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**An investigation into the socio-economic Factors and Community perception in the
direction of the conservation and management of the wetland: A case study of
Thohoyandou Block F**

By

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**A Research project submitted at the School of Management Sciences of the
University of Venda in partial fulfillment of the requirements for the degree Master
of Public Management**

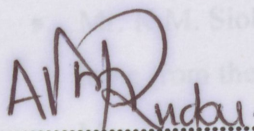
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2012



DECLARATION

I, **Avhatakali Christopher Ndou** hereby declare that the dissertation for the degree of Master of Public Management at University of Venda hereby submitted by me, has not been submitted previously for a degree at this university or any other university; that it is my own work in design and execution, and that all reference material contained therein has been duly acknowledged.


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Signature

02/05/2012
.....

Date

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My sincere gratitude is directed to the following persons who supported me during the enormous task of my studies towards the Masters degree and who made the completion of this research possible:

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DEDICATION

- On my personal note, I dedicate this project to my parents, Mrs. Thinawanga Radali and the late Mr Ntsieni Balanganani Ndou. You were there for me all the way.
- My kids, Mystery, Ipfani, Vhuthu and Ndiene who remained behind during our absence and played the role of father and mother at home.

ABSTRACT

This study deals with people's perceptions toward conservation of wetlands biodiversity at Thohoyandou. People's perceptions of conservation biodiversity are seen as an important instrument to conserve the remaining portions of the wetlands sites since wetland are disappearing as result of human interventions. About 65 % of South Africa receives an average of less than 500mm of rain a year which makes it a water-scarcity country.

Drought in South Africa leads people to depend on the wetlands to sustain their livelihoods. Indeed the people's perceptions of biodiversity conservation influence the kind of interaction between people and natural resource. Currently in South Africa about 90% of wetlands has been lost or modified through human intervention and it is important to conserve these ecosystems since they provide many services to human being.

The study uses both quantitative and qualitative techniques for data collection and analysis. Qualitative techniques were mostly used in that they provide the researcher with the understanding of people's perceptions toward the conservation of wetlands. Snowballing samplings were used for the selection of sample for the study. Both primary and secondary data were used for analysis in this study. Secondary data were obtained from government publications, research publications, and reports. Primary data were obtained through field observation and questionnaires.

Although the government has committed itself to protect wetland ecosystems, findings of this study indicated that this fundamental principle is still far to be reached particularly in Thohoyandou. This is because people of Thohoyandou still practice various activities on the wetland catchments that lead to the negative effects on the wetland biodiversity.

This study recommends that Building of awareness about the environmental issue and issues connected with the wetlands among the local community can help to conserve wetland biodiversity.

	Orientation	i
	Acknowledgement	ii
	Dedication	iii
	Abstract	iv
	Table of contents	vii
	List of tables	xi
	List of Figures	xii
	List of Pictures	xiii
	List of Abbreviations	xiv
	CHAPTER I: ORIENTATION OF THE STUDY	
1.1	Background of the study	1
1.2	Problem Statement	2
1.3	Research Objectives	4
1.3.1	Research aim	4
1.3.2	Specific Objectives	4
1.4	Research Questions	4
1.5	Research Hypothesis	5
1.6	Significant of the Study	5
1.7	Delineation of the Study	5
1.8	Limitation of the Study	6
1.9	Operational Definitions	6
1.10	Brief summary of Literature review	7
1.11	Chapters overview	10

TABLE OF CONTENTS

	CHAPTER 2: LITERATURE REVIEW	
2.1	Declaration	i
2.2	Acknowledgement	ii
2.3	Dedication	iii
2.4	Abstract	iv
2.5	Table of contents	vii
2.6	List of tables	xi
2.6.1	List of Figures	xii
2.6.2	List of Pictures	xiii
2.7	List of Abbreviations	xiv
	CHAPTER 1: ORIENTATION OF THE STUDY	
1.1	Background of the study	1
1.2	Problem Statement	2
1.3	Research Objectives	4
1.3.1	Research aim	4
1.3.2	Specific Objectives	4
1.4	Research Questions	4
1.5	Research Hypothesis	5
1.6	Significant of the Study	5
1.7	Delimitation of the Study	5
1.8	Limitations of the Study	6
1.9	Operational Definitions	6
1.10	Brief summary of Literature review	7
1.11	Chapters overview	10
2.1.1	Socio-economic impacts driving biodiversity loss	32
2.1.1.1	Threats on biodiversity	32

2.11.2	The scope of scale around biodiversity loss	33
2.12	CHAPTER 2. LITERATURE REVIEW	34
2.1	Introduction	11
2.2	Description of the study and wetlands in Thohoyandou	11
2.3	The importance of wetlands	14
2.4	Nature of Biodiversity	16
2.5	Political ecology and biodiversity conservation	17
2.6	Socio-economic factors degrading biodiversity	19
2.6.1	Competition for land	19
2.6.2	Socio-economic activities and social classes	20
2.7	Local perceptions of biodiversity conservation within wetlands	21
2.8	Other studies on the biodiversity conservation within protected areas	22
2.8.1	Australia	23
2.8.2	Benin	23
2.8.3	South Africa	23
2.9	Threats and issues associated with conservation of wetland biodiversity	24
2.9.1	Agriculture conversion	24
2.9.2	Development conversion	26
2.9.3	Urbanization	26
2.9.4	Bush fire	27
2.10	The management of wetland ecosystems	27
2.10.1	Protection laws and government initiatives	28
2.10.2	Building awareness	29
2.10.3	Trust funds and initiative system	30
2.10.4	Wetland's creation, restoration and banking	31
2.10.5	Advance Identification of Disposal Areas (ADID)	31
2.11	Socio-economic impacts driving biodiversity loss	32
2.11.1	Threats on biodiversity	32

2.11.2	The issue of scale around biodiversity loss	33
2.12	Environmental benefits of wetlands biodiversity	34
2.13	Future potential for biodiversity use	37
2.14	Conclusion	37
	CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY	
3.1	Introduction	39
3.2	The Research Design	39
3.3	Research Methodology	39
3.4	Population of the Study	40
3.5	Sampling Procedures	41
3.5.1	Sampling Method	
3.5	Sampling Procedures	41
3.6	Methods of data collection	42
3.6.1	Primary data collection methods	43
3.6.1.1	Field Survey	43–
3.6.1.2	Questionnaire	43
3.6.2.	Secondary data collection methods	44
3.6.2.1	Literature survey	44
3.6	Method of data analysis	44
3.7	Research Ethics	44
3.8	Conclusion	45
	CHAPTER 4: DATA INTERPRETATION, PRESENTATION AND ANALYSIS	

4.1	Introduction	46
4.2	Biographical information	46
4.3	Factors influencing local community's perceptions toward conservation of wetlands	49
4.4	Socio-economic factors that affect the conservation of wetland biodiversity	57
4.4.1	Agriculture activities	57
4.4.2	Pollution	59
4.4.3	Grazing by domestic stock	60
4.4.4	Infilling	61
4.5	The demographic and socio-economic profile of the household's members	63
4.5.1	Hydric soil excavation	64
4.6	Lack of enough residential areas and other essential resources	65
4.7	Losses which household members experienced through the conservation of wetlands	66
4.8	Cracking, Sinking and Collapsing of buildings	68
4.8.1	Paving, Lining stones and stumping of the floors	69
4.9	Conclusion	71
	CHAPTER 5: FINDINGS, CONCLUSION AND RECOMMENDATIONS	
5.1	Introduction.	72
5.2	Major Findings of the study	72
5.3	Conclusions	76

5.4	Recommendations	78
5.5	Recommendations for further research	80
	References	81
	Appendixes	84

Table 4.2: gender status of the respondents

Table 4.3: Percentage distribution of the occupational level of the household members (source: survey data, 2011)

Table 4.4: People practice agriculture on the wetlands

Table 4.5: Grazing occurs on the wetlands

Table 4.6: Soil erosion occurs on the wetlands

Table 4.7: Thulamela Municipality informs people about the importance of wetlands.

Table 4.8: Local people know the importance of wetlands.

Table 4.9: It is important to teach about the importance of wetlands.

Table 4.10: Wetlands are diminishing.

Table 4.11: Percentage distribution of the benefits brought by wetland to the household members (source: survey data, 2011)

Table 4.12: Percentage distribution of the opinions of the household members on the importance of conserving wetlands (source: survey data, 2010)

LIST OF TABLES

Table 4.1: Percentage distribution of the education level of the household members
(source: survey data, 2011)

Figure 4.1: Percentage distributions of the Opinions of household members on the
Table 4.2: gender status of the respondents (2010)

Table 4.3: Percentage distribution of the occupational level of the household members
(source: survey data, 2011)

Table 4.4: People practice agriculture on the wetlands household members experienced
through wetlands conservation (source: survey data, 2011)

Table 4.5: Grazing occurs on the wetlands

Table 4.6: Soil erosion occurs on the wetlands

Table 4.7: Thulamela Municipality informs people about the impotence of wetlands.

Table 4.8: Local people know the importance of wetlands.

Table 4.9: It is important to teach about the importance of wetlands.

Table 4.10: Wetlands are diminishing.

Table 4.11: Percentage distribution of the benefits brought by wetland to the household
members (source: survey data, 2011)

Table 4.12 Percentage distribution of the opinions of the household members on the
Importance of conserving wetlands (source: survey data, 2010)

LIST OF FIGURES

Picture 4.1: Agriculture activities along the wetland ecosystems

Figure 4.1: Percentage distributions of the Opinions of household members on the management wetlands (source: survey data, 2010)

Figure 4.2: Pie chart indicating factors influencing human settlements on wetlands in the study area

Figure 4.3: Percentage distribution of losses that household members experienced through wetlands conservation (source: survey data, 2011)

Picture 4.3: Deposition of solid waste on the Mhovanu stream

Picture 4.4: Hydric soil excavation spot

Picture 4.5: Cracked sunk toilet at Thohoyandou Block F wetland

Picture 4.6: Paved surfaces in Thohoyandou Township

LIST OF PICTURES

Picture 4.1 agriculture activities along the wetland ecosystems

Picture 4.2: broken sewage hosepipe and deposition of waste water at Mbovana wetland

Picture 4.3: livestock grazing and trampling caused by cattle movement at block-G wetland

IUCN- International Union for Conservation of Nature

Picture 4.4: Infilling of Lukunde wetland by soil for construction of new shopping centre.

NEMA- National Environmental Management Act

Picture 4.5: Deposition of solid waste on the Mbovana stream

NEMBA- National Environmental Management: Biodiversity Act

Picture 4.6: Hydric soil excavation spot

NWA- National Water Act

Picture 4.7: Cracked sunk toilet at Thohoyandou Block F wetland

USEPA- U. S. Environmental Protection Agency

Picture 4.8: Paved surfaces in Thohoyandou Township

WWF- World Wildlife Funds

LIST OF ABBREVIATIONS

CARA- Conservation of Agricultural Resources Act

CBD- Central Business District

ADID - Advance Identification of Disposal Areas

IUCN- International Union for Conservation of Nature

NEMA- National Environmental Management Act

NEMBA- National Environmental Management: Biodiversity Act

NWA- National Water Act

USEPA- U. S. Environmental Protection Agency

WWF- World Wildlife Funds

CHAPTER 1: ORIENTATION OF THE STUDY

1.1 Background to the research problem

The term wetland generally refers to the land transition between terrestrial and aquatic ecosystems where the water table is near or above the earth's surface (Mitsch & Gosselink, 1986:7). According to Kotze (2005:53) most of wetlands are found in the area which saturate for long time to be unfavorable to most plants but favorable to the anaerobic soil conditions. According to Beach (2009:675) there are wetlands which are forested and others which are dominated by herbaceous species. Hence forested wetlands include areas such as mangroves, seep, channel whereas herbaceous wetlands include areas such as ponds, marshes and floodplains. Most wetlands are found on the river riparian zone, along the margins of the river, lakes and areas where ground water intercepts the soil surface.

Most of wetlands in developing countries such as South Africa continue to be degraded or lost through the conversion to agriculture and various uses such as settlement and infrastructure developments. Despite their disappearance in our environment, wetlands provide both direct and indirect benefits in our environment (Scondari, 1990:9). Wetlands provide direct benefits to the society such as the productions of timbers, harvestable fishes and handicraft production. Besides these direct benefits, wetlands provide indirect benefits by controlling floods and erosion, water quality improvements (Bryan & Jammy, 1998:97). According to Matiza & Chabwela (1992:32) wetlands have the ability to store water and release that water during dry seasons.

According to Bryan & Jammy (1998:62) the conservation status of wetlands in South Africa varies from good to bad depending on the socio-economic values attached to them. Therefore wildlife conservation and wetlands were doomed unless local communities become an integral part of conservation efforts (Hummel & Murphree, 2001:12). The local communities' perceptions of protected areas such as wetland ecosystems influence the kind of interactions people have with them and thereby conservation effectiveness (Ormsby & Kaplin, 2005:65).

According to Durrant & Shumway (2004:73) successful conservation initiatives require the active contribution of local communities in decisions as well as changes in perceptions in order to put together local development with environmental conservation. The community especially those living in and around the wetland areas have important and long-standing relationships with these areas, therefore their needs, aspirations and attitudes of these local communities should be considered to conserve the wetland biodiversity. Therefore this study intends to investigate the perceptions of people towards the conservation of wetlands with special reference to the social and economical factors that involve the disturbance and the conservation of wetlands around Thohoyandou.

Therefore, this study intends to examine the disappearance of wetlands, with special reference to the political, economical and social factors that are involved in the degradation and the disappearance of wetlands at Thohoyandou Block F. Wetlands are part of the common ecosystem that characterizes these two villages. People in these villages derive resources from the wetlands to sustain their livelihoods socially and economically. In economic terms, they extract wild vegetables and thatch grasses as resources to consume and sell. The findings of this study are meant to inform the development of formal strategies that will be used in the conservation of the remaining portion of the wetlands within these villages

1.2 Statement of the problem

South Africa is one of the countries which have a higher water scarcity. According to World Wildlife Funds (WWF), (2005:8) 65 % of South Africa receives an average rainfall of less than 500 mm a year which makes it a water-scarce country. Therefore conservation of wetlands in South Africa is important because many people remain directly dependent on wetlands for their water and other natural resources. Drought in South Africa leads people to depend on the wetlands for the sustaining of their livelihoods. Currently in South Africa about 90% of wetlands have been lost or modified through human intervention. Indeed local community's perceptions of protected areas influenced the kinds of interactions of local people in protected areas.

Many wetland studies often adopt a functionalist approach of wetland valuation that emphasizes the hydrological, biogeochemical and ecological functions of wetlands (Maltby, 2009:32). This approach often ignores the impact of socio-economic and political factors on the disappearance of wetlands. Hence, the magnitude and extent to which such factors give rise to wetland degradation and disappearance become relatively less understood. This study however, is informed by the political ecology framework. Political ecology is an approach that studies how political, economical, and social issues which give rise to environmental issues (Blaikie & Brookfield, 1987:32). Similarly, environmental impacts associated with community inhabitation and retaliation impacts of wetland on communities in the study area are relatively unknown or at best undocumented.

According to Bauer (2003:43) benefits obtained directly from protected areas are the main factors which improve peoples understanding about biodiversity conservation. However the local community of Thohoyandou used the wetlands for various activities that result in negative effects on the wetland biodiversity. In addition by understanding the factors that influence the local community's perceptions of biodiversity conservation in Thohoyandou may help in the conservation of the remaining portions of the wetlands. Therefore this study provides a good example to assess the local community perceptions of Thohoyandou toward the conservation of wetland biodiversity. The factors that disturb the conservation of wetland biodiversity are to be investigated. The research also intends to undertake developing sound, affordable and practicable strategies for managing wetland biodiversity in the area of study.

Communities in the study area have always employed mitigation and coping strategies to offset the retaliation impacts of wetland on their livelihoods. The nature of such impacts and the effectiveness of these strategies need to be examined and documented.

1.3 Research aim and Objectives

1.3.1 Research aim

The aim of this study is to investigate the socio-economic factors and community perception in the direction of the conservation and management of the wetland in Thohoyandou Block F.

1.3.2 Research objectives

The research objectives are therefore to:

- To examine the coping strategies employed by community living on wetlands to sustain their livelihoods
- Identify the factors that influence the local community's perceptions towards the conservation of wetlands.
- identify and examine socio-economic and political factors that have contributed to an increasing disappearance of wetlands
- Evaluate the environmental impacts of socio-economic activities on the biodiversity;
- Examine the current management strategies that can be used to conserve the biodiversity of wetlands.

1.4 Research questions

- What are the coping strategies employed by the communities living on wetlands for their livelihood?
- What are the factors that influence the local community's perceptions toward the conservation of wetlands?
- What are the socio-economic and political issues contributing to the degradation of wetlands?
- What are the spatial distribution and the physical limits of wetlands in the study area?
- What are the current management strategies that can be used to conserve the biodiversity of wetlands?

1.5 Research Hypothesis

- Anthropogenic activities cause environmental degradation on the wetlands
- Population growth increase the demand of space for the socio-economic activities
- Poor management of the conservation of wetland will results in their gradual disappearance

1.6 Significance of the study

Conservation of the wetland biodiversity in South Africa is affected by many factors. Most of these factors result in the ways in which the local people interact with the wetland ecosystems. Indeed local community's perceptions of protected areas influenced the kinds of interactions of local people and protected areas. Many wetland studies had focused on the status of the wetland ecosystems without considering the perceptions of local residents towards the management of these areas (International Union for Conservation of Nature, 2002). Therefore there is a need for this research to be undertaken in order to acquire information on factors which support the local people positive perceptions about wetlands and biodiversity conservation. By understanding the factors which support the local resident's perceptions of biodiversity conservation on the wetland will help to improve the relationship between the residents and wetlands. It will also improve their awareness about the biodiversity conservation within these areas.

1.7 Delimitation of study

This study was primarily focus on the socio-economic factors and community perception in the direction of the conservation and management of the wetland in Thohoyandou Block F, Thulamela Municipality, Limpopo province. The assessment covered the period from 2009 to 2012. The study itself did not touch other areas, though they may be having other problems of wetlands, but it focused directly to Thohoyandou Block F in Thulamela Municipality, in Vhembe District, Limpopo province.

1.8 Limitation of the study

There are potential threats pertaining to this study. The possibility of people affected by wetlands in the wrong interpretation of questions, in case of primary sources could not be ruled out, particularly with the collection of primary data through questionnaire. The use of secondary sources in this study created a very serious problem as the credibility of these sources is highly questionable due to limited scope of the study; the researcher made generalization and that also create a serious problem in the process of assessment. The lack of knowledge of the importance of wetlands could possibly hinder the prompt assessment of the issues affecting wetlands at Thohoyandou Block

1.9 Operational definitions

- **Wetlands-** is an area where water cover soil is present either at or near the earth's surface which is either permanent (Duga, 1990:34).
- **Biodiversity loss** – is the removal of species 100 to 1000 times faster than at any previous time in the history of the planet (Blaikie & Brookfield, 1987:132).
- **Conservation-** is the management of human use of the biosphere so that it may yield the greatest sustainable benefits to the present generations while maintaining the needs of future generations (Blaikie & Brookfield, 1987:32).
- **Biodiversity-** refers to the variety of life forms (Leeuwis, 2004:31).
- **Socio-economic development** - is the social and economic development in a society (Leeuwis, 2004:81).
- **Sustainable development** - is the development seeking to economic growth while ensuring the future generation's ability to do the same, by not exceeding natural regenerative capacity (Duga, 1990:3).
- **Environmental perception-** is an approach that studies how individuals or groups feel about the environment, the creations of those understandings and their impacts on decision making (Warner & Rubec, 1997:5).

1.10 Brief summary of Literature review

According to Warner & Rubec, (1997:65) the term wetland is defined as the area that is saturated enough for a long period to promote aquatic processes and it usually indicated by poorly drained soil, hydrophyte vegetation and different kinds of biological activity which are adopted to a wet environment. Most of the wetlands occurred on the lake margins which extend from shallow littoral zones out to deeper limnetic zones where light penetrates to support rooted vegetations (Duga, 1990)

Nature of Biodiversity

“Biodiversity is the majesty of life. When one say the planet should be saved, the word biodiversity is used to enclose this entire concept. Biodiversity is the life, the world, the variation of life for the entire globe. Biodiversity found on Earth recently consists of millions of distinct biological species, as a product of four billion years of evolution. Biodiversity is not distributed uniformly on Earth, but is consistently rich in the tropics and in specific localized regions such as the Cape Floristic Province; it is less rich in Polar Regions where fewer species are found. But the word biodiversity itself is actually quite new (Duga, 1990:34).

Local perceptions of biodiversity conservation within wetlands

The concept of perception refers to the outcomes of applying our knowledge to a particular situation (Leeuwis, 2004:9). Local perceptions are influenced by type of management and benefits they perceived from wetlands (Ormsby & Kaplin, 2005:71). According to Kim (2007:32) indicative factors affecting citizen’s perceptions and behaviors concerning wetland areas including the level of trust towards wetland management and instructions responsible for environmental management and their effectiveness.

The perceptions that regard wetlands as wastelands have now shifted towards non-sustainable use. Conservation of protected areas such as wetlands may significantly influence perceptions, needs and desires (Batlett, 2010:43). Therefore this results in conflicts among local community

and manager actors (Brandon, 2005:12). Local people's perceptions of protected areas such as wetlands also depend on their perceived cost and benefits from wetland areas, their dependence on local resources and their knowledge about wetland management.

The management of wetland ecosystems

The policy of habitat conservation plan (HCP) is more likely practice on a mitigation or conservation bank that is large and on connected areas that permanently conserved and managed for its natural resource values. However the policy of wetlands mitigation banking focuses on curtailing wetlands loss and regaining acre in accordance with the clean act, section 404 (*ibid*).

Political ecology and biodiversity conservation

Political ecology approach studies political, socio-economic activities that increase environmental crisis (Blaikie & Brookfield, 1985:90). In this case the environmental crisis refers to the loss of biodiversity at Thohoyandou Blocks. Political ecology contributes towards a better comprehension of cultural autonomous practices and social movements towards environmental resources (Escobar, 1998). It associates the global scale with the local scale by demonstrating locally existing crisis that contribute to the global problems (Blaikie & Brookfield, 1985:56).

In biodiversity loss case, political ecology focuses on the social movements in terms of natural resource consumptions, gender and the economics accountable for resource extractions. According to Escobar (1998:89), political ecology addresses the crisis of disparity and resource access within communities as the factors influencing biodiversity loss. Political ecology makes an effort to notify the state and non-governmental organizations (NGOs) by its research with argument taken in unbiased integrity for activities degrading the environment (Bryan & Jammy, 1998:21). For instance, biodiversity is regarded as rich in natural resources; nonetheless there is disparity of access to such resources with regard to residents' social classes. According to Jarosz (2004:90) in most cases where biodiversity loss occurs, poverty and ignorance or lack of awareness is frequently emphasized as contributing factors. The degradation and continual loss of biodiversity cannot be blamed on poverty as such, but to unequal landownership, inconsistent

capacities for resource extractions and the extent at which they are extracted, distributed and prohibited.

CHAPTER 1: ORIENTATION OF THE STUDY

Environmental benefits of wetlands biodiversity

This study consists of five chapters. Chapter 1 supplies the background of the study, statement of

Habitat destruction immensely increases an area's vulnerability to natural disasters like flood and drought, crop failure, spread of disease, and water contamination. On the other hand, the chance of these events happening will be reduced by a healthy ecosystem with good preservation practices, or will at least severe harmful impacts (Asits & Biswass, 1996:34).

Chapter 2 has to do with a review of the related literature materials on the nature of the wetlands

Arable land can actually suffer from the depletion of the surrounding landscape. Agricultural land has degraded approximately 40% of arable land worldwide via salinization, erosion, nutrient depletion, pollution, compaction, and urbanization. Human beings also lose their direct utilization of natural habitat when the habitat is destructed. Aesthetic utilizations such as birdwatching, recreational uses like hunting and fishing, and ecotourism usually relies on virtually undisturbed habitat. Most people consider the complexity of the natural world valuable and being disturbed by the loss of natural habitats and animal or plant species worldwide (Ahmed *et al.*, 2008:9).

CHAPTER 4: DATA INTERPRETATION, PRESENTATION AND ANALYSIS

Probably the most extreme impact that habitat destruction has on people is the loss of essential ecosystem services. Habitat disturbances have altered nitrogen, phosphorus, sulphur, and carbon cycles, which has accelerated the frequency and severity of acid rain, algal blooms, and the killing of organisms in rivers and oceans and contributed tremendously to global climate change (USGS, 1995:8). An ecosystem service whose significance is becoming more noticed is climate regulation. On a local perspective, trees provide windbreaks and shade; on a regional perspective, plant transpiration recycles rainwater and maintains constant annual rainfall; on a global perspective, plants (especially trees from tropical rainforests) from around the world counter the accumulation of greenhouse gases in the atmosphere by sequestering carbon dioxide through photosynthesis.

1.11 Chapters Overview

CHAPTER 1: ORIENTATION OF THE STUDY

This study consists of five chapters. *Chapter 1* supplies the background of the study, statement of the study problem, research objectives, research hypotheses, and significance of the study delimitations of the study, limitation of the study, operational definitions and chapter overview.

CHAPTER 2: LITERATURE REVIEW

Chapter 2 has to do with a review of the related literature materials on the nature of the wetlands biodiversity, socio-economic activities and political factors causing wetlands biodiversity loss, impacts caused by socio-economic activities on the biodiversity and the associated benefits of biodiversity.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

Chapter 3 provides the overall research design which outlines research methodology and methods of data collection and analysis.

CHAPTER 4: DATA INTERPRETATION, PRESENTATION AND ANALYSIS

Chapter 4 deals with data presentation, interpretations and analysis of the findings.

CHAPTER 5: FINDINGS, RECOMMENDATIONS AND CONCLUSION

Chapter 5 is a summary of findings, recommendations and conclusions, suggestions and issues for further research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

According to Warner & Rubec, (1997:89) the term wetland is defined as the area that is saturated enough for a long period to promote aquatic processes and it usually indicated by poorly drained soil, hydrophyte vegetation and different kinds of biological activity which are adopted to a wet environment. Most of the wetlands occur on the lake margins which extend from shallow littoral zones out to deeper limnetic zones where light penetrates to support rooted vegetations (Duga, 1990:12)

According to Maltby (1986:67) wetlands have historically been viewed as places of waste but they can also be taken as the last truly wild and untouched areas in the world. Wetlands have been identified worldwide as scarce ecosystems which need protection and priority planning. According to Kotze (2005:89) about 90 % of South Africa wetlands has been lost or modified. At present the wetlands are regarded as highly productive areas with a rich biodiversity, hence they can be used as outstanding areas for conservation of rare and endangered species (Rao *et al.*, 2002:88). But the successful conservation of wetland biodiversity in most of African countries is being challenged since African countries are characterized by poor policies and a shortage of sustainable frameworks as a result of insufficient political conviction to formalize the wetland conservation.

2.2 Description of the study and wetlands in Thohoyandou

The study site-Thohoyandou is located in the Thulamela municipality in the Vhembe District of the Limpopo province. Thohoyandou consists of five (5) blocks namely C, D, F, G and P (Fig 1.2).It lies 70 km east away from Louis Trichardt. In the area of study three wetland sites were identified (Mbovana, Lukunde and block-G wetlands). Mbovana wetland is situated on the east side of the Thohoyandou CBD approximately 500 meter away from Thohoyandou CBD.

Lukunde wetland is situated on the south eastern part of the CBD whereas block-G wetland is situated on the eastern side of Mbovana wetlands (Kabanda 2008:34).

2.2.1 Climatic Conditions

Thohoyandou is characterized by the average rainfall which varies between 350 and 750 mm per annum. The highest amount of rainfall in the study area occurs during the summer season (from October to April) as compared to other seasons. The lowest amount of rainfall occurs during winter season (from May to July). Thohoyandou also experiences other forms of precipitation during the periods in the year in the form of dew mostly in the summer morning and fog along the mountains range. This study area is characterized by warmer summer seasons of temperature ranging from 11°C to 38°C and with relative warmer winter of temperature ranging from 11°C to 27°C. Winter seasons are sunny, but cold in the morning as well as in the evening (Kabanda, 2004:8).

2.2.2 Vegetation

Vegetation in the area of study is originally dominated by dense stands of reeds and sedges. Recently the area of study is characterized by tree species and grass as result of human activities that took place and the dominant terrestrial tree species are *Acacia* and *Rhus* species Sinthumule, 2006:67).

2.2.3 Land use

Due to rapid population growths Thohoyandou is now densely populated and each available piece of land including wetlands are used for human activities. At the present situation in the area of study there are different land-use activities that are being practiced along the wetlands. Agricultural activities are the dominant land-use activities followed by the infilling of wetlands for the space of building settlements and infrastructures. In addition to this, there is an extraction of plant species in and around the wetland for hand-craft productions.

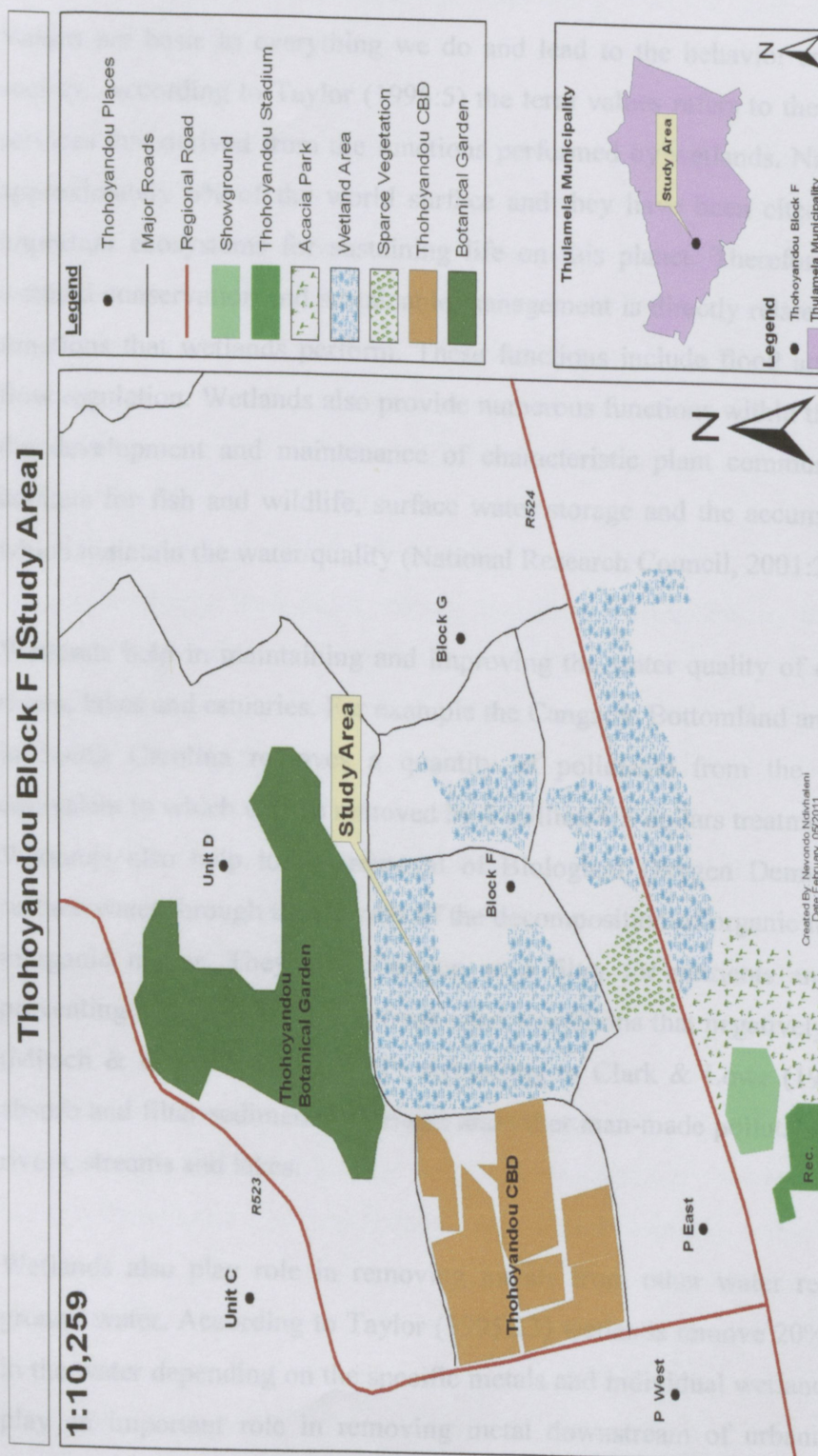


Figure 2.1: The map of the study area

2.3 The importance of wetlands

Values are basic to everything we do and lead to the behavior and expectations from society. According to Taylor (1995:5) the term values refers to the benefits, goods, and services that derived from the functions performed by wetlands. Natural wetlands cover approximately 6% of the world surface and they have been cited as one of the most important ecosystems for sustaining life on this planet. Therefore, the importance of wetland conservation and sustainable management is directly related to the values of the functions that wetlands perform. These functions include flood attenuation and stream flow regulation. Wetlands also provide numerous functions within the landscape, such as the development and maintenance of characteristic plant communities which provide habitats for fish and wildlife, surface water storage and the accumulation of sediments which maintain the water quality (National Research Council, 2001:23).

Wetlands help in maintaining and improving the water quality of our nation's streams, rivers, lakes and estuaries. For example the Cangaaree Bottomland and Hardword swamps in South Carolina removes a quantity of pollutants from the watershed resources equivalent to which will be removed by 5 million US dollars treatment (USEPA, 1995:9). Wetlands also help in the removal of Biological Oxygen Demand (BOD) from the surface water through the process of the decomposition of organic matter or oxidation of inorganic matter. They also function as a filter for nutrients and chemicals thereby preventing algal blooms and various other conditions that negatively affect water quality (Mitsch & Gossenlink, 1993:41). According to Clark & Lowe (1992:17) wetlands can absorb and filter sediments, nutrients and other man-made pollutants that would degrade rivers, streams and lakes.

Wetlands also play role in removing metals from other water resources, run-off and ground water. According to Taylor (1995:23) wetlands remove 20% to 100 % of metals in the water depending on the specific metals and individual wetlands. Forested wetlands play an important role in removing metal downstream of urbanized areas. Wetlands purify water by trapping pollutants, micro-organisms such as viruses and bacterias which

cause diseases like diarrhea and dysentery to human beings. The importance of wetlands increasingly recognized as systems supporting specific and valuable biodiversity (Moreno, 2007:45).

Wetlands play a significant role in the livelihoods of rural communities in South Africa (Taylor, 1995:34). They act as reservoirs for watershed (Mitsch & Gosselink, 1993:89). Therefore wetlands have an ability to store water during the wet seasons and release it during the dry seasons and then provide farmers in the semi- arid areas the opportunities to grow crops all over the year (Matiza & Chabwela, 1992:43). Wetlands release the water they store from the precipitation such as rain, dews and fog into associated surface water and ground water (Matiza & Chabwela 1992:6)

According to Kotze (2005:7) wetlands provide the local community with the crop production due to their ability to store moisture during the dry season and inherently fertile soil which make possible for farmers to plant their crops throughout the year. They also provide important commercial products such as fish, shellfishes, cranberries, timber and wild rice as well as some medicines derived from wetland soils and plants. They are also used for agricultural, forestry or amenity purposes that can accept high water table (Mitsch & Gosselink, 1993:89). Wetlands reeds are used for making mats (*Thovho* in Venda community) for sleeping on and basket for selling fruits and vegetables (Bryan & Jammy, 1998:76). In addition wetlands reeds are commonly used by Zulu tribe in South Africa as roofing materials for thatched huts.

Local people also rely on wetlands to exploit non-timber forest products which are main sources of Livelihoods of forest-dwelling communities (Ros-Tonen, 2000:76). Wetlands are also important for poverty reduction and wealth creations for the local communities.

These ecosystems provide many services that contribute provisioning services from wetlands, such as food and fiber are essential for human welfare (Ahmed & Deaton, 2008:78). However in order to harness this opportunity there is need for sustainable management of these wetlands (Kangalawe & Liwenga, 2005:9). In developing countries

wetlands are popular destinations for wild life tourists and tourism and has the potential to generate sustainable local benefits, sufficient for local people to value and therefore these ecosystems protect their wildlife heritage as a source of income (Goodwin, 1996:8). Wetlands have considerable aesthetic, cultural, educational values and provide sustainable opportunities for recreation and tourism.

Wetlands protect adjacent and downstream properties from potential damage (USEPA, 1995:43). They also play significant role during floods period by mitigating floods and trap suspended solids and nutrients (Mitsch & Gosselink, 1993:65). Wetlands have ability to control erosion as the states and landowners are restoring wetlands to control shorelines in coastal area (Ahmed & Deaton, 2008:34).

Aquatic species such as fish, dragonflies, livestock and even migratory water birds that act as visitor species increase the diversity of mammals that use wetlands as place of habitat. According to Kusler & Kentula (1990:1) about 35% of all rare and endangered animals depend upon wetland habitat. In addition, wetlands act as feeding and breeding areas for wildlife and they also provide a stopping place and refuge for waterfowl. According to Groombridge & Jenkin (1998:43) wetlands support species diversity and have a complex of wetland value.

2.4 Nature of Biodiversity

“Biodiversity is the majesty of life. When one says the planet should be saved, the word biodiversity is used to enclose this entire concept. Biodiversity is the life, the world, the variation of life for the entire globe. Biodiversity found on Earth recently consists of millions of distinct biological species, as a product of four billion years of evolution. Biodiversity is not distributed uniformly on Earth, but is consistently rich in the tropics and in specific localized regions such as the Cape Floristic Province; it is less rich in Polar Regions where fewer species are found. But the word biodiversity itself is actually quite new. It was coined as an amalgamation of biological diversity in 1985. A conference in 1986, and the follow-up book Biodiversity, edited by biologist E.O.Wilson

shaped the way for common acceptance of the word and concept” (Wilson, 1986:35). As politicians, scientists, and conservationists began to pay attention to the state of the global environment and the wonderful complexity of life people became quite attached to this new word. The world has started, relatively recently, to lose species and habitats at an ever-increasing and buzzing rate because of socio-economic activities (WWF, 2002:12).

Human beings are an integral part of nature; their fate is strongly linked with biodiversity, the huge variety of other animals and plants, the places they live and their surrounding environments, all over the world. Human beings rely on this diversity of life since it provides the food, fuel, medicine and other essentials that human beings cannot live without (Mellor, 1996:98). This rich biodiversity is being lost at an accelerated rate as a result of socio-economic activities. This impoverishes human beings and weakens the ability of the living systems, on which human beings depend, to resist growing threats such as climate change.

The continued loss of biodiversity can no longer be seen as an issue separate from the core concerns of society: to tackle poverty, to improve the health, prosperity and security of present and future generations, and to deal with climate change. Each objective is undermined by current trends in the state of our ecosystems, and each will be greatly strengthened if biodiversity is given the priority it deserve (Alexander *et al*, 2008:78). Regardless of the existence of environmental protection agencies meant to protect the biodiversity, it has unique benefits that are frequently over-exploited by communities all over the world. Due to ineffective policies for biodiversity management, the biodiversity is frequently degraded regardless of existing institutional and technological support.

2.5 Political ecology and biodiversity conservation

Political ecology approach studies political, socio-economic activities that increase environmental crisis (Blaikie & Brookfield, 1985:23). In this case the environmental crisis refers to the loss of biodiversity at Thohoyandou Blocks. Political ecology contributes towards a better comprehension of cultural autonomous practices and social

movements towards environmental resources (Escobar, 1998:65). It associates the global scale with the local scale by demonstrating locally existing crisis that contribute to the global problems (Escobar, 1998:67).

In biodiversity loss case, political ecology focuses on the social movements in terms of natural resource consumptions, gender and the economics accountable for resource extractions. According to Escobar (1998:39), political ecology addresses the crisis of disparity and resource access within communities as the factors influencing biodiversity loss. Political ecology makes an effort to notify the state and non-governmental organizations (NGOs) by its research with argument taken in unbiased integrity for activities degrading the environment (Escobar, 1988:67). For instance, biodiversity is regarded as rich in natural resources; nonetheless there is disparity of access to such resources with regard to residents' social classes. According to Jarosz (2004:86) in most cases where biodiversity loss occurs, poverty and ignorance or lack of awareness is frequently emphasized as contributing factors. The degradation and continual loss of biodiversity cannot be blamed on poverty as such, but to unequal landownership, inconsistent capacities for resource extractions and the extent at which they are extracted, distributed and prohibited.

The concept of biodiversity conservation is based in a meticulous demonstration of the "threats to biodiversity" that emphasize the loss of habitats, species introduction in alien habitats, and habitat loss due to fragmentation, rather than underlying causes. It offers a set of prescriptions for the conservation and sustainable use of resources at the international, national, and local scales; and it evokes proper methods for biodiversity management, including scientific research, in-situ and ex-situ conservation, national biodiversity planning, and the establishment of proper methods for compensation and economic use of biodiversity resources, primarily through intellectual property rights (WRI/IUCN/UNEP, 1992:5 This prevailing dialogue is vigorously being promoted through various academic, institutional, managerial, and political practices.

2.6 Socio-economic factors degrading biodiversity

Political ecologists argue that, in the course of development a particular focus should be paid to the environment and scale of development. Such focus will help in diminishing conversion of biodiversity for development activities (Hagerman, 2007:66).

2.6.1 Competition for land

Competition for land is mostly considered to be the major driver for biodiversity loss at a local scale (Hagerman, 2007:12). Development activities increase land degradation related issues, which cause severe impacts on fragile ecosystems such as the freshwater wetlands and mountainous ecosystem. The activities that cause biodiversity loss include the pricing of land, because it influences the disadvantaged to reside on biodiversity rich regions since the price is out of their range.

Biodiversity around rapid increasing settlement regions are at a high risk of disturbance caused by socio-economic activities (Amy, 2005:21). These activities cause the paying off for the conversion of biodiversity rich regions for the practicing of various activities and this poses high risks for the conversion of such regions. Political ecologists argue that, in the course of development a particular focus should be paid to the environment and scale of development. Such focus will help in diminishing conversion of biodiversity for development activities (Hagerman, 2007:13). Consideration of the environment seems very political and ecological to the capitalists and it promotes less attention to the biodiversity conservation. Unlike capitalists political ecologists seek integrity between the society and environment by promoting the sustainable use of natural resources. From the political ecology's point of view, money directed to the development of infrastructural projects should also be used for rejuvenation and conservation.

2.6.2 Socio-economic activities and social classes

There are increasing conflicts between the protection of the environment because of divisions on social classes and such divisions create problems on small areas where the biodiversity is rich (David & Douglas, 1995:56). Global perceptions towards natural resources are that, there is easily available land for development to the extent that they are lawfully drained and reclaimed for development activities. In support of this statement, Water Quality Group (1994b) stated that, urbanization is one of the major factors causing the degradation of different ecosystems.

Urbanization increases direct loss on biodiversity. Pollutants linked with urbanization are sediment, nutrients, oxygen-demanding substances, road salts, heavy metals, hydrocarbons, bacteria, and viruses (USEPA, 1994b). Degradation occurring on biodiversity results from changes on land and water quality, quantity, flow rates, increase in pollutants inputs and changes in species composition (David & Douglas, 1995:66), and these lead to habitat loss. Habitat loss caused by human beings includes conversion of land to agriculture, urban sprawl, infrastructure development, and other anthropogenic changes to the characteristics of land. Pollution, habitat degradation, and fragmentation are aspects of habitat destruction caused by humans that do not necessarily involve overt destruction of habitat, yet result in habitats collapsing. Deforestation, desertification, and coral reef degradation are specific types of habitat destruction for those areas (deserts, forests, coral reefs).

According to Geist and Lambin (2002:32), 152 case studies assessed on net losses of tropical vegetation cover to determine any patterns in the causation and existence under the superficial causes of tropical deforestation. Their out comings, yielded as percentages of the case studies in which each parameter was an important factor, which provide a quantitative prioritization of which approximate and underlying causes were the most important. The approximate causes were clustered into extensive categories of agricultural expansion (96%), infrastructure development (72%), and fuel (wood) and timber extraction (67%). Consequently, according to this study, forest conversion to

agriculture is the main land use change responsible for tropical deforestation. The specific categories show further insight into the specific causes of tropical deforestation: transport expansion (64%), commercial wood removal (52%), permanent cultivation (48%), cattle ranching (46%), shifting (slash and burn) cultivation (41%), subsistence farming (40%), and extraction of fuel (wood) for domestic utilization (28%). Another outcome is that shifting cultivation is not the primary cause of deforestation in all parts of the world, whereas transport extension (including the building of new roads) is the biggest approximate factor responsible for deforestation (Vorosmaraty, *et al.*, 1997:67).

The issue of biodiversity loss did not occur rapidly at once due to population growth. Instead it is argued by Yuhas (1996:81) that biodiversity loss is increased by technological innovations, the level of society development and physical aspects of the environment. According to Turner (1987:3) anthropogenic activities are to be considered in the background factors.

The destruction of biodiversity in most societies has begun with the construction of settlements in the colonial times. This was dated back to the early 1600s to 1800, a period of colonial settlements in most countries because of the society's level of development and technological development. Settling on biodiversity rich regions by then was done for easy access to water and this was advocated by the states in most countries of the world (Yuhas, 1996:14).

2.7 Local perceptions of biodiversity conservation within wetlands

The concept of perception refers to the outcomes of applying our knowledge to a particular situation (Leeuwis, 2004:77). Local perceptions are influenced by type of management and benefits they perceived from wetlands (Ormsby & Kaplin, 2005:69). According to Kim (2007:9) indicative factors affecting citizen's perceptions and behaviors concerning wetland areas including the level of trust towards wetland management and instructions responsible for environmental management and their effectiveness.

2.8.1 Australia

The perceptions that regard wetlands as wastelands have now shifted towards non-sustainable use. Conservation of protected areas such as wetlands may significantly influence perceptions, needs and desires (Batlett, 2010:78). Therefore this results in conflicts among local community and manager actors (Brandon, 2005:23). Local people's perceptions of protected areas such as wetlands also depend on their perceived cost and benefits from wetland areas, their dependence on local resources and their knowledge about wetland management. Since local people are not homogenous and do not share common norms, therefore their interests and resources use patterns which differ greatly at both the individual and households (Agrawal & Gibson, 1999:90).

Valentine *et al.* (2010:45) studied community perception of biodiversity conservation

According to Trakolis (2001:3) people's perceptions influence their attitudes. Local community perceptions of wetland management play an important role in their attitudes toward them (Alexander, 2000). According to Soderqvist *et al.*, (2000:678) estimation of the monetary value of wetlands and information about attitudes toward wetlands conservation can be used in policy decisions. In general higher conservation attitude of the people around the wetlands are largely determined by alternative income and conservation education.

2.8.2 South Africa

2.8 Other studies on the biodiversity conservation within protected areas

Waters (1988:34) studied attitudes of a rural community toward conservation of protected

Biodiversity in wetlands is considered very high because of their position at the interface between land and water. Therefore biodiversity conservation can be achieved through environmental friendly, traditional human cultural practices and beliefs (Boaten, 1998:23). Human activities have contributed and still contribute to unprecedented areas rate of biodiversity loss which threaten the stability and continuity of ecosystem (Brown, 2002:34). For example the impact of human activities has changed the diet of several migratory birds as some of species are now feeding on crops and grassland instead of aquatic organisms.

2.8.1 Australia

In Australia Lai (2004:89) studied the attitudes and behavior of local people towards the conservation of biodiversity. The findings of this study indicated that personal experience of costs and benefits from protected areas experience was the major factor influencing local people's perceptions towards the conservation of biodiversity within protected areas rather than level of education or affluence.

2.8.2 Benin

Vodouhe *et al.*, (2010:45) studied community perception of biodiversity conservation within protected areas in Benin. The findings of this study indicated that positive perceptions of local community towards the conservation of biodiversity within protected areas were highly related with the management strategy that involve local communities. In addition the community perceptions toward the conservation of wetlands biodiversity within protected areas also correlated with the education level of community and geographical origin.

2.8.3 South Africa

Infield (1988:54) studied attitudes of a rural community toward conservation of protected areas in Natal, South Africa. The findings of this study indicated that education could make people more conscious and less useful in their attitudes towards protected areas. Infield (1988:34) assumed that people who are highly educated are wealthier and they tend to have positive or cooperative attitudes towards the conservation of biodiversity.

Infield (1988:76) also proposed that affluence is a good indicator of people toward the conservation of biodiversity within protected areas. The assumption of this study also indicated that rich people tend to have positive attitude toward the conservation of biodiversity because they have capacity to afford the loss of resource inherent in the

establishment of PAs which the poor people who are dependent on natural resources would lack.

2.9 Threats and issues associated with conservation of wetland biodiversity

The conservation of biodiversity is a total of focal issues in the world. Nevertheless, few people are aware about the fact the density of biodiversity and densities of people are connected (Boaten, 1998:4). Biodiversity is the most important but least appreciated resource and it can also be a key to the maintenance of the world (Wilson, 1992:75). Biodiversity in wetlands is considered very high because of their position at the interface between land and water. Therefore biodiversity conservation can be achieved through environmental friendly, traditional human cultural practices and beliefs (Boaten, 1998:7). Human activities have contributed and still contribute to unprecedented areas rate of biodiversity loss which threaten the stability and continuity of ecosystem (Brown, 2002:62). For example the impact of human activities has changed the diet of several migratory birds as some of species are now feeding on crops and grassland instead of aquatic organisms. Various human activities have contributed to clearing wetlands as results of agriculture, harvesting of fuel woods and settlement affect vegetation patterns and composition within areas (Matiza & Chabwela, 1992:7).

2.9.1 Agriculture conversion

According to Kotze (1995:1) in the eastern part of South Africa approximately 50 % of the wetlands have disappeared as result of modification by commercial or subsistence farming. Many parts of South African's wetlands are being increasingly degraded and lost mainly through conversion to cropland (Matiza & Chabwela, 1992:6). For example in European countries many exotic timber plantations have been practiced on the wetland ecosystem and they caused severe impact on the wetland as these exotic species or plants absorb too much water causing wetland to dry (Turner et al., 2000:65). Therefore water is the key affecting the value of wetlands. Recently statistics show that agriculture has consumed more than 75 % of the water resources in the plain and it is predicted that its

irrigated acreage under paddy may double in the next 15 years which will require—under current farming practices with increasing quantities of irrigation water leading to a sharp drop in the water table in the wetlands (Wang, 2005:7). Agricultural activities have extensively modified the ecological status of the wetlands. According to Sarron (2005:41) half of the world wetlands had been converted to cropland. According to Kotze & Breen (2000:85) convections of wetlands have been demonstrated to have high rate of negative effects on wetland characteristics and functions.

The farms also caused excessive withdrawal of fresh water and increased pollution load on water lime and diseases to organisms (Anon, 1989). Baines (1988:65) suggested that agricultural developments such as drainage, inorganic fertilizing, and reseeded have led to the disappearance of some species in the wetland ecosystems. Land cultivation may increase sediment and nutrient input to a wetland by increasing erosion. Hydrological conditions of wetlands that are caused by domestic, industrial sewage and agriculture runoff as results of insecticides and fertilizers can change chemical and physical properties of wetland ecosystems such as nutrients availability, degree of substrate, sediment properties and PH.

The hydrology of the wetlands may be negatively affected by artificial drainage of water which is mostly caused by wetland farmers in order to extract access water to create favorable growing conditions. These modifications have direct impact on the biotic responses in the wetland such as in species richness, composition and ecosystem productivity. Similarly fertilizer application and the removal of ground cover also may produce changes in the stability of such inputs. Mensing (1998:3) found that fish species richness and diversity in riparian wetlands were lower as results of high cultivated land were higher in the surrounding landscape.

Grazing in a wetland's catchment may increase soil erosion and therefore increase the level and instability of sediment inputs to the wetland system. Nutrient inputs are also likely to be increased and in some cases pathogens may be introduced to the system. Grazing in wetlands, as is practiced in some places, particularly during drier periods, may

lead to a reduction in the area of the wetland and produce tracks which alter the micro hydrology. Damage from over-grazing through cattle movement can be severe. In addition the disturbance of vegetation and soil through cattle movement in wetlands where surface flows are common can lead to gully erosion and the subsequent loss of the wetland (Wyatt, 1995:87).

2.9.2 Development conversion

Development is often identified as the problem and a main cause of biodiversity loss in a strictly sustainable sense (Brown, 2002:35). The interaction of man with the wetlands during the last decades were mostly concerned due to the high population growth which is accompanied by industrial, commercial, and infrastructure development that may lead to the pollution on the wetland ecosystem through domestic and industrial sewage and agricultural run offs (Foote Lee *et al.*, 1996:91). However with industrial development and expansion of population all over the world, trees and wetlands have had to be changed into valued commodities through the process such as deforestation and filling of wetlands (Brown, 2002:10). Therefore the debate on biodiversity loss and development has become trapped in wider discussions of globalization where both biodiversity and rural people are seen as being threatened by globalization. Construction activities are a major source of suspended sediments that enter wetlands through urban runoff.

2.9.3 Urbanization

Urbanization is a major cause of destruction of wetlands (USEPA, 1995:66). It has resulted in direct loss of wetland acreage as well as degradation of wetlands. Degradation is due to changes in water quality, quantity, and flow rates; increases in pollutant inputs; and changes in species composition as a result of introduction of non-native species and disturbance. According to USEPA (1995:45) the main pollutants linked with urbanization are sediment, nutrients, oxygen-demanding substances, road salts, heavy metals, hydrocarbons, bacteria, and viruses. These pollutants may enter wetlands from point sources or from non-point sources. But advance of urban development on wetlands may

encourage attempts to eliminate or control mosquitoes the consequences for the wetland environment depend upon the nature of control used (Dale, 1993:32).

2.9.4 Bush fire

The most important cause that influence people to set fire in the wetlands could be explained by the fact that most of human activities on the wetlands require the use of fire as short-cut to achieving desired results such as farming and hunting (Korem, 1985:44). Unfortunately bushfire setters do not often take into consideration the direct destructive effects such as killing through burning and indirect destructive effects including clearing vegetation and exposing vulnerable animals to predation on the wetland ecosystem. Poor management of the fire on the wetland ecosystem tends to affect flora and fauna species especially during dry seasons when wind blows.

According to Kotze & Breen (2000:23) the burning of wetlands can result in both negative and positive effects. On alien plants have also negative impacts on the biodiversity and ecosystem functioning (Meffe & Carrol, 1996:67). Positively effects on the wetlands such as fire can be helpful in controlling alien plants and preventing degradation through moribund. Although this fire brought positive effects on the wetlands, it can also result in negative effects on the wetlands dominated by woody-stemmed species and those with peaty soil.

2.10 The management of wetland ecosystems

The policy of habitat conservation plan (HCP) is more likely to become practice on a mitigation or conservation bank that is large and on connected areas that permanently conserved and managed for its natural resource values. However the policy of wetlands mitigation banking focuses on curtailing wetlands loss and regaining acre in accordance with the clean act, section 404 (Yuhas, 1996:90).

2.10.1 Protection laws and government initiatives

Most of the world ecosystems are protected by regional, national or international laws (Army & Michael, 2006:445). Perhaps the most notable feature of federal wetlands protection policy today is that there are no specific, comprehensive national wetland laws. As a result, jurisdiction for wetland protection is spread over several agencies and federal wetland protection is not as affective or cohesive as it could be (Mitsch & Gosselink, 1993:89).

Lots of states have enacted laws for the protection of the wetlands, and their regulations are promulgated in many states since they are included in the definitions of water (Salvesen, 1990:46). Therefore federal, state and local government regulatory or permitting, programs are essential tools in the nationwide effort to protect wetlands. For instance the wildlife conservation law can be used to directly designate wetlands that form critical shelter areas for important flora and fauna (Athanas *et al.*, 2001:43). The culture heritage conservation law can be used to preserve sites containing unique, important natural and cultural heritage. The state's provision laws involved in the management of wetlands is done using reasoning and never incorporates ethnographic reasoning. This plays a major role when selecting wetlands to be managed and conserved (Army & Michael, 2006:14).

Wetlands are also protected by various other legislations including the Environmental Impact Assessment regulation which states that one needs environmental authorization if one wishes to conduct an activity within 1-in-10 years flood line of a river or within 32 meters from the bank of a river or stream where the flood line is unknown including the construction of canals, channels bridges, rivers and dams (Wolfing, 2010:60)

The policies such as habitat conservation and wetland mitigation bank are relatively new policies for protection and restoration of wetland ecosystems that support biodiversity (National Research Council, 1995:45). The Water Bank program is another federally operated incentive approach geared mostly to agricultural wetland protection, similar to

the CRP but which initiated long before it with the 1970 passage of the water act (16.U.S.C.1301).

Over the past century conservation has largely relied on national protected areas controlled by government (Berker, 2007:56). Therefore army was developed in wetlands to protect forest and wild resources from people (Hackel, 1999:25). Protections of the wetlands require the government agencies to come up with new ways for the regulation such as the enhancement of and use of programs and wetlands management. Because of developing world donor agencies and non- organization have promoted establishment of marine reserve, wildlife sanctuaries and wetlands to preserve biodiversity and also to prevent degradation from development activities (IUCN, 1994:36).

According to the Department of Environmental Affairs and Tourism (2000:10) South Africa has a variety of governmental and non-governmental agencies that are concerned in wetlands conservation. A National Wetland conservation Programme has been recognized and under this programme, a national Ramsar committee has been formed to help South Africa meet its obligations in terms of the Ramsar Convention.

2.10.2 Building awareness

Sustainable success in the protection of wetland ecosystems can be achieved through creating or building awareness among the general public, educational and corporate institutions (Parikh & Parik, 1999:39). According to Costanza & Cottheib (1998:50) through building awareness of the importance of wetlands will make these ecosystems to be recognized as one of the most economically valuable ecosystems. On a global scale, the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) has played a significant role in promoting awareness of wetlands. But one of the major constraints toward the sustainable management of wetlands is that wetland users and decision-makers have insufficient understanding or knowledge about the consequences of alternative management and policy regimes on wetland functions, ecosystem services and human beings (Wellington, 2010:38).

Most of the communities and individuals have a wealth of knowledge that is relevant to the conservation and diversity and the sustainable use of biological resources. This knowledge may relate to harvesting resources, plant crops, and using natural herbs and other materials for medicinal purposes etc. Traditional knowledge can provide an excellent basis for developing programmes and policies that integrate social, economic and environmental issues and which would benefit both the environment and the local communities. Education is an effective strategy of empowering communities to engage in identifying the management problems of the local environment and natural resources and to come up with local solutions (Natural Heritage Trust, 2000:20).

2.10.3 Trust funds and initiative system

Wetlands represent a kind of capital and the establishment of wetland conservation fund is like setting up a form of savings. Monetary profits generated from wetland conservation such as profits earned from tours in ecological parks should be allocated to wetlands conservation funds and therefore a certain percentage should be used to improve the living standard of the local community (Athanas, 2001:35). Similarly the revenue earned from protected areas management should go directly to the government and while some should be used for local level development (Hackle, 1999:33). Tax incentives such as conservation easements should be considered for managing wetland conservation (Chan & Haung, 2000:22). The use of compensatory and incentive systems encourages the landowners, enterprises and general public to conserve wetland ecosystems. Therefore subsidies should be given to compensate those people whose properties are within the range of the wetland conservation greenway, and whose land use privileges are restricted due to regulations required to meet the conservation goals. According to Emerton (1998:4) economic benefits generated by wetlands and the costs associated with their degradation decision stimulates wetland conversion and degradation.

2.10.4 Wetland's creation, restoration and banking

Wetland creation, restoration, and banking have been extensively used to protect and manage wetland resources and to enhance or increase fish and wildlife habitats. Creation and restoration of wetlands have been undertaken for over two decades, primarily to meet regulatory requirements such as compensatory mitigation for wetland losses and to increase fish and wildlife habitats (Kusler & Kentula, 1990:43). Therefore wetland creation involves the construction of new wetlands at locations that previously had little or no natural wetlands (National Research Council, 2001:43). It can also be used to compensate for habitat impacts associated with contaminant releases and subsequent cleanup at hazardous waste sites, and to restore the habitat disturbed by mining operations, highway construction, housing developments, and other construction or excavation activities.

Wetland restoration also involves the rehabilitation of areas where previously supported wetland communities have been destroyed or degraded. Preparation of the wetland restoration or creation site may require the removal of invasive non native species or control of destructive animals such as geese and muskrats (Perry, 2001:54). Wetland banking is defined as the restoration, creation, enhancement, or preservation of wetlands for purposes of providing compensatory improvement in advance of authorized negative effects to similar resources at another site resulting from approved construction activities (National Research Council, 2001:4).

2.10.5 Advance Identification of Disposal Areas (ADID)

According to King and Bohelm (1994:43) Advance Identification of Disposal areas is a means of setting watershed conservation priorities by identifying wetland functions and sites for restoration. ADID is regarded as one of the good examples of public sector partnership planning process (Salvesen, 2005:9). In this Program EPA cooperates with the corps, state and local government and the public to determine in advance the suitability or unsuitability of all wetlands for the discharge of dredged and fills material

for development activities. It also identifies the most degraded, least valuable wetlands for future development and selects other sites for restoration. Therefore, this promotes the goals of maximizing public benefits from wetlands while satisfying the constraint of no overall net loss of wetland functions. The development of ADID plans is resource intensive, but the information generated can play extremely valuable and important parts in wetlands protection (USEPA, 1995:43).

2.11 Socio-economic impacts driving biodiversity loss

Biodiversity is threatened by activities such as the poor management of fire (Braack *et al.*, 2000:675), the blame in this case is put to those with no formal education; people often ignore aspects like naturally and unintentionally igniting fires from cigarettes buds and other fire hazards. Statistically in South Africa the biodiversity experiences pressure from fire, counting 0.2% each year (Claire, 2003). Poor management of fire tends to affect fauna and flora species especially during the dry season (August) when dry winds blow (Laungaramsi, 2000:7).

2.11.1 Threats on biodiversity

Hasty biodiversity loss contributes to the vulnerability of species towards extinction. The quick loss of biodiversity is claimed to be aggravated by farmers who excavate vegetation in search of new fields (Davies & Douglas, 1995:9). The most spelled out threats on species are habitat alteration plans. Alterations of habitats have main threats from settlement extension.

Diverse socio-economic activities including excavation for agriculture, harvesting of reeds and settlement extension affects the land cover patterns and composition within ecosystems, which as a result alters the functioning of the earth system (Landberg, 1994:6). Types of land covering changes like these are highly associated with the loss of habitat and are recognized as threats to biodiversity.

Annually biodiversity is damaged for different reasons, like for example for the need to improve the grazing value for livestock (Braack *et al.*, 2000:75). Conversely, mismanaged fires can burn soil and plant parts below the ground, which demolishes plant roots. This can drive an increase in soil erosion, while burning has short term impacts on animal species; for example the killing of some animals which are not able to escape. It also has positive benefits such as the controlling of alien plants within the biodiversity.

Plantations of alien timber have been practiced on ecological fragile zones in many European countries such practices have led to relentless impacts on the ecosystem, because alien plants absorb too much water causing dryness (Tuner, 1991:43). Swampy regions can be transformed into temperate areas when alien plantations are practiced because a remarkable amount of water will be absorbed. If plantation of alien plants continues to be practiced, changes on biodiversity are assured into the earthly environment (Davies & Douglas, 1995:7). Nevertheless licenses are still given in central African countries authorizing the plantations of alien plants on sensitive biodiversity. The outcomes of this are: species relocation, to less adaptive species and the loss of hydrophytes not adapted to change in conditions.

2.11.2 The issue of scale around biodiversity loss

On an international scale biodiversity is lost extremely with about half of the world biodiversity already shattered (Peter *et al.*, 2006:32). At this scale species are decisively endangered. At a local scale, land use change driven by cultivations and deforestations diminishes the scale of species in terms of its physical limits (Sala *et al.*, 2000:3) and the impacts are felt both locally and globally with the problem of extinction (Vorosmarty *et al.*, 2000). Yet there are doubts that the global area of biodiversity richness is diminishing at an ever escalating rate. However, evidence of changes on biodiversity is seen on using national inventory maps of decades (Matthews & Fung, 1987:88). Measurements of changes in biodiversity can be done using analytic scales like the quantification of species abundance to the assessment of complete landscapes and varying factors within the biodiversity (Duro *et al.*, 2007 as cited by Southworth *et al.*, 2008b:1).

At the landscape scale, the analysis of biodiversity changes link land cover patterns and changes to conservation of biodiversity together with socio-economic activities causing alteration of ecosystems (Tuner, 2003 as cited by Southworth *et al.*, 2008b:43). Alteration of ecosystems due to socio-economic activities is said to account for overcomes over poverty and hunger, particularly in agricultural stipulations looking at the need of food.

2.12 Environmental benefits of wetlands biodiversity

Habitat destruction immensely increases an area's vulnerability to natural disasters like flood and drought, crop failure, spread of disease, and water contamination. On the other hand, the chance of these events happening will be reduced by a healthy ecosystem with good preservation practices, or will at least severe harmful impacts.

Arable land can actually suffer from the depletion of the surrounding landscape. Agricultural land has degraded approximately 40% of arable land worldwide via salinization, erosion, nutrient depletion, pollution, compaction, and urbanization. Human beings also lose their direct utilization of natural habitat when the habitat is destructed. Aesthetic utilizations such as bird watching, recreational uses like hunting and fishing, and ecotourism usually rely on virtually undisturbed habitat. Most people consider the complexity of the natural world valuable and being disturbed by the loss of natural habitats and animal or plant species worldwide (Ahmed *et al.*, 2008:43).

Probably the most extreme impact that habitat destruction has on people is the loss of essential ecosystem services. Habitat disturbances have altered nitrogen, phosphorus, sulphur, and carbon cycles, which has accelerated the frequency and severity of acid rain, algal blooms, and the killing of organisms in rivers and oceans and contributed tremendously to global climate change (USGS, 1995:65). An ecosystem service whose significance is becoming more noticed is climate regulation. On a local perspective, trees provide windbreaks and shade; on a regional perspective, plant transpiration recycles rainwater and maintains constant annual rainfall; on a global perspective, plants

(especially trees from tropical rainforests) from around the world counter the accumulation of greenhouse gases in the atmosphere by sequestering carbon dioxide through photosynthesis. Other ecosystem services that are diminished or completely lost as a result of habitat disturbances include nitrogen fixation, waste treatment, oxygen production, watershed management, pollination, and nutrient recycling of sewage or agricultural runoff. The loss of tropical rainforests alone represents a substantial diminishing of the earth's ability to produce oxygen and use up carbon dioxide. These services are recently considered essential as increasing carbon dioxide levels is one of the main contributors to global climate change.

The loss of biodiversity may not directly have an effect on human beings, but the indirect effects of losing many species as well as the diversity of ecosystems in general are extremely large. Biodiversity loss leads to the extinction of many species that provide valuable and unique roles to the ecosystem within the environment. The inhabitants within the environment rely on biodiversity to recover from extreme environmental conditions. When there is excessive biodiversity loss, a catastrophic event such as an earthquake, flood, or volcanic eruption could cause an ecosystem to be destroyed, and human beings would obviously suffer from that. Loss of biodiversity also means that human beings are losing animals that could have served as biological control agents and plants that could potentially provide higher-yielding crop varieties, pharmaceutical drugs to cure existing or future diseases or cancer, and the new crop resistant varieties for agricultural species susceptible to pesticide-resistant insects or virulent strains of fungi, viruses, and bacteria (Fukai *et al.*, 1993:5).

The negative effects of habitat loss mostly impact on rural populations more directly than urban populations. Around the world, poor people suffer the most when the natural habitat is destroyed, because less natural habitat means less natural resources per capita, yet wealthier people and countries simply have to pay more to continue to receive more than their share of natural resources (WRI, 1992:38).

Degradation of the environmental resource base (for example, excessive resource extraction, severe land use, and so forth) not only affects the quality of the services that are produced by ecosystems, it also challenges their resiliency (Yuhas, 1996:43). Rejuvenation is the capacity of a system to recover from agitations, shocks and surprises. Ecosystem resilience is its capacity to absorb disturbances without undergoing fundamental changes. If a system loses its rejuvenation it can flip to a totally different new state when subjected to even small agitation. Thus the economist's panacea, the view that there are unending substitutions possibilities among various resource bases so that society will be able to move smoothly from one resource bases to another as each is degraded beyond usefulness, and is at odds with fundamental ecological truths. That ecosystem has limited resilience lies is not easily observable. This is what makes the subject of ecological economics so very difficult (Yuhas, 1996:43).

The ecosystem's carrying capacity is the maximum stress it is capable of absorbing without it tossing to an immeasurably different state. Ecosystems are endemically subject to natural shocks and surprises (for example, fires, storms and so on). This means that it would be incorrect to regard them as fixed stocks of capital that can be relied upon to provide us with a steady flow of resources. Our natural capital base has evolved over millions of years. It has adapted to modifications and fluctuations in the background environment. The self-organizing ability of ecosystems determines its capacity to respond to the perturbation they are continually subjected to (Holling *et al.*, 1994:75).

Biodiversity plays two central roles in the evolution of ecosystems. First it provides the units through which both energy and material flows thus giving the systems its functional properties. Secondly, it provides the system with resiliency (Wilson, 1992:5; Solberg, 1993:9).

According to Landberg (1994:8), biodiversity serves two ecological functions: productivity and drought protection. It can also be emphasized that an ecosystem's carrying capacity does not remain constant, but is subject to change, usually in ways that are unpredictable. This is because ecosystems evolve continually. Economic policies that

apply fixed rules so as to achieve constant yields (for example, fixed sizes cattle herds or wildlife, of fixed sustainable yield of fish or wood) can be accepted to lead to a reduction in an ecosystem's resilience. Large reductions in resilience would mean that the system could break down in the face of disturbances that earlier would have been absorbed (Holling *et al.*, 1994).

2.13 Future potential for biodiversity use

Biologists and other scientists often show that more is unknown about the economic and aesthetic benefits of biodiversity even though there are hundreds of known benefits. There are still unknown important ecosystem services and uses for plants and animals and they await discovery. Nevertheless these cannot be discovered, and benefit humankind, if they become extinct before discovery. The biodiversity threat can be compared to book burning (the destruction of former and future comprehension) (LaSalle *et al.*, 1993:53).

Most valuable goods, such as spices (cinnamon, pepper) and also critical medications (*aspirin, tamoxifen, quinine, and digitalis*) were discovered "accidentally" because plants or animals produced chemicals for defense or attraction. Otherwise the organisms from which these chemicals originated would have not been considered (Vorosmarty, *et al.*, 2000:7).

2.14 Conclusion

From the literature review wetlands are regarded as the ecosystems that serve many values to both the environment and human beings, therefore wetlands are considered to be multifunction ecosystems. Although these ecosystems serve indirect and direct benefits to both the environment and human beings there are many challenges that are facing these ecosystems. In addition many of the wetlands have been destroyed through human intervention such as development and degradation. Since the impact on the wetlands are mostly caused by human intervention, people's perceptions of biodiversity

conservation were examined and indeed the benefits and losses brought by the biodiversity conservation on the natural environment are responsible for people's perceptions. From the literature review the management strategies are also responsible for the conservation of wetland biodiversity and indeed the wetland restoration and building awareness that can help to conserve natural resources.

The purpose of this chapter is to illustrate an overall methodology together with the methods used to achieve the objectives of this research as stated in chapter one. It also describes the overall research methodology adopted; sampling procedures as well as methods for data collection and analysis.

3.2 Research Design

In the present study, the research design discussed was based on Leedy and Ormrod (2001:91-92). According to these writers, in planning the research design, it is extremely important for the researcher not only to choose a viable research problem but also to consider the kinds of data an investigation of the problem will require and feasible means of collecting and interpreting those data. By definition, the term data is plural, singular is datum and derives from the past participle of the Latin verb *dare* which means to give. Data are those pieces of information that any particular situation gives to an observer and data are volatile, they evaporate quickly. This means that at a certain time, respondents who indicated that they held a particular opinion, might change their minds and have a somewhat different opinion. Data are, therefore transient (Leedy and Ormrod, 2001:95) and have ever-changing characteristics.

3.3 Research methodology

The study used both qualitative and quantitative methodology as there is a growing consensus emerging from literature on fieldwork methods that the research output will be of higher quality if methods combined as they yield different but complementary data (White, 2002:86).

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

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Quantitative research is used to answer questions about relationships amongst measured variables with the purpose of explaining, predicting and controlling phenomena. This approach is sometimes called the traditional, experimental, or positivist approach. (Leedy and Ormrod, 2001:101) In contrast, qualitative research is typically used to answer questions about the complex nature of phenomena, often with the purpose of describing and understanding the phenomena from the participant's point of view, constructivist or post positivist approach.

According to McMillan and Schumacher (2001:14) the terms quantitative and qualitative are used frequently to identify different modes of enquiry or approaches to research. Quantitative and qualitative research studies are both conducted in education. The most obvious distinction to a reader between quantitative and qualitative research is the form of data presentation. Qualitative research presents statistical results presented in numbers. Qualitative research presents data as a narration with words. In order to justify the use of both quantitative and qualitative research paradigms in this study, these two paradigms are discussed in detail in the subsequent paragraphs.

The sample size in this study was selected using the snowball sampling technique. Different research methods reflecting qualitative and quantitative research perspectives were used in the collection of both primary and secondary data. In this study both primary and secondary data were used to get information on and about wetland conservation. Primary data included the use of field observations and questionnaires. Secondary data were used to search management information through the use of literature reviews. The researcher visited the study area before conducting the survey in order to give necessary explanations regarding the purpose, date and the time of the collection of data.

3.4 Population of the study

Best and Kahn (1993:13) define a population as any group of the individuals that have one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type, or more restricted part of that

group. A population is defined by Wimmer and Dominick (1988:57) as a group or class of subjects, variables, concepts or phenomenon. Not all the members of the population were studied, only those who were selected by means of purposive sampling were involved. In this case; the researcher purposively selected respondents who are local Municipality manager, and stakeholders of Thohoyandou Block F.

3.5 Sampling procedures

Mouton further mentions that the aim of sampling is to produce representative's selection of population elements. With regards to presentation Wimmer and Dominick (1983:58) mentioned that a sample that is not representative of population, regardless of its size, is inadequate for testing purposes-the results cannot be generalised for the population.

Cohen and Manion (1989:10) view a sample as a smaller group or subset of the population from which the researcher attempts to collect information so that the knowledge gained typifies the total population under study. Best and Kahn (1993:13) also share similar views regarding sampling by defining a sample as a small proportion of a population selected for observation and analysis.

According to Wimmer and Domminick (1988:68), determining an adequate sample size is one of the most controversial aspects of sampling. How large a sample should be in order to be representative of the population has no simple answer (1983:68)? Best and Kahn (1993:19) stated that there is no fixed number or percentage of subjects that determine the size of an adequate sample. It may depend upon the nature and the population of interest or data gathered and analysed

The criteria for the selection of the sample were those household members who are directly or indirectly related to the wetlands since they rely on the wetlands for various activities such as cultivation, extraction of natural resources and other activities. As the area of the study consists of many households, to show the representativeness the researcher selected ten percent (10, 7%) which comprises one hundred and fifty (150)

households from a total population size of 1400 households. Household sampling was done randomly for questionnaire distribution in the study area. As such, in sampling the population to be interviewed, snowball sampling was utilized, for a specific reason for their selection. Therefore, the researcher selected one household in the area of study and then interviewed one member of the household. The interviewed household members were also requested to tell the researcher about other house members who are directly and indirectly related to the wetlands. This was conducted in order to capture the heterogeneity of household members who occupied different areas which are directly or indirectly related to the wetlands and thus may influence the community's perceptions.

3.5.1 Sampling methods

According to Saunders, Lewis and Thornhill (2000:150), sampling method provide a wide range of methods that enable the researcher to reduce the amount of data needed to collect by considering only the data from sub-group rather than all possible cases. . A simple random and purposive sample was used for selection of a sample population. Simple random and purposive samplings are used in different contexts for the selection of a population sample. In this study purposeful method of sampling will be used so that individuals are selected because they have experienced the central phenomenon. A purposive sampling technique was employed in selection study participants. All participants in this study already met the requirements and characteristics that the researcher needed as they were serving in different structures. In simple random sampling, every member of the population has an equal chance of being selected. The selection of the households and study sampling was done randomly for questionnaire distribution in Thohoyandou Block F. Not all members of the population were studied only those who were selected by means of purposive sampling were involved.

3.6 Methods of data collection

In this study, data were collected using field survey and questionnaires to the household members and published documents related to this study.

3.6.1 Primary data collection methods

3.6.1.1 Field Survey

In this study, field observation was conducted to collect data about the set up of the study area. In this study observations conducted were unstructured, and have taken the form of free flowing observations. Variables observed included the distribution and characteristics of each wetland in the area of the study and socio- economic activities associated with those wetland biodiversity. Points of interest were captured using a digital camera for later analysis. This method was deemed effective in accomplishing one of the objectives.

3.6.1.2 Questionnaires

A total of one hundred and fifty (150) questionnaires with closed and open-ended questions were divided and distributed to the household members in the area of study. The closed questions and the possible alternative answers were asked to the household members while the open-ended questions were asked to gain an in-depth understanding of their answers. The open-ended questions covered two (2) variables related to the respondents:

- Their perception toward wetland conservation
- Their knowledge about wetland biodiversity management

3.8 Research Ethics

In addition the researcher also used closed questions to record data about household members' occupations, and education levels (demographic & socio-economic characteristics) in order to determine how these variables correlate with their perceptions toward the wetland conservation and management.

3.6.2 Secondary data collection methods

3.6.2.1 Literature survey

Government gazettes and journals in the form of literature reviews have contributed to the understanding of current management strategies to be considered to conserve wetlands with integrated development towards the community. It has served as the secondary data source.

3.7 Method of data analysis.

Questionnaires were distributed to the household members using snowball sampling technique. Quantitative data obtained by means of questionnaires were summarized and displayed in table and bar graphs using Microsoft Excel 2007 and analyzed statistically using statistica 7.1 to differentiate the factors that contribute more to the local household member's perceptions toward the conservation and management of wetland ecosystems. During data analysis quantitative approach used to get logic of primary data. The test-retest approach was used to check the organization and reliability of data obtained by means of questionnaires whereby the researcher repeated drawing tables and graphs using Microsoft Excel 2007. In addition data verification was also done by getting 100% of the total data and checking against the questionnaires to determine whether that had been entered correctly.

3.8 Research Ethics

Mouton (2001:238) indicates that the ethics of Science concerns what is wrong and what is right in the conduct of research. Because scientific research is a form of human conduct, it follows that such conduct has to conform to generally accepted norms and values. Leedy (2001:45) emphasizes the importance of studying ethics in research in order to determine ethical principles underlying protection of human rights. The rights of human research subjects need to be protected by the researchers.

CHAPTER 4: DATA INTERPRETATION, PRESENTATION AND ANALYSIS

The aim of implementing ethics is also justified to allow respondents to enter the research project voluntarily and to ensure that the subjects are not exposed to risk that are greater than the gains they might derive. The interviewer acquired consent from the respondents that participated in the research project and informed them of their rights (Leedy, 2000).

3.9 Conclusion

This chapter has covered all issues concerning overall research methodology adopted, population identification, sampling procedures and units of analysis, the means of access to study sites and methods for data collection and analysis. The issue of how data were collected and analysed were dealt with in this chapter. The next chapter deals with the interpretation and analysis of the collected data.

4.1 Biographical Information

4.1.1 Level of education

With regard to education level of the household members, about 16.4% of the household members were found illiterate, 25.6% educated to primary school, 40% to secondary school, 10.7% to undergraduate and 4.3% to postgraduate (table 4.1). According to Gillingham & Lee (1999) education is usually considered as a first step in improving people's perception toward conservation. The majority of household members (85%) at Thohoyandou did not go beyond matric. This indicated that majority of people at Thohoyandou have lower education level and they tend to have non-favorable perceptions of biodiversity conservation. Since they have non-favorable of biodiversity conservation they tend to harvest wetlands biodiversity unsustainable. In the case of this study few household members have high level of education and favorable perceptions of

CHAPTER 4: DATA INTERPRETATION, PRESENTATION AND ANALYSIS

4.1 Introduction

The focus in this chapter revolved around five major themes. The first theme explores the spatial distribution of wetlands in the study sites of Thohoyandou Township. This is followed by an examination of the socio-economic and political factors contributing towards increased disappearance of wetlands. The chapter further examined environmental impacts associated with community inhabitation on wetlands as well as the retaliation impacts posed to communities inhabiting the wetlands. Finally, the chapter focused on the coping strategies employed by the communities in sustaining their livelihoods. All these themes were analyzed from a political ecology perspective whose central focus is on the role of socio-economic and political factors towards the disappearance of wetlands and management decisions to make wetland sustainable while not alienating local people completely from their use.

4.2 Biographical information

4.2.1 Level of education

With regard to education level of the household members, about 16.4% of the household members were found illiterate, 28.6% educated to primary school, 40% to secondary school 10.7% to undergraduate and 4.3% to postgraduate (table 4.1). According to Gillingham & Lee (1999) education is usually considered as a first step in improving people's perception toward conservation. The majority of household members (85%) at Thohoyandou did not go beyond matric. This indicated that majority of people at Thohoyandou have lower education level and they tend to have non-favorable perceptions of biodiversity conservation. Since they have non-favorable of biodiversity conservation they tend to harvest wetlands biodiversity unsustainable. In the case of this study few household members have high level of education and favorable perceptions of

biodiversity conservation; this indicated that they understood the role of wetlands play toward them and the helpfulness of the conservation of its biological diversity.

Table 4.1: Percentage distribution of the education level of the household members
(source: survey data, 2011)

	Frequency	Percentage
Illiterate	25	16.4
Primary	37	28.6
Secondary	60	40
Undergraduate	16	10.7
Postgraduate	6	4.3
Total	150	100

Analysis educational qualifications shown in table 4.1 indicated the proportion of household members who had higher education level and favorable perception of biodiversity conservation is lower than the number of household members who had lower educational level and non- favorable perception of biodiversity conservation. This suggests that the people who are not well knowledgeable about the natural resource affected the conservation of wetlands biodiversity by practicing activities that resulted negative effects along wetlands due to the lack of awareness and knowledge about the environment issue in general and on issues connected with wetlands. Based on these conversional beliefs in this study, conservation education can give high priority for improving the relationship between household members and wetlands

Table 4.2: gender status of the respondents

	Frequency	Percentage
Male	70	47%
Female	80	53%
Total	150	100%

Out of the 150 responses the observations made were that 142 were males and 121 were females which constituted 53% and 47% respectively while 2% of respondents had not indicated their gender (See table 4.2). This means that males were in majority and the two local municipalities had to recruit more females to participate in ward committee structures and municipal governance. In addition, the 50/50 male and female ratio as required in terms of Project Consolidate is not yet achieved by the municipalities.

Table 4.3: Percentage distribution of the occupational level of the household members (source: survey data, 2010)

	Frequency	Percentages
Pensioners	26	17.1
Public sectors	55	36.9.
Unemployed	47	31
Self employed	20	13.6
Domestic workers	2	1.4
Total	150	100

Table 4.3 shows that approximately 31 %of household members reported that they were unemployed and they did not have any source of income. According to Marshall *et al.*, 2006 protected areas contribute approximately 7 to 95 % of households annual incomes in rural areas for sustain their livelihoods. Therefore unemployed household members tend to have favorable perceptions of biodiversity conservation because they depended on the wetland sites to sustain their livelihoods. The household members with the highest level of income are working in the public sectors constituting 36.9% of the sample. Therefore they tend to have non-favorable perceptions of biodiversity conservation along the wetlands because they were not depended on the wetland for generating income to sustain livehods. Therefore household members with moderate and lower income were self employed constituting only 13.6 % of the sample and approximately 17.1 % of the household members relied on pensions for livelihoods. Only 1.4% of the household members were domestic workers who mostly worked in the homes of high level income people for little *income*. Based on these conversional beliefs in this study, eradication of

poverty is being given high priority for improving the relationship between household members and wetlands

4.3 Factors influencing local community’s perceptions toward conservation of wetlands

Table 4.4: People practice agriculture on the wetlands

	Frequency	Percentages
Strongly Disagree	30	20
Disagree	15	10
Neutral	0	0
Strongly Agree	60	40
Agree	45	30
Total	150	100

Table 4.4 reveals that 105 respondents constituting 70% of the total sample agreed that people practice agriculture on the wetlands and this could be based on the fact that people locally have little knowledge about the importance of wetlands. 45 respondents constituting 30% of the total sample disagreed that people practiced agriculture on the wetlands and this is a clear indication that the local people know little about the existence of the wetlands

	Frequency	Percentages
Strongly Disagree	39	26
Disagree	15	10
Neutral	0	0
Strongly Agree	57	38
Agree	39	26
Total	150	100

Table 4.5: Grazing occurs on the wetlands

	Frequency	Percentages
Strongly Disagree	30	20
Disagree	21	14
Neutral	15	10
Strongly Agree	54	36
Agree	30	20
Total	150	100

According to this Table 4.5 the majority of respondents agree that grazing occurs very often in the wetlands, and this is revealed by 84 respondents constituting 56 % of the total sample who agreed that grazing occurs in the wetlands area, and this could be based on the fact that wetlands are always green even in winter and could pose as better area for grazing in winter. 51 respondents constituting 34% of the total sample disagree that grazing occurs in the wetlands, something which could be based on the lack of information on the side of respondents. Confusion is likely to occur, taking note of 5 respondents constituting 10 % of the total sample who are neutral, and it is a clear indication that certain respondents lacked information concerning the existence and importance of the wetlands in the area.

Table 4.6: Soil erosion occurs on the wetlands

	Frequency	Percentages
Strongly Disagree	39	26
Disagree	15	10
Neutral	0	0
Strongly Agree	57	38
Agree	39	26
Total	150	100

In accordance with Table 4.6; 96 respondents constituting 64% of the total sample agree that soil erosion occurs on the wetlands and this could be based on the fact that grazing and ploughing on the wetlands are negatively affecting the wetlands. The fact that 54 respondents constituting 36% of the total sample disagreed confirmed lack of knowledge of the respondents on the occurrence of soil erosion on the wetlands.

Table 4.7: Thulamela Municipality informs people about the impotence of wetlands.

	Frequency	Percentages
Strongly Disagree	45	30
Disagree	15	10
Neutral	0	0
Strongly Agree	39	26
Agree	51	34
Total	150	100

In view of Table 4.7 60 respondents which constitute 40% of the total sample disagree that Thulamela Municipality very often informs people about the importance of wetlands. This point is based on the fact that nothing was done by Thulamela Municipality to inform people about the existence and impotence of wetlands. On the contrary 90 respondents constituting 60 % of the total sample agreed that indeed Thulamela Municipality informs people about the importance and existence of wetlands, something which could be based on the lack of information of the respondents concerned.

Table 4.8: Local people know the importance of wetlands.

	Frequency	Percentages
Strongly Disagree	42	28
Disagree	54	36
Neutral	0	0
Strongly Agree	60	20
Agree	24	16
Total	150	100

Table 4.8 presents 96 respondents constituting 64% of the total sample who disagreed that local people know the importance of wetlands, something which could be based on the fact that people were never trained on the importance of wetlands. The fact that 84 respondents constituting 36% agreed that local people know the importance of wetlands is based on the misconception of the local people, and the misconception could not be directed to the local people as they were not trained on the value and importance of wetlands.

Table 4.9: It is important to teach about the importance of wetlands.

	Frequency	Percentages
Strongly Disagree	33	22
Disagree	18	12
Neutral	0	0
Strongly Agree	54	36
Agree	45	30
Total	150	100

Teaching about the importance of wetlands is essential, and this is also confirmed on Table 4.9 by 99 respondents constituting 66 % of the total sample, who agree that it is important to teach people about the importance of wetlands. People regard teaching as important as they can gain knowledge about the importance of wetlands through learning.

Contrary to the above, 51 respondents constituting 34% of the total sample disagreed that it is important to teach about the importance of wetlands, the notion which could be based on the misconception of a smaller section of the community.

Table 4.10: Wetlands are diminishing.

	Frequency	Percentages
Strongly Disagree	30	20
Disagree	12	8
Neutral	9	6
Strongly Agree	66	44
Agree	33	22
Total	150	100

According to Table 4.10 it is clear that wetlands are diminishing and this is clearly supported by 99 respondents constituting 66% of the total sample who agree that wetlands are indeed diminishing, something which could be based on the fact that many wetlands have thus far disappeared. 42 respondents constituting 28% of the total sample disagreed that wetlands are diminishing, something which could be based on the lack of information of the respondents. 9 respondents constituting 6% of the total sample are neutral and this could be based on the lack of knowledge of the respondents.

The perceptions of household members toward the conservation of wetland were examined based on the benefits that they obtained from wetland, losses that they experience through conservation of wetland, their opinions on the importance of wetland conservation and knowledge toward wetland biodiversity management.

Table 4.11: Percentage distribution of the benefits brought by wetland to the household members (source: survey data, 2011)

Benefits	frequency	Percentage distribution (%)
Handcraft productions	12	7,9
Source of water	2	1.4
Land for cultivation	85	56.4
None	51	34.3
Total	150	100

The results of the questionnaire survey shown in Table 4.11 indicate 65.7 percent of the household members suggested that the conservation of wetlands brought them benefits whereas 34.3 percent considered no benefits. According to Bauer (2003) benefits obtained directly from protected areas are the main factors which improve people awareness about biodiversity conservation. From figures shown in table 4.8 majority of the household members tended to have favorable perceptions of biodiversity conservation and admitted that the conservation of wetlands because wetlands brought them some benefits.

According to Mehta & Heinen (2001) the relationship between benefits and favorable perception of biodiversity conservation has been confirmed to be positively significant in many cases. Majority of household members (56.4%) at Thohoyandou indicated that they conserved wetland biodiversity because they generate revenue from tangible benefits through selling crops such as maize, sugarcanes, sweet potatoes and cabbage that they cultivated throughout the year along the wetlands. About 7.9% of household members indicated that they also generated income by selling handcraft such as traditional mats (*thovho* in Venda community) and baskets made of reeds and sedges that they harvest from wetlands sites. Only 1.4% of the household members indicated that the used wetlands as source of water through using irrigation to watering their crop fields because they can afford to pay communal tap's bills.

Therefore the improvement of benefits, that household members get from the wetlands can increase their willingness about the biodiversity conservation in the area of the study. According to *Fu et al.*, 2004 households' size and cropland were examined as the major factors affecting local people's apparent benefits and costs. This suggests that household members who obtained benefits from wetland sites tend to have favorable perception of conservation of wetlands biodiversity so that they capable to collect enough resources for household use or sale to increase the household income.

From table 4.11 shown that about 34.3 % of household members do not obtained tangible benefits from wetland sites. These household members tend to have non-favorable perceptions of biodiversity conservation because they have indicated that they are getting nothing from wetlands. This is evident that majority of people affecting or disturbing the conservation of wetlands in Thohoyandou through infilling the wetland by waste, settlements, pollution and other activities are those have are not obtained tangible benefits from wetlands. In addition people who have non-favorable perception of biodiversity conservation tend to resulted negative impacts on these ecosystems because they thought that wetlands increased number of mosquitoes and make people susceptible to malaria.

The results of the questionnaire survey shown in table 4.10 indicated that 87.2 % of the household members are aware about the importance of the conservation of wetlands biodiversity whereas 6.7 % of the household's members are not aware about the importance of wetlands biodiversity. Household's members who are aware about the importance of biodiversity conservation tend to have favorable perceptions of biodiversity conservation within wetlands. This may reduce negative effects on the wetlands sites and government can easy to manage and monitor those ecosystems without any conflict between household members and government since they understand the importance of wetlands in our environment.

From Table 4.12 indicated that about 12.8 % of household members were not aware about the importance of conservation of the wetlands biodiversity tend to have an non-perceptions of biodiversity conservation and start to practice the activities that may lead to the disappearance of some wetlands species.

Table 4.12 Percentage distribution of the opinions of the household members on the Importance of conserving wetlands (source: survey data, 2011)

Importance of wetlands	frequency	Percentage distribution (%)
Floods reduction	50	33.6
Sustained stream flow	31	20.7
Water purification	49	32.9
None	19	12.8
Total	150	100

With the regard to the opinions of the household members on the importance of conserving wetland biodiversity shown on figure 4.12 indicated that about 33.6 % of the household members known that wetlands are important since wetlands reduced the speed of water flow during the floods periods. Figure 4.12 also indicated that about 20.7% of household’s members know that wetlands sustain the stream flow and whereas 32.9% of household members indicated that wetlands are important because wetlands purify water that are contaminated. The results of the questionnaire survey shown in table 4.10 indicated that 87.2 % of the household members are aware about the importance of the conservation of wetlands biodiversity whereas 6.7 % of the household’s members are not aware about the importance of wetlands biodiversity. Household’s members who are aware about the importance of biodiversity conservation tend to have favorable perceptions of biodiversity conservation within wetlands. This may reduce negative effects on the wetlands sites and government can easy to manage and monitor those ecosystems without any conflict between household members and government since they understand the importance of wetlands in our environment.

From Table 4.12 indicated that about 12.8 % of household members were not aware about the importance of conservation of the wetlands biodiversity tend to have an non-perceptions of biodiversity conservation and start to practice the activities that may lead to the disappearance of some wetlands species.

Figure 4.1 Percentage distributions of the Opinions of household members on the management wetlands (source: survey data, 2011)

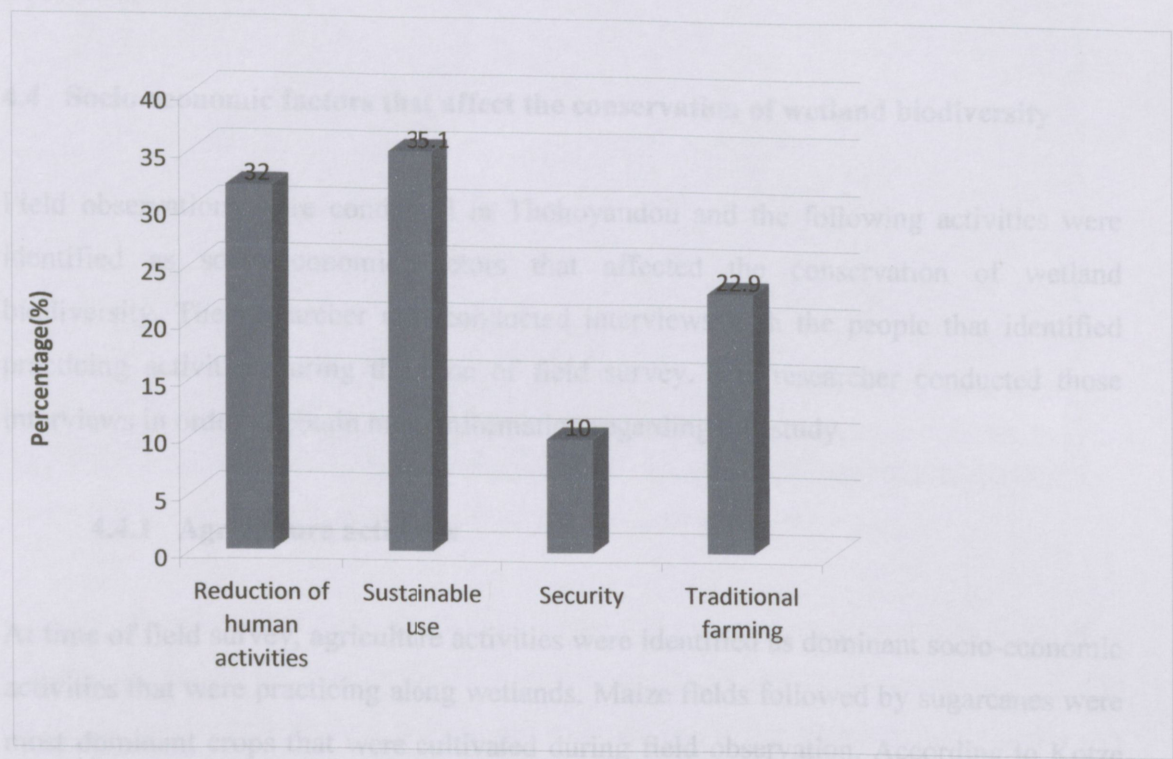


Figure 4.1 indicates the opinions that household members have towards the management of wetland biodiversity. Approximately 32% of household members thought that the decreasing of human activities along the wetlands could be a solution on the conservation of wetland biodiversity. Only 35.1% of household members suggested that by utilizing resources in the sustainable manner can help to conserve the wetland biodiversity. This could be done through harvesting natural resources that are not exceeding carrying capacity in which wetlands are produced. Finally 10% of house members suggested that security around the wetland sites with only 22.9% of household members indicated that the use of traditional farming methods when cultivating such as biennial cultivations can also help to conserve wetland biodiversity.

From the above suggestions of household members on the management of wetlands this indicated that many people know about the various strategies that can be used to manage

wetlands and this may lead to building community's perceptions of biodiversity conservation if these strategies could be implemented among community members in the study area.

4.4 Socio-economic factors that affect the conservation of wetland biodiversity

Field observations were conducted in Thohoyandou and the following activities were identified as socio-economic factors that affected the conservation of wetland biodiversity. The researcher also conducted interviews with the people that identified practicing activities during the time of field survey. The researcher conducted those interviews in order to obtain more information regarding this study.

4.4.1 Agriculture activities

At time of field survey, agriculture activities were identified as dominant socio-economic activities that were practicing along wetlands. Maize fields followed by sugarcane were most dominant crops that were cultivated during field observation. According to Kotze (2005) sugarcane use the most water and sometimes may increase the water loss by more than twice that of natural grassland. In addition few parts of these wetlands sites were covered by vegetables. The reason of household members for practicing agricultural activities along wetlands indicated that wetlands sites were free for everyone to use and are easy access water from groundwater instead of paying high water bill from municipal taps.



Picture 4.1: Agriculture activities along the wetland ecosystems

A farmer found cultivating in the field indicated that many of these cultivated fields after summer season are left bare or tilled for the preparation of next cultivation periods. Tilled fields are mostly prepared for productions of crops like maize which require the dry soil to survive. A fence in the study area found moved further into the Lukunde wetland in order to increase the fields or areas for cultivating their crops and the other parts of wetlands were burnt to reclaim the area for agricultural activities.

Since the area is bare because of these activities this led to the soil erosion to the wetlands during the rainfall periods. In addition soils are also loosening due to the previous cultivation activities and they can be easy to erode to the wetland sites. Erosion to the wetlands resulted in a deep gully which drain the water in the faster rate from wetland sites and also make the water regimes much less. Drains can also dry out these areas, reducing the likelihood of wetland species persisting in them. However in doing so it affects the conservation of wetland biodiversity since this gully reduces the values of the wetlands.

According to Kotze (2005) the impact results by cultivation on the wetlands may be reduced if people practice traditional cultivation methods which are sensitive to the functioning of wetland. For example residents of Thohoyandou must plant crops which tolerate saturated soil rather than planting crops such as maize which require dry soil and this may minimize the need to drain the wetland.

4.4.2 Pollution

During field observation in the study area several car washes were identified along the Mbovana wetland. Most of the cars used those car washes were public transports (taxes and buses) this is because Mbovana wetland is situated just approximately five (5) meters away from buses and taxes ranks. The tax driver indicated that public transport drivers used these car washes everyday because they paid low prices as compared to the amount that they paid on the car washes that are found in the Thohoyandou CBD. This Mbovana wetland is a perennial wetland which its spring supports the Mbovana stream throughout the year. People are using this stream as source of water to wash cars of their clients.

During the field survey the disposal of sewage water from Thohoyandou CBD were also identified linked to the Mbovana wetland. Therefore all these activities lead to pollution of the wetland site because sewage water, soaps and other chemicals that are used to wash cars contain detergents that may change the stream water quality and soil chemistry to be acidic or alkalinity. All these may contaminate the stream water quality and soil PH in the area of study because these pollutants may greatly exceed the capacity in which the wetlands can purify the water. This affects the functioning of Mbovana wetland because hydrophytes (sedges and reeds) are fail to adapt with these certain conditions and end up getting withered and die. As results some portions in the area of study became bare and exposure to the sun which lead to the dryness of the wetlands and extinction of wetlands species,



Picture 4.2: broken sewage hosepipe and deposition of waste water at Mbovana wetland

4.4.3 Grazing by domestic stock

During the field survey, grazing by domestic stocks (cattle) identified as one of socio-economic activities that affect the conservation of wetlands through trampling. Even though people of Thohoyandou are not engaged themselves with this activity but people of nearby villages (Magidi and Mariini villages) are followed the green pasture that attached with the block F wetland for their cattle to graze. Therefore people of the study area are not allowed by Thulamela municipality to have domestic stocks at the place of residents.

Herd of the cattles indicated that they use these wetland sites everyday because of shortage of space in his village due to the expansion of settlement. The expansion of settlement is influenced by the rural people who want to stay closer to Thohoyandou CBD. Grazing in the wetland sites has decrease vegetation cover and exposed soil to erosion as well as increased runoff. Cattle movement may also disturb the flow concentration of wetland sites which results a severely eroded wetland. In these situations

the erosion may cause the channel to cut up into wetlands and this may also caused the dryness to the wetlands.



Picture 4.3: livestock grazing and trampling caused by cattle movement at block-G wetland

4.4.4 Infilling

At time of field survey, large part of Lukunde wetland was filled with gravel soil for creating the space for building new shopping centre called Thohoyandou Regional mall. In addition other parts of Mbovana and block-F wetlands were converted to settlement. The reason for doing this was to create a space for building infrastructure because around Thohoyandou CBD there is no enough space for building these developments. As results of development activities and issue of expansion of settlement, open space were found small as compared to the ones currently occupied and these affect the conservation of wetland biodiversity because some of its were removed and lost whereas hydrophytes species are getting withered and die due to the lack moisture content.



Picture 4.4: Infilling of Lukunde wetland by soil for construction of new shopping centre.

During field observation large part of Mbovana wetland was filled with broken bricks mixed with solid cement mud, dry leaves of fruit trees and dumped waste (papers, plastics, old steel and plastic materials, and sewage materials). Household member found dumped in her bin full of waste indicated that people used wetland sites because waste management employees are not allowing the residents to dump the steel materials such as broken steel chairs into waste plastic bags. They also dumped the waste because these areas are not occupied by settlement meaning that it does not belong to anyone.

However deposition of waste within wetlands increase sediments from wetland's catchment, these changed wetland landforms which may affect the hydrological regime of the wetlands. This causes water discharge to weaken and retain less water than previously. Evidence from field survey some parts of Lukunde wetland was covered by

non- use wetland grasses and trees whereas dependent species (sedges and reeds) are dry. This indicated that moisture level in the wetlands was reduced due to the increase of sediments resulted from infilling activities and therefore sedges and reeds are not able to survived in this harsh conditions because of lack of wetness at a particular time.



Picture 4.5: Deposition of solid waste on the Mbovana stream

4.5 The demographic and socio-economic profile of the household's members

This theme covers socio-economic characteristics of the respondents that may influence people perceptions toward the conservation of wetland. Demographic factors such as gender, age and ethnic grouping are not significant predictors of people perceptions about biodiversity conservation. Therefore this study considered education level and occupation of the household members to predict the people's perceptions about conservation of wetlands biodiversity.



Picture 4.6: Hydric soil excavation spot

4.5.1 Hydric soil excavation

At the time of this research, there was evidence of hydric soil extractions along the four wetlands identified. Upon learning that the main culprits for such extractions were females, an interview was then conducted with one of them. The responses indicated that hydric soil is excavated for decorating walls surrounding the thatched huts and the floors in and around the huts. However, the women are not necessarily to blame since they are representing the entire family. Based on repeated field survey, excavations increased in dry season because of low rainfall. These motivated women to excavate the soil with the purpose of decorating huts and floors around them, especially in dry seasons, which it is believed spoil their decorations less. This tends to lead to more hydric soil excavations in dry seasons.

Respondents found excavating hydric soil indicated that they were doing so because they could not afford to pave their floors using cement bricks. Based on the interviews excavations were practiced by both employed and unemployed people settling on and away from wetlands in both villages. In this case both groups regardless of their socio-economic class, invariably contributing to the degradation of wetlands.



Picture 4.6: Hydric soil excavation spot

Picture 4.6 was captured in Bovana – a cross border wetland between Maniini and Thohoyandou Block F villages, but this picture was shot from the Thohoyandou Block F side of the study area. In plate 4.1, hydrophytes were removed from the wetland when digging the soil. Hydrophytes removal led to its structural degradation. Penetration by sun is also making the wetland to lose moisture while losing habitat for many plant and animal species. An interview with the headman indicated that community meetings were held intended at urging hydric soil excavation to stop. Even though village meetings were held, excavations seem to be continuing. This gives the idea that communal land management is not effective in terms of conserving the wetlands, because people often defy its implementation.

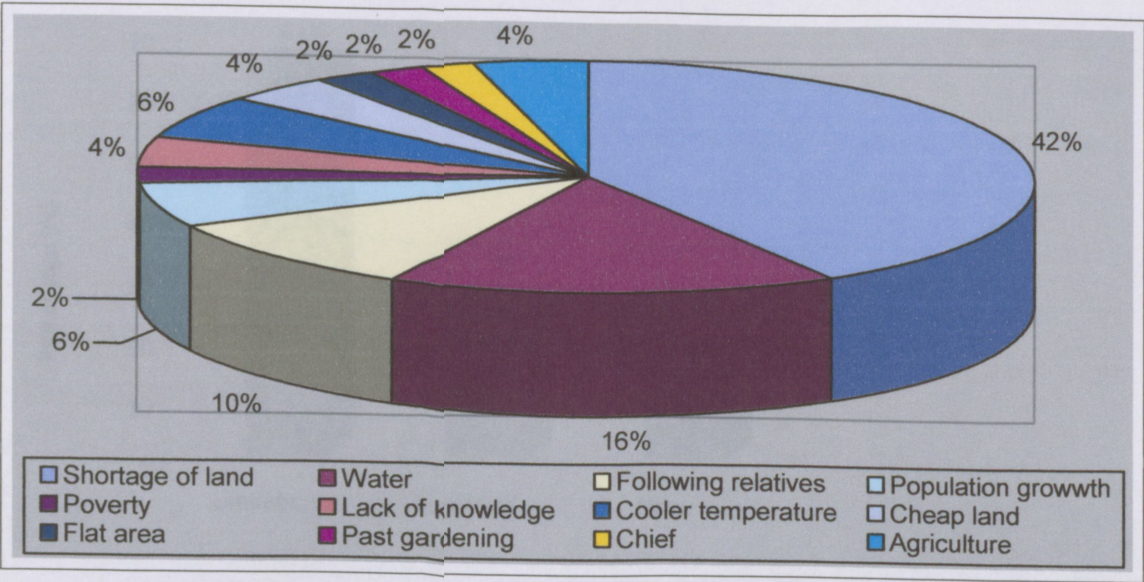
4.6 Lack of enough residential areas and other essential resources

Based on the information obtained through questionnaires for both villages, 52% of respondents settle on wetlands due to shortage of space. But realistically the issue of space shortage in both villages is not valid since residents can also move to settle in the nearby villages; rather it is only their preferences. As wetlands are the source of water, 16% of the respondents mentioned that, they utilize wetlands for water meant for cultivation. Figure 4.6 is linked to this subtopic because it gives a statistical view of the major activity inhabiting wetlands and its associated activities.

4.7 Losses which household members experienced through the conservation of wetlands

The following graph (fig: 4.3) represents the losses that respondents experienced through conservation of wetlands in the area of study.

Figure 4.2: Pie chart indicating factors influencing human settlements on wetlands in the study area

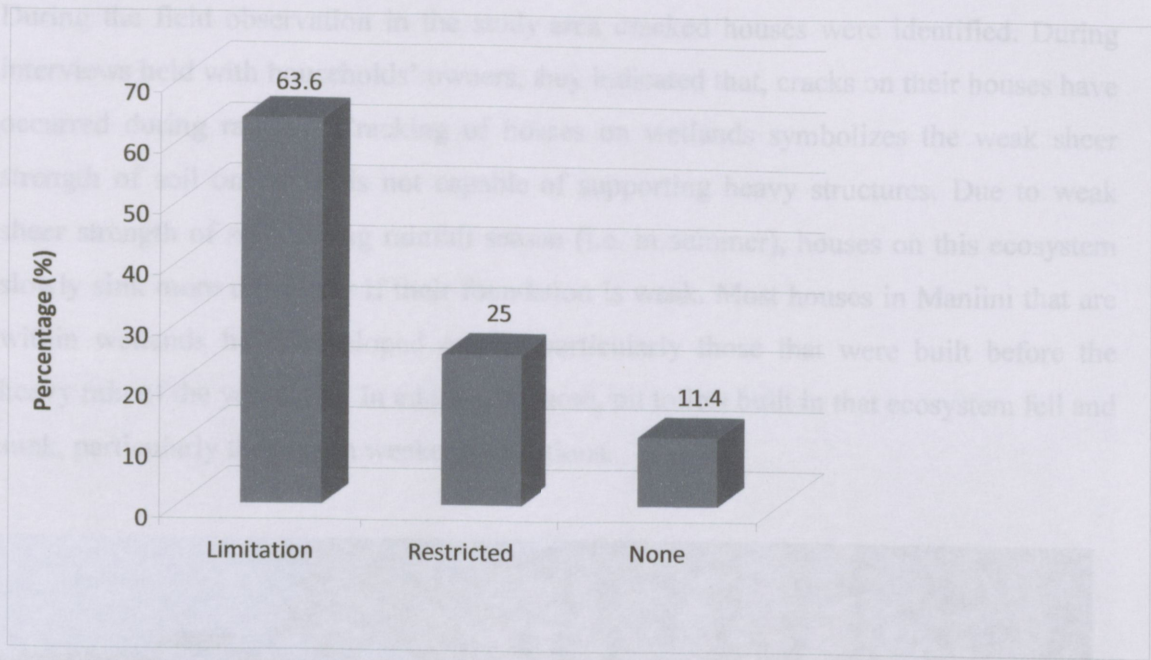


So as the issue of space shortage arose they started to settle in their fields. Others are settling in wetlands due to social attachment while others indicated that they are attracted to wetlands by physical conditions, i.e. 4% indicated that they are attracted by cool temperatures in wetlands, while 6% of the respondents indicated that they are attracted by the flatness of the area.

4.7 Losses which household members experienced through the conservation of wetlands

The following graph (fig: 4.3) represents the losses that respondents experienced through conservation of wetlands in the area of study.

Figure 4.3: Percentage distribution of losses that household members experienced through wetlands conservation (source: survey data, 2011)



With regard to the data obtained through questionnaire survey ($n=150$) in Thohoyandou 63.6% of household members indicated that their fields of cultivating crops are reduced and they also left with inadequate space. Approximately 25% of household members indicated that the conservation of wetland biodiversity restricted them from using natural resources for traditional products. Only 11.4% of the household members do not experience any losses through the conservation of wetlands biodiversity. According to questionnaire findings shown in figure 4.3 above large percentage of respondents suggested that conservation of wetland areas has negative effects on the household member's income due to the limitation of the mechanization of agriculture and handcraft products that they derived from wetlands. Therefore this may develop the negative perceptions of biodiversity conservation especially to those who obtained tangible benefits through practicing various activities along wetlands. This shows that those household members who do not experience losses tend to have favorable perceptions of biodiversity conservation since the majority of them are not utilizing wetlands for benefits.

4.8 Cracking, Sinking and Collapsing of buildings

During the field observation in the study area cracked houses were identified. During interviews held with households’ owners, they indicated that, cracks on their houses have occurred during rainfall. Cracking of houses on wetlands symbolizes the weak sheer strength of soil on wetlands not capable of supporting heavy structures. Due to weak sheer strength of soil, during rainfall season (i.e. in summer), houses on this ecosystem slowly sink more especially if their foundation is weak. Most houses in Maniini that are within wetlands have developed cracks, particularly those that were built before the heavy rain of the year 2000. In addition to these, pit toilets built in that ecosystem fell and sunk, particularly those with weaker foundations.



Picture 4.7 Cracked sunk toilet at Thohoyandou Block F wetland

4.8.1 Paving, Lining stones and stumping of the floors

When doing a survey in the study sites it was found that there were paved floors within other residents' yards. Such pavings were around houses and along the paths towards the gates. Through interviews it was learned that to some the idea of paving is to avoid mud and preventing the wetness around the houses during rain. Paving determines economic status since it is expensive and this validates that well financed people degrade wetlands more than those in low social class.



Picture 4.8 Paved surfaces in Thohoyandou Township

Those who cannot afford to buy paving bricks rather put stones along paths and roads or stump the surface to make soil more compact and harder for hydrophytes to easily develop. From all these strategies the most degrading is paving and during field survey it was mostly found Thohoyandou Township (See picture 4.8 for comparison and evidence

4.9 Conclusion FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

The socio-economic and political factors are leading to biodiversity loss in the study area. Conflict between the headmen and the municipality as a result of authority in allocation of plots is also another factor contributing to biodiversity loss. The demographic profile of the community shows that due to socio-economic circumstances such as poverty, people become vulnerable and end up depleting species although they know about the importance of the biodiversity degradation, recommendations were given with regard to their management. Future research topics were also suggested for further studies pertaining to wetlands management.

5.2 Major findings

- The findings indicate that household members of Thohoyandou who had lower education level and non-favorable perception of biodiversity conservation is higher than those who had favorable perceptions. This may result in negative effects on the various biodiversity within wetland sites because the majority of people may not take care when they utilizing the natural resource along wetlands. Therefore building of awareness among people around Thohoyandou can be a useful strategy that may be implemented to achieve sustainable access in the protection of these wetlands.
- During field survey, different socio-economic activities have been identified practiced on the wetland's catchments of both three identified wetlands. This validated that the community members of Thohoyandou have not enough knowledge about the environmental protection laws. Activation of these protection laws among the community members can minimized the negative effects to the wetlands that resulted by human activities in the area of study.

CHAPTER 5: FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

This chapter provides a summary of the main research findings and makes conclusions. Suggested options emerging from the study are recommended in this chapter. In the light of wetland resources and their degradation, recommendations were given with regard to their management. Future research topics were also suggested for further studies pertaining to wetlands management.

5.2 Major findings

- The findings indicate that household members of Thohoyandou who had lower education level and non-favorable perception of biodiversity conservation is higher than those who had favorable perceptions. This may result in negative effects on the various biodiversity within wetland sites because the majority of people may not take care when they utilizing the natural resource along wetlands. Therefore building of awareness among people around Thohoyandou can be a useful strategy that may be implemented to achieve sustainable access in the protection of these wetlands
- During field survey, different socio-economic activities have been identified practiced on the wetland's catchments of both three identified wetlands. This validated that the community members of Thohoyandou have not enough knowledge about the environmental protection laws. Activation of these protection laws among the community members can minimized the negative effects to the wetlands that resulted by human activities in the area of study.

- The results of the questionnaire survey shown in Table 4.3 indicate 65.7 percent of the household members suggested that the conservation of wetlands brought them benefits whereas 34.3 percent considered no benefits. Benefits obtained directly from protected areas are the main factors which improve people awareness about biodiversity conservation.
- The findings indicates that approximately 31 %of household members reported that they are unemployed and they do not have any source of income. According to Marshall *et al.*, 2006 protected areas contribute approximately 7 to 95 % of households annual incomes in rural areas for sustain their livelihoods. Therefore unemployed household members tend to have favorable perceptions of biodiversity conservation because they depended on the wetland sites to sustain their livelihoods.
- With the regard to education level of the household members, about 16.4% of the household members were found illiterate, 28.6% educated to primary school, 40% to secondary school 10.7% to undergraduate and 4.3% to postgraduate (fig:4.6). According to Gillingham & Lee (1999) education is usually considered as a first step in improving people's perception toward conservation. The majority of household members (85%) at Thohoyandou did not go beyond matric. This indicated that majority of people at Thohoyandou have lower education level and they tend to have non-favorable perceptions of biodiversity conservation.
- The findings indicated that 87.2 % of the household members are aware about the importance of the conservation of wetlands biodiversity whereas 6.7 % of the household's members are not aware about the importance of wetlands biodiversity. Household's members who are aware about the importance of biodiversity conservation tend to have favorable perceptions of biodiversity conservation within wetlands. This may reduce negative effects on the wetlands sites and government can easy to manage and monitor those ecosystems without

- any conflict between household members and government since they understand the importance of wetlands in our environment.
- During the field observation in the study area cracked houses were identified. During interviews held with households' owners, they indicated that, cracks on their houses have occurred during rainfall. Cracking of houses on wetlands symbolizes the weak sheer strength of soil on wetlands not capable of supporting heavy structures. Due to weak sheer strength of soil, during rainfall season (i.e. in summer), houses on this ecosystem slowly sink more especially if their foundation is weak.
- During rainfall, roads that are constructed on wetlands develop muddy conditions; which creates a problem for the people settling along wetlands. Delivery cars coming to that area get stuck in the mud, making it hard to access the area.
- Findings shown that about 34.3 % of household members do not obtained tangible benefits from wetland sites. These household members tend to have non-favorable perceptions of biodiversity conservation because they are known that they are getting nothing from wetlands. This is evident that majority of people affecting or disturbing the conservation of wetlands in Thohoyandou through infilling the wetland by waste, settlements, pollution and other activities are those who are not obtained tangible benefits from wetlands.
- With regard to the data obtained through questionnaire surveys for both villages, 31% of participants settle on biodiversity rich and fragile areas as a result of inadequacy of space. Practically the crisis of space inadequacy in both villages is not totally convincing as residents can also move to settle in the neighboring villages; rather it is only their preferences. As springs are the main source of water, 12% of the participants mentioned that they use the spring for water meant for cultivation.

- Terrestrial ecosystems are characterized by hydrophytes that are increasingly growing. The utilization of chemicals to eliminate weeds will impact negatively on the aquatic ecosystems. Weeds within people's plots will eventually die and the surface will be bare and receive direct solar radiation causing the surface of the area to lose moisture. Such chemicals also cause pollution to aquatic ecosystems, because during rainfall, contaminated water could flow towards the spring and thus degrade the water quality.

- As a result of inadequacy of settlement space, people in the study area tend to extract the plant species for settlements and the effect of clearing includes the reduction in the number of native biomass in aquatic ecosystems, turning it into a terrestrial ecosystem. Through the field survey that was conducted, it was noticed that clearing can be done using fire (slash and burn), metal tools (hand hoes and spades) and herbicides. These activities also led to an impact on indigenous wild fruit trees and vegetables. As such most indigenous plant animal plant species have gone extinct. All these lead to the loss of biological diversity
- From the questionnaire which was conducted in the study area, the biodiversity, which is the variability among living organisms from all sources, is of critical value to the community. It forms the basis of food suppliers and provides raw materials since the community rely on indigenous knowledge of plants, animals, insects, microbes and farming methods for food and for medicinal purposes. The natural resources also provided the community with building materials such as reeds and grasses for thatching. It is therefore likely that people observe and find out how natural resources are consumed. Livelihoods are more important than conservation due to socio-economic circumstances such as poverty in the households since the majority of people are not permanently employed
- The majority of the community members rely on the indigenous knowledge of plants, animals, insects, microbes and farming systems for either food or medicines. As such most plant and animal species are endangered and others have

already gone extinct within the study area as a result of unsustainable utilization of natural resources. Other community members claim that they know about the importance of the biodiversity and the legislations, regulations and local by-laws for biodiversity conservation.

5.3 Conclusions

Land-use activities are responsible for affecting or disturbing the conservation of wetland biodiversity in the area of study. The dominant land-use activities affecting biodiversity conservation is agricultural activities followed by infilling of wetlands by waste and soil for creation of space of building infrastructure. Other identified land-use activities are also responsible for affecting the conservation of wetland biodiversity.

The benefits and losses brought by the conservation of wetland biodiversity determined people's perceptions toward these ecosystems. However people, who obtained tangible benefits such as land for cultivation, handcraft productions and other benefits for generate revenue to sustain their livelihoods tend to have favorable perceptions of biodiversity conservation. Losses which households members experience through the conservation of wetland biodiversity such as restriction from natural resource utilization and limitation of human activities on the wetlands through the management of these ecosystems by Organizations turn them to have non-favorable perception of biodiversity conservation within wetlands. Household members who aware about them importance of wetlands tend to have favorable perceptions of biodiversity conservation within wetlands. Management strategies that may implement by these Organizations can be solutions to build the local community's perceptions toward the conservation of wetlands biodiversity.

In line with the first and second objectives (as stated in chapter 1), wetlands in the study area were delineated (see Figure 4.1) and socio-economic and political factors influencing their disappearance, examined. Figure 4.1 shows the spatial distribution of

wetlands and the threats associated with their disappearance. Wetlands in the study area are unevenly distributed, the majority of which, are degraded by anthropogenic activities.

Socio-economic and political factors are also responsible for wetlands degradation in the study area. The dominant socio-economic factor is settlement invasions which trigger other activities such as tillage, uprootment of vegetation, hand dug wells, washing, sand mining and hydric soil extractions that cause wetlands degradation and their gradual disappearance. The conflicting political decisions about wetland resource use and land ownerships by the headmen, civic organizations and municipality as governance institutions contribute towards poor wetland management and their consequent disappearance in the study area. Decisions pertaining to soil excavations, clearing of vegetation, soil compaction, and reduction of size due to increased number of settlements, bring about negative impacts which cause the disappearance of wetlands in the study area. Such retaliation impacts posed on community inhabiting wetlands are evident in the cracking of houses, the mushrooming of algae on houses, mud along foot paths and roads, and the increased number of mosquitoes, making people susceptible to malaria.

In an attempt to sustain their livelihoods, however, people adopted strategies such as maintaining strong building foundations; paving of floors; draining water through trenches and boreholes; large windows on buildings; stumping of floors and aligning of stones along the roads; introduction of soil from other areas and the utilization of herbicides and pesticides to kill mosquitoes. Since all these strategies are applied at different magnitude due to differential access to income and resilience levels they contribute differently, towards the disappearance of wetlands in the study area. Deforestation, alien plants introduction and the cultivation of subsistence crops are also responsible for wetlands degradation since they are practiced while not giving the wetlands a chance to regenerate.

5.4 Recommendations

Based on the research findings as presented in the previous chapter, this study recommends the following

- The national, provincial and local government should build trust and collaboration learning to the community members. This should be done in school especially for young people and in community sing the local language to adults. This will help to build the awareness to the community member about the importance of biodiversity conservation and how they could contribute to conserve biodiversity. These will also building the positive perceptions to the community members that hold negative perceptions of biodiversity conservation.
- Since people are not using traditional methods when they harvesting natural resource, traditional cultivation such as Bovana should be practiced as tan alternative cultivation method along wetlands. Therefore by planting crops which are tolerant of water logging (Bovana) will minimized the need to drain wetlands sites.
- Since the households members tend to have favorable perceptions of biodiversity conservation because they get benefits from wetlands. Government should develop a policy to increase this positive perception about its management strategy. This political arrangement will secure and enhance benefits that they obtain from wetlands.
- Since the household members tend to have negative perception of biodiversity conservation due to the reduction of income-generating activities and other activities. Government should promote less extensive farming to the community member especially to those who practicing agriculture activities and also promote some alternative income-generating activities.

- Regarding to the developments and settlement that expand to the wetland areas. The government should remove those building and compensate the owners and then rehabilitate the affected areas and then continue to manage and monitor those wetlands.
- Need for government surveyors to demarcate biodiversity rich areas in order to manage and conserve them. This will enable the government to easily implement and effectively apply the laws and regulations of biodiversity conservation. It will also be easy to budget for the rehabilitation and restoration of the affected biological diversity if biodiversity rich zones are demarcated.
- Biological diversity rich zones should be fenced in or poles must be placed around them as demarcations and thus diminishing the effects of anthropogenic activities associated with their gradual loss.
- Since the community could not be completely alienated from their traditional utilization of natural resources, rejuvenation should be applied where applicable as an alternative to provide a chance for the biodiversity to regenerate and recover.
- The municipality, community members in the study area should consider participatory decision making on the management of biodiversity and related activities. This would avoid conflict associated with land allocation and ownership.
- With regard to the natural springs that are within the residents' plots or stands, the researcher suggests that the government must repossess those plots and compensate their owners. Then the government should then rehabilitate the springs and manage the ecosystem around them.

- The headmen and the municipality should determine the plots size in an area before it is settled so that when people want plots they should choose from the ones already demarcated rather than having to choose where to settle. Free-choice in this regard allows some people to settle in ecologically sensitive zones which are threatened by fragmentation and gradual loss of biodiversity.

5.5 Recommendations for further research

Future research should consider the following areas of focus:

- Political ecology of cultivations in wetlands.
- Integrations of indigenous knowledge and western knowledge for wetlands conservation.

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APPENDIX: Questionnaire

Section A: Demographic and Socio-economic Status of the respondents

NB: Provide answers by putting a tick (✓) or a cross(X) in front of your answer

1. Education level

Illiterate	
Primary	
Secondary	
Undergraduate studies	
Postgraduate	

2. Occupation

pensioner	
Public sectors employment	
unemployment	
Self employment	
Other (please specify)	

3. Sex People's perception towards the conservation of the wetlands

Male		Female	
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4. What do you use wetlands for?

Cultivation	grazing	Dumping sites	Building infrastructure

5. What do you rely on natural resources for?

Cultivation	Settlement	Raw material extraction	Other (please specify)

Section B: Peoples perception towards the conservation of the wetlands

Please complete all questions Mark with an "x" Mark from Strongly Agree to Strongly Disagree

Statement	Strongly agree	agree	Neutral	disagree	Strongly disagree
People practice agriculture on the wetlands					
Grazing occurs on the wetlands					
Soil erosion occurs on the wetlands					
Thulamela Municipality informs people about the importance of wetlands.					
Local people know the importance of wetlands.					
It is important to teach about the importance of wetlands.					
Wetlands are diminishing.					

Thank you for your Participation