Apart from having well-kept vegetation and a variety of sporting disciplines, these sports complex also have resting areas, braaing areas, refreshment areas and secure parking which attract many people into these facilities. There were very few people seen in parks with little or no recreational activities taking place in them except a few people strolling around. Absence of recreational infrastructure and security might be deterring residents from these recreational spots. Some open spaces have been developed to provide picnic sites and a few recreational activities while many of them are open with grass.



Figure 4.18: A view into the Empangeni private Golf course (Photo: Field based 2014/15).

4.4.8 Connection between discussed themes above.

Open spaces and parks in urban areas are signs and indications of urban greenness. These are areas where vegetation thrives under constant protection and upkeep by people. The amount and nature of such spaces can give an idea of the level and nature of greenness in a city. On the other hand parks, open spaces and wetlands are part of urban greenbelts that offer several ecological benefits that can help in improving quality of life and reducing adverse environmental effects like urban heat islands, air pollution, noise pollution, soil erosion and many others. With the constantly increasing demand for land, unutilised open land may be found along roads and streets. It is for this reason why the observation embarked on vegetation observation along streets. Many green cities have streets lined with trees forming beautiful skyline canopies along roads. Green spaces therefore help to include vegetation environments in cities and also act as a good measure of human and environmental health. All these are can act as reflective measure which can be used in measuring and assessing environmental development and sustainability in a city. In many cities, streets have become the most available land for urban greenness where tree planting and maintenance takes place.

Urban greenness has now taken many forms like urban agriculture, especially in low income suburbs. Agriculture in open spaces is becoming dominant and need to be recognised, planned for and promoted as a form of urban greenness. Community gardens observed in low income residential areas helping in re-greening vacant areas and improving tree plant diversity in public green open spaces, making them a valuable asset for improving quality of life in urban areas. In ESikhaleni many open spaces are being used for farming, these diversifications of the use of open space create an opportunity for active recreation and improvement of the urban environment. Low income groups can be encouraged to help green the city by not

only planting trees but, planting what they know best which is farming. It is interesting that the city of UMhlathuze has not taken a negative stance against this kind of farming, although at the moment it is illegal to farm in these open spaces. However proposed plans of new Complex parks incorporate the farming concept as another ecological practice apart from arboriculture.

4.5 Map Analysis

4.5.1 Vegetation mapping and urban planning.

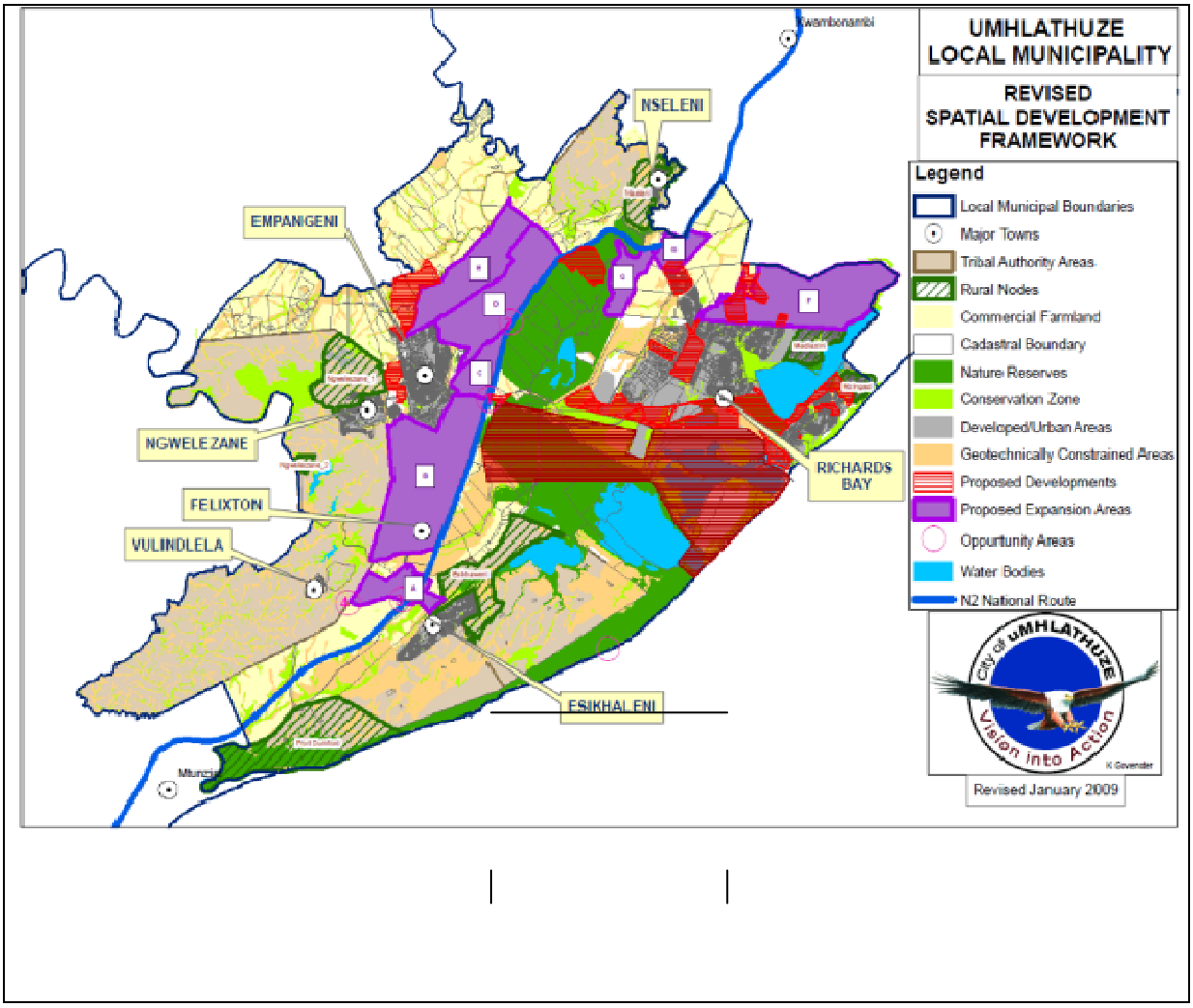


Figure 4.19: An SDF map of UMhlathuze showing different land zones and nature reserve areas (UMhlathuze Municipality, Spatial Development Framework Review, 2014/2015 FINAL DRAFT 30 JUNE 2014 page 10).

Vegetation maps make it easy to monitor changes in vegetation cover, composition and structure in relation to natural or human influenced events. In addition, these maps can aid the setting up conservation and habitat management goals to safeguard urban vegetation. The red coloured areas on the map (see Figure 4.19) indicate proposed developments and purple colour indicate proposed expansion areas which are continually expanding into conservation areas (light green), nature reserve (dark green) and commercial farming land (cream). This means more vegetation will be removed despite the planning that has been done. If greenness is to be achieved in urban areas, more vegetation or trees need to be grown especially in urban areas where more trees are being lost to urban expansion. While certain protected areas will remain, this will not be enough to cover the losses and gain the same ecological advantages in future like mitigation against adverse climate. The map also shows that the municipality has more than one third of the city under tribal authority (light brown) around Vulindlela, ESikhaleni, Ngwelezane, and Madlanzini, Mzingazi and Nseleni which makes it difficult to control the destruction of open spaces or compliance with environmental law. Although there are some conservation areas in tribal authority land (yellow in light brown areas) it will be difficult to conserve these areas and develop more green spaces due to lack of environmental planning, compliance and monitoring.

Apart from field surveys the research also used current planning maps, google maps from 2004 to 2015 and aerial photographs of 2006 and 2013 of the city to assess the changes in city greening. The aerial photographs help to identify changes in city expansion in open land and its effects on vegetation while planning maps help to show the nature of planning of open spaces in the city, the connection of green belts, and areas already planned for city growth but not yet occupied. These aerial photographs were also used to assess the growth of the city into the surrounding areas and the changes in greening levels. For all the study area few changes of all the

stated aspects could be seen as a result of a short time period between the images. However, more buildings continue to be built in infill areas of the city with less outward expansion into the rural urban zone. However proposed plans indicate that the city will expand its boundary into nearby farms and forests.

4.5.2 Urban expansion

Most city boundaries have not expanded into the surrounding open land in all formal or planned areas like low income residential area of Meerensee to the south of Richards Bay but the same cannot be said for informal areas of the city in Mzingazi, Madlazini and areas around Esikhawini and Ngwelezane where traditional chiefs are in control. Settlements continue to grow into the surrounding forest land (see Figure 4.20). This is evident from the aerial photographs of Mzingazi and Esikhawini between the year of 2006 and 2013 where some areas that were open and unsettled in 2006 were now settled by 2013 causing clearance of forests. More degradation of vegetation is stronger in the peri urban than within the city where most urban development expands into reserved or infill areas.

2006 2013

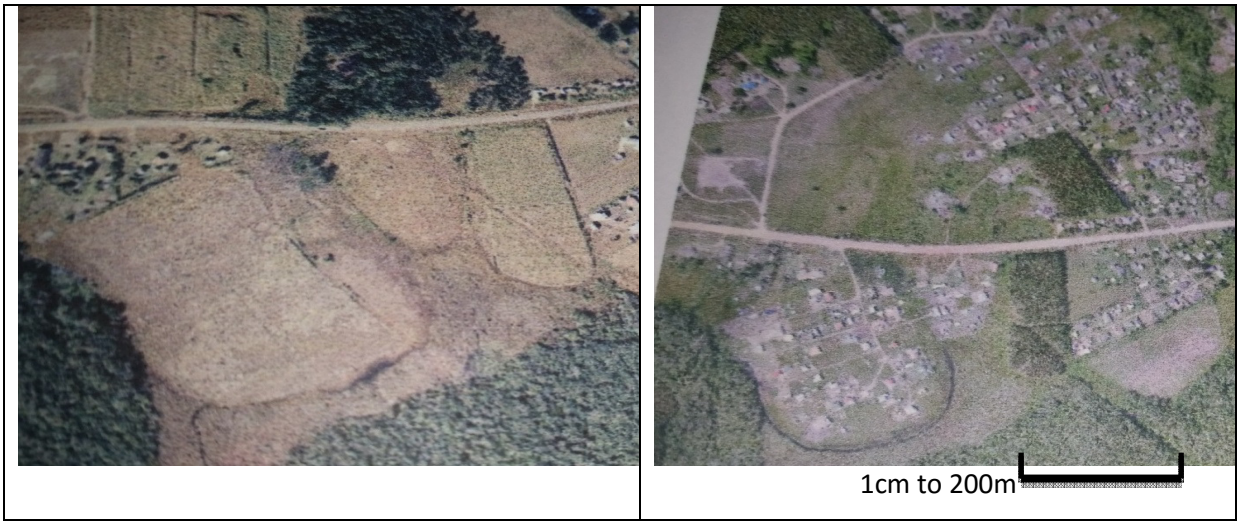


Figure 4.20 Settlements expanding in new areas in unplanned areas around Esikhawini (City of uMhlathuze, Annual Report, 2013) from 2006 and 2013).

In Esikhawini rural around the residential area more settlements have expanded into open land, causing the removal of most trees as shown by the 2006 and 2013 map extracts (Figure 4.21).

2006 2013



Figure 4.21: Thick forest being cleared in Birdswoods due land claims and informal settlement (City of uMhlathuze, Annual Report, 2013) Arial photographs from 2006 and 2013).

In the north east of Richards Bay the area marked 11488 was a thick forest in 2006 but the whole forest was almost gone in 2013 indicating cleared land ready for development (see Figure 4.21). In 2006 the UMhlathuze sports complex was still undergoing construction and shows many bare areas, but by 2013 it was already completed and its vegetation cover is denser than in 2006 as shown by photograph extracts below (see Figure 4.22).

2006 2013



Figure 4.22: Changes in greening levels in UMhlathuze Sports Complex (City of uMhlathuze, Annual Report, 2013) Arial photographs from 2006 and 2013).

Green belts and open spaces in all parts of the city are more connected to each as an indication of planning that promotes functional greenbelts. Esikhawini residential area has interconnected green belts which are good for biodiversity. Outside the formal area open spaces are disjointed and it is difficult to protect them from being encroached by settlement. Planned areas make it easy to protect open spaces and vegetation, but in unplanned areas vegetation slowly disappears due to uncontrolled and unregulated human activities. Figure 4.23 shows connected greenbelts in Esikhawini and disjointed open spaces in Mzingazi.



Figure 4.23: Connected greenbelts or open spaces in Esikhawini Low income residential area (scale: 1: 5 500, (City of uMhlathuze, Annual Report, 2013) Arial photographs for 2013).

4.5.3 Newly planned and re-planned areas

Public areas made up of different types of vegetation can provide improved and pleasing living standards in urban areas. For this reason and many others the City of UMhlathuze has replaned residential areas of Mzingazi and Madlazini to improve quality of life and ensure environmental protection and creation of open spaces in these suburbs. The extract below shows the proposed plans and the same area without plans where many people live below flood lines.



Figure 4.24 (a): Unplanned map of Mzingazi showing the current picture of the area today (scale: 1: 5 500, City of UMhlathuze photographs from 2006 and 2013).

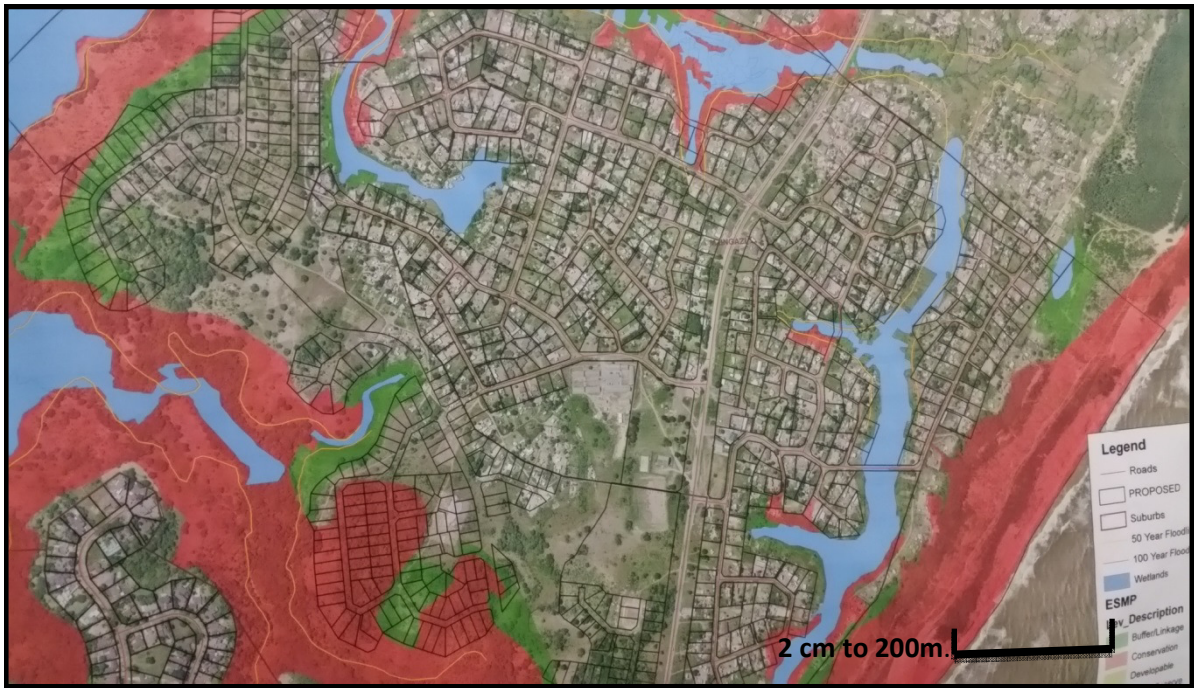


Figure 4.24 (b): Planned map of Mzingazi not yet implemented, (scale: 1: 5 500, City of UMhlathuze Planning Maps, 2013).

The planned map of Mzingazi show conserved areas (red), buffer linkages (green), wetlands (blue) and open spaces that can be conserved due to urban planning (see Figure 4.24 b). However the current situation shows that most of the planned open spaces; wetlands and conservation areas are already occupied making it difficult to conserve green spaces. All maps of different areas of UMhlathuze show that this city is dominated by wetland areas, especially due to its altitude, creating more sensitive areas in the city where more green spaces are located.

In Empangeni, the area opposite Qalakabusha Prison and Hill view suburb along R34 has been planned for residential expansion (see Figure 4.25), while in Richards Bay's south industrial area more land has been planned for industrial development (see Figure 4.26) . All these are plans that will mean the expansion of the city into vegetated areas as these plans are implemented. More continuous green spaces are going to be fragmented as the town grows due to industrial development and population growth.



Figure 4.25: Newly planned areas around Hill view (Empangeni) expanding into surrounding farm land (scale: 1: 5 500, City of UMhlathuze Planning Maps, 2013), photographs for 2013).



Figure 4.26: Planned area in Richards Bay where development of buildings has not yet started (scale: 1: 5 500, City of UMhlathuze Planning Maps, 2013), Photographs for 2006 and 2013).

According to Appendix B2 showing the environmental area of Empangeni, the town has been planned to grow. New plans can be seen around the town expanding into surrounding farming land. Such growth will result in loss of urban greenness in in the peri urban areas. Views from old and new aerial photographs of the city shows that the town is expanding into reserved areas in the formal areas, although this is per development plans such reserved areas have been acting as open spaces and reserves for urban vegetation contributing to ecological benefits in the city. In most informal settlements found around formal settlements like around Esikhawini, Ngwelezane and Vulindlela settlements are expanding into farm and forest land where more vegetation is being cleared for house construction, farming and for firewood. Some of these informal settlements are found in areas under traditional chiefs where municipal planning is not being followed.

4.6 Results of Questionnaires

4.6.1 Introduction

This section reports on findings made from questionnaires. Respondents were from the suburbs of Empangeni, Richards Bay, Esikhawini and Mzingazi (see Figure 4.27)

and a total of 138 questionnaires were collected for analysis using the Statistical Package for Social Sciences (SPSS). The results are presented in a descriptive form using tables and figures (bar graphs). The first section gives the general information of the respondents, followed by subsequent sections on the critical examination of the relationship between urban greenness and sustainable development of urban spaces in uMhlathuze Municipality.

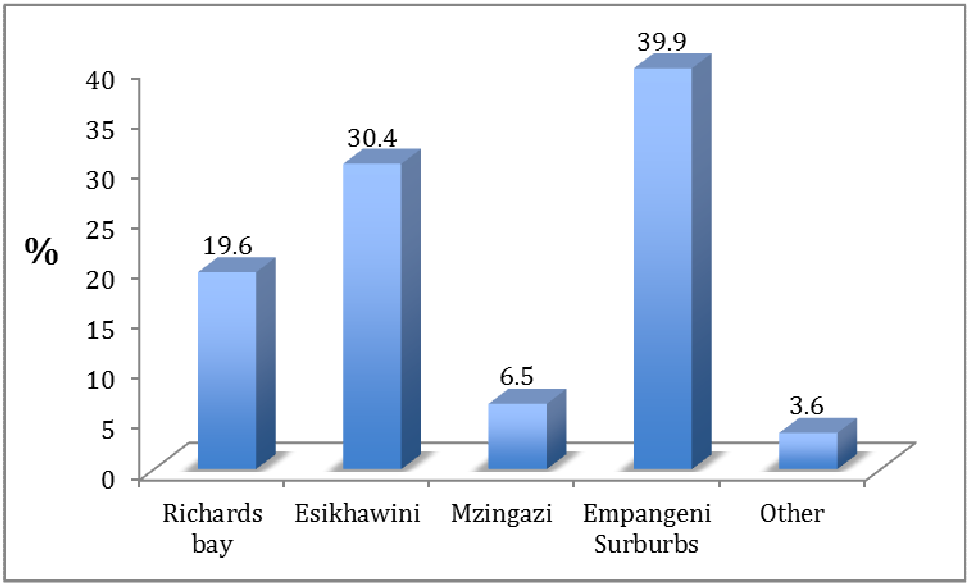


Figure 4.27: Question A1: In which residential area do you live in currently (%)?

4.6.2 Growth and expansion of the city

With the city expanding rapidly, the city's inhabitable environment has been expanding into green spaces of the peri urban areas. Most of the respondents believe that physical expansion of the city in the form of buildings in commercial and residential areas causes a decline in urban green in the city (see Figure 4.28 and 4.29).

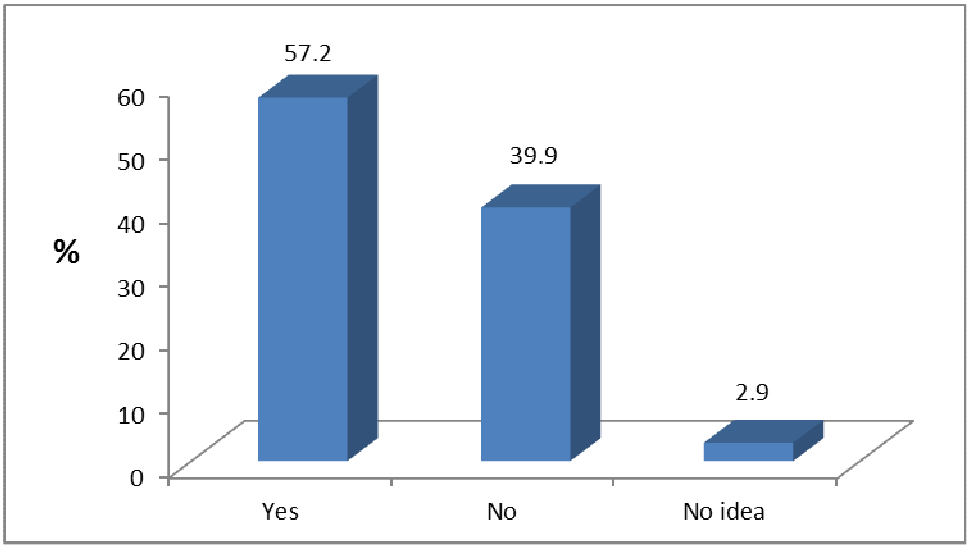
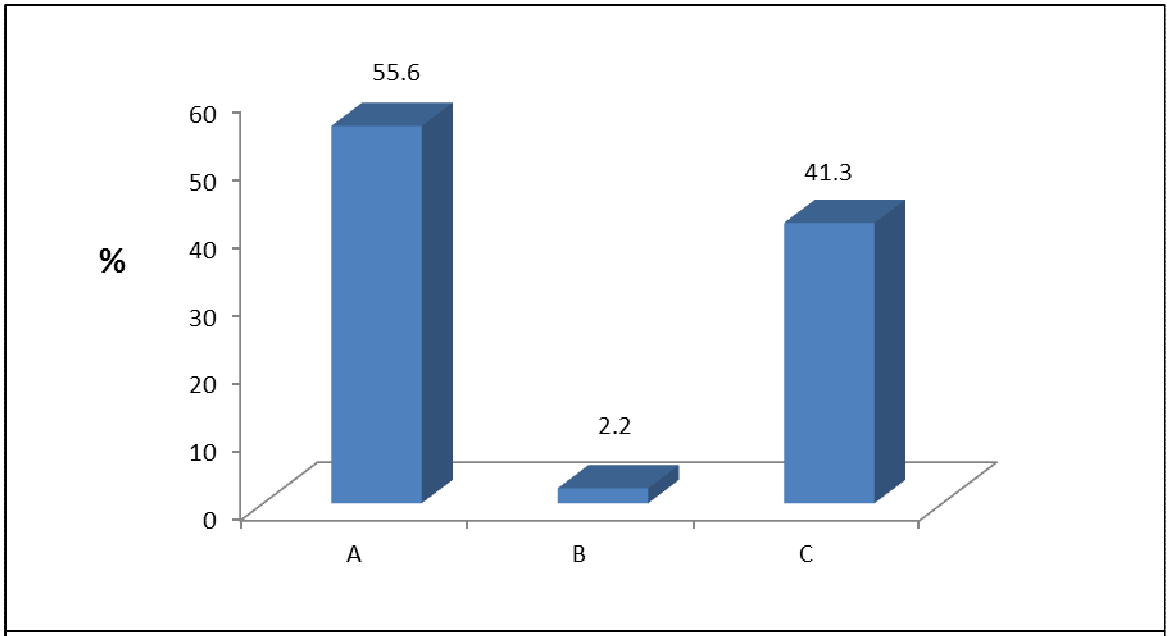


Figure 4.28: Question B 3: Has your residential area expanded in the last 10 years,



A = Building/expansion of shopping complexes and residential areas led to more vegetation destroyed
B = Reduction in sugarcane fields
C = N/A (Has not affected vegetation)

Figure 4.29: Question B 4: how has residential expansion affected natural vegetation in the area?

Urban expansion can also be in the form of informal settlements which may threaten the green spaces in urban areas by not adhering to environmental policies and law. About 73.3 % of respondents from different suburbs agree that residential areas are

not experiencing any threat from informal settlements growing into residential areas. However 26.8% of respondents believe the informal settlement threat is there in UMhlathuze (See Figure 4.30 and 4.31).

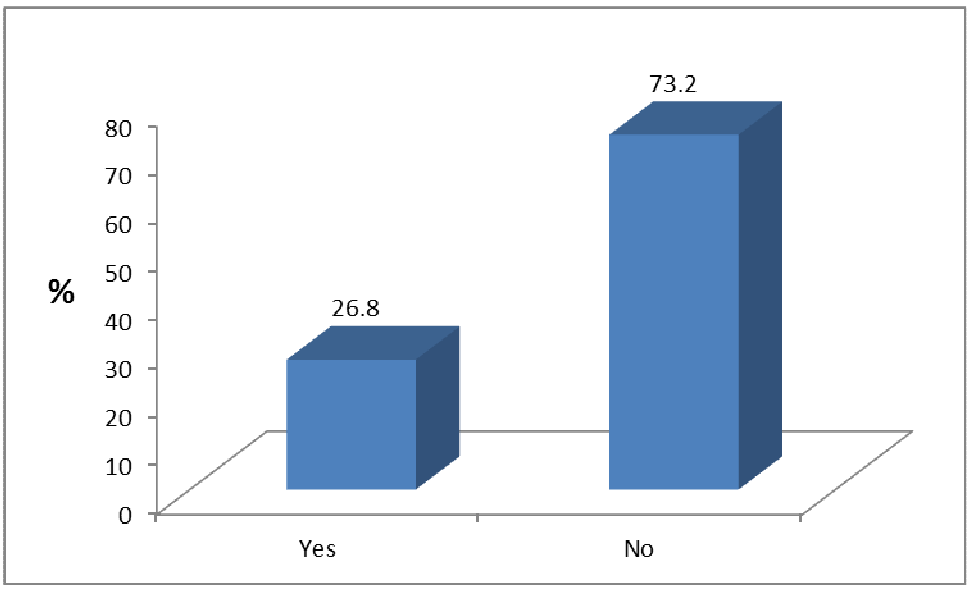


Figure 4.30: Question B10: Is your area under threat from the growth of informal (squatter) settlements?

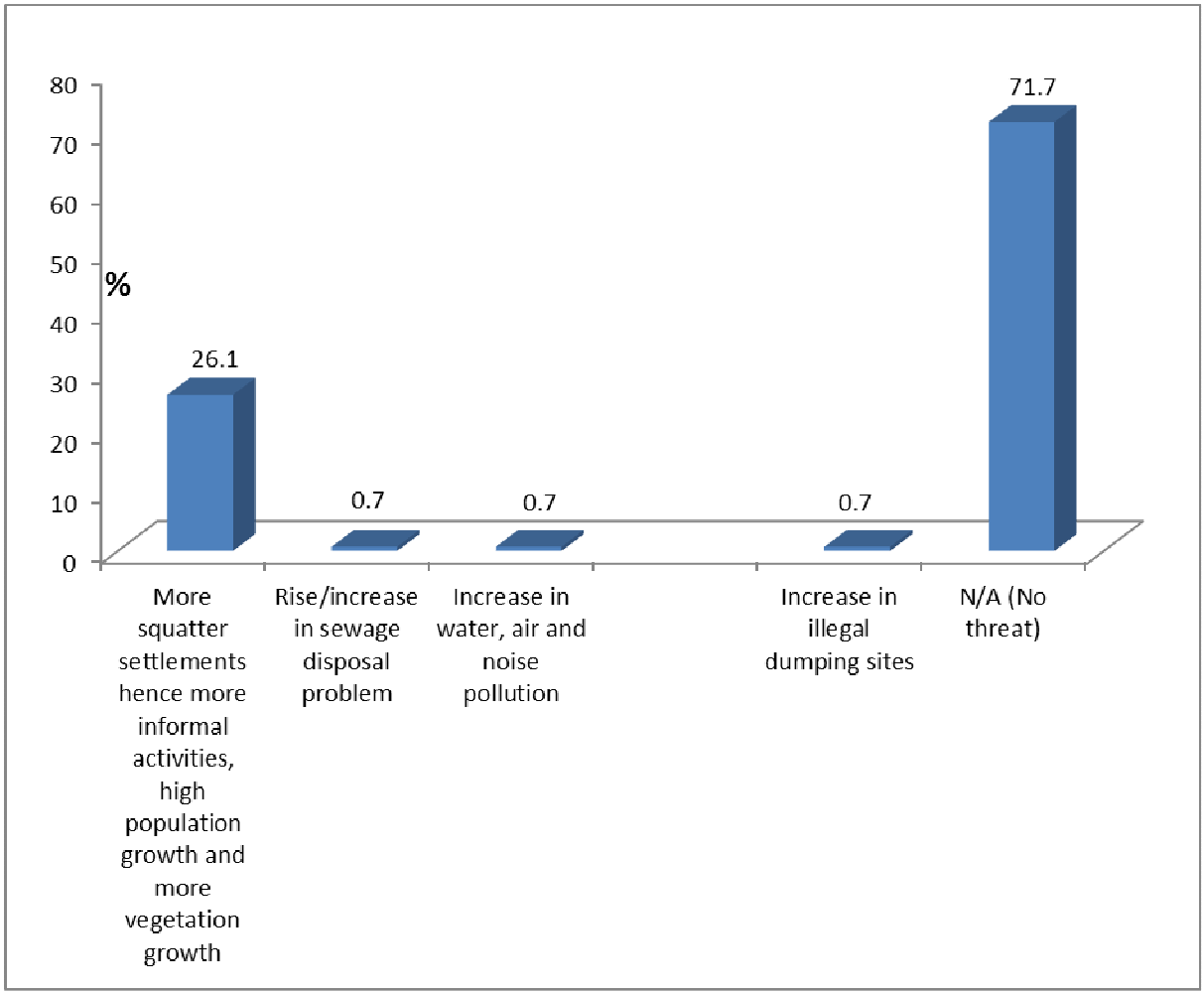


Figure 4.31: Description of threat from squatter settlement growth

4.6.3 Public awareness of urban greening

Greening urban areas can be determined by the residents' awareness levels of the need and importance of urban greening. Municipality can raise this awareness in many ways by engaging urban neighborhoods in the community stewardship of local green spaces through education, outreach training and demonstration projects for residents and youth on how to restore and enhance open and green spaces. In UMhlathuze most people in the surveyed areas think that the local municipality or department of parks (73.9%) is not doing anything with regard to raising awareness on the importance of urban greenness in sustainable development, while 23.9% think that the municipality is trying to raise greening awareness in many parts of a given city (see Figure 4.32). The biggest criticism leveled against sustainable development

is its inability to promote enough environmental conservation in the present and this is rooted in the belief that, the harm done in one part of the city can be counter balanced by creating environmental conservation in the other part of the city. This in the end creates more environmental injustice in disadvantaged areas and defeats the concept of equity in sustainable development. Awareness of environmental sustainability through urban greenness should be extensively promoted through effective environmental campaigns and education.

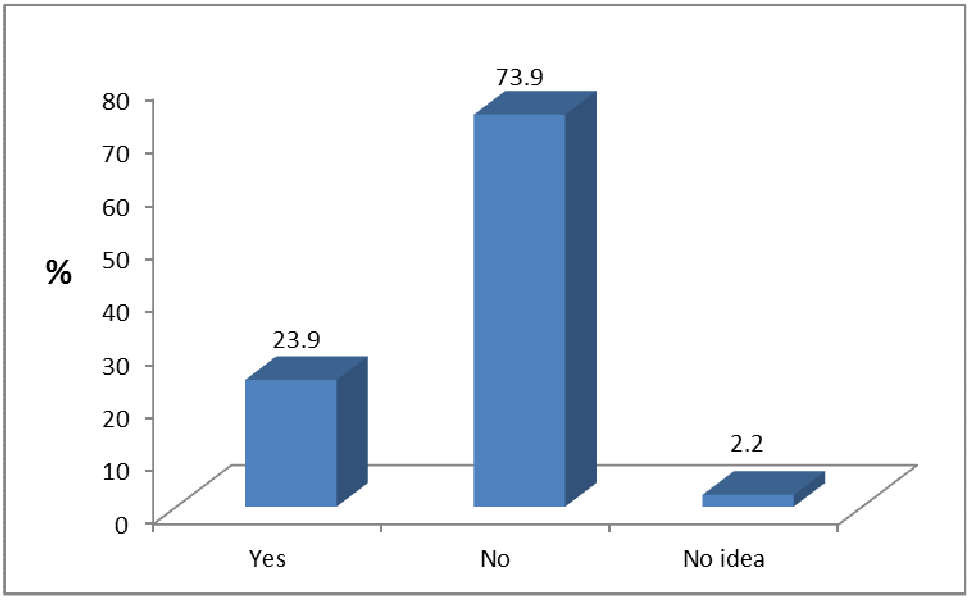
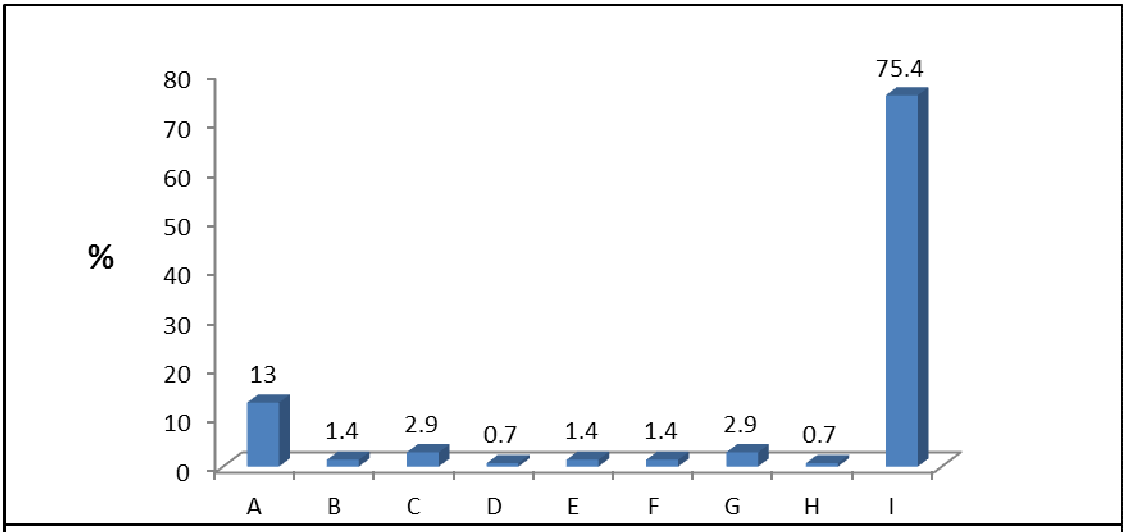


Figure 4.32: Question B11: Does the municipality or Department of parks carry out any green space or vegetation protection awareness programs in the media, in schools or in your area?

Of the 23.9% who said yes in Figure 4.32 several methods are being used by municipality to increase urban greening awareness with most people agreeing to the use of environmental campaigns in schools and planting of trees, encouraging the one home garden campaign and observing the Arbor week annually (see Figure 4.33). Although these percentages are very low, they show that the municipality is engaged in some awareness campaigns.



A = Environmental campains in schools and planting of trees

B = Agricultural campaigns

C = Sponsoring and encouraging One home one garden (giving out seeds)

D = Hosting competetion on planting trees and receiving a grocery voucher

E = Litter recycling

F = Maintaining and planting more flowers in the parks

G = Observing the ABA day/month

H = Publications - municipal newsletter

I = N/A (No awareness programs)

Figure 4.33: Question B12: If yes, describe the awareness program you have seen or heard.

Apart from the city council raising awareness on urban greening, people's perceptions of greening may influence their efforts to improve the greening of their neighbourhoods. Most respondents (71.7%) felt that they need more trees and green spaces in their suburbs compared to 28.3% who do not need more trees in the places they live (see Figure 4.34). This positive perception is good for raising awareness and implementing greening projects in the city as most people are in need of more green and open spaces. The positive perception is supported by the results in Figure 4.35 where 94.9% of surveyed respondents agree that they are

prepared to support tree planting policies from municipality like one tree or fruit tree per family or per yard.

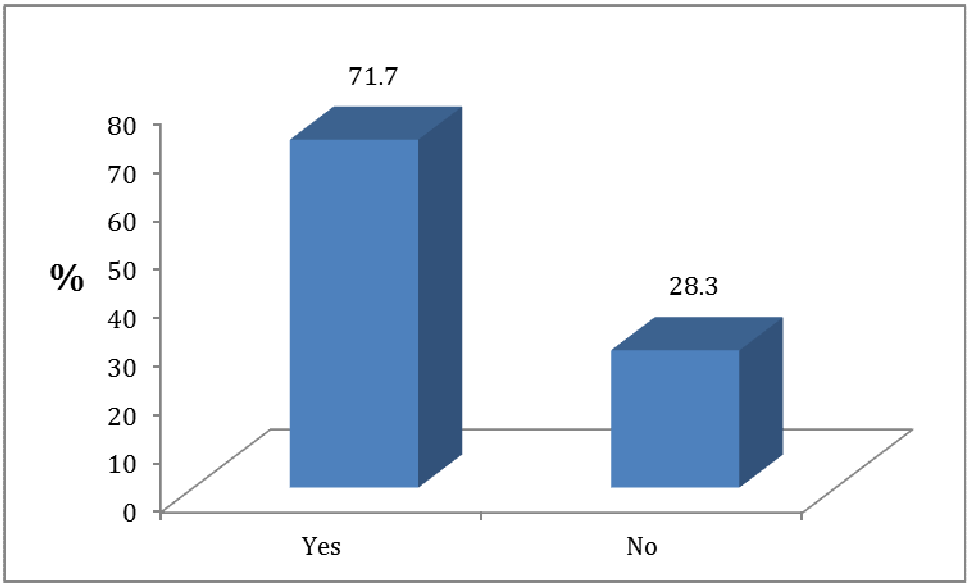


Figure 4.34: Question B14: Do you think your suburb or city of UMhlathuze need more trees or green spaces?

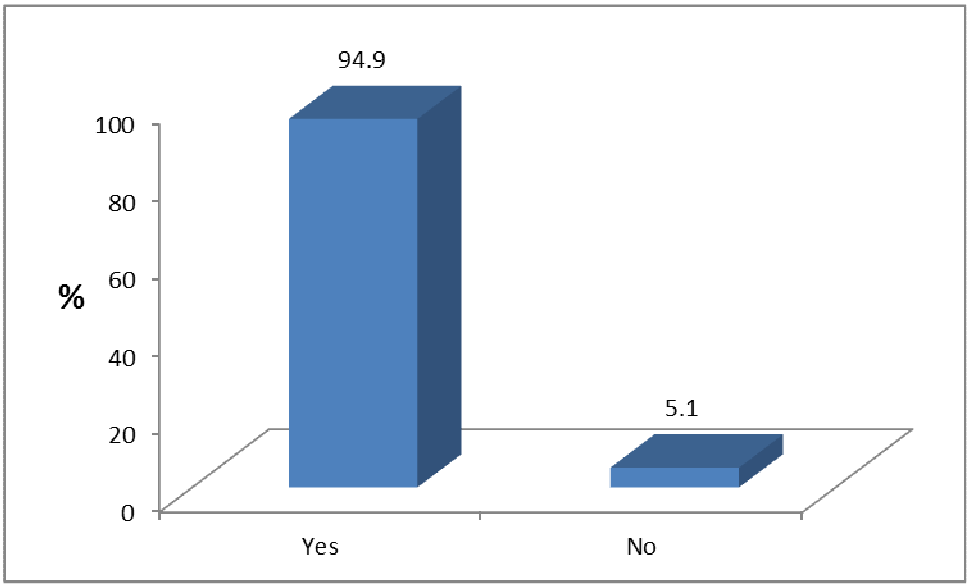


Figure 4.35: Question B20: If the municipality is going to come up with a policy that says each family should at least plant one tree or fruit tree in their yard or around their area, would you support it?

Several reasons for greening the city were given by respondents with most of them emphasizing that vegetation (trees) help to provide clean fresh air and reduce air pollution and global warming as given in Table 4.6. Other reasons include the aesthetic needs and for recreational purposes.

Table 4.8: Reason for the need of more trees or green spaces in the suburbs or city

Reason for the need of more trees or green spaces in the suburbs or city	**Frequency**	**Percent (%)**
For clean fresh air	44	31.9
N/A (No need of more vegetation)	39	28.3
Help reduce air pollution and global warming	23	16.7
Green spaces/areas keep the area green and nice	11	8
There is already not enough vegetation/trees in the suburb	8	5.8
For recreational purposes	5	3.6
For shade in parks and playgrounds	4	2.9
Help in reducing land degradation/erosion	3	2.2
To serve as wind breaks	1	0.7
Total	**138**	**100**

In many cities of the world, people hold different views and attitudes on city trees, but overally an enlarged natural urban landscape can increase physical health benefits while some residents in the city believe dense vegetation shelters criminal activities. 23.2% of people asked feel that there are enough trees and green spaces in the city, while a few are of the opinion that there are less spaces in suburbs for planting trees and the smallest percentage feels that more focus should be on the provision of basic services like houses (see Table 4.7).

Table 4.9: Reason for not wanting more trees or green spaces in the suburbs or city

Reason for not wanting more trees or green spaces in the suburbs or city	**Frequency**	**Percent (%)**
There are enough trees and green spaces already around	32	23.2
There is no space for planting more trees	5	3.6
Need more houses than trees	1	0.7
Because of poor maintenance and care from the municipality	1	0.7
N/A (More vegetation needed)	99	71.7
Total	**138**	**100**

Parks are another form of green space in the city, and wanting to live close to one can be regarded as being aware of the importance of urban greening in improving one's quality of life. Open spaces or parks can aid relaxing, children playing and recreational activities which are all critical in improving quality of life. In Table 4.8 15.9% of the respondents gave reasons for wanting a park, recreational and open space close by as opposed to 12.3% who feel parks are not safe and they are noisy.

Table 4.10: Reason for wanting or not wanting a park nearby

Reason for wanting a park nearby	**Frequency**	**Percent (%)**
For chilling and relaxing mind	9	6.5
Playground for kids	7	5.1
For fun and recreational activities	6	4.3
Sub total	**22**	**15.9**
Reason for not wanting a park nearby		
Parks are noisy and overcrowded	10	7.2
Parks not safe, full of crime	7	5.1
Sub total	**17**	**12.3**
N/A (Visiting Park)	92	66.7
No comment/response	7	5.1
Total	**138**	**100**

4.6.4. Different levels and measures of greening

Apart from vegetation found in public open spaces like parks, cemeteries, streets, buffer zones and reserved areas, most urban vegetation is found in residential properties in different forms like vegetables, flowers, trees (fruit trees). 61.6% of the respondents use a flower, fruit or vegetable garden while 38.4% do not own any of these (see Figure 4.36). Such ratios may be influenced by the type of property ownership that one has. Those who are renting or staying with friends and relatives may not have any motivation to green their yards with trees as their stay may be temporary (see Figure 4.37). On the other hand vegetables and flowers may not be dependent on the type of property ownership as they can quickly grow and mature and there are no gardens with apartments.

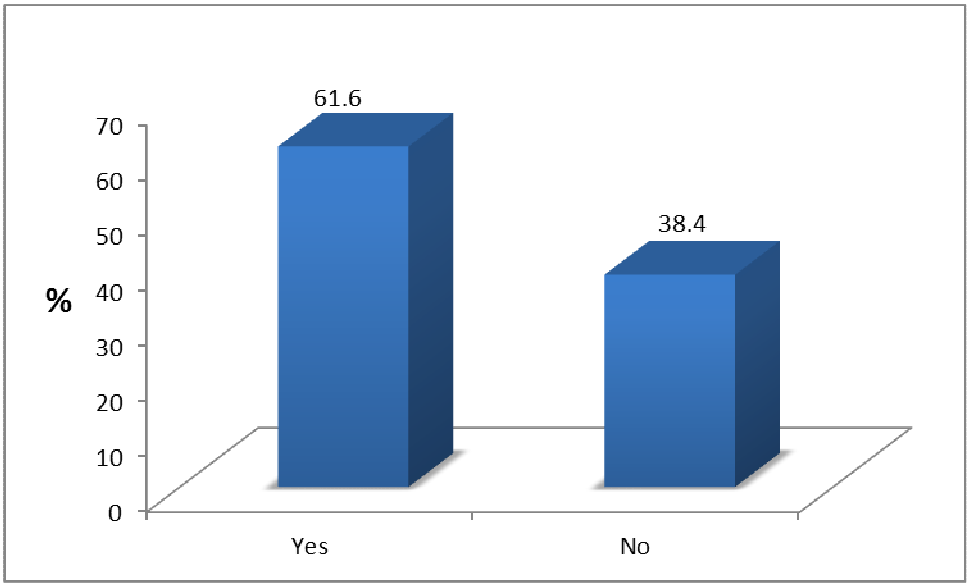


Figure 4.36: Question A6: Do you make use of a flower or vegetable garden or open green space with trees (fruit trees)

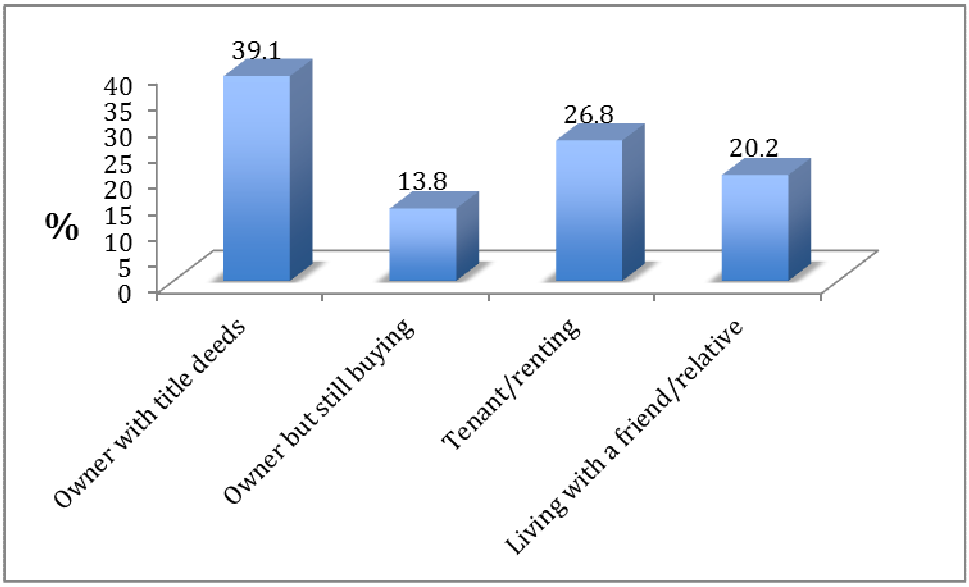


Figure 4.37: Question A5: Which of the following types of ownership applies to you?

For the residents owning gardens most have vegetable gardens as these greatly help in alleviating food shortages and supplementing household income.

Table 4.11: Question 6b): Specify the type of garden used.

Type of garden	Frequency	Percent (%)
N/A (Do not own a garden)	52	37.7
Vegetable garden	42	30.4
Open green space with fruit trees	23	16.7
Flower garden	14	10.1
Flower and vegetable garden	7	5.1
Total	**138**	**100**

Overally when looking at the density of trees in most parts of the city, 48.6% of respondents are agreeing that trees are generally sparse, while 33.3% believe vegetation is dense and 3.6% believe it's very dense. This confirms that there a fairly dense part of the city while overally trees are sparse as shown in Figure 4.38.

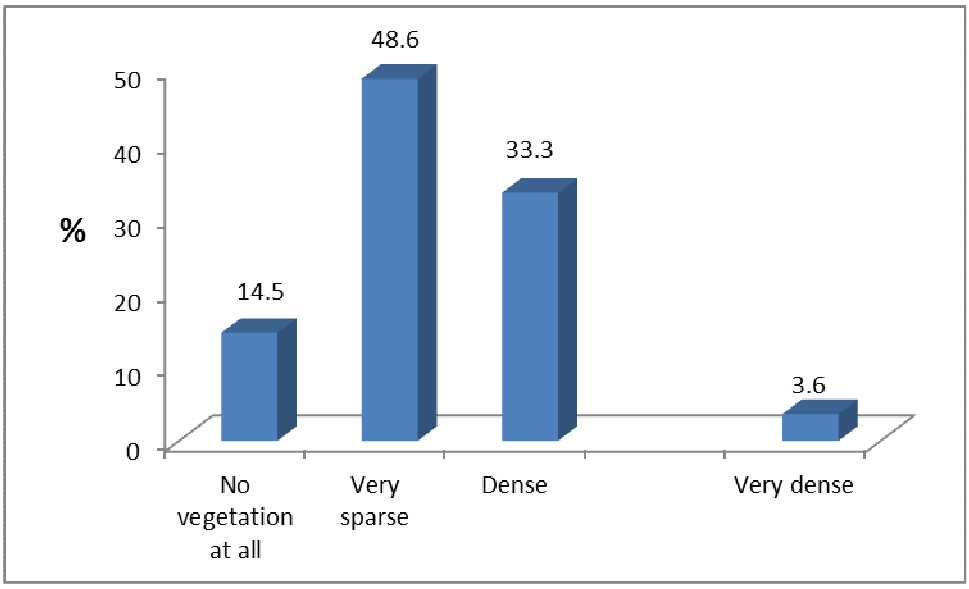
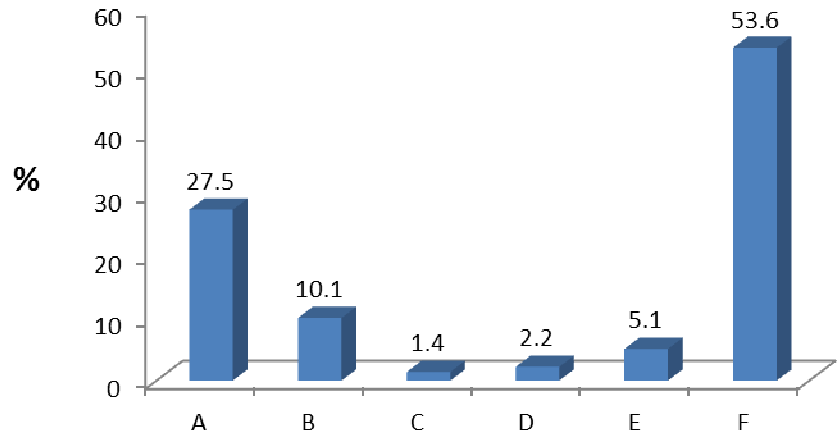


Figure 4.38: Question B8: How would you describe the street trees in your residential area or suburb and along roads?

Growing the urban forest or increasing urban greening requires consistent application of greening strategies. The contribution of such strategies may be low, but when constantly applied they make huge differences. Urban greening is sustainable when its promotion is not a once off project, but a series of continued improved projects. Results from the survey also indicate some of the strategies being

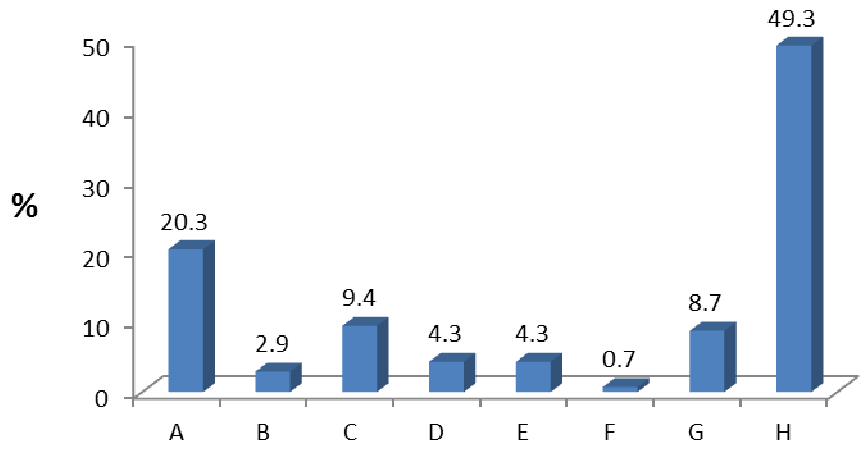
used by the city to improve its green open spaces. 27.5% agree that the municipality maintains open green spaces by trimming the grass and pruning trees while 10.1% think that the municipality is planting more trees around, along streets and in schools. Other strategies are being implemented sporadically and not frequently resulting in the low polling percentages (see Figure 4.39).



A = The municipality maintains open green spaces, trim grass and trees
B = The municipality is planting more trees around, along streets and schools
C = Educational campains on the benefits of afforestation and risks of deforestation
D = The municipality is encouraging each family to have a garden and/or plant a fruit tree
E = The municipality is erecting barriers/barricades for vehicles not to park in recreational areas
F = N/A (The municipality is not doing enough)

Figure 4.39: Measures taken by the municipality to preserve the natural vegetation

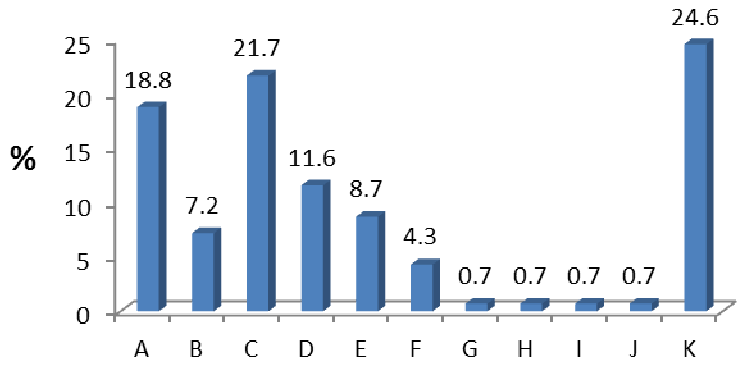
Apart from what the municipality is doing to grow urban vegetation, community members in the survey suggested other measures that they think may help to preserve the natural vegetation in the city as illustrated in Figure 4.40. The most popular suggestion was that the municipality should maintain and protect green open spaces, and should create more secure recreational parks in new residential areas. Other measures include municipality accelerating the planting of more trees along new property developments and increase educational campaigns on environmental conservation.



A = The municipality should maintain and protect open green places
B = The municipality should create more recreational parks
C = The municipality should plant more trees along with property developments
D = The municipalityshoud do educational campains/programmes on environmental conservation
E = Strengthen laws and avoid informal settlements
F = Build arial/storey buildings
G = No idea
H = N/A (The Municipality is already doing enough)

Figure 4.40: Measures that need to be done to preserve natural vegetation

For urban greening to be sustainable and successful, it must be integrated with both social and economic development activities in the city. Community members of different suburbs in UMhlathuze also agree with the above relationship and suggested different measures that can help to integrate greening with other forms of development based on their experiences as indicated in Figure 4.41. The most popular measures include municipality working with communities to plant trees and carrying out educational campaigns on environmental awareness mostly to the youth and in residential, commercial and industrial areas. 11.6% of the respondents also voiced that city policies developed for environmental sustainability must be fully and consistently implemented to increase environmental advantages.



A = The municipality should work together with the community on environmental programmes
B = Environmentalists and town planners should work together
C = Education/campaigns on environmental awareness
D = Policies must be developed on environmental sustainability and implemented
E = The municipality should plant more trees together with property developments
F = The municipality should demacate residential areas from green areas/gardens
G = Green spaces should be managed and maintained
H = Building of Tall/Arial buildings and not lateral buildings
I = The municipality should donate trees to the community for planting
J = The municipality should promote agriculture - vegetable gardens
K = No idea

Figure 4.41: Measures for ensuring development and green areas to work together

4.6.5 Proximity to green spaces and frequency of visits to such spaces

For green spaces likes parks to be functional they need local residents to use them effectively to enable the municipality to keep on maintaining them. Through the use of these recreational areas people's quality of life improves. The survey in UMhlathuze shows that in most residential areas most people live close to an open green space like a park, sport ground, golf course and open green space (see Figure 4.42). Having green spaces close by is a social and environmental benefit that is vital to people's lives because such spaces provide many benefits ranging from economic, social and environmental. However having open spaces nearby can be meaningless if

these are not accessible and frequently used. Figure 4.43 show that most people visit these open recreational areas.

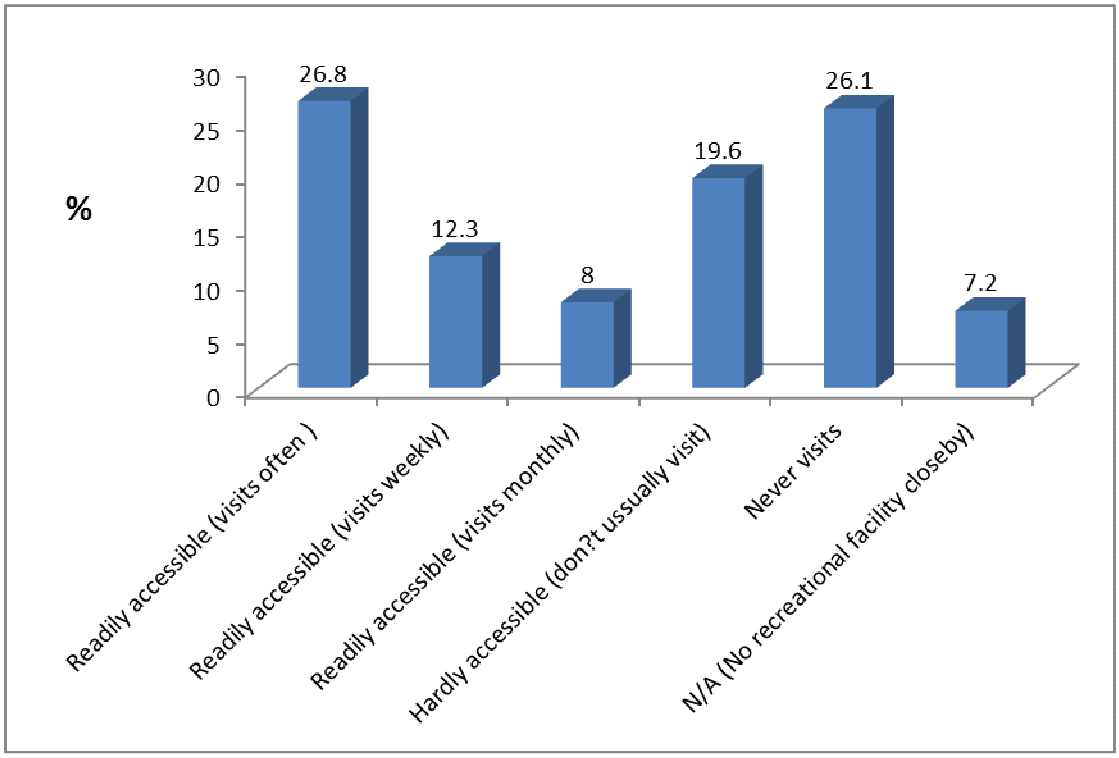


Figure 4.42: Question 8b): Choose the type of park or recreational area nearest to your place of residence

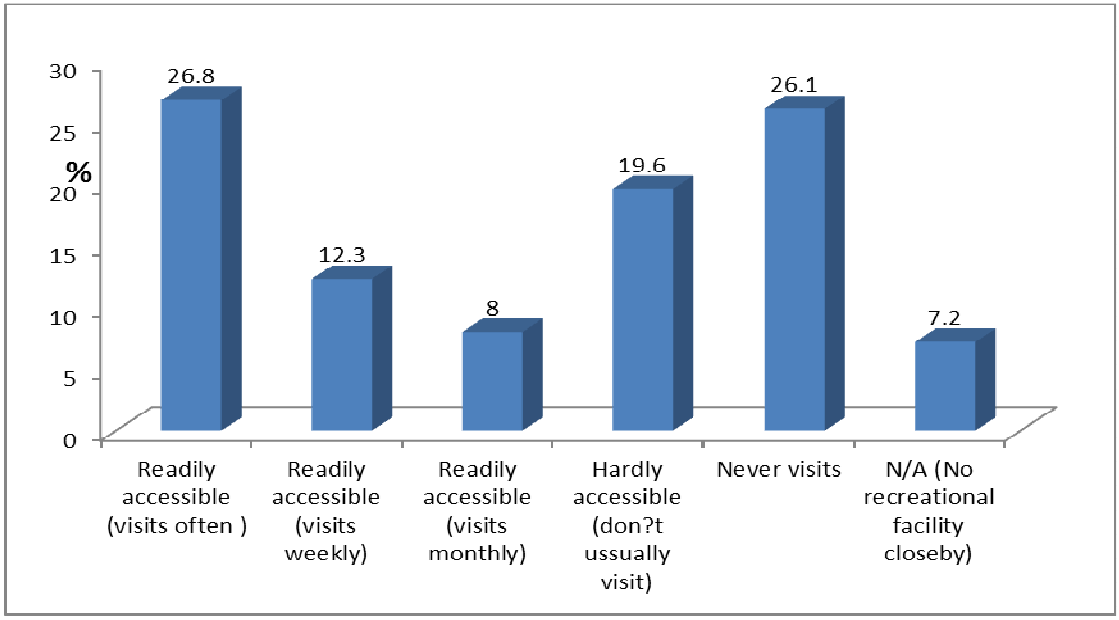


Figure 4.43: Question B9 a):) If you sometimes visit a nearby park/playground or open green space how accessible is it from your place of residence and how often do you or your family members visit this park?

A total percentage of 47.1 showed that they visit the parks at varying periods while a total of 52.9% do not use the nearby recreational areas (see Figure 4.43). A further survey on the time it takes to walk or drive to the nearby park revealed that most recreational places are very close to where people live i.e. 5 minutes' drive (68%) and 1 to 15 minutes walking distance away (67.4%). Very few people live far away from parks and recreational open spaces (see Figure 4.44 and 4.45 respectively). However less people visit these recreational areas not because of the distance to these places.

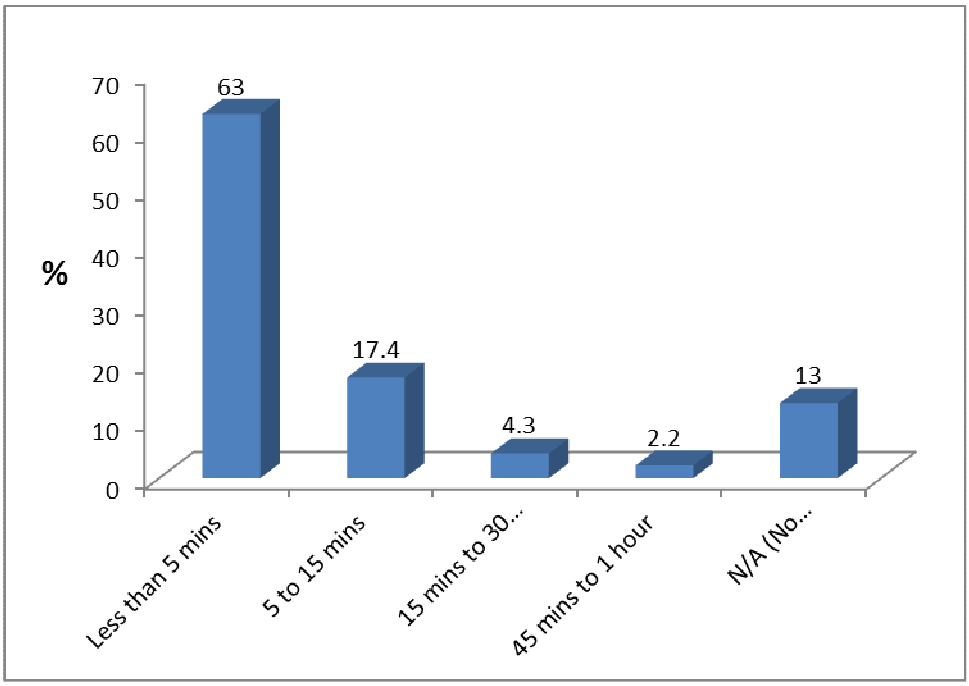


Figure 4.44: Question B9 b): Driving time to get to park/open green space

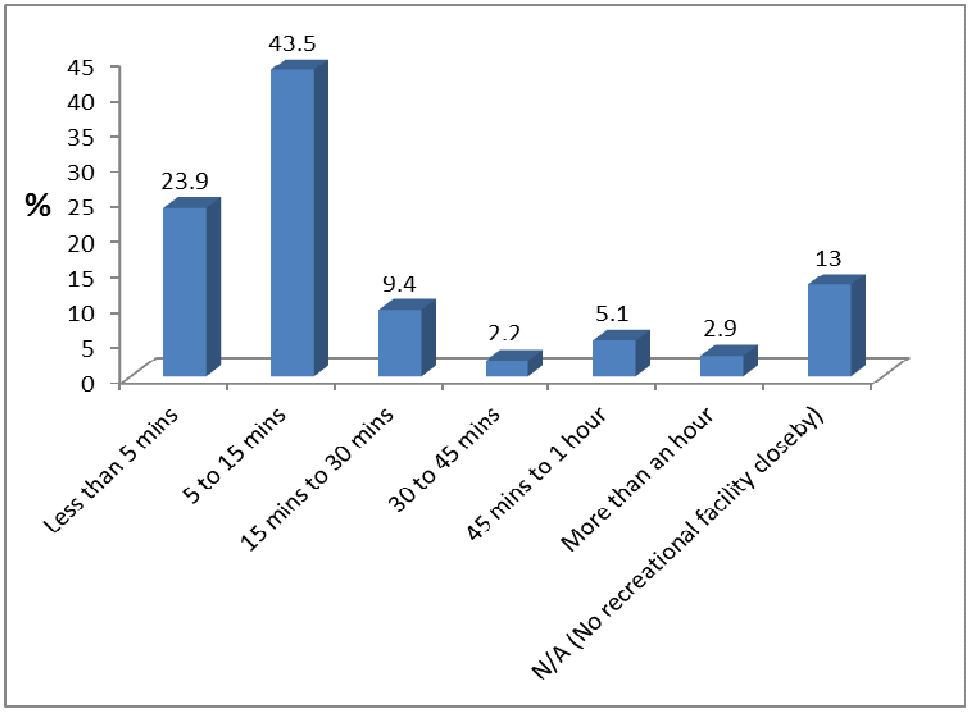


Figure 4.45: Question B9 c): Walking time to get to park/open green space

Visiting recreational areas may be influenced by many factors. Owning pets like dogs that require to be walked around can also lead people to visit the parks. The majority of respondents do not own pets (80.4%) compared to 19.6% who own pets. This may be the reason why so many people do not visit nearby recreational areas (see Figure 4.46)

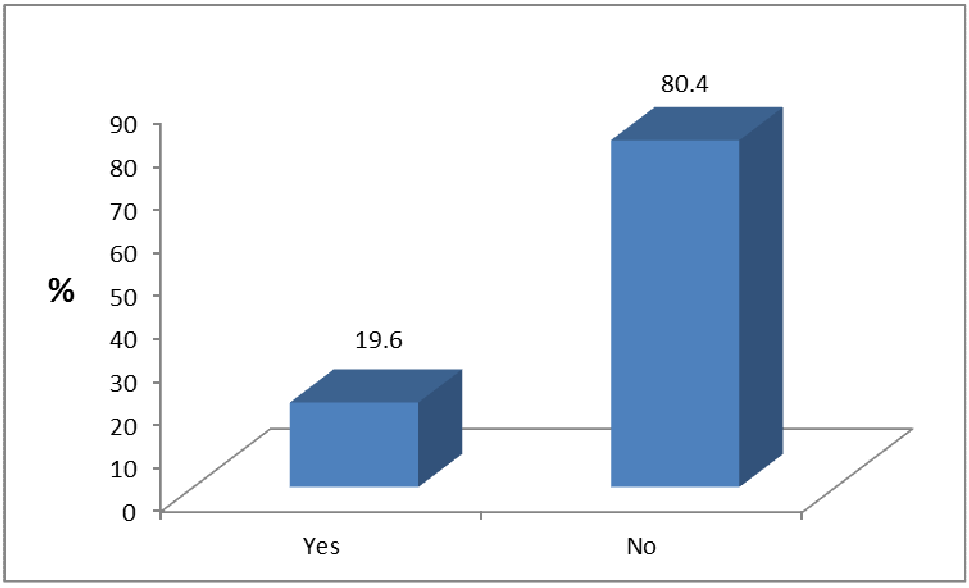


Figure 4.46: Question B 16 a): Do you have pets that need to be walked around?

Of the 19.6% who take their pets for walks in nearby open spaces 4.3% does this daily, 5.8% take them out in 2 to 3 days, 2.2% take them out in 4 to 6 days and 2.9% takes them out in a weekly basis (see Figure 4.47). All these figures show that walking pets in parks is not a common practice among most of the respondents in UMhlathuze.

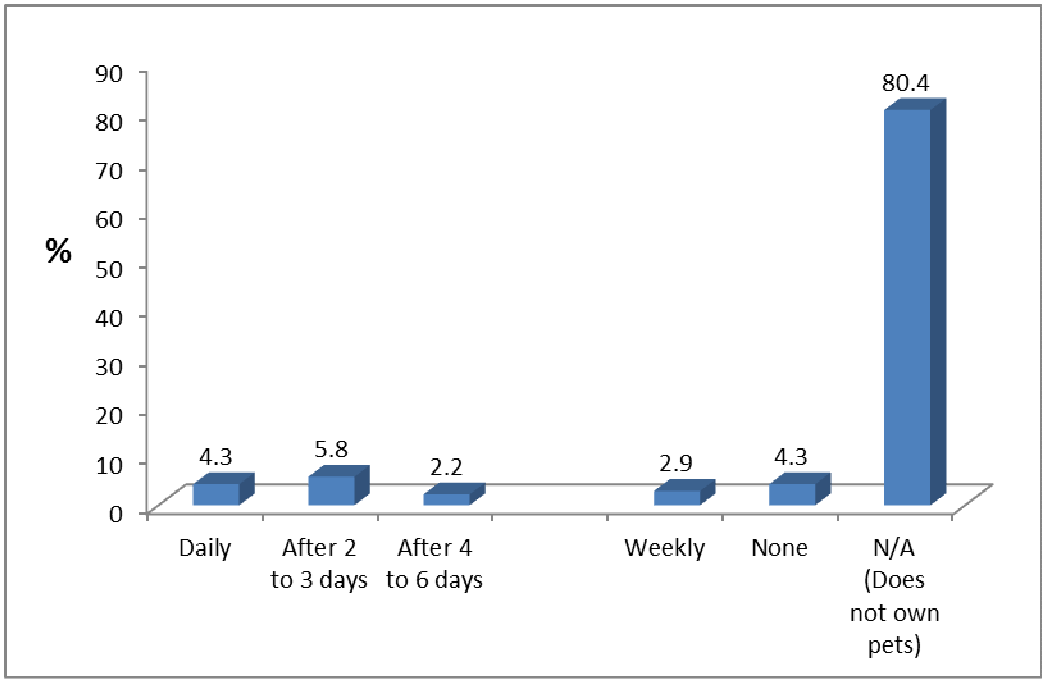


Figure 4.47: Question B 16 b): If you have pets how often do you walk your pet around?

Having young children around also influences people to go out and use recreational spaces as kids need to play around in open spaces. Again the numbers of people who take their kids out to these recreational areas are very low, as shown in Figure 4.48. Several reasons were given as to why people visit parks and other recreational spaces the way they do and some of the most recurring reasons are shown in Figure 4.49.

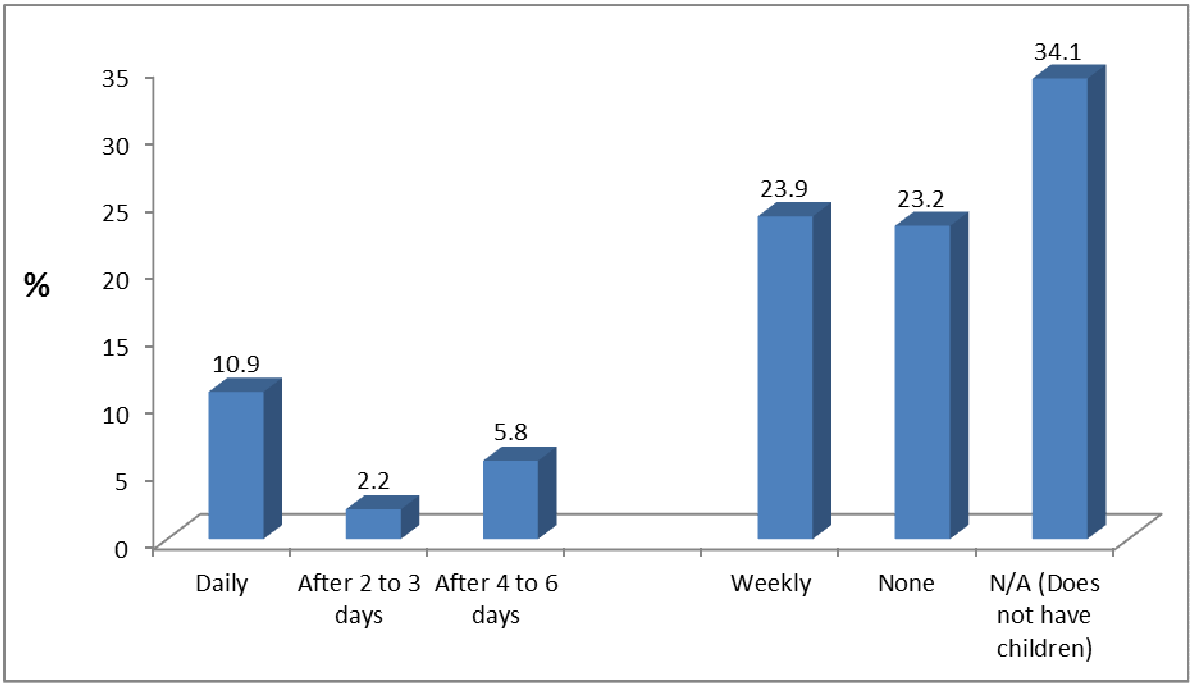


Figure 4.48: Question B18 a): How often do you take children out to parks or sports fields?

Table 4.12: Question 18 b): Reason for the indicated frequency of taking out children to parks or sport fields

Reason for the indicated frequency of taking out children to parks or sport fields	**Frequency**	**Percent (%)**
Has a very busy schedule	30	21.7
Goes to work during the week only free on weekends	23	16.7
Children attend school during week days	9	6.5
Parks not in good state/condition usually no events	6	4.3
Children go to the parks on their own, park close to home	4	2.9
Weekends there are sports activities in the playgrounds	4	2.9
Children like the parks very much for sporting activities and as a playground	3	2.2
Parks not safe, crime, do not feel secure	3	2.2
Not much recreational parks in the area, other parks distant	3	2.2
Do not like outdoor activities	2	1.4
Does not stay with the children	1	0.7
Inappropriate activities in parks for kids	1	0.7
Children are not interested	1	0.7
Still new in the area	1	0.7
N/A (Does not have children)	47	34.1
Total	**138**	**100.0**

4.6.6. Role of residents and municipality in urban greening

Greening the city is the responsibility of respective municipal departments, private sector and community members. Co-ordination between these stakeholders can help to ensure a continued increase in urban green spaces and improved living standards. 55.8% of the respondents think that the municipality is not doing enough in terms of planting trees, improving park vegetation and urban farming compared to 43.5% who agree that the municipality is doing enough in this regard (see Figure 4.50).

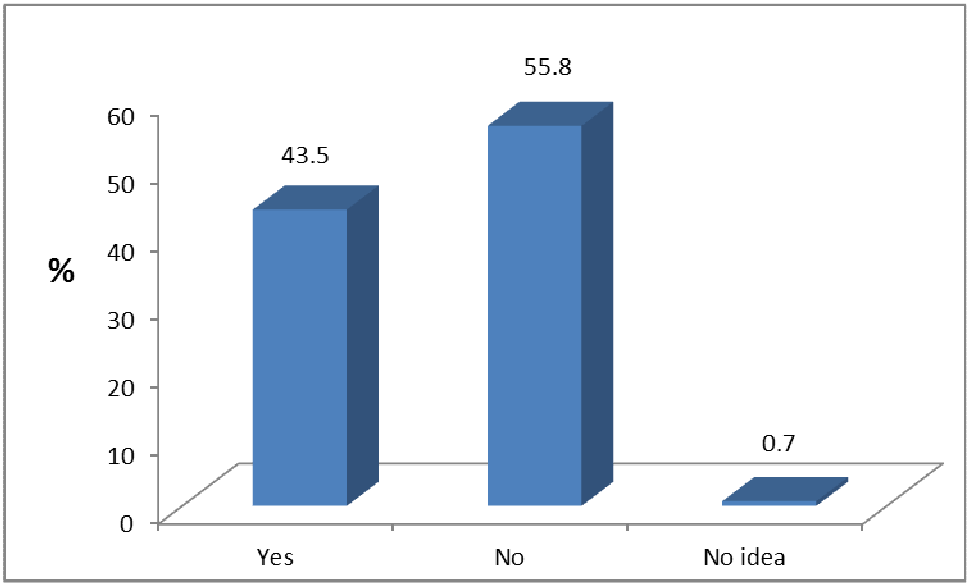


Figure 4.49: Question B 9: Do you think the local residents and municipality are doing enough to plant more trees, grass, flowers and agricultural crops around your area or in your suburb?

4.6.7 Link between urban greening and social and economic development.

Urban green spaces offer a wide range of ecological services ranging from filtering air, habitat for wildlife, carbon storage and providing recreational benefits. It is therefore crucial to incorporate green spaces into urban designs as well as appropriate land use policies. In many cases green spaces are lost to economic development activities as competition for land between these two favour economic developments. 60.9% of the respondents agree with the above observation and think

that this is not fair considering the sustainable ecological benefits that accrue from green spaces. 34.1% think the dominance of economic development over environmental development is fair (see Figure 4.51).

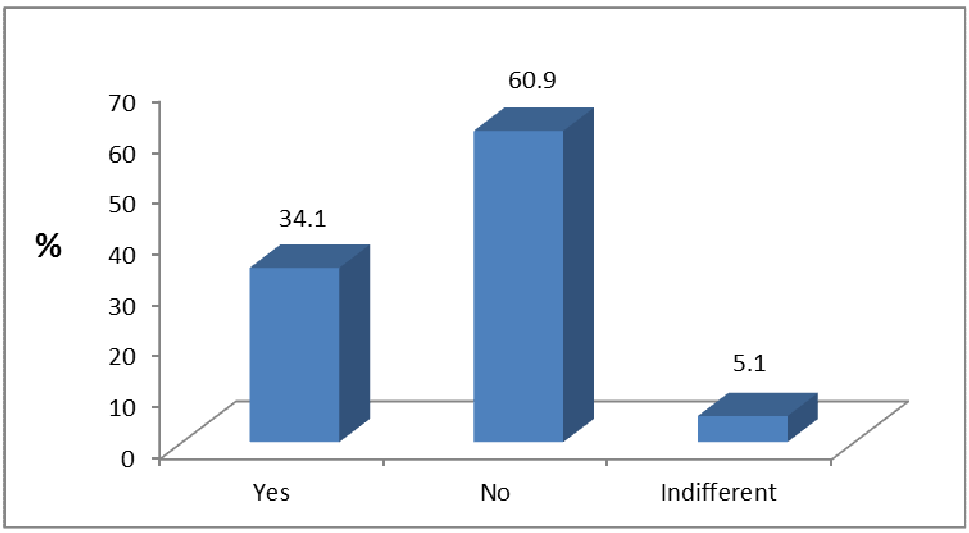


Figure 4.50: Question B19: Whether the competition for economic development and environmental development was fair

Although the relationship between environmental development and economic development exist, it is not balanced. Respondents have suggested measures that they think can help improve this relationship and increase urban greening (see Figure 4.52). The most recurring measures revolved around the view that priority should be given to environmental greening as well as ensuring that there is a balance with economic development.

Table 4.13: Question B 15: What needs to be done to strengthen economic development and environmental development?

Measures needed between economic development and environmental development	**Percentage**
Priority should be given to environmental greening as well as ensuring that there is a balance with economic development	42.8
There is need for economic development for a sound economy to eradicate poverty	21
Educational campaigns on environmental importance and planting of more trees	11.6
Planting more vegetation - trees and vegetable gardens	7.2
Strategic town planning by both departments involved	6.5
Municipality should enforce by-laws on environmental sustainability	0.7
Building storey buildings to save more space for vegetation	0.7
No idea	9.4

Life in urban areas is controlled by the linkages that exist between the natural environment and economic systems. The survey also looked at the levels of social and economic developments in the city as these make up two thirds of sustainable development. Many of the respondents indicated that infrastructure was well developed in the city (see Figure 4.53 and 4.54) which means the foundations of sustainable development are in place and are critical in improving living standards of present and future generations.

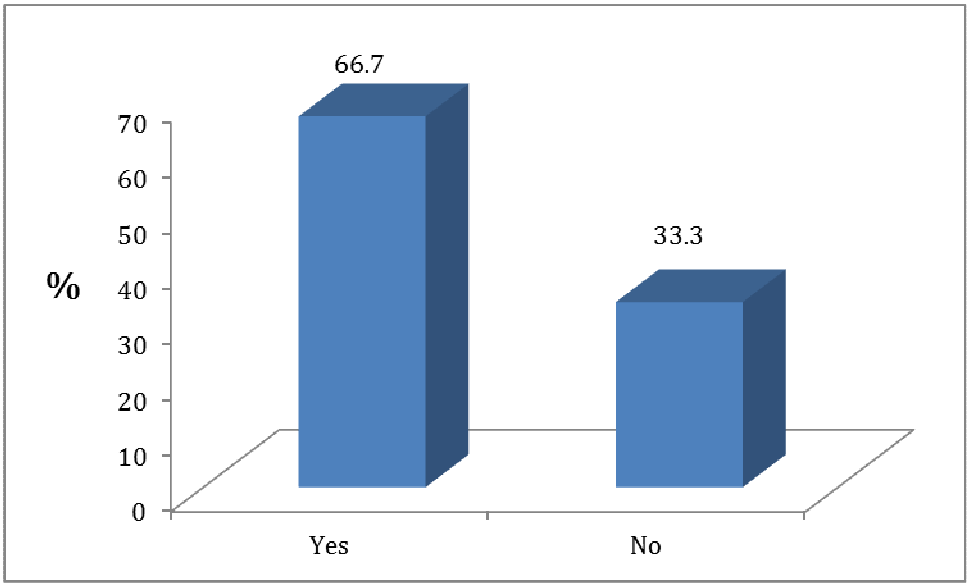


Figure 4.51: Question B1: Are the roads, telephone lines, tapped water and other infrastructure services like parks and outdoor recreational areas well developed and available in your area?

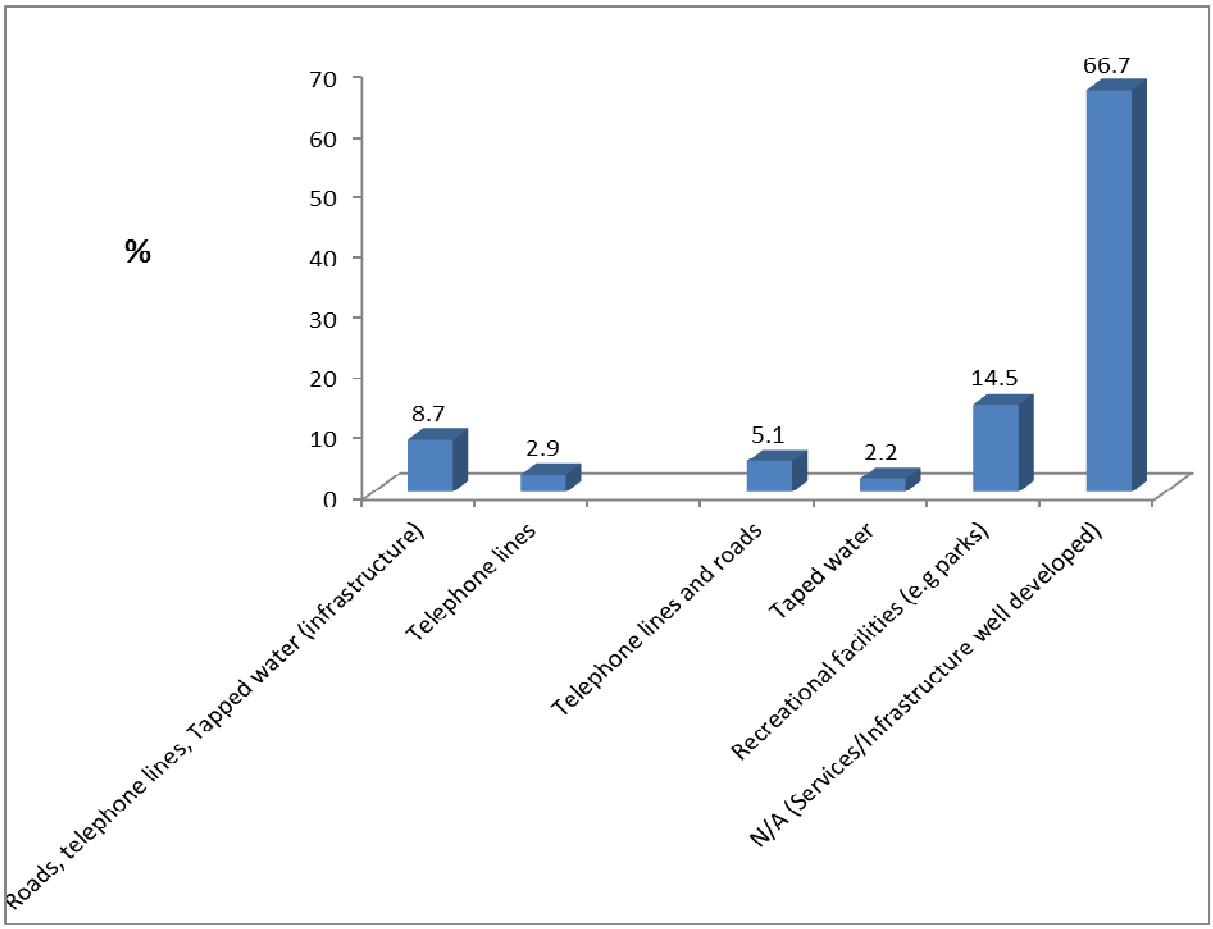
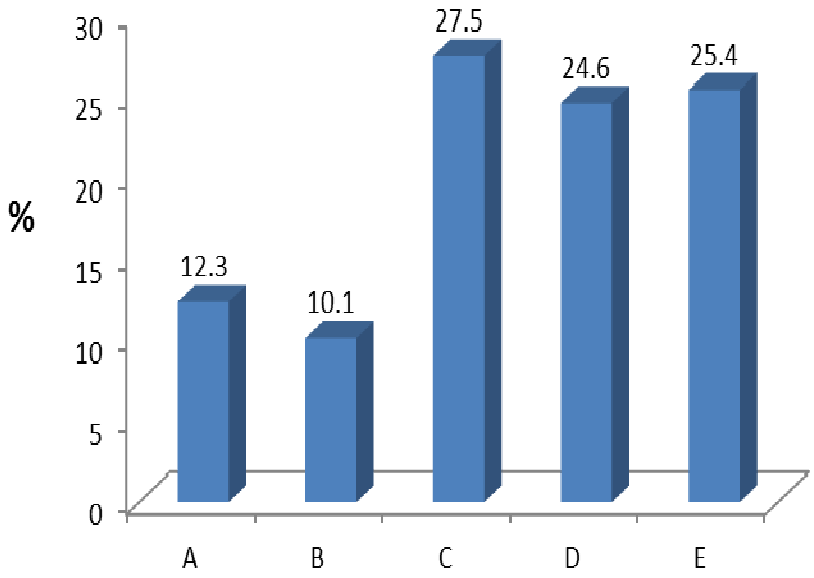


Figure 4.52: Question B 2: If no which services are lacking or poorly developed in your area?



A = Construction of more houses
B = Building more shops and other needed infrastructure
C = Farming activities like vegetable growing, fruit farming etc.
D = Develop parks, playgrounds
E = Conserve natural vegetation and plant more trees

Figure 4.53: Question B13: Which of the following land uses do you think should be given priority on available open land in your town?

On the issue of competition that exist in the city for urban land and prioritization, most respondents (27.5%) emphasized that farming activities like gardening and fruit farming should be strongly considered, followed by conserving natural vegetation (25.4%) and thirdly, developing parks and recreational grounds (24.6%) should also be highly prioritized when it comes to the use of open spaces in the city (see Figure 4.55).

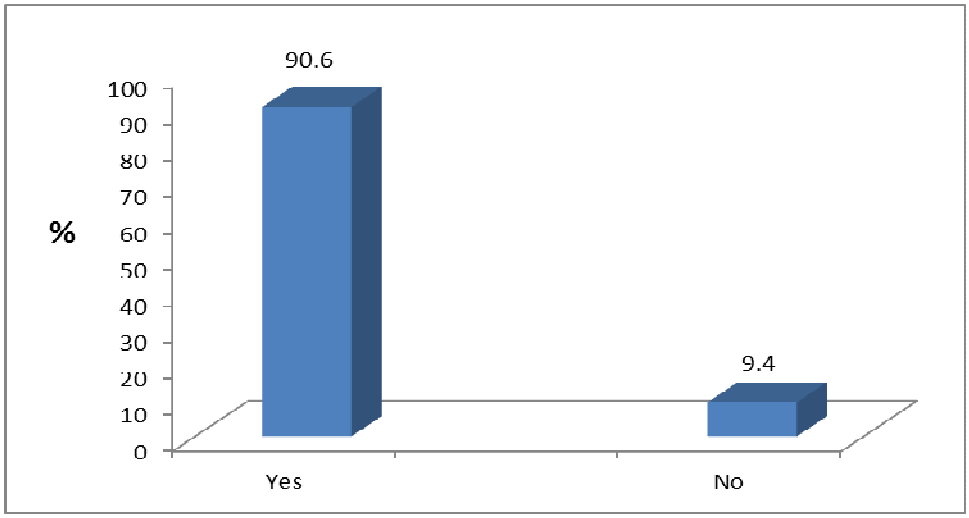


Figure 4.54: Question B18 c): Do you think having more green spaces around you or in a town can improve people's quality of life?

Trees are a source of life and can improve people's lives. This is one of the general views of most respondents involved in this survey as shown in Figure 4.56. Table 4.10 is a follow up on what respondents think are the good reasons for having more green spaces around in order to improve people's lives.

Table 4.14: Question B 18 b): Reasons on whether having more green spaces around could improve people's lives

Reasons on whether having more green spaces around could improve people's lives	**Frequency**	**Percent (%)**
Reasons on how green spaces will improve people's lives		
Through supply of fresh, clean air	54	39.1
Green spaces keep you in touch with nature, people will appreciate and start learning about the environment	27	19.6
Green spaces are good for chilling, relaxing and refreshes mind (reduce stress)	22	15.9
Industries will create more employment than green areas to improve people's lives	15	10.9
Green spaces can be playground for children and for recreational and sporting activities	9	6.5
Green spaces will make the area/town beautiful	8	5.8
Creation of green areas could create employment for people employed to maintain them	1	0.7
Reasons on how green spaces will not improve people's lives		
Need more space for housing	1	0.7
Not safe, lot of crime in green spaces like parks	1	0.7
Total	**138**	**100**

4.6.8 Summary

Results of this section give a variety of greening aspects that are common prevailing in the city of UMhlathuze in as far as urban greening as a form of sustainable development is concerned. Most respondents believe that more should be done by the city authorities to improve urban green spaces and their related recreational functions so as to upgrade people's lives. On a positive note, towns have green and open spaces which are crucial for sustainable development, however much of these open and green spaces need more conservation and improvement if they are to promote sustainable development and improved living standards as expected by the respondents. These results also serve to strengthen that a complimentary relationship exist between urban greening and sustainable development and that the two can ensure improved quality of life in the city of UMhlathuze. Overally planning is central to most of the expansion programs being implemented in urban areas, however many of the plans cannot serve the natural vegetation from being removed and be replaced by concrete covered surfaces. Most plans in the city are backed by environmental law and policies, but have received less political support in implementation. High income areas of the city have greener spaces than low income areas as a result of differences in historical inequalities and cultural and social views of greening. The city continues to grow, especially in the peri urban areas, areas reserved for further expansion and in areas controlled by chiefs. All these expansions are reducing the level of greenness slowly and need to be compensated by greening activities like street tree planting, increasing more city parks, increasing urban forestry and improving urban farming.

CHAPTER 5: DISCUSSION

5.1 Introduction

This section of the research analyses and discusses the results and findings in chapter 4 in using various linked themes, integrating the different lines of evidence from the different research tools used. Results from these different tools will be compared and contrasted in order to critically discuss the link between urban greenness and sustainable development of urban areas. The following themes were identified and their discussion will help in formulating findings and recommendations for chapter 6.

- Effects of urbanization on urban greening.
- Use of policies and Environmental law, in urban greening
- Relationship between urban greening and socio-economic development
- Role of planning in urban greening and sustainable development
- Levels of greening, awareness and success of urban greening
- Challenges of urban greenness and sustainable development

5.2 Effects of urbanisation on urban greening

UMhlathuze is a fast growing city in terms of population and areal coverage. Major losses of green space according to interviews with DCD and EPD, is common in areas controlled by the chiefs around Mzingazi, Mandlazini, Esikhawini and Vulindlela and peri urban areas of Empangeni and Richards Bay, where future urbanisation continues to pose direct threats to valuable ecosystems, reducing the greenness of the city. Most of the land is being taken over by residential, commercial and industrial land uses (City of UMhlathuze Annual Review, 2005/06). This is emphasized by Figure 4.28 and 4.29 which confirm that urban expansion is mainly due to commercial, industrial and residential areas growth in the city, responsible for

reduction of urban green spaces. Apart from the growing suburbs and commercial nodes, notable examples include the expansion of the Industrial Development Zone in Richards Bay, expansion of the harbour, upgrade and expansion of the airport. All this means natural areas of the city are lost to industrial and residential expansion and development needs. As more ecosystems and open spaces are disrupted and destroyed, vegetation is being lost and replaced by hard urban concrete surfaces that absorb more heat, lowers infiltration and overally devalues the natural cooling function of vegetation (Bounoua et al., 2015).

The appropriation of open land by various urban land uses is one of the most irreversible human effects on the environment. It also alters urban agriculture, climate change and hydrological elements of the environment. This causes the fragmentation of open spaces and habitats (Seto at al., 2012). Although smaller cities like UMhlathuze have less pronounced increases in temperature than its surroundings, with rapid urbanisation, heat island will soon be a big problem as the scarcity of vegetation increases with increasing urbanisation. The highest rates of land conversion into built up areas in the near future are likely to occur in areas of ecological importance that were once preserved and protected for ecological benefits and functions (Seto and Satterthwaite, 2010). On a positive note, as emphasized by document review (GEG11/12), urbanisation result in economic growth which helps to improve living standards. It can therefore be commented that programs and activities that plan to improve people's quality of life in urban areas should recognise that this cannot be realised without environmental protection and preservation (Makhelouf, 2009).

Field surveys discovered that streets in the city have a variety of indigenous and exotic trees as an attempt to green the city roads. This is also supported by the vegetation maps of the city showing high levels of greening in high income areas of

Meerensee, Central Park, Birdswoods and Veldenvlei compared to low income areas of Esikhawini, Ngwelezane, Nseleni and Vulindlela. It is expected that as an urban area grow, an increase in vegetation within the urban areas i.e. along roads, in parks and wooded neighbourhoods can increase ecological and social benefits (Milton, 2002). This is not the case in the City as greenness remains low in low income areas. This scenario can be traced back to South Africa's past where all basic aspects and resources and this has caused a big ecological gap between the green vegetated high income suburbs and the almost bare township areas (Greenpop, 2014). The legacy of this past continues to influence greenness inequalities in the different suburbs of the city. Studies conducted in western countries of Europe also discovered that there is a noticeable difference in the provision of urban green spaces between high income suburbs and poorer low income suburbs (Martin et al., 2004). All these greenness inequalities can be caused by the differences in affordability as many housing developments in low income areas do not have gardens and maintained open spaces attached to their household yard (Shackleton and Blair, 2010). As growing cities presses ahead with plans of densification of houses to maximise land shortage, other household dwellings will not have large enough gardens to provide multiple benefits obtained through the existence of urban green spaces. Urban green spaces therefore have a role to play in sustainable development and liveability of towns and cities (Shackleton and Blair, 2010).

Questionnaire results, especially Table 4.8 gives several roles of green spaces or vegetation in a city. The same sentiments are echoed by document review and field survey, that despite the shortage of greenness in urban areas, green open spaces continue to play sustainable roles that are responsible for improving quality of life. Urbanisation causes many changes to groundwater conditions as it modifies the relief, vegetation density and soil characteristics in favour of pavements and buildings (Makhelouf, 2009). As cities continue to expand, an understanding of the

trade-offs between urban land and vegetation will be highly beneficial in helping urban planning and environmental conservation while solving the negative environmental effects of urbanization (Bounoua et al., 2015). Sustainable development can bring about lasting stability instead of short term benefits that most political leaders are pursuing. Many developments in developing cities have benefited people at the expense of the environment, yet if development is to benefit cities it must be sustainable, for sustainable development benefits people without harming the earth's resources.

Based on this research's results, urbanisation means the natural set up of an area is changed into an artificial one and the same is true for natural vegetation. For environmentalists to continue pressing for the planting and maintenance of indigenous vegetation is a noble and ecological idea but this may continue to lose out to exotic vegetation. Indigenous trees are best suited to the local environment, but now this environment has been changed by urbanisation and may no longer be suitable for them. Exotic vegetation is fast becoming suitable for the new artificial urban environments; hence cities must start considering planting more exotic trees. The question here is on how to reconcile the need to maintain indigenous species and biodiversity. There is no simple answer to this debate and decisions have to be made on individual merit, but it is safe to say the combined use of indigenous and exotic trees have merit. In places where native trees are difficult to grow and have made invaluable contributions exotic species with more ecosystem benefits should be considered (Carvalho, 1997). In the Philippines, Leucaena (an exotic tree) is now neutralised and is now the main source of tree fodder and of fuelwood. Growing of this tree has also brought about the sustainable beef cattle production in northern Australia (Middleton et al., 1995). Similarly, in Brazil, the exotic tree species of Acacia Mangium and Acacia auriculiformis were introduced in the acidic infertile soils of the mountainous area of Minas Gerais and achieved a faster growth than the existing

indigenous species of B. decumbens (Carvalho, 1997). In India fast growing multi-purpose exotic trees were successfully introduced in relatively slow growing Acacia nilotica areas (an indigenous species) to enhance biomass production. Not all exotic species are bad and the city should consider this in urban areas where the natural environment is failing to support native species. Careful planning and thoughtful species selection are recommended before implementation of such programs (Neelam-Bhatnagar et al., 1993).

5.3 Use of policies and Environmental law in urban greening

In any given town, a sound policy framework is the key to enabling strategic implementation of green infrastructure. Changes to existing policies, regulations, standards and guidelines need to be effected during planning, land use acquisition and development of the urban design. Although adverse effects of greenness reduction like urban heat islands are not threatening issues in small cities like UMhlathuze, it makes more sense to implement urban greening and sustainable development at an early stage when the policy framework is still flexible enough to accommodate greening improvements than at a later stage, when policies and systems are too rigid to accommodate environmental corrections and improvements. A sound policy framework is an indication of a strong intends to lower and militate against environmental pressures and challenges that threaten ecosystems especially in urban areas. Urban greening and sustainable policies will be effective when implemented as a proactive measure of urban greening enhancement, rather than a reactive measure to the pressures of socio-economic development needs. It is therefore important to ensure that existing policies and standards do not cause an unreasonable barrier to green spaces implementation.

Specific documents in the city of UMhlathuze all concur that municipality is increasingly using policies and environmental law to promote urban greening and

sustainable activities in the city. Compliance policies like EMPs, EIAs, SEAs and NEMA have gained more prominence in shaping environmental activities in the municipality of UMhlathuze. Both documents review and interview results agree with this observation and add that in comparison to old city policies that were not inclusive to all environmental, social and economic activities, current policies and environmental law are continuously being updated to bring desirable results of sustainable development. The government of South Africa has committed itself to becoming a more environmentally sustainable country through the National Development Plan (NDP) by 2030 (JCPZ, 2014). It is therefore important for municipalities like UMhlathuze to align their greening and sustainable development objectives with the NDP through the use of environmental policies and law. However, a point of departure was raised by the DCD (Brenda Strachan) and EPD/PM (Sharin Govender) that most policies and plans of the city are more aligned with ensuring environmental protection with less drive towards a radical shift towards sustainable development. Both departments agree that there has been improvement in environmental management in the city, but in terms of designing and maintaining the urban green infrastructure, more needs to be done to balance the priorities between environmental development and economic development as the latter is still dominantly prioritized. City documents also indicate that the city is improving towards sustainable development through improving quality of life in the city by balancing the synergy between industry, the city's rich environmental assets and the community (UMhlathuze annual report, 2012/2013).

The continuous use and upgrading of policies that favour environmental management according to the interview with DERM, is a positive step towards sustainable development in the city. To move towards effective policing, lawmakers require grassroots information on how different urban prioritize critical urban aspects. Where aspects are highly prioritized by a given community, it should be

expected that co-operation and interest among members will be high (JCPZ, 2014). Job creation, housing, agriculture and recreation are some of the goals that continue to dominate in the city of UMhlathuze and policy priorities should work to improve these. NEMA emphasizes that sustainable development can be achieved by integrating or strengthening the relationship between socio-economic and environmental needs with urban planning and projects implementation in order to satisfy present and future needs (TRP 449 N RTP 169 Institutional Document) Sustainable development in this case should be a way of addressing development needs while maintaining the potential of natural environments like the urban green, to continue providing the natural resources and ecological services for the benefit of all urban residents. The city of UMhlathuze lies in a rich biodiversity region where green spaces and abundant natural vegetation can assist its transformation to sustainable development (UMhlathuze wami, February 2015). Failure to enhance this slows down the achievement of sustainable development with grave consequences for future generations. If economic development that gives people more jobs and high standards of living is going to leave future human societies unable to meet fundamental human needs like the availability and quality of air, food, shelter and public health through pollution, and natural resource depletion, then such development is not worth it. The basis of sustainable development requires addressing public health risk through investment in ecosystem services which urban greening spearheads (Anderson et al., 2014)

Interviews and documents closely agree that the city of UMhlathuze has made progress in ensuring compliance with environmental law and statutes to promote environmental conservation. NEMA, EMPs, EIAs and SEA have been used to save the urban vegetation from complete destruction by encroaching economic development activities. Through these statutes nature reserves have been established, buffer linkages are being implemented, while critical wetland areas are being protected in

the city. The South African constitution through legislative measures promotes environmental conservation and equitable use of natural resources while on the other hand upholds the use of social and economic means to improve quality of life (JCPZ, 2014). However, considering the increase in unplanned settlements in areas owned by chiefs and clearance of land for new houses in the peri urban, it can be stated that people continue to cut down trees faster than they are replenishing them. Human pressure on life supporting systems like urban green infrastructure are causing them to deteriorate rapidly and irreversibly despite the progress made in environmental management by the city (Baur and Tynon, 2010).

Interview results with the DERM agree with most documents reviewed that South Africa has embarked on a journey to correct the inequalities created through spatial development policies in the past. Mainstreaming of environmental concerns into major policy documents has occurred in the city (JCPZ, 2014). Compliance with international treaties the Rio Summit (1992) has helped most South African municipalities like UMhlathuze to move from conservation, to sustainable use of resources and further explore green economy principles. However, the EPD/PM confirmed that the mandate to protect the environment still remains difficult to pursue when the tension between development and environmental sustainability continues to influence greening levels in the city.

5.4 Relationship between urban greening and socio-economic development

In old days politicians and industry captains used to believe that environmental protection and promotion of economic development were incompatible objectives (Young, 2010). According to the interview results of this research, the opposite is true, that the two are highly connected in a compatible relationship. Documents, questionnaires, field surveys and interviews all agree that a strong complementary relationship exists between urban greening and sustainable development in the city of UMhlathuze. 77.7% of questionnaire respondents in Figure 4.34 agreed that they

strongly need trees in their suburbs to increase quality of life. In Figure 4.56, 90.7% of the positive responses agree that having more green spaces could improve people's lives. This is an indication that no matter the level of development people may have, the natural environment like vegetation continues to be a necessary benefit to many people.

In addition to this, interviews with the DERM, EPD/PM and DCD concurred that more parks and open spaces in urban areas help to improve ecological benefits, improve recreation and increase aesthetic value of the city. They all view urban greening as an essential part of city development which should be promoted through planning of new parks and open spaces. Street surveys also revealed that in high income suburbs like Central Park, are greener with more vegetation and open spaces as compared to low income areas of Mzingazi and Esikhawini. As an area and its people improve economically and socially, they demand, availability of more ecological services of urban trees, shrubs and grass (Massey, 1999).

A sustainable development perspective agrees with the above view and emphasizes that thriving ecosystems in sustainable economic development is impossible, and that improving and preserving green spaces are a prerequisite to all forms of development. If urban areas fail to change to economic systems less relying on one time use of natural resources, then its highly likely that basic resources like water, power, raw materials and many others will be more expensive and may slow economic development in poor urban municipalities (Garnett, 2014). Green infrastructure like open spaces and vegetation can be used by cities to meet socio-economic needs of human wellbeing by supporting, providing, regulating and cultural enhancement of urban life. DERM and several reviewed documents agree that urban vegetation support life through the nutrient cycle of the soil, soil formation, provide food, purify water, fuel, regulate climate, act as wind breaks, and

reduce air pollution (Kitchener and March, 2011). In addition, urban ecosystems offer many opportunities for human improvement in the city of UMhlathuze like ecological education, recreation, medicinal and aesthetic values. All these values were given by different respondents as reasons they need more vegetation in their surroundings (See Figure 4.56 and Table 4.10).

Although urban greening is strongly related and compatible with socio-economic development, their relationship, according to all interviewees and questionnaire results is not balanced but is tilted more towards economic development. Development in most developing countries is strongly aligned to economic development as the best way to create more jobs and reduce poverty in communities (Heckert and Mennis, 2012). The general perception among influential stakeholders like local government and industrial captains is that the city of UMhlathuze is known as an upcoming industrial node. This has influenced prioritisation of development programs and has affected the balance that should exist between environmental development and economic development in favour of economic development. Interviews with the EPD/PM and DCD noted that most political leaders undermine environmental management in favour of economic policies and projects as these are viewed as the fastest way to improve people's lives and gain more support from the public. In contrast to this, sustainable development can promote long term economic stability that can help to implement various forms of greening (Gardiol, 2009). It is therefore more beneficial to promote both environmental improvement and economic development in order to strengthen the relationship between urban greening and sustainable development.

Although a lot of environmental management policies (SEA, EIA and ESMP) and procedures are well documented in the city's documents, the dominance of economic development is clearly visible in many programs of the city. The goal of

sustainable development is to achieve a balance or harmony between environmental sustainability, economic sustainability and socio-political sustainability (International Society of Environmental Botanists, 2000). Research by WHO confirms that growing cities like UMhlathuze face one of the biggest challenges where the goals of sustainable development are not fully formed and its fundamental concepts are still debated, leaving most supporting economic development more than environmental development. Such imbalances between social, economic and environmental development slow down the process of sustainable development and is capable of reversing economic gains as more money will be spent in mitigating environmental damage caused by industrial developments. Sustainable development values the interrelationship between social and economic systems with the natural systems as represented by the model in Figure 5.1.

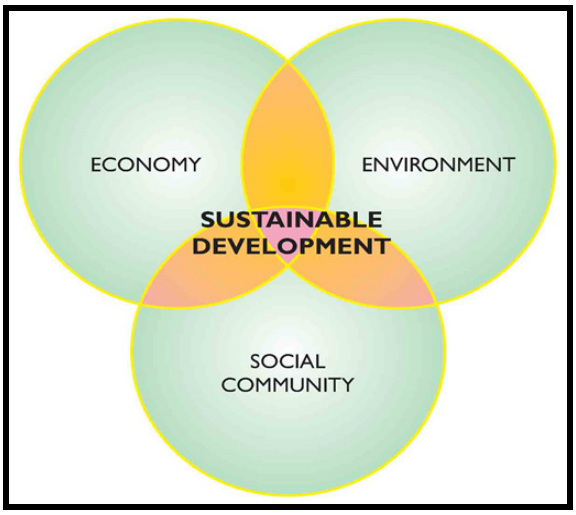


Figure 5.1: Model demonstrating the balanced relationship of sustainable development elements (City of uMhlathuze, Integrated Development Plan TRP 449 N RTP 169 Institutional Document, page 4)

In general the human world and the environment and socio-economic principles of development shall remain compatible and complimentary with the natural system. The role of humans is considered with the formulation and delivery of planning activities (Morelli, 2011). Human actions result in direct and indirect effects on natural resources, both detrimental and beneficial. The challenge in urban greening and

conservation planning is to balance the short term demand for goods and services and the long term sustainability of ecological systems (Barredo and Demicheli, 2003). Sustainable development can be viewed as a process that attempts to bring together, "elements of economic efficiency, inter-generational equity, social concerns and environmental protection" (TRP 449 N RTP 169 Institutional Document). Although the term sustainable development has many interpretations, it broadly focuses on non-declining human wellbeing overtime and one way of enhancing this in urban areas is through urban greening as a form of environmental protection and improvement. This can be in the form of agriculture or tourism promotion as noted by UMhlathuze Municipality Draft (2010/2011) that,

> "UMhlathuze generally has a good climate and is well endowed with natural resources whose comparative advantages are: a good climate that opens up avenues for productive agricultural and tourism development"

This has made the city of UMhlathuze to start changing industrial views and start promoting it as a growing tourist destination through the assistance of the UMhlathuze Tourism Association. This will strongly assist in improving the ecology of the city.

Nature conservation in its various forms that include urban greening was cited by documents, interviews and questionnaires as instrumental in improving both economic and social qualities of people's lives if properly planned and implemented (Table 4.6). Contrary to many people's thinking that nature conservation is about protecting wild animals and game reserves (Morelli, 2011), nature conservation is increasingly being regarded as a critical tool for society's well-being both in rural and urban areas (Mentis, 2010). Nature conservation can play a fundamental role in the upliftment of livelihoods of poor communities like those in rural areas of the city. It encompasses the looming pressures of climate change and is increasingly adopting a greater environmental responsibility by caring for the green heritage which lays the

foundation for a cleaner and healthier society as emphasised by City of UMhlathuze Annual Review (2004/05) that:

> "Just as built or engineered services, such as waste disposal and water supply infrastructure, are valuable municipal services, so too are the environmental services delivered by the natural resources of the Municipality. Environmental goods and services produced by these natural resources include: Water supply, Climate regulation, Flood mitigation / attenuation, Provision of habitats for biodiversity …"

In addition to this the DERM also emphasized that urban greening and nature conservation should not be considered for only providing open spaces and beautiful views but should be regarded as the natural world that is rapidly becoming a major focus for stimulation of future job opportunities and income generation for people even on a small scale or at grassroots levels like the example below where

> "The old Alton landfill site and offices were revamped and the recycling area secured with palisade fencing at a cost of R2 million. Community members were trained regarding recycling, plant propagation, herb growing and vegetable gardening practices. With cash in hand from recyclables such as clean plastics, paper, tins, metals, bottles and produce grown in the vegetable gardens, the sustainability of the project is secure" (City of UMhlathuze Annual Review, 2004/05).

Urban greening integrated with economic activities has high chances of success. However, such projects are very few in the city mainly as a result of less political will to engage the private sector to take a leading role in urban greening hinged on empowering local people economically.

5.5 Role of planning in urban greening and sustainable development

The interview with the DERM and field survey found that most parks and recreational areas are not being efficiently used by residents, calling for the city to decide on planning complex parks (see Figures 4.1 - 4.4). Most parks in the city of UMhlathuze especially in low income areas like Esikhawini, Mzingazi and Ngwelezane are just the simple open space type with children's playgrounds and very little if no recreational infrastructure for older people of 16 years and above as shown on Figure 4.16 (a) and (c). All this calls for new plans that focus on upgrading the city and its green infrastructure as a way of improving quality of people living in urban areas. Examples of new plans linked to urban greening includes a plan to revitalise the CBD of Empangeni with green vegetation patches (Figure 4.5), new residential plans for the suburbs of Mzingazi and Madlazini are waiting implementation, the Alkantstrand beach (Figure 4.6), is being improved with more vegetation, while plans for new parks in low income residential areas of Esikhawini and Ngwelezane are waiting for implementation. All these plans use vegetation to soften most of the areas where they are to be actioned.

Interview results and reviewed documents concur that in a growing city, constant environmental planning is required in order to refocus development work and align it with environmental changes. These need to be done without undermining the relationship that exists between natural systems and human systems to safeguard present and future needs. These results indirectly acknowledge the existence of conflicting goals that planning deals with in ensuring sustainable development. Planners must reconcile three areas of conflict highlighted in Figure 5.2 i.e. to grow the economy, fairly spread growth and reduce ecosystem degradation (Hirokawa, 2010). This conflict is shown in Figure 5.2.

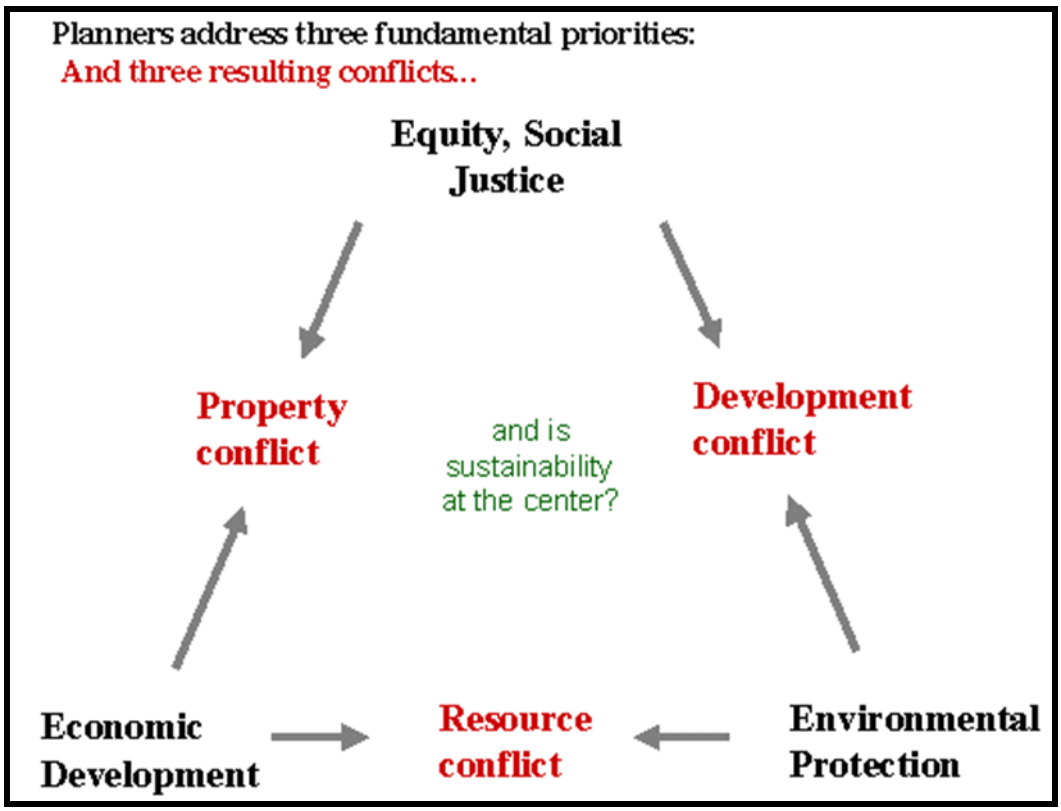


Figure 5.2: The triangle of conflicting goals for planning (Campbell, 1996)

The tendency in many cities is that in trying to implement development measures, large forests have to be cleared, rivers and air are fouled and planners have to come to defence of nature through the work of conservationists, planners, open space preservationists, greenbelt planners and modern environmental planners (Campbell, 1996). Urban planning strives to create a balance among these goals in Figure 5.2 (the three corners of the triangle of sustainable development), but shortage of skills and finance are big limitations to the progress of most planners (Campbell, 1996). In the end, planning leans heavily on one corner of the triangle at the expense of others, i.e. planning more for economic development and conserving green spaces or providing basic services to those with low affordability. This situation also exists in the city of UMhlathuze with most urban planning favouring economic development.

As urban areas expand, more planning conflicts arise between recreational planning and biodiversity conservation on one hand and socio-economic development

planning on the other. This therefore informs all city planners that green spaces of cities should be taken into consideration as an entity of green infrastructure and afforded the same status as buildings or highways (Sandstrom, 2002). To achieve better results from planning for ecological improvement, legislation backup becomes an important driver for effective green space planning. Urban greening is therefore directly and indirectly related to urban planning and for urban greening to assist in promoting sustainable development and improving quality of life; green structures should be reshaped and planned for at the same time with other infrastructural plans so as to gain quality even if quantity may be reduced by urban expansion with time (Sandstrom et al. 2004).

The City of UMhlathuze is characterised by many wetland areas, and the interview with the Department of Environmental Planning confirmed that wetlands continue to be sacrificed for land to cater for economic development and that the legislature governing wetlands in the city is still a challenge as it offers less protection to wetlands which contain a large number of native vegetation species. The above Department also emphasized that it is now difficult to conserve and protect fragmented wetlands, especially in residential and industrial areas as they offer limited ecological benefits when fragmented. Political leaders and business people are in favour of more economic progress with less attention being paid to environmental development and protection. Reviving important green spaces like parks can be a long and costly process, therefore it requires the backing of effective regulatory and development policies fused together with integrated involvement and support of all stakeholders in order to deliver creative solutions. In many developing countries parks and green spaces continue to be exposed to splitting decisions from leading government departments created by policies that are not complementary. Planners and planning mechanisms need to consider the needs and interests of the

communities they serve designing urban plans that are related to the local municipalities in order to achieve more success in greening efforts (JCPZ, 2014).

The plan to develop complex parks to replace the current parks and recreational open spaces was strongly echoed by the Department of Environmental and Recreational Management, and the city is strongly supporting the idea. The challenge is the long delay that is caused by the delays in following protocols and the long line of bureaucracy in getting approval and implementation. This is an urban greening strategy with ecological, social and economic benefits and is one concrete way of bringing about sustainable development and improved living standards. These parks have the ability to cater for the needs of different users and different ecological needs which makes them more favourable and versatile. These parks have been developed in many European cities and have brought many advantages to the respective cities, like in the North Myrtle Beach Park and Sports Complex in South Carolina (See Appendix A4). These parks are normally located in areas with good transport connections and facilities, where transport connections are not good such parks can bring about transport improvement in the area as the city authorities increases accessibility to such parks. Accessibility to such parks is highly prioritized, as the value of a green area is considered to be high when many users can get there within a short time. Given the biodiversity in the city of UMhlathuze complex parks will be an added tourism boost while delivering ecological benefits to the city.

Green spaces like gardens, open spaces and parks should become compulsory features when planning any urban area whether it's small or big. This idea was strongly agreed upon by results from all research tools in this study. Green areas in a town have low pollution, disperses pollution, create air breezes, increase rainfall chances and reduce high temperatures yet these roles in many municipalities are undermined, lowering the potential to improve living standards of people living in

cities and sustainable development (Berke et al., 2006). As more people live in the cities of developing countries, urban areas become known areas of most environmental problems mostly likely to affect everyday life of urban people. The current challenges created by global warming and pollution are the source poor living standards in some urban areas, therefore the current and future plans of towns and cities should also be mandated to implement effective development measures to fight these challenges.

Towns and cities critically need urban planning at any stage of their development in order to improve on sustainable development. As economic development increases in the city of UMhlathuze use of SEA policy has been co-opted into decision making. This promotes greening as it helps in anticipating and addressing environmental consequences of development and also to improve living standards within the environment's capacity as supported by this statement:

> "The SEA will provide the UMhlathuze Municipality with the necessary strategic tools to facilitate decision-making for sustainable development. The tools will assist in assessment, management and monitoring for sustainable development…"
>
> (TRP 449 N RTP 169 Institutional Document, page 4)

These results emphasize that urban planning is more effective in greening urban areas and bringing sustainable development when efficiently applied at an early stage in the development of an urban area, when land use zones are still at youthful or flexible stages to accommodate sustainable changes at low costs. It also emerged from the interview with the DCD and EPD, that urban planning involves almost all stakeholders of a city. Other interviewed departments indicated that their success in improving city vegetation hinged on cooperation with other city departments and stakeholders like Department Agriculture and Environmental Affairs, Ezemvelo

Wildlife, African Parks, Environmental Justice Networking Forum, Grassland Society of Southern Africa, Green Building Africa, Greenpeace Africa, Community Services Department, Department of Parks, Wildlife and Recreation and Infrastructure Department. In this regard planning can be described as a protection process aimed at improving, growing and managing human and environmental aspects (Seymour, 2012). Urban planning is strongly needed for guiding and ensuring the orderly development of cities and it has grown into a broader discipline that encompasses, planning, transportation and many others (Smetana and Crittenden, 2014).

However this positive picture of urban planning has not led to positive results in all urban areas, as emphasized by results in Figure 4.32 and 4.39. Urban planning has remained on paper in many instances, failing to protect the environment and many green spaces have been lost due to the failed implementation of plans. The most questionable one is the comprehensive long term planning in urban areas of developing countries where there is a need for immediate actions but, often face system failures in urban development (Smetana and Crittenden, 2014). In the city of UMhlathuze the long term Council's Environmental Services Management Plan was developed as a management tool in order to protect sensitive areas and retain ecological functioning of an area (City of UMhlathuze Annual: Draft Scheme 2013). Through this plan the council can prohibit or restrict the destruction of environmental sensitive areas, however very little of this is taking place on the ground. The Environmental Planning Department confirmed in its interview that:

> "The legislature governing wetlands protection is a bit of a challenge. It is bypassed at times in favour of economic growth that leads to job creation"

As a result, many sensitive open spaces like wetlands have been lost to land for economic development in the city. Despite all problems faced by planning or as a result of planning, some sections of the results of this research emphasize that 'some

planning is better than no planning'. A community group discussing with local leaders on where to plant trees is planning, gathering a block of residents and agreeing that a road need to be greened with trees is also a plan (Teriman, 2015). It can be very simple, affordable and flexible until the city is able to move to higher levels of planning.

5.6 Levels of greening, awareness and success of urban greening

Results from interviews and field surveys revealed that the city has an ongoing tree planting program throughout the city, and streets with young trees were observed in the field survey. On the other hand, tree planting on Arbor Day focuses on the growing of indigenous trees in selected parts of the city. The UMhlathuze Annual Report (2012/2013), states that, about 800 to 1 200 trees are yearly planted and continuously require maintenance and conservation against theft and vandalism. This program is an indication of the awareness of the need to increase the urban forest by city authorities; however the scale is too low to match the loss of urban vegetation and rapid increase in the population of the city which continue to exert more pressure on ecosystem services. Low income suburbs like Esikhawini have low street densities (see Figure 4.10 e), maybe as a result of less promotion and coordination of tree planting activities in the area. The low levels of greening according to the DERM, is due to insufficient funding, while other interviewed departments concurred that more needs to be done to conserve city vegetation but financial limitations continue to hinder progress. In addition, this research also emphasizes that low levels of awareness of the importance of urban vegetation in sustainable development and improvement of quality of life are a contributing factor to low levels of greening in low income areas than in high income areas like Central Park (see Figure 4.10 a and Table 4.7).

Most questionnaire respondents also stated that very little tree planting has been carried out by the municipality in their areas. On the contrary, street surveys revealed

that high income areas like Central Park suburbs and Meerensee in Richards Bay have medium to dense vegetation along roads, in yards and in open spaces (see Figure 4.10 a and Table 4.7). Most of the trees are older, with an average age of about 15 or more years (see Figure 4.10 b) which indicates that tree planting has been intensely carried out in the past (before 2000) than it is today. These results show that high income areas have higher vegetation densities than low income areas like Esikhawini, Ngwelezane, Madlazini and Mzingazi. This can be as a result of different levels of affordability as low income residents' focus on basic needs while their counterparts venture further into personal recreation and greening. A big private golf course is found in Fairview (Empangeni Central Park) as shown by Figure 4.18 and the open space map of Empangeni (Appendix B2).

As for some roads with sparse or no trees, the DITS interview explains that some roads cannot be vegetated because of their size or width as a requirement by the Department Roads to reduce traffic obstruction and avoid spreading roots from interfering with underground infrastructure like pipes, telegraphic and electricity cables. If this is the case, many roads in low income residential areas will remain poorly vegetated. Given that the city of UMhlathuze is advocating for the densification of new residential areas to save land and accommodate more people. Therefore more narrow streets will be developed and less vegetation will continue to be grown in low income residential streets. Narrowness of the streets cannot be regarded as a limitation, as field surveys discovered that many narrow streets in high income areas are vegetated. This means, with proper planning appropriate vegetation can be grown along such streets as observed in some narrow streets of Central Park suburb. If trees are not possible along narrow roads less invasive vegetation can be a better strategy of greening these roads. Appropriate planning of narrow roads with underground infrastructure can ensure greening of these streets with shrubs of less extensive roots. The observed large disparity in greenness

between low income suburbs and high income suburbs of UMhlathuze can be traced back to South Africa's divided past which caused high levels of inequality in green spaces. However 20 years after the abolition of this system considerable greenness should be found in the affected areas, but the current situation shows no significant greening changes in low income areas due to low prioritisation and financial commitment by the current leadership to fund and spearhead the planting of trees in low income suburbs.

Figure 4.15 (a), (b) and 4,16 (b) shows informal farming taking place on public open spaces of low income areas, while farming gardens are common found in all residential areas as observed by street surveys. Documents and policies are almost silent about informal urban farming but field surveys noticed that a lot of farming and gardening are taking place. The interview with the DERM also confirmed this and emphasized that, this is one of the reasons why farming will be included in the future complex parks to be launched in the city. Urban agriculture can be a sustainable form of development as it integrates farming and gardening activities with people's needs and self-sufficiency in a way that produces more ecological benefits. Since some sections of the city are into tree planting while others are into agriculture, agroforestry can be practiced to balance the need for trees and farming. Agroforestry is another positive strategy of urban greening with both trees and plants being mixed (Alvey, 2006). In Table 4.9 focussing on respondents who own some green space, 30.4% owned vegetable gardens, 16.7% owned a green space with fruit trees, 10.1% own flower gardens and 5.1% own a flower and fruit garden. These Figures show that both elements of Agroforestry, that are trees and crops are already being grown in many parts of the city and can be successfully implemented in community gardens or newly allocated farming areas.

All the above elements of greening can be implemented to influence positive changes in managing the urban environment through greenness practices. It is therefore important to ensure that promotion of urban green spaces should not only be a prerogative of parks and road sides, but should also include the likes industrial areas, commercial business areas, former mining areas, taxi ranks and many public areas in the city (Alvey, 2006). Home gardens bring together many functions to the family through Agroforestry with fewer costs to owners while giving them an added opportunity to generate income from selling fruits (Aweto, 2014). On the other hand, edible fruit trees like Almonds, Citrus, Mango and African pears can be used for beautifying urban locations and supplement food, fruit supplies and rendering unquantifiable benefits to the city and its people (Larinde and Oladele, 2014). Due to these various benefits, city and town planners in UMhlathuze require progressive policies that edible fruit trees and farming in residential areas as a sustainable way of improving urban greenness and development.

The above discussed activities are already being practiced in the city, but agriculture is too fragmented and being carried out at very low uncoordinated levels as compared to forestry. Mzingazi and Madlazini were established as agri-villages but field surveys and interviews have shown that this land use has not been successful at all and residential land use has taken over. In Figure 4.28, 56.5% of respondents agree that commercial building and residential expansion is increasing rapidly in the city resulting in the loss of more natural vegetation. Figure 4.29 further emphasizes the above view as 57.2% of questionnaire respondents concurred that, residential land use in the city has been the fastest growing land use than any other land use. In addition to this, the new residential plans for Mzingazi and Mandlazini awaiting implementation (Appendix P, Q and R) are no longer for agricultural purposes but are now serving the residential needs of the city. Encouraging Agroforestry will be an added advantage given the limitedness of land in the city. As more urban trees

are lost to new developments in the peri urban area, city authorities should maximise planting of road vegetation and islands with indigenous vegetation, upgrading parks and gardens in the inner city areas and changing of urban landscapes through the use architects to reflect a more natural and green surroundings (Bentsen et al., 2010). However the successful implementation of these projects remains overshadowed by the financial limitations of the city. In addition to this, the pressure of economic development continues to threaten urban greening. Like in many other growing cities in developing countries, these greening projects can work up to a certain point until the pressure of development planning begins to cut into green areas. This was supported by the DERM when it emphasised that priority in the city is increasingly being given to economic matters of development more than greening the city with vegetation.

The generally low level of tree planting in the city also includes the planting of fruit trees, mostly in low income suburb yards where there is less land available for planting trees along the narrow streets. Despite this low contribution to the urban forest, this is a potential effort that can lead to the planting of more trees with less effort and financial spending by the city as people are already willing to plant fruit trees more than indigenous trees due to personal benefits. In Figure 4.35, 94.9% of questionnaire respondents indicated that they are willing to support a policy of the municipality that each family should plant one tree or a fruit tree in their yard and this is also supported by survey results which revealed that in all residential suburbs almost each yard has more than one fruit tree (see Figure 4.36). What is needed is for the municipality authorities to prioritize this form of urban greening and raise people's awareness on the ecological benefits of trees whether they are fruit trees or not.

Vegetation is a source of life, not only for oxygen production and sequestrating carbon dioxide, but is also a habitat of animals, responsible for recharging groundwater and soil fertility and reducing soil erosion, soil and noise pollution (Garnett, 2014). Adding indigenous or fruit tree in urban residential environments can also increase the environmental and socio-economic benefits of urban greening. This type of development bequeaths the same or improved ecological resource endowment in the future and this is a fundamental goal of sustainable development which can be achieved through urban greening (Bentsen et al., 2010). The current state shows that the municipality will only give fruit trees to residents when their streets are too narrow to accommodate trees (City of UMhlathuze Annual: Draft Scheme, 2013). Providing more fruit trees for planting may help to kick start this greening process. The maintenance of these trees will be very cheap as residents will take over and care for them due to perceived benefits of these trees.

The level of urban greening in open spaces is determined by residents' awareness of the need to green the city and the various benefits that trees can offer to improve quality of life. In some cases this level can be influenced by the municipality's planning and coordination of greening projects. Most of the documents consulted indicate that the city is carrying out awareness campaigns, especially during the Arbor week in targeted schools and public areas, and running greening articles in the city newsletter monthly. The same methods were echoed by the DERM during interviews, but in contrast 73.9% of questionnaire respondents emphasized that there is or no publicity being carried out by the local municipality or Department of parks on how to increase vegetation in the city. Although awareness is slightly higher during the Arbor week it is not enough to bring the sustainable greening of urban areas. The fact that many people are not aware may mean that awareness methods being used are not very effective or widely spread. Giving incentives to beneficiaries of successful tree planting activities like a reward of fruit trees can spread the

message fast with effective results. One way of upholding effective tree management and maintenance is to constantly monitor greened sites and correct and shortfalls and this to interview results, is done by city authorities alone. Survey results showed that many newly planted trees dry up or are dying in the first three years of planting and were not being replaced, a sign of poor monitoring and maintenance of newly planted trees.

Results of interviews and documents review, shows community involvement is a key element to the success of urban planning and development of best green spaces. However, less of this is taking place in the city of UMhlathuze, which results in fragmented efforts of greening where city authorities are involved alone in greening projects as reiterated by the DERM during their interview. Community involvement requires various levels of greening expertise, research and financial support (DTLR, 2006). For transparency purposes in working with the public on sustainable development programs, those in charge should:

i) avail information on what other people are doing for the respective community,
ii) work with the community to develop policies and plans through basic surveys, consultation and through partnership with community leaders in decision making positions on how to prioritize resources as a sustainable measure,
iii) Seek funding of community led activities and greening initiatives (DTLR, 2006). Given the unique 'make-up' of the city of UMhlathuze where part of it is rural and being controlled by chiefs, the stated ways may be carried out at different times and places as many communities will need to be involved at different times to accommodate most of the people and obtain a strong buy into economic, social and greening policies and projects of the city.

Document review results portray that much is being done by the city of UMhlathuze at local level to improve environmental awareness and promote environmental education;

> "Continued awareness and educational talks are conducted at schools to create awareness on the role trees are performing in the environment. A successful tree planting day was held at Aquadene Secondary School during Arbor Week and supported by various role-players including national and provincial departments as well as industry"
>
> (Mhlathuze annual report: 2012/13).

In addition to the above, environmental education and awareness to the public in the city is being promoted by the "Environmental Watchdog", an initiative where an article with an environmental theme is placed once every two months in the "UMhlathuze News". The Environmental Planning website is also operating under the Departments of Integrated Development Planning, and Environmental Planning, where one can find out about new initiatives of the Environmental Planning Section (UMhlathuze Municipality Draft, 2010/2011). Despite all these positive plans, the biggest challenge of the City is to transform policy into practice especially at grassroots level. The lack of integrated environmental education in schools is a major constraint to urban greenness and practice of sustainable development. It is advisable for local government and the private sector to direct more greening and sustainable development programs for the youth as the next generation of environmental citizens who in are capable of rising to the challenges posed by global environmental change in future (JCPZ, 2014). Increasing greening awareness and environmental concern among the young and old, include creating a foundation of environmental knowledge which include knowledge of how to act in more sustainable ways,

and this according to interview and questionnaire results is extremely low among the South African youth. This assertion can be supported by the following statement from the DERM interview on how the municipality does not work with young people in planting trees:

> " .. Due to safety issues the department does not use volunteering school children to avoid risking injuries and contamination by the chemicals used"

Environmental education can act as a long term solution in inculcating behavior change that impacts on greening activities and understanding while instilling a culture of wanting to do something to address these environmental challenges (DTLR, 2002). As it stands in the city of UMhlathuze, most of the youth does not know much about the state and the level of greenness in their city and challenges that greening can solve to promote sustainable development. Environmental awareness and education is essential to empower current and future generations with environmental awareness and solving skills to improve quality of life in harmony with the environment (DTLR, 2002).

The city of UMhlathuze has long since stopped the use of volunteers in tree planting exercises due to fear of injury especially among school pupils. Asking for volunteers from local areas to plant trees in schools, streets and other public spaces can also help to increase greening awareness with good results. Municipalities can ensure that this is carried out cooperatively between older and younger community members, as opposed to the current status where the city does not use volunteers and school children, but contract private companies to do the planting, thus denying community members the chance to participate and gain useful information. Giving out tree

planting tenders to private companies is more costly to the city of UMhlathuze that is already facing financial constraints in urban greening. The volunteer option is affordable and helps to increase education, awareness and networking of various stakeholders working on environmental issues like urban greening. The city of Cape Town runs such a program with volunteers from different walks of life, including tourists (Greenpop, 2014). Volunteers are involved in visiting and offering education lessons and demonstrations in schools on various forms of urban greening or environmental improvement and protection. In addition, they can assist in assessing the planted trees by recording information and communicating with community leaders about the progress of tree planting (Kuo and Sullivan, 2001). Such a method helps volunteers and stakeholders to network and share knowledge and skills of implementing greening programs.

The above discussion shows that current greening programs are often based on inadequate data due to limited research and co-ordination of greening information by municipal authorities. This calls for all involved researchers, community and related municipal department leaders to learn and upgrade their skills so as to be effective on where and where greening projects can be implemented (Alvey, 2006). This can reduce the challenges faced by the city of UMhlathuze where less people participate in tree planting activities while others advocate for clearance of trees to reduce crime. This greening program addresses the needs of the people, which encourage local residents to support such a program. For more success in this field, greening programs should be applicable or compatible with the area where it is to be implemented (Nature, 2013).

5.7 Challenges of urban greenness and sustainable development

Results from reviewing documents emphasize that maintaining vegetation and planting more trees is a growing challenge in the city due to insufficient financing. The same challenge was voiced by the DERM and DCM during interviews and that the reason for less greening activities was largely due to:

> "Vandalism of trees and related facilities, theft of planted trees and shortage of financial resources to buy the trees"

Street trees need to be constantly pruned while grass need to be trimmed. Unmaintained trees in open spaces have increasingly been associated with more crime and illegal dumping activities. All this is because the city does not have enough money to efficiently provide such services. Limited funding of planning, road rehabilitation and construction of new complex parks slows down greening of the city. Most parks according to questionnaire results fail to attract more people due to less recreational infrastructure, security and unmaintained vegetation due to limited funding.

As time goes by socio-economic and ecological importance of urban forests will also increase serious maintenance costs, however, indirect costs and disservices may result from lack of maintenance, including tree failures, debris, pests, branches blocking intersections, harbouring criminals in thick undergrowth and many other issues. Urban trees frequently necessitate at least some level of tree maintenance in order to prevent conflicts with other urban infrastructure and proactive maintenance of urban trees should lead to more efficient tree management than reactive maintenance. Allocation of maintenance resources like time, money and labour below an optimal level result in a trade-off potentially less healthy trees that may have a shorter life span or service life (Kuo and Sullivan, 2001). Preventive maintenance sets the stage to provide greater service life, and if done correctly, it should cost less than delayed maintenance, for properly planted and maintained

trees are a greater valuable assert that the urban forest is a likely to give (Ryder and Moore, 2013).

Tree stumps and gaps left by tree cutting along some streets and open spaces were also observed in most surveyed suburbs. Even at the time of writing this chapter, sporadic felling of big trees is still ongoing in different parts of the city. What is more worrisome is that, such trees are not being replaced at all. The rate at which trees are being replaced at in the city is lower than the rate at which trees are being removed. Although trees are planted on Arbor Day and on other few occasions, urban greening is slowing down and this is not good for sustainable development needs. It means as time passes ecological advantages are being reduced, but the number of beneficiaries will be increasing. Despite the need to remove old trees or trees posing physical hazards or harbouring criminal activities, the DERM emphasized that, not replacing them is unsustainable behaviour that may soon lead to less greenness in the city centres where trees are needed most.

The financial challenge of funding urban greening programs has been made worse by having just a few private businesses assisting in funding urban greening programs, leaving the state as the sole financier. Partnerships between government departments, local residents and private business can bridge this financial gap and work to improve urban green spaces. Bringing other financing stakeholders into this field can increase effective decision making and implementation of greening projects (DTLR, 2002).

The usual partnership in urban areas is one between the Department of Environmental and Recreational Management. These require the support of all stakeholders in increasing greenness awareness enlisting volunteers and with financial investments in greening projects. All forms of partnerships should ensure

that communities remain in touch with greening activities taking place in their areas. Their awareness and input can be solicited and maintained through newsletters, municipality website, radio, talk shows and media (JCPZ, 2014). In UMhlathuze, newsletters, the web and local newspapers are less used to support the education and raising environmental awareness. The use of a variety of media will target more people in different situations and areas of the city. Partnerships between businesses and the public should be highly prioritized in order to spread the greening benefits and achieve wide and effective coverage.

According to Figure 4.34, 71.7% of questionnaire respondents felt that they needed more trees or green spaces and in Figure 4.35 94.9% confirmed that they are willing to support tree planting policies from the municipality. Of the 5.1% who thought trees should not be a high priority in urban areas felt that thickly vegetated open spaces and parks were not safe and prone to crime. Field surveys also discovered that many park infrastructures have been vandalised and some were missing, and this may be a result of crime. However, members of the public continue to share conflicting perceptions of urban forests, with one view believing that, city vegetation reduces crime and enhance physical healing and urban renewal, while on the other hand residents feel that urban vegetation on more occasions has been used as a screen for criminal activity (Dwyer et al., 1992). The Kuo and Sullivan Report (2001) states that

> ".. Degradation of neighbourhoods exacerbates poor social cohesion, crime, drug abuse and environmental downfall yet urban greening has been closely linked to reductions in these social problems" (Greenpop, 2014).

This may explain why the crime rate is high in informal settlements and peri-urban areas with less vegetation and low standards of living like Mzingazi, Madlazini and in tradition chiefs' areas around ENseleni, Esikhawini, Ngwelezane and Vulindlela. In

support of this, an American study of greener residential suburbs recorded lower levels of fearing crime and aggressive behaviour (Dwyer et al., 1992).

The fact that a number of people in UMhlathuze residential suburbs associate crime with dense vegetation can be true given the high levels of burglary and criminal activities in concealed areas. The belief is that dense trees and shrubs shield criminal activities and their perpetrators (Nasar and Fisher, 1993). Another American research university campus fear of crime discovered that, areas of dense vegetation reduced views by blocking visibility, giving criminals operating cover to steal and commit illegal activities (Michael and Hull, 1994). However not all vegetation conceal criminal activities as well planned and maintained vegetation does not conceals criminal activities. This is typical in high income areas of UMhlathuze where some residents have taken it upon themselves to maintain the vegetation around their properties without waiting for municipality workers who come after a long period of waiting. Apart from crime, some vegetated parts of cities conceal much anti-social behaviour like drug and alcohol abuse, prostitution, illegal dumping and people relieving themselves in these areas (see Figure 4.16 b). This therefore calls for more social transformation and respect of neighbourhood areas (Michael, Hull, & Zahm, 1999).

EPD/PM highlighted that the legislature governing wetland protection was a challenge as it is undermined in many cases in favour of economic growth in the city.

> "The legislature governing wetlands protection is a bit of a challenge. It is bypassed at times in favour of economic growth that leads to job creation and widening the tax base for the city…"

According to this department, this challenge is compounded by political complacency that favours economic development and other populist ideas instead of balancing this with environmental development. Documents are completely silent on this issue, maybe as a result of not wanting to criticize the political administration of

municipal departments. Scrutiny of aerial photographs shows settlements that have grown in wetland areas in Mzingazi, Madlanzini, around Esikhawini and Nseleni. Even in formal areas of the city, development continues to encroach into open areas which were once left out due to Geotechnical issues of being too wet. Land claims of forested urban areas by rural and urban residents especially in Birdswoods has resulted in huge losses of urban forests and mushrooming of informal settlements. The fact that these politically aligned challenges have not received a political solution to save urban forest means they are politically supported and favoured. All this takes place with politicians knowing the dire consequences to the ecology of such areas and sustainable development of the city at large. The DCD cited that the long protocols and bureaucracy that is followed in complying with some environmental laws is too slow, casting doubts on the city's implementation policies of environmental protocols.

According to the DITS some roads in residential areas remain not vegetated to avoid interfering with transport movement through blocking driving vision and also to avoid interfering with ground and underground infrastructure like roads, power lines and water pipes. With better planning and research the idea of planting low growing ornamental trees in concerned areas need to be considered as a greening alternative. Fast growing tall trees interfering with power lines and those with long roots may be removed and replaced by other species. Fast growing trees must be pruned at regular intervals, increasing the municipality's maintenance cost and therefore are not beneficial to the rate payers or the landscape. Replacing such trees with shrubs or trees of low height can save money for pruning and maintaining a greener neighbourhood.

5.8 What is different about this study?

This research strongly focuses on small cities or towns in the developing world which are rarely covered in many studies. Coverage of green spaces and their role in sustainable development is confined to cities like Cape Town, Johannesburg, Cairo, Lagos, Nairobi, Luanda, Harare (African Development Bank, 2012) and many others, and little is known about the role of green spaces in sustainable development in smaller cities. It is in this context that this study is premised.

Economic development has for a long time has been seen as the main way of improving living standards. This research takes a different approach to how small developing world cities can develop sustainable development strategies in an environment of financial shortages, low economic investments and high urbanisation levels. Urban greening can be employed by these cities as one natural and simple way of reducing their carbon footprint, improve the quality of their environments, and increase recreational attractiveness of these cities with less dependence on huge financial investments. The study, however notes that both social and economic development should be balanced with environmental development, which for some reasons has been strongly neglected in these approaches.

Another different aspect of this research is its attempt to review the shortfalls of master plans pursued by city managers in these smaller cities in urban planning and development. It is emphasised that these plans need to incorporate new ideas and designs and not to treat urban development from the perspective of mega cities but to craft plans that are feasible and appropriate for smaller cities.

This research is also different from others because it solicited residents' views on urban greening. The balance between aesthetic values of greening versus basic human needs of shelter was also covered in this research any previous studies show

that planning decisions are made on behalf of residents without their involvement, which weakens the implementation of such strategies. This explains why well written development strategies have remained they lack the support and input of people at grassroots level.

Many small cities are characterised by urban sprawl in their rural fringe zones and this has resulted in more pressure on green resources. The case of UMhlathuze is different as it is a city that is made up of an amalgamation two towns, several growth points and several rural nodes administered by traditional leaders, yet they are being serviced by the UMhlathuze municipality. Urban greening problems encountered in this city therefore apply to similar semi-rural towns.

5.9 How the literature review and methodology used in this study influenced the findings and analysis of results.

The use of four different research methods allowed for comparison of greening levels between different residential suburbs of the city. Information from field observations was supported by interviews, questionnaires and document review. Themes that were not clearly identified during field observations were further investigated in interviews and questionnaires where specific questions were asked. For example, it was not clear from field observations why some roads had no trees at all but analysis of documents and interviews results then clarified that traffic bylaws and underground pipes take priority, hence such roads remain open from trees as the roots will interfere with this infrastructure.

The use of qualitative and quantitative data collection tools enabled triangulation of data during analysis. Information from interviews and documents were backed up by graphs and tables from questionnaires. The research method used here helped to look at the research topic from different approaches as themes were being built

during analysis. The density of vegetation changes over time and methods like field observations managed to capture this where documents lagged behind. On the other hand the use of a qualitative design enabled analysis of results to be an ongoing process where data were continuously collected and analysed while collection continued. The advantage of this was that analysed results, especially developing themes could be further clarified and amended through the ongoing data collection. Interviews greatly helped to clarify most of the themes that came out of document review and part of field observation.

Literature reviewed in this research provided a context to sustainable development and urban greening based on experiences from different countries. This made it easier to compare the data from UMhlathuze to other cities. Some of the strategies suggested were based on ideas from other world cities in similar situations as UMhlathuze.

5.10 Conclusions

The discussion of results in this chapter sheds more light on the relationship that exists between urban greening and sustainable development in urban areas. The rapid increase in urbanization is causing a decrease in the percentage of urban green areas, further straining the relationship between urban greenness and sustainable development. In the city of UMhlathuze more needs to be done to balance progress in economic development and environmental development. Just as growing urban areas require infrastructural and utilities, growing cities like UMhlathuze also require renewal and development of its green infrastructure in order to increase the ecological benefits from green spaces, and promote sustainable development (Ryder and Moore, 2013). A comparison of what should be done and current activities of urban designing, policing and implementation, one can conclude that cities need

radical and structural changes in all societal levels to stop urban greening and sustainable development to be a thing for the future when the future can be now (Mapes and Wolch, 2011). The local governments, business and consumers of any given city should be conscientised on the needs of behavioral and production changes and embraces sustainable development as a new norm.

CHAPTER 6: CONCLUSIONS.

6.1 Introduction

After the discussion of results in chapter 5, this chapter goes on to give the overall findings of this research and recommendations that can further strengthen the relationship between urban greening and sustainable development in order to uplift the living standards of urban people. Irrespective of the size of an urban area, a clear link exists between urban greening and sustainable development. Urban greening is one sustainable way that can be used by any city or town to increase ecological benefits for the present and future generations.

6.2 Recommendations

UMhlathuze Municipality should form local partnerships with local universities and colleges to facilitate short courses on Urban Forestry & Greening towards Sustainable Municipalities as a strategy to increase public participation and raise environmental education and awareness and also to professionalise approaches to urban greening. The University of Zululand, Umfolozi Technical College and Richtek Umfolozi College can assist the municipality with coordination and running of such courses as part of their community outreach programs. Such courses may cover various aspects of urban greening and sustainable development in and around the city such as:

- An outlook on local and global urban vegetation,
- Contributions to water management,
- Urban agriculture and food production,

• Study of socio-economic and environmental benefits of urban greening and sustainability,

• Investigating and assessing the challenges of urban greenness in the context of rapid urban growth and expansion,

• Different methods for assessing urban greening,

• Methods and strategies used to implement urban forestry and improving living standards in urban communities,

• Health and well-being,

• The importance of community involvement and communication in urban greening and sustainable development of the city,

• The role of urban planning, policing, implementation and community involvement in in all these,

• Community cohesion and identity enhancement,

• Participants will embark on field surveys to be exposed to many green spaces and conservation examples and projects,

• How to establish community support networks in urban forestry and environmental conservation and

• Sharing of latest research with emphasis on the South & Southern Africa (Rhodes University: Department of Environmental Science, 2015).

Depending on the city's greening needs, these courses can be constantly changed to cover pressing environmental needs that enhance urban greening. Certification can be arranged as a motivational and empowerment incentive to participants, but such certificates should meet national and even international standards, therefore they can be offered in collaboration with national and international organizations or universities. These can be a Certificate of Competence (for those completing and passing the assessments), or a Certificate of Attendance for those attending but not taking part in assessments. The short courses should be intended to meet the need

for practitioners who are relatively new to the field and offer a baseline refresher for those with experience in the field of environmental management. If attendance is overwhelming, first priority should go to those who have responsibilities for actively facilitating and supporting urban forestry and greening projects in the city of UMhlathuze. However, as a way of bringing different stakeholders together and promoting partnerships and networking for the benefit of urban greening such courses can be aimed at practitioners working in such fields like Urban Greening, Environmental Affairs, Parks and Recreation, Ecosystem conservation, Environmental Impact Assessment, School Teachers, Extension officers, Local and District authorities and NGO officials working with communities on greening and nature conservation (Rhodes University: Department of Environmental Science, 2015).

6.3 Alignment of this research with other existing studies

This research shares many themes with any existing studies and helps to add value to the issues of urban greening and sustainable development.

The research concurs with viewpoints that urbanisation and associated environmental problems increasingly important globally. This will result in the decrease of green areas. Many problems limiting urban greening and sustainable development have been identified (Henderson, 2013; Heckert and Mennis, 2012; Greenpop, 2014 and Byrne, 2012). Some small faces financial shortfalls in addressing urban greening and environmental management to attain acceptable levels of development. Budget prioritisation does not favour environmental development as compared to social and economic sectors. Planning technology and environmental expertise lag behind due to financial limits. Low levels of environmental awareness and education are also identified

Many of the Master Plans which are meant to guide the physical development of cities have not been revised to incorporate new changes within these cities. This study argues that, if properly planned and integrated into urban development and planning policy, urban greening has a number of environmental for small cities.

Many of these cities have good policies and plans, but these fail to be implemented effectively. Results from this research suggest that municipalities should start prioritising the inclusion of vegetation in development plans and that this should be monitored and enforced.

Failure to green with indigenous trees should not be the end of greening attempts, but where possible exotic vegetation should be planted. Although this is highly debatable, the biggest aim of greening will have been achieved. This research also goes on to identify the need of including all stakeholders in urban greening. Greening should be promoted at individual or family level to industries and government department levels. Home gardens, potted plants, office plants, street trees and urban forests should all be promoted.

This research also showed that planting of trees is usually given to service providers through tender procedures, however these companies work alone with less monitoring in planting trees and carry out less maintenance and auditing of trees which survive during a given period. The new suggestion levelled against such greening methods is to encourage integration of service providers with local people to improve accountability, education, awareness and effectiveness.

Many cities have relied on old master plans that are no longer applicable. Re-planning as an urban renewal strategy should be carried out and implemented to

improve living standards and urban environments. The study of green spaces has traditionally been confined to big cities and this has created a gap in knowledge in the functionality of green spaces in smaller towns. It is argued that ecological wellness is a vital ingredient in both social and economic development, and inclusion of more vegetation in town can help to achieve this.

This research has identified stakeholders who should play roles in the field of environmental management, urban greening and sustainable development so as to reduce the sole responsibility of the municipality. Local universities, colleges, vocational centres and schools should promote environmental education. Municipalities should also complement this by forming partnerships with industries, educational institutions and NGOs in funding, research and increasing environmental awareness and participation in greening activities.

6.4 Wider contexts of urban greening

The United Nations anticipates that by 2030, increased urbanisation will result in about 60% (4.9 billion) of the global population living in urban areas and about 23 of the 25 world agglomerations will be found in Africa (UN, 2004). While urban areas constitute a small percentage of the earth's surface, they have the biggest footprint (Rees & Wackernagel 1994). This calls for urban areas to drastically shift towards urban greening and sustainable development in order to deal with complex demographic and environmental changes. Governments are looking for greening solutions to achieve both economic and environmental gains (Hammer et al., 2011). If sustainable development is to be achieved in cities it must strongly relate to urban greenness. More vegetation and open green spaces are needed and these should be fully integrated into urban infrastructure (Heckert and Mennis, 2012). Planning, enforcing bylaws, inclusive development and raising awareness of the significance of

ecological development in cities can help ensure a complementary relationship between urban greenness and sustainable development.

Increased interest in sustainable development and urban greenness can be traced to the increasing challenges of climate change and deteriorating urban climates. If no new planning and management policies are taken by cities, urban areas will have irreversible effects on the world's resource base needed to sustain, social, economic and environmental prosperity (Hammer et al., 2011). Sustainable development can positively lead to long term economic benefits; hence it requires a long term strategy. The same can be said of urban greening as a form of sustainable development, that its benefits are long term, therefore municipalities, urban communities and cities need to adjust their social, economic and environmental habits and practice sustainable development as a norm. Urban greening is one way of making sure that the natural environment in urban areas is conserved as a way of improving quality of life both at present and future.

CHAPTER 7: GREENING RECOMMENDATIONS

7.1 Greening recommendations

The Municipality of UMhlathuze and all other intermediate municipalities in the developing world needs to increase environmental education and public participation in urban greening and policy formulation. Increased awareness of greening methods will continue to facilitate implementation of greening methods of sustainable development as the city experience pressure from increasing urbanization. The purpose of well formulated and drafted environmental laws and policies is to aid environmental improvements and raise living standards in urban areas, therefore cities need to outline and implement several key ways to increase awareness of environmental issues like urban greening and sustainable development. The following recommendations can be used by all small municipalities in similar positions to the city of UMhlathuze to improve the relationship between urban greening and sustainable development:

- Environmental campaigns should be targeted to specific groups of the urban population as many people do not pay much attention to environmental problems due to ignorance as to how environmental problems can affect them and their lifestyles. Integrating urban greening education into extra-curricular activities can act as a long term solution of raising awareness on the importance of environmental conservation and improvement among the youth, and enforce the practice of greening communities at school levels. Tree planting competitions backed teacher workshops on urban greening can help schools to participate and learn more about urban greening in and around the city.
- Intermediate and secondary cities should launch and intensify local outreach programs towards rural authorities with the municipality, church leaders and

various communities in the city to help government organizations, private companies and NGOs working on environmental educating. Community leaders can act as the bridge between the public and those educating and offering awareness campaigns on environmental greening by assisting them with communication with the public who may not be receptive to these.

The city of UMhlathuze can make use of the different types of media at its disposal to increase greening awareness and educate people on environmental management and protection. This according to Quick (2010) can be achieved through conducting press releases, holding talk shows with local radio stations or holding online programs to encourage tree planting by volunteers. Many personnel working in the media do not have strong and accurate environmental information to give out to the public, and an online database with a collection of relevant environmental information can be used to educate and increase greening awareness of volunteers, journalists and the general public. When implementing the above ways it is important to the municipality to understand the local context of green spaces of their different urban areas or suburbs, as people want different things from different spaces (Gairola and Noresah, 2010).

Taking small incremental steps to increase the amount of trees in a city can promote urban greening if consistently followed or backed by flexible bylaws. Follow ups on dead trees, damaged and vandalised trees as a result of human misconduct can ensure the replacement of such trees in order to maintain and improve the current level of greenness in the city. As for ageing trees, replacement planting can be carried out. This involves planting new trees in between or next to these old trees so that as the old trees come to end of their natural cycle, the aesthetic view and ecological benefits may not be severely lost to the city, unlike the current situation where the CBD of Empangeni has lost old trees which have never been replaced.

Currently, many city roads have gaps and stumps of old trees that have been cut and not replaced. The city can also translate this into a policy that for every tree cut; it must be replaced in in a suitable area in any part of the city. Most young trees planted in the city fail to grow due to poor maintenance and in response to this challenge; this research recommends that all trees planted within the city must be subject to a maintenance plan especially in their first 3 years, in order to promote survival of newly planted trees.

These cities should seriously consider the use of volunteers and school children in urban tree planting, especially during the Arbor week to maximize the number of trees that can be planted. With its limited funding for tree planting and maintenance, use of volunteers can help the city to ease this strain while ensuring that the city increases its levels of greening. Volunteering has worked very well for big cities like Johannesburg and Cape Town in South Africa and can do the same in these small cities given the increasing demand for urban trees that comes with increasing urbanization. Volunteers will not only plant trees, but will provide muscle, skills, knowledge, and enthusiasm for tree planting occasions and many of them will be responsible for educating others in their communities on the benefits of trees. Furthermore, respective municipalities can train urban greening volunteers and neighbourhood coordinators with the role of encouraging their own neighbours and family members to plant trees along their streets, and assist in initiating large scale tree planting programs in their neighbourhood. These cities should also encourage the involvement of people at grassroots levels, especially those in low income areas by creating volunteer groups and introducing projects like planting trees on roadsides and open areas in an attempt to include the young and the old members of their respective cities.

Apart from volunteers, cities can make use of free labour from local prisons, like in the city of UMhlathuze; labour force from Qalakabusha prison located in the city can be used to plant trees and improve open spaces, especially with prisoners undergoing rehabilitation in preparation for release. Offenders with petty crimes that warranty community work should also be drafted into tree planting activities of the city. This therefore calls for a closer collaboration between Mucipalities and Prison Departments.

As a sustainable way of promoting urban greening, further research on the value of street trees and open spaces would be useful; to enable the building up of useful information that can be stored in a database for further use. It might also be useful to complement the current study with further greening research on why people express their preference towards exotic trees than native trees (Greenpop, 2014). This might help to adjust tree preservation strategies in line with the needs of an area. In addition to research the municipalities should work together with local universities and academics on research that will promote environmental studies that seek to protect urban green spaces and the urban environment at large. Sharing information with other cities and organizations working with urban greening through organized seminars and conferences can help the developing world cities to accumulate practical data and strategies tested and applied in other areas. The local universities and technical colleges in and around these cities can assist concerned municipal departments to identify research priorities, carrying out research, evaluating results and applying the results. This program will encourage partnership with associates in academia, research institutions, state agencies, the business sector, NGOs and other local authorities.

Urban greening as a form of sustainable development requires sustainable funding for it to be beneficial today and in future. To alleviate financial shortages of funding

urban greening, especially urban tree planting, extra funds apart from government funds are required. The following recommendations can help developing world cities like UMhlathuze in bridging this financial gap in urban greening.

i. Increased engagement of private businesses in the city in funding the planting and maintenance of trees. Such private businesses should fully collaborate with the respective municipality in decision making on sustainable development and urban greening in order to increase their involvement and cooperation. Municipalities as representatives of local governments should change their role from being sole 'actors' to becoming facilitators in financing greening programs.
ii. Cities should encourage the formation of the City's Trust program, which will be responsible for furthering research and education on green related programs like arboriculture through funding. The cities can then appeal to the corporate world and international organizations like the UK based African Dryland Program to support their urban greening projects through these trust fund programs.
iii. Cities should go for large scale request for tree donations from local residents, farmers, forestry agencies, private nurseries, NGOs and from other towns.

Most developing world cities should make it mandatory that any new commercial, industrial and residential plan in their cities that need approval should include a plan of indigenous trees to be planted in or around the property without violating other municipal bylaws. Where this is impossible potted plants and rooftop gardens should be considered. This should be superseded by workshoping local planners and architects on the need to increase greenery in all properties in the city. As for large scale constructions like malls, their plan should include a greening plan around their building or surrounding streets.

Cities should allocate accessible land or streets to act or provide areas where memorial trees can be planted by volunteering residents to honour their relatives and leaders by planting trees in their names and this could be held as an annual recreational event. In addition to this, municipalities should facilitate 'adopt a tree or adopt a street' program that will see groups, individuals and the business sector committing to planting trees in designated city areas as a way of advertising and carrying community outreach programs. Where street trees are often lost due to pruning and maintenance of urban infrastructure like roads, electricity cables and underground pipes, cities should constantly communicate with contractors and utility companies so that they can help to limit vegetation and shrub clearance during construction and maintenance programs.

7.2 Areas for further research

The gaps in knowledge identified in this research need to be closed through further research in fields related to the themes of this research. The following areas are therefore suggested for further research:

- Wider discussions and dialogues on the future of green spaces in urban development and planning in sub-Saharan African cities.
- Use of exotic trees in place of indigenous trees in urban areas where indigenous trees have failed to make ecological and greening improvement
- The role of schools, tertiary institutions and private sector in promoting urban planning, environmental awareness and education and urban greening.
- The impact of informal settlements and housing densification on urban green spaces and sustainable development.
- The need to revise and improve master plans of cities to increase and improve physical growth of intermediate and secondary cities of African countries.

REFERENCES

Africa Development Bank (2012), Urbanization in Africa, Available from: http://www.afdb.org/. [Accessed: 25/04/16]

Aganivanshi, J. (2014) The Urban Progression, Utopia of Modernity: Zlin [Online]. Available from: http://urbanfailure.blogspot.com/2014/01/a-utopia-of-modernity-zlin.html. [Accessed: 03/01/14]

Ahern, J. (2013) Urban landscape sustainability and resilience : The promise and challenges of integrating ecology with urban planning and design. Landscape Ecology. [Online] 28 (6). p. 1203–1212. Available from: http://link.springer.com/article/ [Accessed: 13/04/15]

Aksoy, Y. (2011) Green Planning According to Sustainable Growth and Development Potential in Küçükçekmece. European Planning Studies. [Online] 19 (5). Available from: http://www.tandfonline.com [Accessed: 20/09/14]

Aldous, D.E. (2007) Social, environmental, economic, and health benefits of green spaces. In: Lumpkin, T.A., Warrington, I.J., Proceedings of the International Symposium on Horticultural Plants in Urban and Peri-Urban Life, Horticulture, 762. International Society Horticultural Science, Leuven 1, pp 171–185

Alvey, A. (2006). Promoting and preserving biodiversity in the urban forest. Urban Forestry & Urban Greening [online] 5 (4). p. 195–201. [Accessed: 10/02/15]

Anderson, P. M. L., and P. J. O'Farrell, P.J. (2012). An ecological view of the history of the City of Cape Town. Ecology and Society 17(3): 28. Available from: http://dx.doi.org/10.5751/ES-04970-170328 [Accessed: 18/03/15]

Anderson, P.M., Avlonitis, G. and Ernstson, H. (2014). Ecological outcomes of civic and expert-led urban greening projects using indigenous plant species in Cape Town,

South Africa. Landscape and Urban Planning. [Online] 127 (2014). Available from: http://www.sciencedirect.com/science/article [Accessed 30/04/14]

Andersson, E. (2006). Urban landscapes and sustainable cities: Ecology and Society. [Online] 11(1). p. 34. Available from: http://www.ecologyandsociety.org/vol11 [Accessed 30/04/14].

Atiqul, S.M. (2011). Urban Green Spaces and an Integrative Approach to Sustainable Environment. Journal of Environmental Protection. [Online] 2 (n/a). p. 601 -608. Available from: http://www.scirp.org/journal/jep.[Accessed 22/04/14]

Barredo, J. and Demicheli, L. (2003). Urban sustainability in developing countries megacities: modelling and predicting future urban growth in Lagos. Cities. [Online] 20(5). p. 297-310. Available from: http://www.foresightfordevelopment.org/ [Accessed 27/05/15]

Baur, J.W.R. and Tynon, J.F (.2010). Small-scale urban nature parks: Why should we care? Leis Science [Online] 32(2). p. 195–200. Available from: https://ir.library.oregonstate.edu. [Accessed 01/05/15]

Beder, S (2000). 'Costing the Earth: Equity, Sustainable Development and Environmental Economics', New Zealand Journal of Environmental Law, 4, pp. 227-243.

Bentsen, P., Lindholst, A.C. and Konijnendijk, C.C. (2010). Reviewing eight years of Urban Forestry & Urban Greening: Taking stock, looking ahead, In Urban Forestry & Urban Greening, 9(4). p. 273-280

Berke, P., Godschalk, D. and Kaiser, E., (2006) Urban land-use planning. Chicago: University of Illinois Press.

Bolund, P. and Sven, H. (1999). "Ecological Services in Urban Areas," Ecological Economics, [Online] 29 (1999). p. 293-301. Available from: http://www.fao.org/uploads/media/Ecosystem_services_in_urban_areas.pdf [Accessed 11/10/14]

Boone, C. G. and Ruth, M. (2004). Taking Sustainable Cities Seriously: Economic Development, the Environment, and Quality of Life in American Cities. Cities. [Online] 53 (4). p. 741 – 742. Available from: http://onlinelibrary.wiley.com/ [Accessed 11/10/14]

Bounoua, L. et al, (2015). Impact of urbanization on US surface climate. Environmental Research Letters [Online] 10 (8). Available from: http://iopscience.iop.org/article/ [Accessed 11/105/14]

Bowen, G. A. (2009) Document Analysis as a Qualitative Research Method, Qualitative Research Journal. 9 (2). P. 27 – 40.

Branas, C. C., Cheney, R. A., MacDonald, J. M., Tam, V. W., Jackson, T. D., and Ten Havey, T. R. (2011). A difference-in-differences analysis of health, safety, and greening vacant urban space, American Journal of Epidemiology, [Online] 174 (2012). p. 1296–1306. Available from: http://aje.oxfordjournals.org/content/early. [Accessed 20/04/14]

Bratman, G.N., Hamilton, J.P. and Daily, G.C. (2012). "The Impacts of Nature Experience on Human Cognitive Function and Mental Health," Annals of the New York Academy of Sciences. [Online] 1249: 118–136. Available from: http://www.pubfacts.com/detail. [Accessed 30/05/14]

Brenda Strachan, Head of Department of the Department of City Development, 10 February 2015.

Brownlow, A. (2006). Archaeology of fear and environmental change in Philadelphia, Geoforum. 37. p. 227-245.

Burnard, P., Stewart, K., Gill, P., Treasure, E. and Chadwick, B. (2008). Analysing and presenting qualitative data. British Dental Journal. [Online] 204: 429 – 432. Available from: http://www.nature.com/bdj/journal. [Accessed 19/08/15]

Byrne, R. (2012). Greenspace Planning : problems with standards, lessons from research, and best Practices: Garden cities. City Green. [Online] 6 (n/a). p. 50- 55. Available from: https://www.citygreen.sg. [Accessed 11/12/14]

Byrne, J. and Sipe, N. (2010). Green and open space planning for urban consolidation – A review of the literature and best practice, Urban Research Program Issues. [Online] Issues Paper 11. p. 3 – 27. Available from: http://www98.griffith.edu.au. [Accessed 12/12/14]

Byrne, J. (2012). Greenspace planning: problems with standards, lessons from research, and examples of best practice, Urban and Environmental Planning. City Green. [Online] n/a. (6). p. 50-55. Available from: http://www98.griffith.edu.au. [Accessed 15/04/15]

Byrne, J., Wolch, J. and Newell, J. (2014). Urban Green Space, Public Health, and Environmental Justice: The Challenge of Making Cities 'Just Green Enough'. Landscape and Urban Planning. [Online] 125 (n/a). p. 234–244. Available from: http://www.sciencedirect.com/science/article. [Accessed 03/05/15]

Callenbach, E (1990), Ecotopia: The Notebooks and Reports of William Weston, Available from: http://www.ernestcallenbach.com/Books.html [Accessed: 19/04/16]

Campbell, S. (1996). Green Cities, Growing Cities, Just Cities, Urban Planning and the Contradictions of Sustainable Development. Journal of the American Planning Association. [Online] 62 (3). p. 296–312. Available from: https://my.vanderbilt.edu/greencities/files. [Accessed 10/06/15]

Canada. Parks, Forestry and Recreation Press (2013), SUSTAINING AND EXPANDING THE URBAN FOREST: TORONTO'S STRATEGIC FOREST MANAGEMENT PLAN. [Online] 2012-2022. Available from: http://www1.toronto.ca. [Accessed 02/05/15]

Carvalho, M. M. (1997). Association of sown grass pastures with trees in the Southeast Region of Brazil. Agroforesteria en las Americas. [Online] 4 (n/a). p. 5-8. Available from: http://www.fao.org/wairdocs. [Accessed 23/05/15]

Cilliers, S., du Toit, M., Cilliers, J., Drewes, E. and Retief, F. (2014). Sustainable landscapes: South African perspectives on Trans disciplinary possibilities. LANDSCAPE AND URBAN PLANNING. [Online] 125 (n/a). p. 260-270. Available from: http://www.sciencedirect.com/science/article [Accessed 12/02/15]

City of UMhlathuze Annual Review (2004/05). Building a strong foundation for a sustainable future. Produced by the Community Facilitation and Marketing Department. (http://www.umhlathuze.gov.za)

City of uMhlathuze, (2012/13). Annual Report [Online] Available from: http://www.umhlathuze.gov.za/docs-umhlathuze/annual-report/uMhlathuze 2012-2013.pdf. [Accessed 10/05/14]

City of uMhlathuze, Integrated Development Plan. Report: TRP_449_N_Rpt169. April 2002

City of UMhlathuze Planning Maps, (2013).

Costanza et al., (2013). Green Infrastructure as a tool to support spatial planning in European urban regions. iForest - Biogeosciences and Forestry. [Online] 6 (2). p. 102. Available from: http://www.sisef.it/iforest/?doi=10.3832/ifor0723-006. [Accessed 09/10/14]

DEPARTMENT OF ENVIRONMENTAL AFFAIRS (DEA), Annual Report (2014), [Online]. Available from: www.environment.gov.za, [Accessed 23/09/15].

Donaldson-Selby, G., Hill, T., & Korrubel, J. (2007). Photorealistic visualisation of urban greening in a low-cost high-density housing settlement, Durban, South Africa, Urban Forestry and Urban Greening, 6 (n/a). p. 3–14.

Dwyer, J. F., McPherson, E. G., Schroeder, H.W., and Rowntree, R. A. (1992). Assessing the benefits and costs of the urban forest. Journal of Arboriculture. [Online] 18 (5). p. 227-234. Available from: http://www.google.co.za/url?sa [Accessed 09/03/15]

Environmental Protection Agency (EPA – USA), (2006), Climate Change Adaptation Plan, Available from: https://www3.epa.gov/climatechange. [Accessed: 25/04/16]

Ernst van Biljon (Head of Parks, Sports and Recreation) Department of Environmental and Recreational Management, 10 April 2015.

Falk, Jim, Hampton, Greg, Hodgkinson, Ann, Parker, Kevin and Rorris, Arthur, (1993), Social Equity and the Urban Environment, Report to the Commonwealth Environment Protection Agency, AGPS, Canberra, p.2.

Gairola, S. and Noresah, M. (2010). Emerging trend of urban green space research and the implications for safeguarding biodiversity: a viewpoint. Journal of Nature and Science. [Online] 8 (7). p. 43-49. Available from: http://www.sciencepub.net/nature/. [Accessed 20/05/15]

Gan, M.Y., Deng, J.S., Zheng, X.Y., Hong, Y. and Wang, K. (2014). Monitoring Urban Greenness Dynamics Using Multiple and Member Spectral Mixture Analysis, PLOS ONE. [Online] 9 (11). Available from: http://journals.plos.org/plosone/article. [Accessed 23/09/15]

Gardiol, F.L, (2009). Urban sustainability and governance: issues for the twenty-first century. Oxford: Blackwell Publishing Ltd.

Gamett, T 2014, It's Not Easy Being Green: Assessing the Challenges of Urban Community Gardening, Plos, accessed 21/05/14, < http://blogs.plos.org/.

Grahn, P. and Stigsdotter, U. (2003). Landscape planning and stress. Urban For Urban Green [Online] 2 (1). p. 1–18. Available from: http://www.sciencedirect.com/science/article [Accessed 11/11/14]

Greenhalgh, L. and Warpole, K. (1996). People, Parks and Cities, Department of the Environment. London: The Stationery Office.

Greenpop, (2014), Urban Greening and Environmental Education Volunteer Project Cape Town, South Africa. Greenpop. [Online] Available from: http://www.greenpop.org/docs/Greenpop-CapeTown-Volunteer-Project.pdf. [Accessed 20/08/15]

Griffin, J. (2014). Sustainable Development and Industry Self-Regulation. Business and Society. [Online].53 (4).p. 551-582. Available from: http://philpapers.org/rec/GRISDA-2 [Accessed 11/12/14]

Grimm, N. B., Faeth, S. H., Golubiewski, N. E., Redman, C. L., Wu, J. Bai, Z. and Briggs, J. M. (2008). Global change and the ecology of cities. Science. [Online] 319 (5864). p. 756-760. Available from: http://www.ncbi.nlm.nih.gov. [Accessed 27/06/15]

Gupta et al., (2012). A measure of green spaces in urban areas. Landscape and Urban Planning. [Online] 105 (2012). p. 325–335. Available from: http://www.researchgate.net/publication/257026751_Urban_Neighborhood_Green_Index. [Accessed 11/11/14]

Hammer, S. et al. (2011), "Cities and Green Growth: A Conceptual Framework", OECD Regional Development Working Papers 2011/08, OECD Publishing. [Online] Available from: http://dx.doi.org/10.1787/5kg0tflmzx34-en. [Accessed 25/05/14]

Hangzhou, China: Exuberantly Green (2013), http://www.citinature.org/city

Harnik, P. (2010) Urban Green: Innovative Parks for Resurgent Cities. Washington DC: Island Press.

Heckert, M. and Mennis, J. (2012). The economic impact of greening urban vacant land: a spatial difference-in-differences analysis Environment & Planning A. Sage Journals. [Online] 44 (12). p. 3010-3027. Available from: http://epn.sagepub.com/content. [Accessed 25/06/14]

Henderson, J. C. (2013). Urban parks and green spaces in Singapore. Managing Leisure. [Online] 18(3). p. 213–225. Available from: http://www.tandfonline.com. [Accessed 19/05/14]

Hirokawa, K.H. (2010). Sustainability and the Urban Forest: An Ecosystem Services Perspective. NATURAL RESOURCES JOURNAL. [Online] 51(n/a). Available from: http://ssrn.com/abstract=1722650. [Accessed 22/11/14]

Hourihan, K. (2000) Urban planning in the twentieth century. Urban History, 27(3). p. 390-396.

Hough, M. (1994)."City Form and Natural Processes, London: Croom Helm," In: G. Haughton, and C. Hunter, (2004). Sustainable Cities. [Online] Available from: https://books.google.co.za/book. [Accessed 22/11/14]

Huang, D., Lu, C. and Wang, G. (2009). "Integrated Management of Urban Green Space: The Case in Guangzhou China," 45th ISOCARP Congress. [Online] Available from: http://www.isocarp.net/data/case_studies/1434.pdf. [Accessed 21/10/14]

Images for Svit Slovakia, https://en.wikipedia.org/wiki/Svit

Institute for Sustainable Development (IISD) (2010), Sustainable Development: From Brundtland to Rio 2012. Available from: http://www.un.org/wcm/webdav/site/climatechange. [Accessed 29/10/15]

Institute for International Urban Development, (2012). Sustainable Development vs. Sustainability (Brazil) (IIUD). Available from: http://i2ud.org/2012/06/sustainable-development-vs-sustainability/ [Accessed 20/10/14]

International Society of Environmental Botanists, (2000). Millennium Issue - Sustainable development. 6 (1). Available from: http://isebindia.com/about.html. [Accessed 22/08/15]

Isaac, J. (2013). Grey areas in greening cities. Science for sustainability, From Gray Areas to Green Areas: Developing Sustainable Practices in Preservation Environments (symposium). Available from: www.ecosmagazine.com. [Accessed 24/08/15]

Jackson, L. (2013). The History of Urban Trees in Europe. Available from: http://www.greenspacehealth.com/. [Accessed 30/03/14]

Jim, C. Y. (2004) Green-space preservation and allocation for sustainable greening of compact cities. Cities. 21(4). p. 311-320.

Johannesburg City Parks and Zoo (JCPZ). (2014) Public Dialogues Valuing Natural Capital.

Johnston, J. and Newton, J. (2004). Building Green: A guide to using plants on roofs, walls and pavements. London: Greater London Authority City Hall.

Kates, R.W., Parris, T.M. and Leiserowitz, A.A. (2005) What is Sustainable Development? Goals, Indicators, Values, and Practice. Environment. 47 (3). p. 10-21.

Keller, J.K. Konijnendijk, C.C. (2012) Short communication: a comparative analysis of municipal urban tree inventories of selected major cities in North America and Europe. Arboric Urban Forum. 38(1) p. 24–30.

Kemp, R., Parto, S. and Gibson, R.B. (2005) 'Governance for sustainable development: moving from theory to practice'. Int. J. Sustainable Development. 8 (1-2). p. 12–30.

Kitchener, R. and March, E. C. (2011) Developing a Sustainable Urban Forest. A Sustainable Urban Forest for Today and Future Generations. A REPORT TO KITCHENER'S ENVIRONMENTAL COMMITTEE MARCH 24, 2011.p. 1-11.

Kuo, F.E. and Sullivan, W.C. (2001). ENVIRONMENT AND CRIME IN THE INNER CITY: Does Vegetation Reduce Crime? ENVIRONMENT AND BEHAVIOR. [Online] 33 (3). p. 343-367. Available from: http://willsull.net/resources. [Accessed 14/09/14]

Kronenberg, J. (2014). Why not to green a city? Institutional barriers to preserving urban ecosystem services (Article in press), Sustainable Development Applications. [Online] No. 3. p. 32-40. Available from: http://www.sendzimir.org.pl/images/. [Accessed 10/08/14]

Labuschagne, A. (2003). Qualitative research: Airy fairy or fundamental? The Qualitative Report. [Online] 8(1), Article 7. Available from: http://www.nova.edu/ssss/QR/QR8-1/labuschagne.html. [Accessed 05/01/15]

Larinde S. L. and Oladele, A.T. (2014). Edible Fruit Trees Diversity in a Peri-Urban Centre: Implications for Food Security and Urban Greening. Journal of Environment and Ecology. 5 (2). p. 234-246.

Lawrence, H.W. (2006). City Trees. Charlottesville: University of Virginia Press.

Leedy, P. and Ormrod, E. (2010), Practical Research Planning and Design. Boston: Pearson Education.

Lewis, M.P. (2008). The impact of challenges facing land use management on property development and possible ways towards addressing these challenges", pp 128 – 141 in Lewis, M.P., Coetzee, M.J., Davies, G. and Kihato, M. (Editors), (2008): Planning Africa 2008: Shaping the Future. E-proceedings of the Planning Africa 2008 Conference, Sandton, South Africa

Litman, T (2015), Victoria Transport Policy Institute: Smart Growth Reforms, Changing Planning, Regulatory and Fiscal Practices to Support More Efficient Land Use. Available from: http://www.vtpi.org/smart_growth_reforms.pdf [Accessed: 25/04/16]

Local Government Handbook (South Africa), (2014). A complete guide to Municipalities in South Africa. [Online] Available from: www.munucipalities.co.za. [Accessed 11/07/15]

Maheswaran, R. (2010). The health benefits of urban green spaces: a review of the evidence. Journal of Public Health. [Online] 33 (2). p. 212–222. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20833671. [Accessed 02/03/15]

Makhelouf, A. (2009). The Effect of Green Spaces on Urban climate and Pollution. Journal of Environmental Health Science & Engineering. [Online] 6 (1). p. 35-40. Available from: http://ijehse.tums.ac.ir/index. [Accessed 17/07/14]

Mapes, J. and Wolch, J. (2011). "Living Green": The Promise and Pitfalls of New Sustainable Communities. Journal of Urban Design. [Online] 16 (1). p. 105–126. Available from: http://www.tandfonline.com. [Accessed 07/07/15]

Martin, N.A., Chappelka, A.H., Keever, G.J., Loewenstein, E.F., (2011). A 100% tree inventory using i-tree eco protocol: a case study at Auburn University, Alabama, US. Arboric Urban Forum [Online] 37(5). p. 207–212. Available from: http://www.auburn.edu/administration/facilities/organization/university. [Accessed 21/05/15]

Martin, C. A., Warren, P. S. and Kinzig, A. (2004). Neighbourhood socio-economic status is a useful predictor of perennial landscape vegetation in small parks surrounding residential neighbourhoods in Phoenix, Arizona. Landscape and Urban Planning. [Online] 69 (n/a). p. 355–368. Available from: https://www.deepdyve.com/lp/elsevier/neighborhood. [Accessed 02/02/15]

Massey, D., Allen, J. and Pryke, M. (1999), Unsettling the Cities. London: Routledge.

Mazza, P. (2010). Re-Greening Cities: The Carbon Landscape Green spaces and green infrastructure to build bio carbon and climate resiliency while saving energy and tax dollars, Ecosystem Science for Policy and Practice. [Online] Available from: http://www.europarc.org/ [Accessed 10/03/15]

Mensah, A.C. (2014). Nature and Challenges of Urban Green Spaces in Africa. International Journal of Ecosystem. [Online] 4(1). p. 1-11. Available from: http://www.researchgate.net/publication/259779329_Urban_Green_Spaces_in_Africa_Nature_and_Challenges. Accessed 15/07/15]

Mentis, M. (2010). Environmental Risk Management in South Africa. Johannesburg: Longman.

Merk, O., Saussier, S., Staropoli, C., Slack, E., Kim, J.H. (2012). Financing Green Urban Infrastructure‖, OECD Regional Development Working Papers 2012/10. [Online] OECD Publishing. Available from: http://dc.doi.org/10.1787/5k92p0c6j6r0-en. [Accessed 13/05/15].

Michael, S. N., and Hull, R. B. (1994). Effects of vegetation on crime in urban parks. Blacksburg: Virginia Polytechnic Institute and State University, College of Forestry and Wildlife Resources, Department of Forestry.

Michael, S. N., Hull, R. B. & Zahm, D. L. (1999). Environmental factors influencing auto burglary: A case study. [Online] Manuscript submitted for publication. Available from: http://eab.sagepub.com/content/33/3/368.short. [Accessed 14/03/15]

Middleton, C.H., Jones, R.J., Shelton, H. M., Petty, S. R. and Wildin, J.H. (1995), Leucaena in Northern Australia, In Shelton, H. M., Piggin, C.M, and Brewbaker, J.L (eds), workshop held in Bogor, Indonesia. ACIAR Proceedings. 57 (n/a). p. 214 -221.

Milburn, L. A. (2009). Greening Cities, Growing Communities: Learning from Seattle's Urban Community Gardens. Landscape Journal. 29(n/a). p. 238–239.

Milton, K. (2002). Loving Nature: Towards Ecology of Emotion. New York: Routledge.

Morphet, J. (1999). Unpublished study by Birmingham University for Department of the Environment. [Online] Available from: http://www.birmingham.ac.uk/index.aspx. [Accessed 30/03/15]

Morelli, J. (2011) "Environmental Sustainability: A Definition for Environmental Professionals," Journal of Environmental Sustainability. 1 (2). p. 19-26.

Morris, N. (2003) Health, well-being and open space: literature review. Edinburgh Open space. Edinburgh College of Art and Heriot-Watt University.

Mothilal, A. and Bradley, C. (2014) Pietermaritzburg Urban Renewal Project. Pietermaritzburg: Department of Civil Engineering. South Africa.

Mouton, J., (2011). How to succeed in your Master's & Doctoral Studies, A South African Guide and Resource Book. Pretoria: Van Schawk Publishers.

Mpofu, T. P. Z. (2013). Environmental challenges of urbanisation: A case study for open green space management. Research Journal of Agricultural and Environmental Management. 2(4). p. 105-110.

Naess, P. (2000). Urban Planning and Sustainable Development. European Planning Studies. 9(4). p. 503-524.

Naidoo, E – Head of Department of Infrastructure and Techinical Services, 24 April, 2015

South Africa. Department of Environmental Affairs and Tourism (2008). National Framework on Sustainable Development: Pretoria. [Online] Available from: https://www.environment.gov.za/sites/default/files/docs [Accessed 27/11/14]

Neelam, B., Bhandar, D.C., Kapoor, K., Bhatnagar, N. and Kapoor, P. (1993). Competition in the early establishment phases of an even aged mixed plantation of

Leucaena leucocephala and Acacia nilotica. Forest Ecology and Management. [Online] 57(1-4). p. 213 – 231. Available from: http://www.sciencedirect.com/science/article. [Accessed 12/06/15]

Newman, P. and Jennings, I. (2008). Cities as sustainable ecosystems: principles and practices. Washington DC: Island Press,

Nicholson, L.D. (2000). The Greening of the Cities. London: Routledge & Kegan.

Nowak, D.J. and Walton, J.T. (2005). Projected urban growth (2000-2050) and its estimated impact on the US forest resource. Journal of Forestry. [Online] 103 (n/a). p. 383 – 389. Available from: http://www.fs.fed.us/ucf/. [Accessed 29/05/15]

Nowak, D.J. and Greenfield, E.J. (2012). Tree and impervious cover change in US cities. Urban Forestry & Urban Greening [Online] 11(n/a). p. 21–30. Available from: http://www.nrs.fs.fed.us/pubs/jrnl. [Accessed 12/07/14]

Ostberg, J., Delshammar, T., Wistrom, D. and Nielsen, A.B. (2013). Grading of Parameters for Urban Tree Inventories by City Officials, Arborists, and Academics Using the Delphi Method. Environmental Management [Online] 51 (3). p. 694-708. Available from: http://link.springer.com. [Accessed 07/08/15]

Parc de Joan Miró, http://www.barcelona.cat/

Patton, M. Q. (2002). Qualitative research and evaluation methods (3rd ed.), Thousand Oaks: Sage Publications.

Pataki, D.E. (2013). City trees: Urban greening needs better data. Nature International Weekly Journal for Science. [Online] 502 (7473). p. 624. Available from: https://www.bing.com/search. [Accessed 15/10/15]

Perini, K., Ottelé, M. & Haas, E.M. (2013) Vertical greening systems, a process tree for green façades and living walls. Urban Ecosystem. 16. p. 265–277.

Quick, B. (2010). Ways to Increase Public Awareness about Environmental Problems [Online]. Available from: http://classroom.synonym.com [Accessed 11/10/14]

Quintas, A.V. and Curado, M. J. (2007). The contribution of urban green areas to the quality of life. [Online] Available from: http://www.academia.edu. [Accessed 10/02/15]

Rhodes University: Department of Environmental Science, (2015). Attaining Sustainable Services from Ecosystem Services through Trade off Scenarios, Accessed from https://www.ru.ac.za/environmentalscience/research 15 October 2015.

Roy, S., Byrne, J. and Pickering, C. (2010). A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones, School of Environment. Urban Forestry & Urban Greening [Online]. 11 (4). p. 351–363. Available from: [Accessed 12/07/15]

Ryder, C.M. and Moore, G.M. (2013). The arboriculture and economic benefits of formative pruning street trees. Arboriculture & Urban Forestry. [Online] 39(1). p. 17–24. Available from: http://www.findanexpert.unimelb. [Accessed 01/08/15]

Rydin, Y. (2010). Governing for sustainable urban development. London: Earth scan.

South Africa. Statistics South Africa, 2011. [Online] Available from: http://www.statssa.gov.za. [Accessed 09/09/15]

Sandstrom, U., Angelstam, P. and Khakee, A. (2004). Urban comprehensive planning, identifying barriers for the maintenance of functional habitat network. Landscape and Urban Planning [Online]75 (1-2). p. 43-57. Available from: http://www.sciencedirect.com/science/article. [Accessed 09/09/15]

Satterthwaite, D. (2002). Coping with rapid urban growth. London: RICS Leader Edge Series.

Sauri, D., Pares, M. and Domene, E. (2009). CHANGING CONCEPTIONS OF SUSTAINABILITY IN BARCELONA ' S PUBLIC PARKS, The Geographical review, [Online] 99(I). p. 23–36. Available from: http://onlinelibrary.wiley.com. [Accessed 19/04/14]

Schonwandt, W. (2008). Planning in crisis: theoretical orientations for architecture and planning. Ashgate: Aldershot (UK).

Seeland, S., Dübendorfer, S. and Hansmann, R. (2009). "Making Friends in Zurich's Urban Forests and Parks: The Role of Public Green Space for Social Inclusion of Youths from Different Cultures," Forest Policy and Economics. [Online] 11(1). p. 10–17. Available from: http://www.journals.elsevier.com. [Accessed 13/07/14]

Seto, K, and Satterrhwaite, D. (2010). Interactions between urbanisation and global environmental change, Current Opinion in Environmental Sustainability, vol. 2: 127 – 128.

Seto, K. C., Reenberg, A., Boone, C. G., Fragkias, M., Haase, D., Langanke, T., Marcotullio, P., Munroe, D. K., Olah, B., & Simon, D. (2012). Urban land teleconnections and sustainability. PNAS, 109(20), 7687-7692.

Seymour, M. (2012). Just sustainability in urban parks, Local Environment: The International Journal of Justice and Sustainability. [Online] 17(2). p. 167–185. Available from: http://www.tandfonline.com/doi/full. [Accessed 16/05/14]

Shackleton, C. and Blair, A. (2010). Accessibility and perceptions of urban green space relative to availability in two small towns in South Africa. {Online] In Press Available from: https://www.deepdyve.com/lp/elsevier/perceptions-and-use-of-public-green-space. [Accessed 20/10/14: Unpublished]

Shanahan, D.F., Lin, B.B., Gaston, K.J., Bush, R. and Fuller, R.A. (2014). What is the role of trees and remnant vegetation in attracting people to urban parks? Landscape Ecology. [Online] 30 (1). p. 153–165. Available from: http://link.springer.com/article. [Accessed 12/01/15]

Sharin Govender (Project Manager in Environmental Planning), Department of Environmental Planning, 12 February 2015

Sister, C., Wolch, J., & Wilson, J. (2010). Got green? Addressing environmental justice in park provisions, Geo Journal. [Online] 75(3). p. 229-248. Available from: http://link.springer.com/article. [Accessed 19/09/15]

Smetana, S.M. and Crittenden, J.C. (2014) Sustainable plants in urban parks: A life cycle analysis of traditional and alternative lawns in Georgia, USA. LANDSCAPE AND URBAN PLANNING. 122 (n/a). p. 140-151.

Sola, A. O. (2014). Environmental Education and Public Awareness. Journal of Educational and Social Research. 4(3). p. 233-237.

Sorensen, M., Smit, J., Barzetti, V. and Williams, J. (1997). "Good Practices for Urban Greening,"Inter-American Development Bank. [Online]. Available from: http://www.iadb.org/sds/doc/ENV109KKeipiE.pdf. [Accessed 14/02/14]

South Africa. Department of Environmental Affairs. (2014). National Strategy for Sustainable Development and Action Plan 1 (NSSD 1) 2011–2014. Pretoria

South Africa. National Treasury (2010). The Framework for Strategic Plans and Annual Performance Plans. [Online] Available from: www.treasury.gov.za. Accessed 13/06/15]

Statistics South Africa, (2012). Census 2011. [Online]. Available from: http://www.statssa.gov.za. [Accessed 20/10/15]

South Africa. Government Gazette: NATIONAL ENVIRONMENTAL MANAGEMENT PRINCIPLES (2005). [Online] 401 (19519) Available from: https://www.environment.gov.za/sites/. [Accessed 12/12/14]

Spangenberg, J.H. (2004) Reconciling sustainability and growth: criteria, indicators, policies. Sustainable development. 12(2). p. 74–86.

Takano, T., Nakamura, K., Watanabe, M. (2002). Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. Journal of Epidemiology Community Health. [Online] 56 (n/a). p. 913–918. Available from: http://jech.bmj.com/content/56/12/913.full. [Accessed 19/07/14]

Teriman, T. Y. S. (2013) Rethinking sustainable urban development : towards an integrated planning and development process, Journal of Environmental Planning and Management 56(5). p. 695–719.

Teriman, S. and Yigitcanlar, T. (2015). Rethinking sustainable urban development : towards an integrated planning and development process. International Journal of Environmental Science and Technology. [Online] 12 (1). p. 341-352. Available from: http://link.springer.com/article. [Accessed 20/11/14]

Troy, A.R, Grove, J.M, O'Neil-Dunne, J.P.M, Pickett, S.T.A, Cadenasso, M.L, (2007). Predicting opportunities for greening and patterns of vegetation on private urban lands, Environmental Management. [Online] 40 (3). p. 394 - 412 Available from: http://link.springer.com/article. [Accessed 19/09/15]

uMhlathuze Local Municipality: (Draft) SDF Review 2014/2015. FINAL DRAFT 30 JUNE 2014

UMhlathuze Annual Report, (2012/13). DRAFT ANNUAL PERFORMANCE REPORT. [Online] Available from: http://www.umhlathuze.gov.za/docs-umhlathuze/perfomance-man/apr/2012-2013.pdf. [Accessed 05/01/15]

UMhlathuze Municipality (2012), Gearing for Economic Growth, 2011/2012 Annual Report. Available from: http://www.umhlathuze.gov.za/. [Accessed 20/12/14]

UMhlathuze Municipality Draft 2010/2011 Integrated Development Plan. March 2010 Available from: http://www.umhlathuze.gov.za/docs-umhlathuze/idp/idp2010-2011.pdf.

UMhlathuze Local Municipality: (Draft) SDF Review 2014/2015 (http://www.umhlathuze.gov.za).

UMhlathuze Wami, The official newsletter of the City of uMhlathuze February, 2014.

United Nations Population Fund (UNPF) (2007). State of world population: unleashing the potential of urban growth. Available from: http://www.unfpa.org/swp/.2007. [Accessed 23/12/14]

Unknown Author. ((2015). Landscape, Mexico Urban Design. [Online] Available from: https://pricetags.wordpress.com. [Accessed 11/10/15]

URGE-Team (2004) Making Greener Cities – A Practical Guide. UFZ-Bericht, 8(37) (Stadtökologische Forschungen).

USA. Millennium Ecosystem Assessment (2005), Ecosystems and Human Well-being: Synthesis. Washington DC: Island Press.

U.S. National Research Council, Policy Division, Board on Sustainable Development (1999). Our Common Journey: A Transition Toward Sustainability. Washington, DC: National Academy Press.

Varese, G. B, Ugo Bertelli, (2001), Development of Urban Green Spaces to Improve the Quality of Life in Cities and Urban Regions. Planning Criteria. Available from: www.planning.odpm.gov.uk, [Accessed 12/02/15]

Vasishth, A. (2008). A scale-hierarchic ecosystem approach to integrative ecological planning. Program Plan 70(3). p. 99–132.

Walliser, A., Rajkovich, N. B. and Forester, J. (2012). Exploring the Challenges of Environmental Planning and Green Design. Cases from Europe and the USA, 13(1). p. 113–174.

Wheeler, S. (2004) Planning for sustainability: creating liveable, equitable, and ecological communities. New York: Routledge.

White, R (2008). Sustainable Development in Urban Areas: An Overview

Williams, R.A. (2000). ENVIRONMENTAL PLANNING FOR SUSTAINABLE URBAN DEVELOPMENT. Caribbean Water and Wastewater Association 9th Annual Conference & Exhibition at Chaguaramas, Trinidad 2 - 6 October 2000. [Online] Available from: http://www.bvsde.paho.org. [Accessed 10/09/15]

Wolch, J.R., Byrne, J. and Newell, J.P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough' Landscape and Urban Planning. [Online] 125 (1). p. 234 – 244. Available from: http://urbansustainability.snre.umich.edu/wp-content. [Accessed 12/06/15]

Wolf, K.L., and K. Flora 2010. Mental Health and Function - A Literature Review. In: Green Cities: Good Health. [Online] Available from: www.greenhealth.washington.edu. College of the Environment, University of Washington. [Accessed 29/08/14]

Young, F.R. (2010). The greening of Chicago: environmental leaders and organisational learning in the transition toward a sustainable metropolitan region. Journal of Environmental Planning and Management. 53 (8). p. 1051-1068.

Young, R. (2011). "Planting the living city: best practices in planning green infrastructure – results from major US cities". Journal of the American Planning Association 77 (4). p. 368-381.

Zhao, P. (2010) Sustainable urban expansion and transportation in a growing megacity: consequences of urban sprawl for mobility on the urban fringe of Beijing. Habitat International. 34(2):236–243.

Zhao, J.J., Chen, S.B., Jiang, B., Ren, Y. and Wang, H. (2013). Temporal trend of green space coverage in China and its relationship with urbanization over the last two decades. Science of the Total Environment. [Online] 442 (n/a). p. 455–465). Available from: http://www.sciencedirect.com/science/article. [Accessed 22/04/15]

Zhou, X. and Wang, Y. (2011). Spatial–temporal dynamics of urban green space in response to rapid urbanization and greening policies. Landscape and Urban Planning. [Online] 100 (3). p. 268-277. Available from: http://scholarbank.nus.edu. [Accessed 27/05/15]

APPENDICES

APPENDIX A1: INTERVIEWS TRANSCRIPTS

DEPARTMENT OF CITY DEVELOPMENT AND PLANNING WITH MS SHARIN GOVENDER (PROJECT MANAGER: ENVIRONMENTAL PLANNING) – 12/04/15

1. In terms of resources for planning, is your department well financed?
2. Are there any policy obstacles that reduce the efficiency and effectiveness of your department?
3. Has it been easy to implement new plans, what challenges do you face as a department?
4. How effective has physical planning helped to conserve/protect urban vegetation or open green spaces in the city of UMhlathuze? (See the answer to question 10)
5. Have regulatory bodies or instruments like EIAs helped to protect vegetation and other green areas in the city especially in the peri-urban area?
6. In your planning process are there attempts to increase open spaces or create more green spaces from places already occupied by urban land uses?
7. Has planning been able to bring social, economic and environmental transformations in areas of the city? (See answer to question 16).
8. Have politicians and political parties helped you in achieving your policy objectives or to come up with suggestions to help you achieve your planning objectives?
9. To what extend have local authorities responded positively to your environmental advice when it comes to economic investments priorities in the city?
10. Are there any instances where your department has had to re-plan city areas that are already up and running in an attempt to improve city vegetation and sensitive areas? State such areas, has this been successful, implemented, or being implemented or still on paper?

11. Do you think there is a balance between socio economic developments and environmental development in the city? Which side is losing and why? (See the answer to question 16).

12. Urban planning need to take a long term view and incorporate services that promote sustainable development like provision of services and infrastructure, waste management, pollution levels and ecological conservation. Does the planning department have any long term plans that cover the above fields?

13. Does the municipality have an Environmental Advisory Task Team (EATT) that works with the planning department to safeguard green areas and sensitive areas in the city? If not who provides this advice?

14. Which other municipal departments and independent departments do you work with to increase the greenness or open green spaces of the city?

15. If you are comparing planning in the past and now, has there been any reform in the methods of urban planning? Elaborate.

16. Considering the city of UMhlathuze, would you say or agree that there is a radical shift towards socio-ecological approach in open space planning, designing and maintenance?

APPENDIX A2: <u>INTERVIEW QUESTIONS:</u> DEPARTMENT OF CITY DEVELOPMENT AND PLANNING WITH MRS BRENDA STRACHAN (HOD) -10/02/15

1. In terms of resources for planning, is your department well financed?
2. Are there any policy obstacles that reduce the efficiency and effectiveness of your department?
3. Has it been easy to implement new plans, what challenges do you face as a department?
4. How effective has physical planning helped to conserve/protect urban vegetation or open green spaces in the city UMhlathuze?
5. Have regulatory bodies or instruments like EIAs helped to protect vegetation and other green areas in the city especially in the peri-urban area?
6. In your planning process are the attempts to increase open spaces or create more green spaces from places already occupied by urban land uses?
7. Has planning been able to bring social, economic and environmental transformations in areas of the city?
8. Have politicians and political parties helped you in achieving your policy objectives or to come up with suggestions to help you achieve your planning objectives?
9. To what extend have local authorities responded positively to your environmental advice when it comes to economic investments priorities in the city?
10. Are there any instances where your department has had to re-plan city areas that are already up and running in an attempt to improve city vegetation and sensitive areas? State such areas, has this been successful, implemented, or being implemented or still on paper?
11. Do you think there is a balance between socio economic developments and environmental development in the city? Which side is losing and why?
12. Urban planning need to take a long term view and incorporate services that promote sustainable development like provision of services and infrastructure, waste management, pollution levels and ecological conservation. Does the planning department have any long term plans that cover the above fields?
13. Does the municipality have an Environmental Advisory Task Team (EATT) that works with the planning department to safeguard green areas and sensitive areas in the city? If not who provides this advice?

14. Which other municipal departments and independent departments do you work with to increase the greenness or opens green spaces of the city?

15. If you are comparing planning in the past and now, has there been any reform in the methods of urban planning? Elaborate.

16. Considering the city of UMhlathuze, would you say or agree that there is a radical shift towards socio-ecological approach in open space planning, designing and maintenance?

APPENDIX A3: INTERVIEW SAMPLE: COMMUNITY SERVICE DEPARTMENT.

DEPARTMENT OF PARKS AND RECREATION

INTERVIEWEE: MR ERNST van BILJON Date conducted: 10/04/2015

PART 1: COMMUNITY SERVICE DEPARTMENT

A. COMMUNITY PROJECTS

1. Are there any moves to include schools, churches and other public entities in planting more trees in the city?
2. Are there any outreach programs to try and raise awareness in communities on importance of planting more trees?
3. Which community services have you prioritized in your department and to what extent are you meeting these priorities?
4. Are there any tree planting projects that are being done in collaboration with local communities?
5. Is there a team or committee overseeing the planting and improvement of urban vegetation?
6. State some of the main community projects that have been carried out to uplift the quality of lives of the people in this city
7. Are there voluntary projects to plant street trees or city trees and maintain them?

B. VEGETATION AND STREET TREES

1. Who is responsible for planning and deciding which streets and city sections should vegetation be planted?
2. Who is responsible for planting trees around the city?
3. Road rehabilitation seems to focus on more on grassing than vegetating these areas? Why grass instead of trees? Is it a question of affordability and simplicity in grassing?
4. Is there any monitoring and maintenance of recently planted trees? Are old cut down trees replaced.
5. Does the city provide free trees to people in the neighbourhood who would like to plant them in their yards or along their streets?

6. Are there any major projects lined up by the city or your department that focus on improving city vegetation?

7. Do you think most of the communities are aware of the importance of vegetation in the city and in their lives? Do you think they are doing enough to improve city vegetation?

8. Is the private sector helping in greening the city?

9. What challenges are you facing in trying to improve neighbourhood open spaces, street trees and city vegetation?

C. POLICIES

1. Are there any policies that your department uses or follows in greening the city? How old are these policies?

2. Is there a plan or plans to revitalise urban forests in the city?

3. Would you agree to the statement that socio economic development is at par with environmental or ecological development in the city? Expand your answer.

4. If you compare policies in the past (before 1994) and today, are there any changes that have been made to enhance the operation of your department? (Name a few of these changes)

5. Are there any policies that you feel need to be removed or improvement to bring better development in the city?

6. In most cities today 'development should be sustainable – meet today's needs without compromising needs of the future generations. Would you say sustainable development is taking place in the city?

7. Which other departments are you working with to ensure an improvement in city vegetation?

PART 2: PARKS AND RECREATION

1. Who is responsible for planning and identifying land for new parks?

2. Is there any effort to develop more parks and improve those that are there?

3. When developing a new park, what type of infrastructure is prioritised or provided?

4. Recreational activities can take place in open green spaces without developing these into parks. Are there any green spaces in the city that are being developed for this purpose?

5. Does the city have an inventory of street trees in the city and are there any plans to have one. If not what are the reasons/challenges?

6. Are open spaces in the city being threatened by urban expansion? If yes how big is the threat of urban growth on already existing open spaces? Are there any open spaces that have been lost to new developments?

7. Would you say in the past 10 years, there has been an increase or decrease in the number of private and public parks in the city?

8. Do you think the number of green spaces in the city is increasing in a matching way to urban growth? OR is there a balance between economic development and environmental development in the city? Any reason(s) for the imbalance?

9. There are many open spaces that are left out and unmaintained, can trees and vegetation be planted in these areas to improve the aesthetic value of the city?

10. There are many open spaces in the city where more trees can be planted. Is there a criterion that is followed in deciding on areas where trees are to be planted?

11. Is there any competition for city land between parks/recreations and commercial and industrial development?

12. Is the general public using parks as you envisioned?

13. Is anything being done to bring more people into these parks to enjoy and spent time?

14. Do you think the ecological environment of the city together with its parks and green open spaces have helped to bring more business into the city?

APPENDIX A4: INTERVIEW SAMPLE QUESTIONS: DEPARTMENT INFRASTRUCTURE AND TECHNICAL SERVICES WITH Mr NAIDO (HOD): (Appendix A4).- 24/04/15

Provision of a sound and sustainable transport system is built upon a good road infrastructure. In the process of providing better roads green spaces can be encroached and destroyed as seen in the photograph below. A view on how roads development impacts on green spaces of the city is the main aim of this interview.

1. Briefly describe the roles and responsibilities of Infrastructure and Technical Services Department.
2. Does planning of roads in the city fall under your department?
3. When road sides and islands are vegetated, does this improve quality of roads in the city?
4. Is your department involved in any way in road rehabilitation or improvement through planting of vegetation?
5. When urban roads are being laid or repaired what ecological measures are taken to safeguard green spaces or city vegetation?
6. Are there areas where new roads are being planned for or under construction in the city?
7. Which other municipal or government department closely works with your department especial in development and improvements of city roads.
8. Which policies guide your department in dealing with ecological systems in the city?
9. What challenges are you facing in trying to improve roads in the city?
10. Roads can be designed to protect natural and cultural resources. Do you think this is fully complied with in developing city roads?
11. Conventional guidelines for transportation safety regard trees as roadside fixed objects that constitute driving hazards but urban foresters, designers and planners encourage tree planting to improve urban streets and roads. What's your comment on this regarding roads in the city?
12. Some roads have Islands of grass, is there any problem if these divides can be vegetated?
13. Thank you very much, is there any other office that you think can help me in this line of research?

APPENDIX A5: North Myrtle Beach Park and Sports Complex in South Carolina (http://nmbpark.com/)



APPENDIX A6: QUESTIONNAIRE FOR RESIDENTS

TITLE OF THE RESEARCH: **A critical examination of the relationship between urban greenness and sustainable development of urban spaces in UMhlathuze . Kwa-Zulu Natal, South Africa**

This questionnaire is for a University of the Witwatersrand masters student (Fidelis Chihambakwe, Student No. 849075 Email address: 849075@students.wits.ac.za or chi.fidelis@gmail.com Tel: 0718899556) in the School of Geography, Archaeology and Environmental Studies researching on the relationship between greenness and sustainable development in urban spaces in the city of UMhlathuze. Completion of this questionnaire is taken to mean that you agree to take part in this study. The information you are going to provide will be treated with confidentiality and will ONLY be used for research purposes. *Thank you in advance for your assistance.* Please write your response to the questions in the spaces provided; indicate your answer with an X (**×**) where you are required to choose an answer.

A. GENERAL INFORMATION

1. In which residential area do you live in currently:

Richards Bay ( ) Esikhawini ( ) Mzingazi ( ) Empangeni suburbs ( ) others ( )

2. For how long have you been living here? **Less than 1 year ( ) between 1 to 10 years ( ) more than 10 years ( )**

3. Where were you staying or living before you moved to your present suburb?

_____

4. What was the reason for moving to the current address or suburb?

_____
_____

5. Which of the following types of ownership applies to you?

Owner with title deeds ( ) owner but still buying ( ) tenant/renting ( ) living with a friend/relative ( ).

6. a) Do you make use of a flower or vegetable garden or open green space with trees (fruit trees)? **Yes ( ) No ( )**

b) Specify the type of garden:

_____

7. If yes, how big is your garden? **Less than 7 m^2 ( ) between 7 and 20 m^2 ( ) more than 20 m^2 ( ).**

8. a) Is there a nearby park, playing field or open green space in your suburb?

Yes **( )** No **( )**

b) Choose the type of park or recreational area nearest to your place of residence

Recreational park ( ) sports playground ( ) golf course ( ) open green space with no facilities ( )

9. a) If you sometimes visit a nearby park/playground or open green space how accessible is it from your place of residence and how often do you or your family members visit this park?

   _____

   _____

   _____

b) If you are driving how many minutes will it take to get there? _____

c) If you are walking how many minutes will it take to get there? _____

10. If you do not visit any park/playground or open green space, would you want to have a park or any open green space near your home? Give a reason for your answer.

_____

_____

B. <u>DEVELOPMENT IN YOUR AREA</u>

1. Are the roads, telephone lines, tapped water and other infrastructure services like parks and outdoor recreational areas well developed and available in your area?
   Yes ( ) No ( )

2. If no which services are lacking or poorly developed in your area?

_____

3. Has your residential area expanded in the last 10 years? **Yes ( ) No ( ).**

4. If yes how has this expansion affected natural vegetation in the area?

_____
_____
_____

5. Do you think the local municipality is doing enough to protect and preserve green spaces or natural vegetation in your area? **Yes ( )** **No ( )**
6. If **yes** what are they doing?
   _____

_____
_____

7. If No what do you think they should do to reverse the situation?

_____
_____
_____

8. How would you describe the street trees in your residential area or suburb and along roads? **No vegetation at all ( ) very sparse ( ) dense ( ) very dense ( )**
9. Do you think the local residents and municipality are doing enough to plant more trees, grass, flowers and agricultural crops around your area or in your suburb? **Yes ( ) No ( ).**
10. Is your area under threat from the growth of informal (squatter) settlements or informal activities that clears or remove natural vegetation? **Yes ( ) No ( )**

If yes describe the threat

_____
_____

11. Does the municipality or Department of parks carry out any green space or vegetation protection awareness programs in the media, in schools or in your area? **Yes ( )** **No ( )**
12. If yes describe the awareness program you have seen or heard _____

_____
_____

13. Which of the following land uses do you think should be given priority on available open land in your town?

    A. Construction of more houses **( )**

B. Building more shops and other needed infrastructure in the area **( )**

C. Farming activities like vegetable growing, fruit farming etc **( )**

D. Develop parks, play grounds **( )**

E. Conserve natural vegetation and plant more trees **( )**

14. Do you think your suburb or city of UMhlathuze need more trees or green spaces?

Yes ( ) No ( ), If **yes**, for what purpose?

_____

_____

If **No ( )** why do you say so?

_____

_____

_____

15. What do you think should be done in your area to make sure that development and green areas work together? _____

_____

_____

16. a) Do you have pets that need to be walked around? **Yes ( ) No ( )**

b) If you have pets how often do you walk your pet around? **Daily ( ), after 2 to 3 days ( ) after 4 to 6 days ( ) weekly ( ) none ( ).**

c) If your answer to the above question is none, please explain why? _____

_____

_____

_____

17. Do have young children between 2 and 20 years living with you? **Yes ( ) No ( ).** How many? _____

18. a) How often do you take them out to parks or sports fields?

Weekends ( ) weekly ( ) Once per month ( ) When I get time ( ) none ( )

b) State a reason for the choice of your answer

_____

_____c)

Do you think having more green spaces around you or in a town can improve people's quality of life?

Yes ( ) **No ( )**

d) Give a reason for your answer _____

_____

_____

_____

19. In many municipalities there is competition for resources and priority between economic development (having more industries, creating jobs, building more houses and roads) than environmental development (improving and increasing parks, planting more vegetation, preserving forests, increasing crop farming/horticulture farming) and environmental development always loose.

Is this **fair? Yes ( ) No ( )**? Briefly outline what you think should be done to improve the imbalance above

_____

_____

_____

20. If the municipality is going to come up with a policy that says each family should at least plant one tree or fruit tree in their yard or around their area, would you support it? **Yes ( )** **No ( )**

21. If you have any more comments on the theme of urban greenness and sustainable development please write them here.

_____

_____

_____

_____

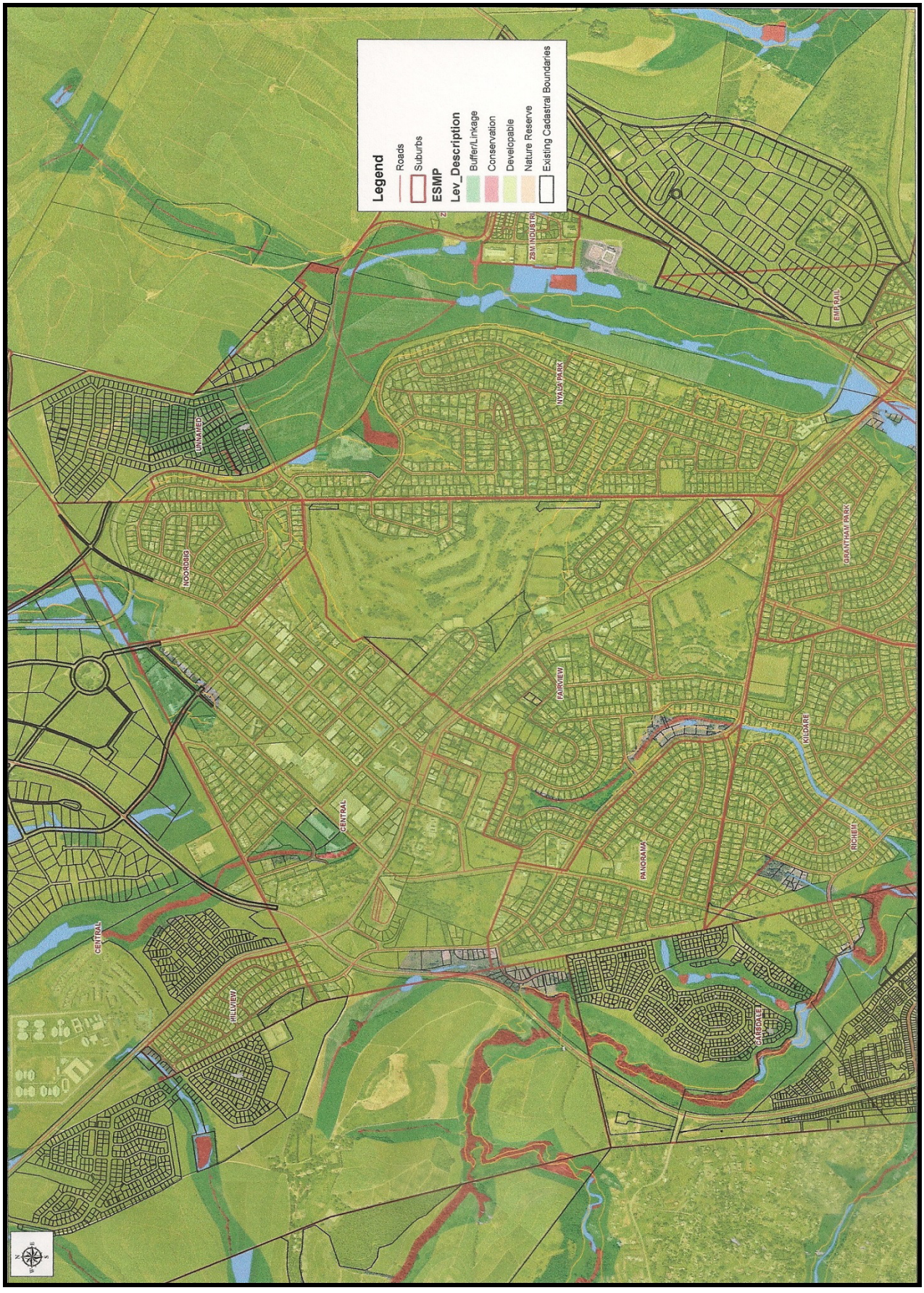
_____

_____

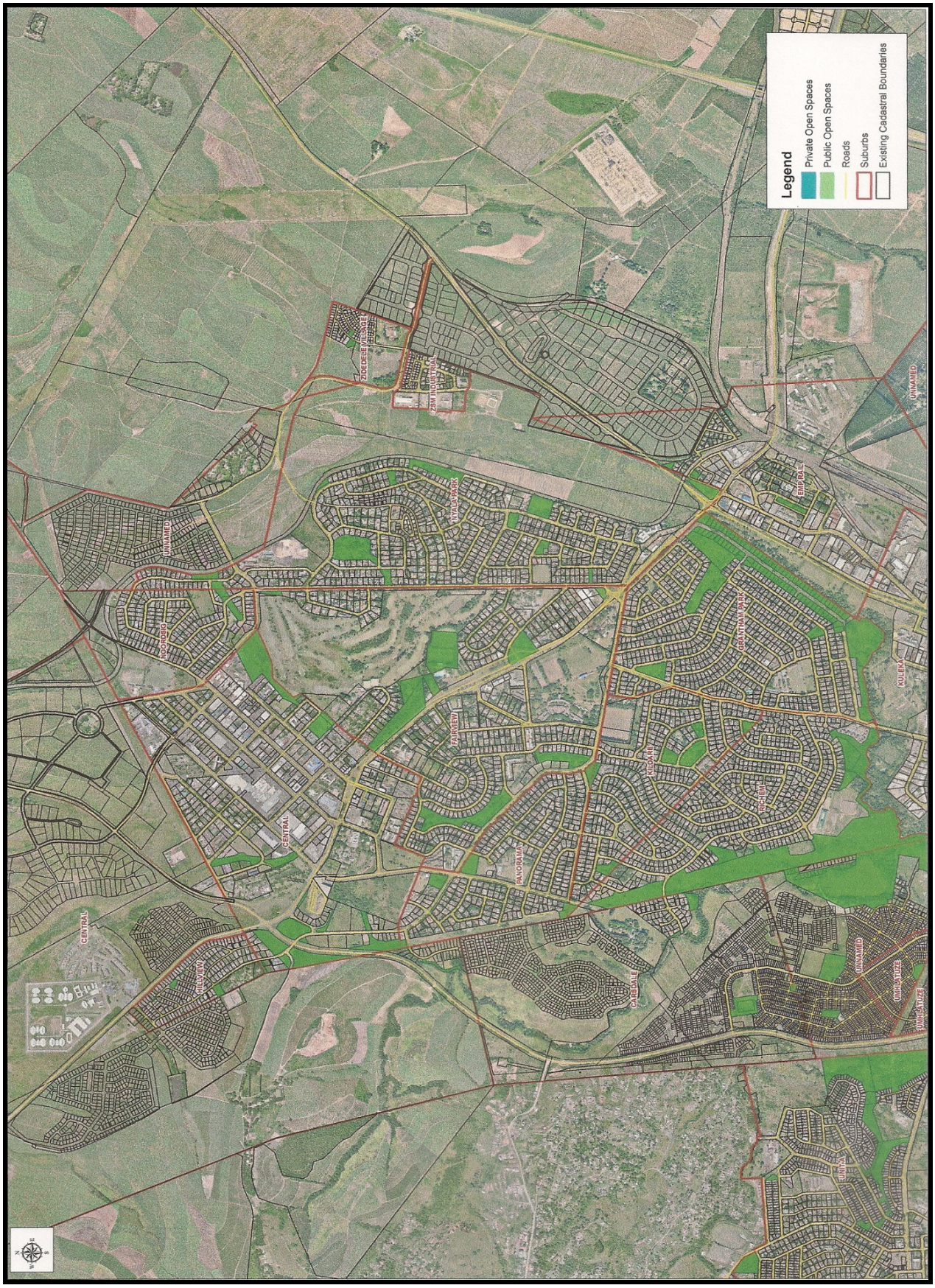
_____

THANK YOU FOR YOUR TIME.

Appendix B 1: Map of Empangeni Environment



Appendix B2: Map of Empangeni Open spaces



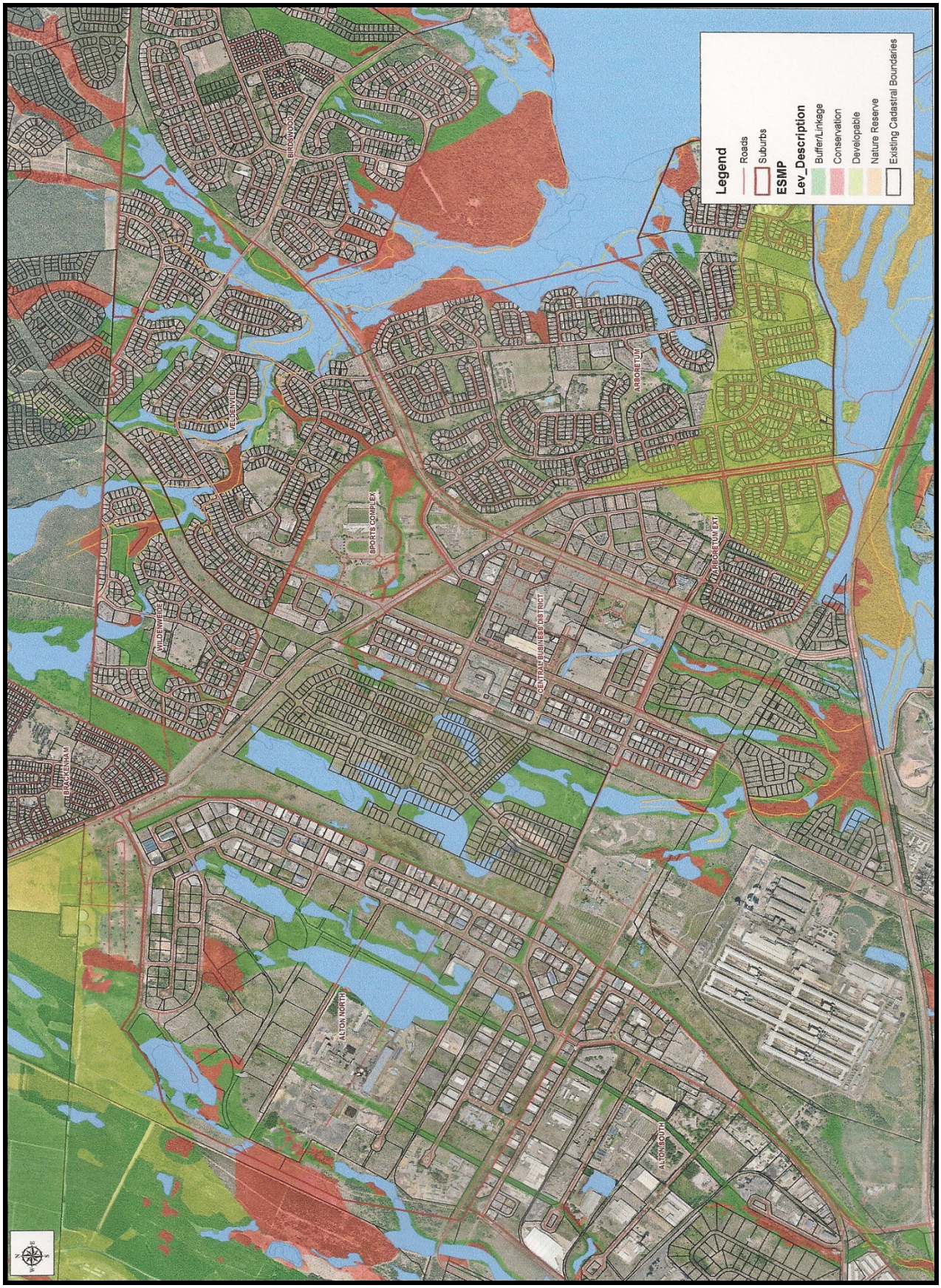
Appendix B3: Street Map of Empangeni Town



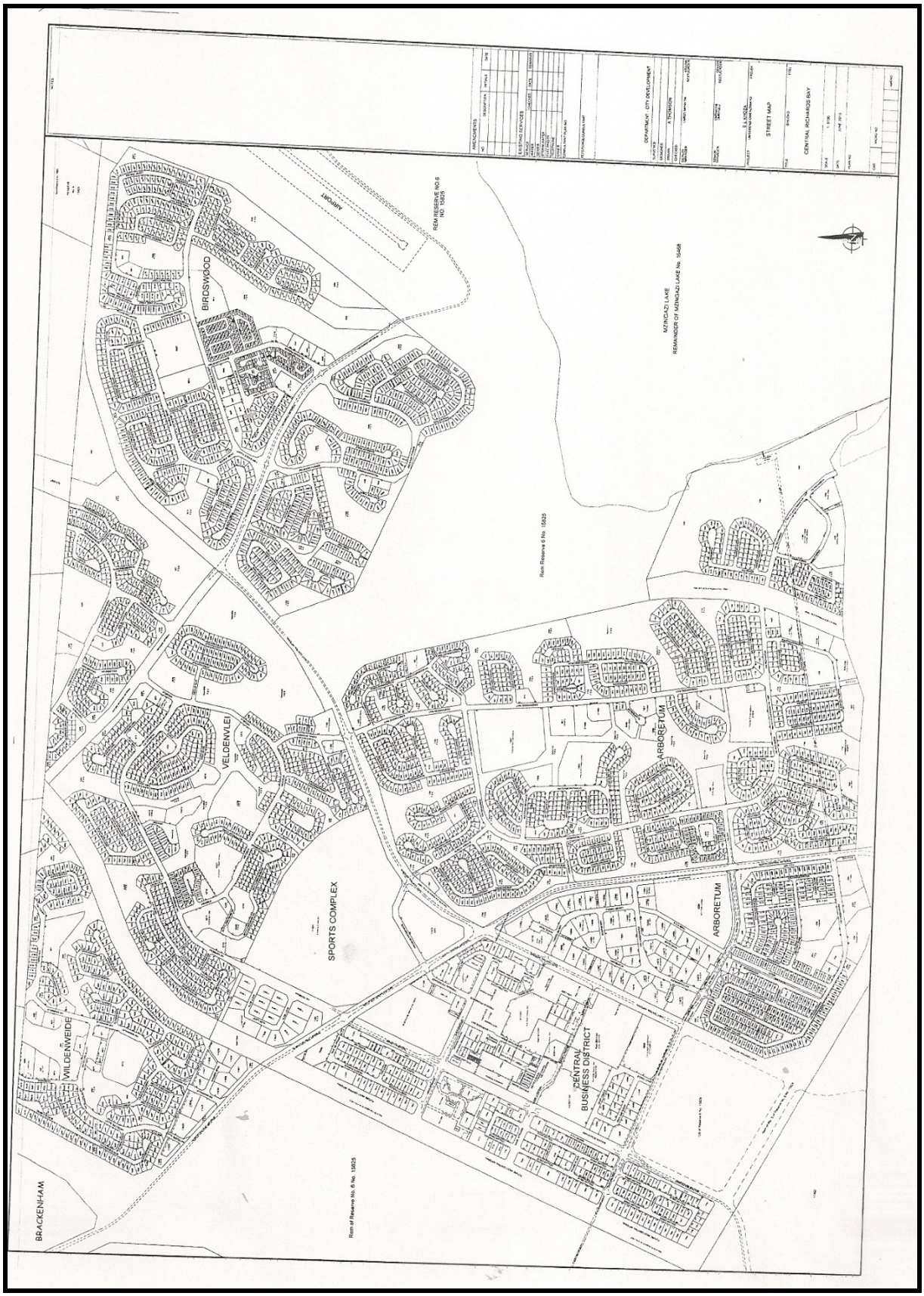
Appendix C1: Map of Richards Bay Open Spaces



Appendix C2: Map of Richards Bay Environment



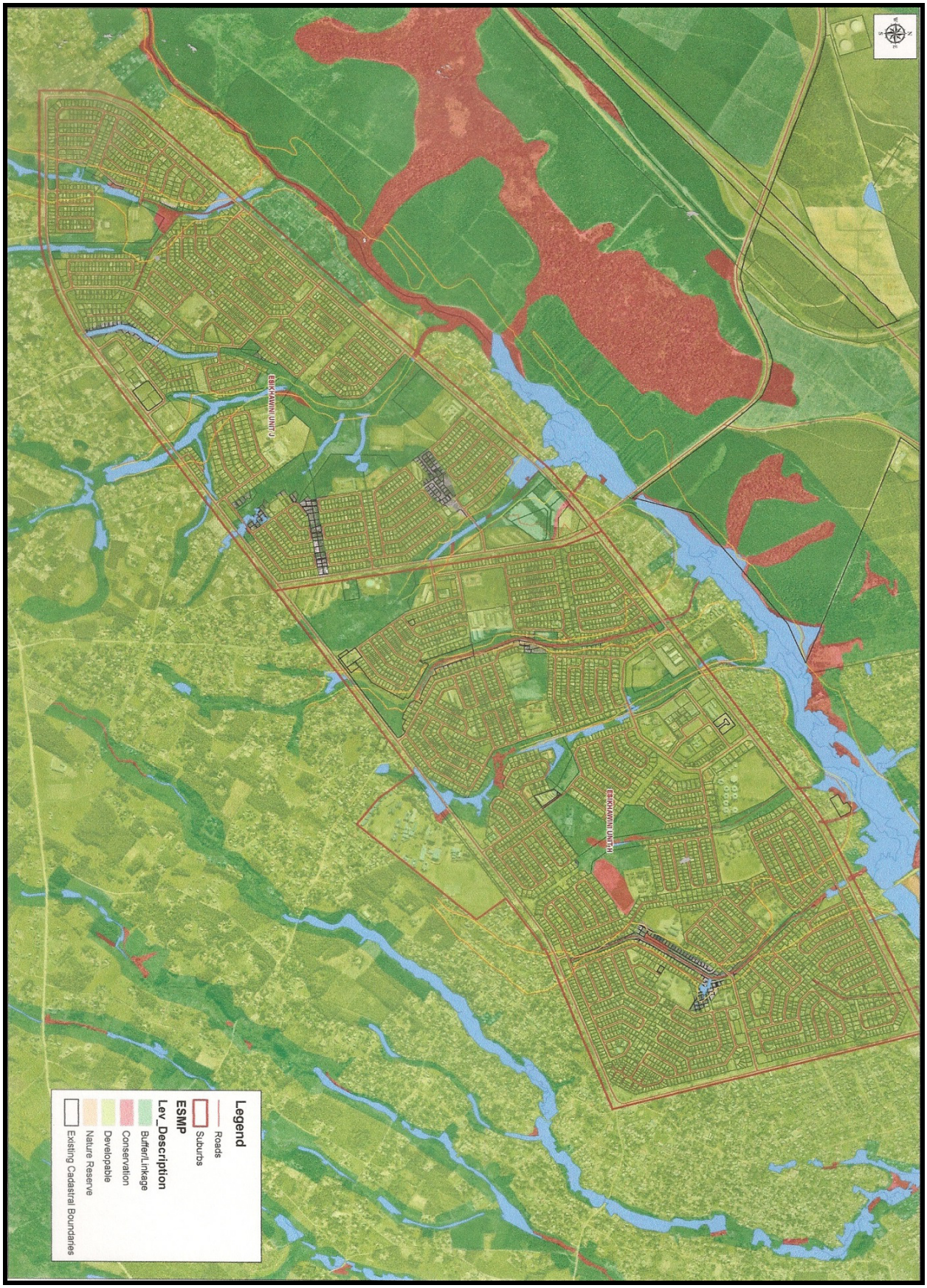
Appendix C3: Street Map of Richards Bay



Appendix D1: Map of Esikhawini H & J Open Spaces



Appendix D2: Wetland Map of Esikhawini



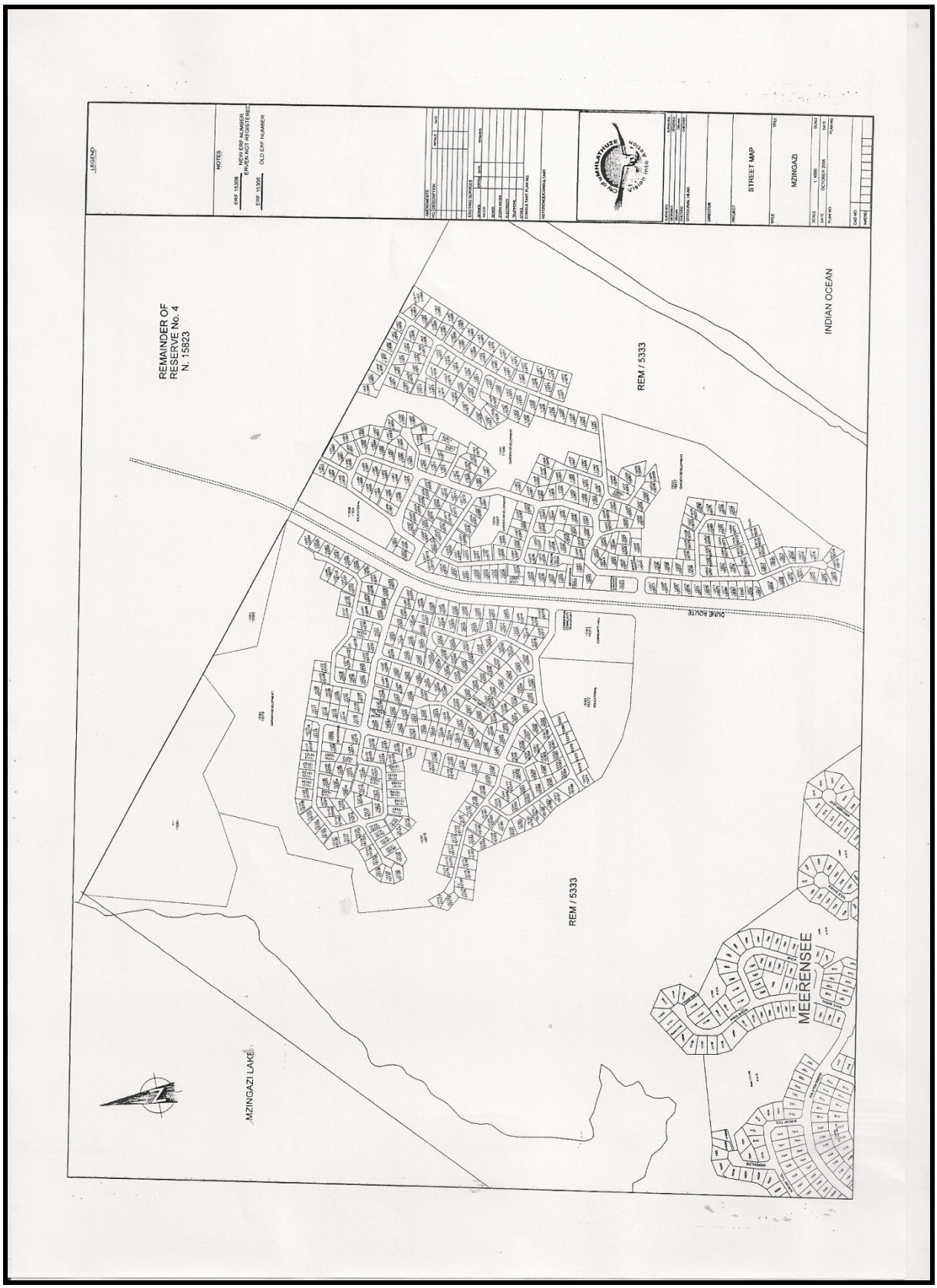
Appendix D3: Street Map of Esikhawini H1 and 2



Appendix E1: Wetland and Open Space Map of Mzingazi



Appendix E2: Proposed Plan for Mzingazi



Appendix F: Approval Letter from the UMhlathuze municipality

CITY OF uMHLATHUZE
VISION INTO ACTION

5 Mark Strasse Civic Centre
Business District
Private Bag X1004
Richards Bay 3900
E: reg@umhlathuze.gov.za
T: 035 907 5000
F: 035 907 5444/5/6/7
Toll Free No: 0800 222 827
www.umhlathuze.gov.za

Your ref:
Contact: Mrs B Strachan

Our file ref:
In response to DMS No: 984242
Date: 21 August 2014

The Faculty of Science
Department of Geography and Environmental Sciences
Private Bag x3
Wits
2250

BY HAND

REQUEST FOR PRMISSION TO CARRY OUT AN ACADEMIC RESEARCH STUDY IN THE CITY OF UMHLATHUZE

Kindly be advised that we have received a request from Mr F Chihambakwe (Student No. 849075) to carry out research in the uMhlathuze Municipality as per the following topic:

A critical examination of the relationship between urban greenness and sustainable development of urban spaces in uMhlathuze.

The Municipality will endeavor to assist Mr Chihambakwe as per the request. To this end, it is advised that Mr Chihambakwe can contact the following persons for assistance, interviews or further guidance:

City Development Department

Mrs Brenda Strachan	035 9075415	strachanb@umhlathuze.gov.za
Ms Sharin Govender	035 9075174	sharin.govender@umhlathuze.gov.za
Mr Mthokozisi Mhlongo	035 9075612	mhlongoms@umhlathuze.gov.za

Community Services Department

Mr Ernst van Biljon	035 9075396	evbiljon@umhlathuze.gov.za

Infrastructure and Technical Services Department

Mr Sbonelo Zondi	035 9075376	zondisat@umhlathuze.gov.za
Ms Bronwyn Nunn	035 9075053	nunnb@umhlathuze.gov.za

It is trusted that the above information is of assistance. Please do not hesitate to contact this office should you require additional information.

Yours faithfully

S.M. MBATHA
ACTING DEPUTY MUNICIPAL MANAGER: CITY DEVELOPMENT
DMS 985199

ALL CORRESPONDENCE MUST BE ADDRESSED TO THE MUNICIPAL MANAGER