

Sustainability challenges for informal plantations in Isimangaliso Wetlands Park: impacts and perceptions

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DECLARATION

I declare that this research study: **Sustainability challenges for informal plantations in Isimangaliso Wetlands Park: impacts and perceptions**, except where specifically indicated to the contrary in the text, is my own work both in conception and execution. All the theoretical information and related sources that have been used or quoted have been duly acknowledged by means of complete references. It is further declared that this dissertation has not previously been submitted to any institution for degree purposes.

By

Bongani Loveous Mdluli

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ABSTRACT

Certain forest activities in the iSimangaliso Wetland Park have made a significant contribution to the economy; forest products range from natural forest products to commercial forest products derived from forests ranging from timber to non-timber forests products. The local communities of iSimangaliso Wetland Park practise informal afforestation (Eucalyptus, Wattle and Pine). All these informal activities are progressively contributing, not only to the gradual deterioration of the status of the water resources, but also to spoiling the ecosystem between living organisms and non-living organisms around the iSimangaliso Wetland Park.

These occurrences are impacting adversely on the aesthetic appeal of the Park. What is implicit is that the rate at which informal afforestation is taking place at the Wetland Park will increase which will reduce the water availability in the river catchments and in turn affect the employment rate within the local communities. Pursuant to these observations and problems, the researcher found it appealing and necessary to explore the informal afforestation and its reduction caused by afforestation in the catchment. In an attempt to address the research question or problem, the following research objectives were set up:

- To assess how local communities in the iSimangaliso Wetland Park perceive the practice of informal afforestation;
- To assess the reduction of water resources caused by the informal afforestation (Eucalyptus, Pine and Wattle) in the iSimangaliso Wetland Park in order to project future use of water resources; and
- To project the future status of water resources in the iSimangaliso Wetland Park.

The research methodology applied to achieve the objectives of the research study involved collecting information from the local communities of iSimangaliso Wetland Park. Data were collected by means of sets of questionnaires. The data collected was analysed using the Statistical Package for the Social Science (SPSS) computer statistical package and spread sheets, which led to obtaining the research findings. Various findings that emerged and were deduced from the research data analysed. The findings indicated that too much informal afforestation is practised by the local communities in the iSimangaliso Wetland Park. The findings further indicated that, among the respondents from the study area of the Park, a limited number of them had received tertiary education. It is believed that the lack of tertiary education had influenced the availability of skills, which resulted in a large number of people participating in practising informal activities that would pose negative to water resources. The Department of Water and Sanitation (DWS) needs to improve awareness about the negative impacts about the

practised of informal afforestation in water resources. The delayed of the issuance of Water Use Licences(WUL) by the Department of Water and Sanitation will cause the local communities of iSimangaliso Wetland Park to practised informal afforestation. Finally, the local communities indicated that if the government come up with alternative crops to plant and markets to sell, they can remove all the informal afforestation and to plant that crops.

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DEFINITIONS OF KEY TERMS AND CONCEPTS

Local communities refers to the local residents who encounter informal afforestation.

Perception refers to an insight into what local communities in the iSimangaliso Wetland Park perceive to be the right direction for their development by practising informal afforestation (Eucalyptus, Wattle and Pine trees).

Informal afforestation refers to the agricultural practices of planting Eucalyptus, Wattle and Pine trees without Water Use Licences (WUL) and Environmental Impact Assessment (EIA).

Lack of Water Resources Management refers to the practice of informal afforestation activities with unplanned, improper development and unfair distribution, and the optimum use of water in the study area not being managed.

Model refers to a simplified representation or abstraction of reality.

ACRONYMS

ACRU	Agricultural Catchments Research Unit
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DWAF	Department of Water and Forestry
EIS	Ecological Importance Sensitivity
EI	Environmental Importance
EIA	Environmental Impact Assessment
EC	Ecological Category
ESBC	Ecological Sustainability Base Configuration
FCF	Forestry Communities Forums
GDP	Gross Domestic Product
HDIs	Historical Disadvantage Individuals
IUA	Integrated Units of Analyses
IWRM	Integrated Water Resource Management
MCM	Million Cubic Metres
NEMA	National Environmental Management Act
NMAR	Natural Mean Annual Runoff
PES	Present Ecological Status
RDM	Resource Directed Measures
SEA	Strategic Environmental Assessment
SFRA	Stream Flow Reduction Activity
SPSS	Statistical Package for the Social Science
WC& DM	Water Conservation & Demand Management
WRC	Water Resource Classification
WUL	Water Use Licences

CHAPTER 1. ORIENTATION TO THE STUDY

1.1 Introduction

Certain forest activities in the iSimangaliso Wetland Park make a significant contribution to the economy. Forest products range from natural forest products to commercial forest products derived from forests ranging from timber to non-timber forest products (Dawson, 2002:44). Non-timber forest products are produced from the natural forests while timber products, such as pulp, paper, and wood supplies, are mainly produced from the commercial forest plantations. Truesdell (2002:124) calls the reader's attention to the fact that natural forests had been seriously depleted during the nineteenth century; so much so that it was considered necessary to obtain alternative, fast-growing trees for building timber, mine-props, packaging material and of course more recently, to feed the local paper mills. In this manner the growth of commercial forests increased. In terms of the economic contribution, commercial forests dominate the forestry industry in South Africa, and this industry is mainly driven by forestry companies (Kothari 1985:46). The forestry industries contribute to a reduction in the unemployment rate in South Africa.

The rate of unemployment compels local communities in the iSimangaliso Wetland Park to plant timber such as Eucalyptus, Wattle and Pine in order to alleviate poverty. The unemployment rate in iSimangaliso Wetland Park is around 48.2%. In particular the unemployment rate among youths increased from 32,7% to 48,2% between 2008 and 2016 in the post-recessionary period. The unemployment rate has consistently been 20% higher among youths than among adults (Umkhanyakude District Municipality, 2017:235). The high level of unemployment in iSimangaliso Wetland Park seems to be a driver for informal afforestation of species such as Eucalyptus, Wattle and Pine (Edward, 1994:44). The informal afforestation practices also seem to expand ever more across sensitive areas of the iSimangaliso Wetland Park. It is estimated that the local communities in iSimangaliso Wetland Park are practising informal afforestation (Eucalyptus, Wattle and Pine species) on approximately 5,937 ha (Venter, 2013:140).

Moreover, it is important for local communities to be aware of the regulatory context and for them to understand it, for example that planting Eucalyptus, Wattle and Pine species without a Water Use Licence (WUL) is prohibited in terms of the National Water Act (No 36 of 1998) under section 21(a-k). The question is whether local communities in the study area know that all water use activities are administered by the Department of Water and Sanitation (DWS) in terms of the said National Water Act and that the issuance of water use licences in the study areas had been suspended due to all river catchments (Kosi Bay, Lake Sibayi, Hluhluwe, Msunduzi

and Mfolozi) being stressed (Mallory, 2008:48). These prohibited water use activities are: taking, storing, discharging and disposing of waste water into watercourses.

However, over the years so-called informal timber plantations, not linked to commercial forestry companies, have significantly increased. These informal timber plantations (Eucalyptus, Wattle and Pine) have implications for water resources management and biodiversity. When land is cleared for the informal planting of timber crops the effect can be harmful to the environment (Schael et al., 2005:34). This is due to the fact that such expansions of export-oriented timber production in South Africa will displace other crops or threaten ecosystem integrity by shifting from a biodiverse ecosystem and farming systems to industrial monoculture (Schultz et al., 2002:67). Replacing natural grassland with Eucalyptus, Wattle and Pine species not only leads to the loss of soil fertility, but also destroys its productivity and water availability in the long run (Schulz, 1982:88). Grasslands are complex ecosystems, supporting large numbers of birds, insects, and plant species. When tree plantations are established informally and outside the set regulatory framework (without for example a water use licence), it limits the state's ability to manage these activities in a way that avoids water resources and biodiversity being impacted.

South Africa has experienced a drastic increase in small-scale informal plantations and interventions to support growers. People from rural areas in iSimangaliso Wetland Park are the main participants in the creation of informal plantations as part of the small-scale forestry industry. These informal plantations contribute significantly to their livelihoods and to rural development (Nick, 2007:46). The demand for timber and the availability of a market place in northern KwaZulu-Natal (Richards Bay) drives local communities of iSimangaliso Wetland Park to practise informal afforestation. However, the regulatory context imposes certain requirements on all forms of water use, such as the use due to afforestation. As per Section 21(a-k) of the National Water Act 1998 (No.36 of 1998) all water use activities require a water use licence prior to commencing therewith. The requirements for licence application also include complying with other environmental legislation such as the National Environmental Management Act (NEMA) regulations, which require environmental impact assessments.

Different views prevail with regard to how forestry can best contribute to rural development (Nick, 2007:14). One view is to tap into the external demand for timber products which stimulates exports from South Africa. However, informal afforestation of Eucalyptus, Wattle and Pine leads to increased water consumption in catchments. Moreover, informal afforestation is also associated with poor plantation management such as misplaced planting of large areas, poor species selection, plants of poor quality and poor management of water resources. The question is whether local communities of the iSimangaliso Wetland Park are aware of the

impacts on and regulatory context of informal afforestation/plantations (Eucalyptus, Wattle and Pine species).

For example, do local communities of the iSimangaliso Wetland Park understand that commercial afforestation is identified as a Stream Flow Reduction Activity (SFRA) under the National Water Act 1998 (No. 36 of 1998) and is subject to licensing? One of the considerations when issuing licences is the efficient use of water and implementation of Water Conservation & Demand Management (WC&DM) (s27 (1) (c)). Therefore demonstrated efforts to implement WC&DM are likely to improve the ability of the inhabitants of the said Park to secure licences for water use. WC&DM focuses on implementing a co-ordinated strategy to improve water efficiency of existing and new forestry plantations. The impacts of informal afforestation in the iSimangaliso Wetland Park streams are estimated to be approximately 2,820,464 m³/a.

1.2 STATEMENT OF THE PROBLEM

This study aimed at investigating the perceptions of the local communities in the iSimangaliso Wetland Park, as to what drives them to practise informal afforestation (Eucalyptus, Wattle, and Pine species) without water use licences and why they do it. Further to this it aimed at determining how much water resources reduction has already been caused by the existing informal afforestation as well as to contrast formal afforestation (Eucalyptus, Wattle and Pine) with the informal afforestation in the study area. Moreover, the study aimed at establishing whether these communities are aware of the negative implications of informal afforestation for water resources management in the vicinity of five river catchments, namely Kosi Bay, Lake Sibayi, Hluhluwe, Msunduzi and Mfolozi that all feed water into the iSimangaliso Wetland Park. It also anticipated to ascertain perceptions of the local communities of the existing knowledge concerning degradation associated with individual informal afforestation and also to determine whether demographics and factors such as participation in an activity, do affect perceptions. All of this is aimed at assisting local communities of the Park in improving their knowledge concerning participation in informal afforestation (Eucalyptus, Wattle and Pine) – making them understand that informal afforestation is not user-friendly towards water resources management.

Informal afforestation (Eucalyptus, Wattle and Pine species) and agricultural practices without a Water Use Licence (WUL) and an Environmental Impact Assessment (EIA) in the iSimangaliso Wetland; has led to results suggesting the improper management of water resources by the Department of Water and Sanitation (DWS). Once too much informal afforestation takes place on the ground, these forests will consume more water, resulting in a stressed catchment, meaning that the people who are using water in the iSimangaliso Wetland Park are exceeding the water availability in the river catchment. The precipitation decline from 800 mm to 600 mm in

the study area has resulted in an alteration of the characteristics of water resources, geographical features and natural resources used by tourism destinations to attract more tourists both domestically and internationally (Taylor, 1991:8). The natural vegetation and water resources of the study area are destroyed and degraded by the huge invasion of informal afforestation of alien species (Eucalyptus, Wattle and Pine) (Mallory, 2001:4). The natural beauty and water resources management of the study area is embedded in the availability of water from precipitation (surface and groundwater run-off). The water table along iSimangaliso Wetland Park is close to the surface while Eucalyptus, Wattle, and Pine plantations have much deeper rooting systems and higher rates of evapotranspiration and are considered to be the major source of abstraction of water resources in the study area (Kelbe et al., 2002:104). This study would assist, amongst others, in conservation, preservation and local community development and ensure that beneficiation takes place effectively in the area of iSimangaliso Wetland Park.

The 27 applications with a total of 5,600 ha for Streamflow Reduction Activities (SFRA) were submitted to the Department of Water and Sanitation for the issuance of water use licences (DWS 2002a:34). These applications were put on hold due to the following concerns: uncertainties regarding reserve determination and a stressed catchment. In recognition of these adverse concerns, the Department of Water and Sanitation (DWS) has commissioned a study to determine a reserve (DWS, 2001:32). Over the years conservationists have claimed that exotic plantations are diminishing the ground and surface water and damaging the hydrological balance of an area covered or surrounded by, or in the proximity of such a plantation (Blackmore et al., 1996:86; Pithers, 1996:82). These viewpoints have been opposed mostly by the forestry industry, or defended on the basis of the economic importance of afforestation (Scotcher, 1996:86).

Informal afforestation (Eucalyptus, Pine and Wattle species) exists in the iSimangaliso Wetland Park, that will abstract more water in the catchment and kill all natural vegetation (Bosch, 2006:29). Additionally, people will also struggle to obtain water for drinking purposes. "On the other hand most local communities in iSimangaliso Wetland Park were unemployed; they depend on forestry plantations (Eucalyptus, Wattle and Pine), then they sell it to the forestry market which is situated in northern KwaZulu-Natal (Richards Bay) in order to alleviate poverty." (Chikanga, 2004:89).

After completion of the study, once the results have been analysed and synthesized, an integrated plan and consideration of policies and legislations will be utilised to raise awareness in the local communities and gather the support of forestry stakeholders and government departments in order to drive the sustainable use of water resources in the park. Again,

afforestation also alleviates poverty among the local communities of iSimangaliso Wetland Park' (Mallory, 2001:23). The aim of this study was to assist the local communities in iSimangaliso Wetland Park in improving their knowledge of the principle that practising informal afforestation (Eucalyptus, Wattle and Pine) is not user-friendly towards water resources management.

1.3. DELINEATION OF THE STUDY

The delineation of the study highlights two aspects, namely spatial and conceptual. The spatial aspect looks into physical features related to the study area for direction purposes. Conceptual aspect is concerned with simplifying the core concepts of the study, being the perceptions of the local communities.

The geographical conditions and climate of the area have been explored. The motive behind the said exploration is that those reading this study gather an idea or picture in mind about the area before physically “arriving” at the study area.

The iSimangaliso Wetland Park is located in the north-eastern corner of KwaZulu-Natal and is confined by the South Africa-Mozambique border to the North, the Indian Ocean to the East, and the Lebombo Mountains and Swaziland to the West. The area forms part of the Mozambique coastal plain and comprises a broad, flat to undulating, cretaceously uplifted, sandy region of about 60 km in width. This current study concentrates on the five river catchments that feed water into iSimangaliso Wetland Park, which are Kosi Bay, Lake Sibayi, Hluhluwe, Mfolozi and Msunduzi because their water resources are scarce due to informal afforestation (Eucalyptus, Wattle and Pines) that was practised by the local communities of the study area. The area is also situated mostly within the Coastal Bushveld or Grassland Biome of South Africa (Low et al., 1996:230).

The following terms are central to the study and therefore deserve special clarification. An understanding of these terms will clarify and operationalize the variables in the rest of the study: The perceptions of the local communities, informal afforestation, and water resources management are the key concepts of the study theme.

Macintosh et al. (1995:25) regard local communities as the local people who become involved in the practice of informal afforestation and maintain a face-to-face relationship with water resources management. In this study the term *local communities* refers to the local residents who practise informal afforestation, and in the process of doing so, alter the characteristics of water resources management – especially water quantity. *Informal afforestation* (Eucalyptus,

Wattle and Pine) refers to timber being planted without any water use authorisation, which results in the improper reduction impact of water resources management (Chikanga, 2004:89).

The term *perception* refers to the way the world looks, sounds, feels, tastes or smells to the individual and a person's perceived world of an immediate experience (Carr, 1986:230). Morgan et al., (1982:252) suggest that sense and experience therefore form the cornerstone of perception. Perception is stimulated and cast by what takes place around people. By implication, perception is also a psychological process.

Straton et al., (1993:139) define perception as "the process by which we analyse and make sense out of incoming stimuli." Psychological value judgement is therefore part of perception since the mind is not a passive receiver of stimuli. Morgan et al., (1982:252) believe that "part of what we perceive comes through our senses from the object before us. Yet another part always comes out of our own." Perception therefore is shaped by experience but is never the sum total of it. Perception in this study is used to refer to the host communities' psychological value judgement based on emotions, since "emotions influence perception, experienced both past, and present". Water resources management is the activity of planning, developing, distributing and managing the optimum use of water resources. In this regard, informal afforestation has been suggested to be true and has been indicated as having a negative impact on water resources management (Mathieson et al., 1982:89).

1.4. OBJECTIVES OF THE RESEARCH

The overall objective of the study is to explore challenges related to dealing with informal afforestation in the iSimangaliso Wetland Park. The following specific objectives are identified:

- 1) To assess how local communities in the iSimangaliso Wetland Park perceive the practice of informal afforestation.
- 2) To assess the reduction of water resources caused by the informal afforestation of Eucalyptus, Pine and Wattle species in the iSimangaliso Wetland Park in order to project future use of water resources.
- 3) To project the future status of water resources in the iSimangaliso Wetland Park.

1.5. STRUCTURE OF THE DISSERTATION

The Orientation of the Study is covered in Chapter 1, which includes a discussion on the Background to the Study, Problem Statement, Delineation of the Study, Definition of Key Concepts, and the Objectives of the study. Chapter 2 illustrates the methodology applied in the study. The Literature Review of the study is discussed in Chapter 3. Chapter 4 compares

related modelling of spatial features: Afforestation, Water Resources, and Wetland Park in KwaZulu-Natal. The Study Area of this study is addressed in Chapter 5. The Data Analysis and Interpretation concerning the research are addressed in Chapter 6. The Summary, Conclusions drawn and Recommendations made with regard to the research and the manner in which it had addressed the study objectives are covered in Chapter 7.

CHAPTER 2: RESEARCH METHODOLOGY

2.1. Introduction

This chapter outlines the research methods and design followed in this study. Moreover, it gives an explanation of and justification for how the methods and design were employed while collecting data. Merriam (1998:40) explains that a plan for collecting, organising and integrating data is essential so that an outcome or end-result can be reached. This section provides an account of the methods, population and procedures used for obtaining relevant data that match the initial objectives of the research. This chapter discusses the elements of the empirical study including the section on the research approaches (quantitative and qualitative). In this chapter, a literature review was utilised as the foundation for the instruments used (questionnaires and Interviews) for an empirical study.

2.2. Research Design

This research relies on a quantitative and qualitative approach as explained in this section (Kothari, 1985:23). A quantitative research method, as indicated by Cresswell, (1994:40) and Locke et al., (1998:40), “measures a phenomenon using numbers in conjunction with statistical procedures to process data and summarise results”. In this study, the quantitative method was followed to quantify data so as to address the second objective described in the previous section, namely to assess the reduction of water resources caused by the informal afforestation of Eucalyptus, Pine and Wattle in the iSimangaliso Wetland Park in order to project the future use of water resources.

Quantitative data will be made up of the total hectares of formal afforestation as from before 1972 until 2017 in five river catchments (Kosi Bay Estuaries, Lake Sibayi, Mfolozi, Msunduze and Hluhluwe). The quantitative data as analysed in collaboration with the KwaZulu-Natal Department of Water and Sanitation Streamflow Reduction Activities (KZN-DWS-SFRAs) (Sub-Directorate) using existing information from Water Use Authorisation Registration Management Systems (WARMS), Geographical Information Systems (GIS), Gisap and Google Earth in order to assess SFRA’s existing legal water use authorisations of iSimangaliso Wetland Park according to River Catchments.

WARMS is the registration programme or system used by the Department of Water and Sanitation for registering all formal water users and its water use that is contemplated in terms of the National Water Act (Act 36 of 1998). The National Water Act (Act 36 of 1998) enables the Department of Water and Sanitation to use WARMS to gather information that needs to be used in the management of water resources. The registration of water use in WARMS is captured around the following six questions:

1. Who are you? Are you in possession of a water use license/ SFRA?
2. Where are you? (This relates to where the water user may be contacted i.e. contact details / postal address and physical address).
3. How much water are you using?
4. What are you using it for?
5. Where are you using it? (This relates to where the water use is situated (i.e. taking place): Water management area, Quaternary drainage region, Latitude and Longitude, Property).
6. Where are you obtaining your water from?

Geographical Information Systems (GIS) is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information (i.e. spatial data). GISAP refers to the tools used to gather, transform, manipulate, analyse, and produce information related to the surface of the Earth. Google Earth is a virtual globe, map and geographical information program, originally known as EarthViewer 3D. Once the researcher understands the extent of lawful water use it is possible to determine the informal afforestation in the study area.

Qualitative research was conducted in a real-world setting and is concerned with viewing experiences from the perspective of those involved – the aim being to attempt to understand why individuals act or behave as they do (Cresswell, 1994:40; Locke et al., 1998:40). In this study, qualitative methods were used to address the following objectives:

- 2) To assess how local communities in the iSimangaliso Wetland Park perceive the practice of informal afforestation.
- 3) To project the future status of water resources in the iSimangaliso Wetland Park.

Qualitative data were obtained from interviews conducted with representatives from local communities in iSimangaliso Wetland Park. The interviews were based on a questionnaire designed to test perceptions, as will be described in the following sections.

2.3. Primary and Secondary sources

This research project relied on both primary and secondary data sources (Buston et al., 1998:45). The primary data sources in the form of questionnaires were used to test the perceptions of local communities concerning water resources management and the implications of informal afforestation (Eucalyptus, Wattle and Pines) in order to quantify the following

research objective, namely 1) to assess how local communities in the iSimangaliso Wetland Park perceive the practice of informal afforestation.

Existing secondary data sources from KZNDWS were used such as Water Use Authorisation Registration Management Systems (WARMS), Geographical Information Systems (GIS), Gisap and Google Earth in order to assess SFRA's Existing Legal Water Use Authorisations of the iSimangaliso Wetland Park. Maps and Satellite data (remote sensing) were used in this research project in order to create a comparison of the landscape between existing formal afforestation and informal afforestation prior to 1972. This is done for the spatial area covering five river catchments (Kosi Bay Estuaries, Lake Sibayi, Mfolozi, Msunduze and Hluhluwe) in order to quantify the following research objectives: (2) to assess the reduction of water resources caused by the informal afforestation of Eucalyptus, Pine and Wattle trees in the iSimangaliso Wetland Park in order to project future use of water resources; and 3) to project the future status of water resources in the iSimangaliso Wetland Park.

2.4. Interview Data

The interviewing method was applied to collect data for this study. The researcher covered all the questionnaires during the face-to-face interviews. Structured interviews were conducted with the representatives from the local communities in the study area (Dawson, 2002:56). The Cluster (Area) Random Sampling Method interview was used in this research project. Cluster sampling is a technique used when "natural" but relatively homogeneous groupings are evident in a statistical population (Burgess, 1982:25). With this technique, the total population was divided into these groups (or clusters) and a simple random sample of the groups selected (Clark, 1989:83). Then the required information was collected from a simple random sample of the elements within each selected group. A common motivation for cluster sampling was to reduce the total number of interviews and costs while maintaining the validity and representivity of the results. The interviews were conducted with twenty people per river catchment. The researcher interviewed 100 participants, which covered the entire study.

2.5. Survey Data Sources

The Global Positioning System (GPS) was used during this project in order to find the exact total hectares of trees planted informally and formally by the interviewees. The Survey method was used in order to collect data in which information was gathered via questionnaires. The surveys allowed the researcher to gain information quickly and required relatively little effort to gain large amounts of data (Bohme et al., 1991:29).

2.6. Data Collection Techniques

Questionnaires and Interviews were used in this study. The main aim of using these data collection techniques was to measure people's perception of the communities' role in and awareness of informal and formal afforestation and its espoused benefits which needed to be validated by using more than one data collection method. The data collection techniques for this study varied due to the different sampled populations. The questionnaire and interviews design is a reliable instrument for measuring people's attitudes or capabilities but requires careful planning (Goddard & Melville, 2001:46). Efficiency was ensured while structuring a questionnaire, and interviews and data collection instruments were planned in advance.

2.6.1. Questionnaire

The research was made up of two forms of questions, namely Closed-ended and Open-ended questions. Closed-ended questions were those that could be answered with a simple "yes" or "no", while Open-ended questions were ones that required elaboration on answers in the respondents' own words and expression of any ideas they thought were applicable. The answers could come in the form of a list, a few sentences or something longer.

The questionnaires were distributed to individuals who elected to take part in the research. The completed questionnaires were collected a week after distribution. One of the advantages of a questionnaire survey is that questionnaires are distributed to targeted respondents at lower costs. A questionnaire-based survey relies on information from respondents and usually involves only a proportion or sample of the population in which the researcher is interested (Veal, 2006:231). To achieve the objectives of this study, fieldwork was conducted by means of distributed questionnaires in the study area which covered five river catchments being situated close to the iSimangaliso Wetland Park, namely Kosi Bay, Lake Sibayi, Mfolozi, Msunduzi and Hluhluwe. The time-span of interviewing and data collection stretched from 1 October 2016 to 20 October 2016.

All questionnaires were hand-delivered to the respondents and hand-collected. The researcher emphasized that the names of the river catchment be written on the questionnaires. Questionnaires were separated per river catchment. Questionnaires allow the respondents to express their views freely, especially on controversial issues (Mouton, 2008:63). Using a questionnaire was the best data collection technique, since the study dealt with or investigated people's perceptions or opinions, which are regarded as being sensitive topics.

2.6.2. Questionnaire design

The questionnaires distributed to respondents were all in English and isiZulu for consistency. The most important principle to adhere to while designing a questionnaire is to formulate the

questions as short and simple as possible so that it can be clearly understood. This should be done by bearing in mind the reason for undertaking the research and by including questions that are relevant to the research only (Veal, 2006:249). The questionnaire was formulated by considering the research questions aimed at receiving responses that would assist in achieving the objectives of the study, and also by taking into consideration the following:

- The researcher should have sought out as much as possible previous research performed on the topic or related topic, which is done during a literature review.
- The objectives also need to be taken into account with a view to achieve the aim of the study.
- Inclusion of the questions in the questionnaires and interviews alike.
- The factors of open-ended and closed-ended questions as well as their importance or benefits need to be taken into consideration.

The following section explains the format along with the content of the questionnaire used in this study.

2.6.3. The structure of the questionnaire (see Annexures B & C)

In the development of the questionnaire necessary instructions and guidelines were provided in respect of each question (see Annexures B & C). Annexure B displays the English questionnaire and Annexure C the isiZulu questionnaire). A four-page questionnaire was designed which contained eight questions that were open-ended and twenty that were closed-ended.

Questions 1.1 to 1.7 requested respondents to provide certain demographic information such as their role in the community. Questions 1 to 16 required the respondents to provide information which could assist in achieving the first objective of the current study, namely to assess how local communities in the iSimangaliso Wetland Park perceive the practice of informal afforestation. It consisted of six closed-ended questions to which the participants had to respond by simply making a tick in the appropriate box. Ten questions were open-ended, which required the respondents to further elaborate on their answers.

Questions 17 and 18 requested the respondents to answer questions the second objective of the current study, namely to assess the reduction of water resources caused by the informal afforestation of Eucalyptus, Pine and Wattle species in the iSimangaliso Wetland Park, which could assist in making projections on the future use of water resources. Question 17 was open-ended and Question 18 closed-ended.

Questions 19 to 21 requested the respondents to answer questions aimed at achieving the third objective of this study, namely to project the future status of water resources in the iSimangaliso Wetland Park. Questions 20 and 21 were open-ended and Question 19 was closed-ended.

2.7. Permission to conduct the study

2.7.1. Data collection procedure

Permission to conduct this study was obtained from the Tribal Authority and Department of Agriculture, Forestry and Fisheries: Forestry Section, seeing that it is their area of jurisdiction. The necessary arrangements were made with the respondents telephonically. The study was conducted in five river catchments which resort under the KwaZulu-Natal: Department of Water and Sanitation area of jurisdiction in accordance with river catchment, and the areas fall under the administration of tribal authorities. The researcher had to comply with the customs of the tribal authorities and their ethical procedure, which was also incorporated into the application and during data collection. For instance, the researcher had to be introduced to local authorities (chiefs) of nine tribal authorities before commencing with the research. Before the data collection could take place, the study was introduced to each of the nine chiefs and the purpose thereof was also explained to them.

A covering letter (see Annexure A) was attached to all distributed questionnaires in order to inform the respondents about who the researcher is, the purpose of the study, and why they had been chosen to participate in the study.

2.7.2. Questionnaire for all respondents

The intention with the questionnaire was to collect data from five groups of communities in accordance with the applicable river catchment. All groups were co-operative in answering questionnaires and participation. The introduction of the questionnaires and of the research topic thereof to the respondents took approximately 15 minutes per group of participants. The procedure was such that the researcher would distribute questionnaires to communities in their own settings (river catchments and tribal authorities). It was made clear that the questionnaires should be left with willing respondents and collected in the following week. The respondents were instructed to take as much time as they needed to complete the questionnaire, which also increased the response rate. The researcher collected all the questionnaires the following week.

2.7.3. Sampling Technique

The study applied a specific sampling technique. According to Strydom et al., (2002:198), *sampling* means “taking any portion of a population or universe as representative of that complete population or universe”. Sampling was performed to select community members

based on the following: it takes people or other units that are readily available (Leedy & Ormrod, 2013:214). The study used a probability convenience sampling technique by which the community members in the population all stand an equal chance of being included in the sample. A *probability sampling method* is any method of sampling that utilizes some form of random selection (Oppenheim, 1992:175). A randomised sample was used to select 20 people of local communities per river catchment, which added up to 100 participants for the entire study area.

The questionnaires were completed by communities' members who were selected to complete a questionnaire. The number of respondents in the study was large but it was approached according to the area of jurisdiction in accordance with selected river catchments, namely selected such as Kosi Bay, Lake Sibayi, Mfolozi, Msunduzi and Hluhluwe. In this research, the study object was the population. A *population*, as defined by, Powers (1985:235), is "a set of entities in which all the measurements of interest to the practitioner or researcher are represented" Neuman (2000:200) states that a population is the 'large pool' specified and has a geographical location and boundaries. Thus this study sampled various populations which would provide different categories of data to satisfy the research mission.

Research findings were generalised based on the assumption that what was observed in the sample group could also be observed in any other group within the population. Each population group had a representative sample that matched each category of respondents. It was made easier for the researcher to follow up and assemble the results during analyses.

A sampling frame was used in this study. A *sampling frame* is a list of units of observation of a population of interest known as sampling units (Limb et al., 2001:89). The example of the sampling frame for this research with probably about 100 people in the iSimangaliso Wetland Park; with an equal number of women and men aged from 18 to +65 years (see Table 1).

Table 1: 100 sampling units/women and men from a list similar to this (Walford 1995:275).

Name	ID Number.	Race	Gender	Age 18-65	River Catchment	Educational Level	Sub- quaternary Catchment

CHAPTER 3: LITERATURE REVIEW

3.1. Introduction

The forestry industry ventures were increasing in South Africa and contributed approximately R102 billion to the Gross Domestic Product (GDP) in 2013 (Institute of Natural Resources, 2003:24). A number of job opportunities, approximately 10.3% per annum, were created forestry industry, and created enterprise opportunities for the Historically Disadvantaged Individual Groups (Guyer *et al.*, 1997:199). Due to the uniqueness of “iSimangaliso Wetland Park landscape: biodiversity and vegetation, it is regarded as one of the more significant and fastest growing components of the timber industry in South Africa” (Alzue *et al.*, 1998:9) and Herbert (2001:28). The increase in informal afforestation in the Park will create improper management of water resources in South Africa (Herbert, 2001:35).

The water table along iSimangaliso Wetland Park is close to the surface; Eucalyptus, Wattle and Pine plantations have much deeper rooting systems and higher rates of evapotranspiration and are conceived to be the major source of abstraction of water resources (Kelbe *et al.*, 2010:104). An increase in informal afforestation (Eucalyptus, Pine and Wattle) in the iSimangaliso Wetland Park will abstract more water in the catchment and kill all natural vegetation (Department of Water and Sanitation report 2001). “A precipitation decline from 800mm-600mm per annum with 45% of the rain falling in summer (November to March) was noted in December 2001, as a result there is a shortage of water available in the iSimangaliso Wetland Park.” (Mallory, 2001:413.)

3.2. Community Perception

The iSimangaliso Wetland Park has its special values and concerns. “Although the forestry industry provides opportunities for many local communities, it may also represent different kinds of threat for residents like insufficient water supply and sanitation. In order to minimise these threats, there is a need for dialogue, cooperation, and collaboration among the various local communities involved” (Aas *et al.*, 2005:32). The involvement of local communities needs to be included in any sustainable water resource management plan in order to reduce conflict (Locke *et al.*, 1998:62). The forestry industry affects local communities in many ways; people should be made aware of the economic and social impact of timber and the role it plays in improving the quality of life, standard of living, promotion of peace and understanding among other people (Mbongwe, 1998:18).

James (1991:31) describes *informal afforestation* (Eucalyptus, Wattle and Pine) as being caused by the economic crisis, illiteracy rate and urban unemployment in the cities. According to Locke *et al.* (1998:188) there is call for “an ethic of conceptual responsibility” in the approach to

managing informal afforestation (Eucalyptus, Wattle and Pines species) because on the one hand they pose a problem of high consumption of water resources, but eliminating them entirely would disturb the economic injection into the Gross Domestic Product (GDP) provided by forestry industries. An increasing population, a rise in poverty and inadequate intervention from the government in the form of grants or subsidies, contributes to the pressures that cause people in the rural areas to practise informal afforestation (Herbert, 2001:124). The population increase in the country is pushing people to use their thinking skills to come up with alternative ways of boosting their economies for their survival (Stamp, 2002:125). My assumption is that once populations increase with unemployment in urban areas, urban-rural migration will take place. However, possibilities of informal afforestation are strong in rural areas.

Quantitative and Qualitative research methodologies were followed when this current study was undertaken in order to bridge the gap or quantify research questions that were formulated following the literature review. A *quantitative research method*, according to Creswell (1994:40) and Locke et al. (1998:40), “measures a phenomenon using numbers in conjunction with statistical procedures to process data and summarise results”. Qualitative research was conducted in a natural setting and was concerned with viewing experiences from the perspective of those involved; the aim being to attempt to understand why individuals act or behave as they do (Cresswell, 1994:40; Locke et al., 1998:40).

The methods followed for sourcing data for this research were interviews and surveys. Structured interviews were conducted with representatives from the local communities of the study area (Locke et al., 1998:21). This study used questionnaires as well as interviews – the survey methods of data collection in which information was gathered. Surveys in this research could allow the researcher to gain information quickly and it required relatively little effort to gain large amounts of data (Edwards et al., 1994:29).

The data collection technique used in this study was in the form of a questionnaire. Randomised sampling was performed to select 20 participants from local communities per river catchment, which yielded a sample of 100 participants for the entire study area. Data analyses and interpretations were adopted by using frequency-percentages, tables and graphs to present the analysed data. The responses received by means of the interviews and the findings from observations were analysed using the content analysis method which groups data into relevant categories (Merriam, 1998:40).

Informal afforestation can contribute towards rural development by either improving or innovating the production process, or by providing an ecological infrastructure for an attractive rural landscape (Hoyt, 2005:484). The role of forestry is gradually changing, with stronger emphasis being placed on its role in maintaining and recreating ecological and amenity services

as a means to contribute towards environmentally attractive living and leisure areas for a growing urbanised population (Stamp, 2002:38). Herbert (2001:28) pointed out that the rate of informal afforestation was increasing and that it was creating improper management of water resources in South Africa.

3.3. Informal Afforestation

Informal afforestation (Eucalyptus, Pine and Wattle) took place in the iSimangaliso Wetland Park which would have abstracted more water in the catchment and would kill all natural vegetation (Mallory, 2001:23). This research aimed at identifying all informal afforestation and its impacts on the abstraction of the water resources and natural resources.

3.4. Wetland Park

In the Eastern, mountain range of iSimangaliso Wetland Park the topography had flattened substantially and had developed into lowland undulating watercourses and the formation of floodplains and off-channel pan-type wetlands which are typically characteristic features of the river courses (DWS, 2009:78).

There were peat wetlands in the Park that played an important role in maintaining the functions of the rivers, lakes and estuaries. There were permanent wetlands in the study area, with an average thickness of peat being 0.5 – 1.0 m. According to Grundling (2013:34), the peat wetland is in the Mfabeni Mire adjacent to Lake St Lucia. Mfabeni is one of the largest (1 650 ha) known peat wetlands in South Africa; it consists of peat depths of 10.8 m. In general, the swamps and marshes were surface expressions of the groundwater table, with perched aquifers within the dunes draining to the interdune valley floors (Grundling et al., 1998:202). This wetland is a World Heritage Site.

3.5. Water Resource Management

Water Resource Management is an international, multidisciplinary forum for the publication of original contributions and the exchange of knowledge and experience on the management of water resources (Herold, 1980:24). The study area is located along the North-East coast of South Africa. The main rivers that affect the water resources management in the Park are Hluhluwe, Kosi Bay, Lake Sibayi, Msunduzi and Mfolozi adjoining catchments and all flow in a general Eastward direction to affect the iSimangaliso Wetland Park. Time series flow data were used to determine the groundwater-surface water interaction, for example using a curve fitting method to improve confidence in the model (Herold, 1980:23).

3.6. Conclusion

A comprehensive literature review for this study was performed in order to explore a gap. Too much informal afforestation has taken place in the study area, causing the government to find it difficult to manage water resources due to the said informal afforestation. Most river catchments in the iSimangaliso Wetland Park were stressed due to water demand exceeding water supply (Department of Water Affairs and Forestry, 2004:25). The study area also consists of protected areas which were affected negatively by the informal afforestation (Eucalyptus, Wattle and Pines) practised by the local communities in the study area. This study wished to determine the perceptions of the local communities on why they planted timber without applying for water use authorisation.

CHAPTER 4: RELATED MODELLING OF SPATIAL FEATURES: AFFORESTATION, WATER RESOURCES AND WETLAND PARK IN KWAZULU-NATAL

4.1. Introduction

What is a model? A *model* is a simplified representation or abstraction of reality. Models would encompass everything from physical analogues and scale models to conceptual and arrow schematic diagrams and various forms of mathematical modelling (Macmillan, 1989:89). Models are used to predict and thereby manage everything from whether it is likely to rain on your picnic day to the responses of consumers to changes in interest rates. The practical applications depend upon and help to inform the development and use of models in the context of pure research.

Models have assumed such prominence because they provide a method of understanding and predicting the operation of systems that either for practical or political reasons or because of their complexity, spatio-temporal scale, or both, do not lend themselves to experimental methods of parameter or control group manipulation (USGCRP, 2000:12). The presence of Afforestation, Water Resources and Wetland Parks is dependent on the availability of precipitation. In order to know the future use and status of Afforestation, Water Resources, and Wetland Parks, the geographical researchers use modelling in geography in order to quantify results.

4.2. Role and Significance of Modelling in Geography

Modelling has arguably become the most widespread and influential research practice in the discipline of geography, as indeed within the sciences more generally. The role of modelling in geography will assist the geographer in developing a conceptual model. A *conceptual model* is an abstract representation designed to articulate the processes operating in a system of interest (Tiwari et al., 2000:43). Conceptual models may take a narrative form and use words to

describe the system at hand, but with their long spatial science tradition, geographers have frequently drawn on geometry and graphical forms of visual representation to render their conceptual models (Openshaw, 1998:334). Modelling is at once theoretical, helping to flesh out theory and make it more explicit and applicable, and experimental: manipulating model phenomena so as to test their correspondence to theory and to independent observations of the phenomena they are modelling (Burgess, 1982:21). Geography modelling tries to reduce the complexity of a real-world element or phenomenon to combinations of elements such as a set of mathematical equations (mathematical modelling), a number of descriptive characteristics (database modelling), or a set of rules and behaviours (dynamic or predictive modelling) (Openshaw, 1998:45).

4.3. Planning and Modelling of Forest Reserves in KwaZulu-Natal

The KwaZulu-Natal forests have by far the highest number of tree species per unit area of any temperate forests in South Africa (Kothari, 1985:49). An index of subsistence and commercial resource use of forests was modelled using population density, extent of electrification, forest accessibility and the buffering effect of plantations and woodlots (Mulligan et al., 2003:23). 25% of the total forested area in KZN occurs within formal statutory protected areas, but most of this is made up of only a few forest types (Richard, 1990:88). A rule-based modelling approach is followed which enables ecological heuristics to guide the selection of priority forests.

The expansion of formally protected area networks, improvements in management of forest reserve management and regulation of land use change within forested catchments and river catchments linked to forests (Sayer, 1992:45). Modelling indicates that integrated land management strategy needs to directly involve local communities in the forest conservation programmes. The focus of forest management and reserve planning in KwaZulu-Natal has tended to view forests as geographically and functionally distinct ecosystems without adequate consideration of landscape processes and requirements for connectivity (Pithers, 1996:129). The modelling indicates that there are few Historically Disadvantaged Individuals (HDIs) that are nowadays benefiting from the forest reserves in KZN. Forestry planning through Department of Agriculture, Forestry, and Fisheries (DAFF) planned that in 2020, 50% of forests need to be owned by HDIs (NHRA, 1999:456).

4.4. Planning and Modelling of Water Resources in KwaZulu-Natal

The Pitman model is the hydrological model that forms the backbone of the Department of Water and Sanitation water resource planning suit and typically operates on a monthly time-step basis (Pitman 1973:90). Essentially it is a rainfall-runoff model that operates by using explicit soil moisture accounting, representing interception, soil moisture and ground water storages, with model functions to represent the inflows and outflows. The ACRU was most commonly

used for assessing the impacts of various land-use changes (especially commercial forestry) or climate changes on water resources (Low et al., 1997:34). The Pitman and ACRU models were used in order to determine future use and status of water resources in KZN and the rest of South Africa. Plantation forestry is the largest contributor to the land cover modification in KwaZulu-Natal (Le Grange, 2011:56). The modelling results of 1996 indicated that irrigation and afforestation are already using water resources in KwaZulu-Natal to an extent of approximately $3,722 \times 10^6 \text{m}^3/\text{a}$ (Management of Water Resources in the Republic of South Africa, 1996:25). According to the Management of Water Resources in the Republic of South Africa (1996:26), the planned use of water resources for irrigation and afforestation is approximately $565,410^6 \text{m}^3/\text{a}$ for 2030.

4.5. Planning and Modelling of Wetland Parks in KwaZulu-Natal

KwaZulu-Natal divides the wetland park into four areas, namely Maputaland, Upper Mzintlava, Penny Park, KZN Midlands and KZN North (Byrd, 2007:18). Maputaland Wetlands Park is the largest single complex of wetlands in the province (Scotcher, 1996:99). It is extremely important to plan for the provision of water supply for agricultural practice and in so doing, to also contribute to the livelihoods of surrounding communities. The KZN North Wetland Park on the Blood River near Scheepers Neck in KwaZulu-Natal is identified as a priority wetland in the province (Clark, 1989:89). It is one of the largest inland marshes in the country and of high importance for biodiversity conservation. Its main beneficiaries are commercial farmers and the Mondlo community downstream that relies on it for water (Clark, 1989:90). It provides a number of important ecosystem services, including livestock grazing, stream-flow regulation, flood attenuation, water assimilation, and sediment trapping (Aas, 2005:50).

The Penny Park wetland is an important source of water for the town of Kokstad and others and also supplies water to the downstream users during dry periods, and is of extremely high importance for biodiversity protection (Management of Water Resources of the Republic of South Africa, 1996:380). The KZN Midlands Project is active in two distinct areas in KwaZulu-Natal, the Hlatikulu wetland bordering the uKhahlamba-Drakensberg Park near Giant's Castle, and the Ntabamhlope Vlei near Estcourt (Schulze, 1982:100). The National Aquatic Ecosystem Health Monitoring Programme (NAEHMP) has been used to determine the future aquatic ecosystem status and health in the wetland park of the province (KZN) (Grundling, 1998:207). The Management of Water Resources of the Republic of South Africa (1996:390) reported that the planned use of the Wetland Park for water supply in KZN will be approximately 75% in 2030.

4.6. Integrated Management Plan and Local Communities in KwaZulu-Natal

An Integrated Management Plan (IMP) is the primary overarching protected area planning document that describes the administrative and legal framework, contextual background, public participation processes followed, vision or mission statements, prioritised management objectives, zonation as well as a management policy framework and guidelines (Grundling, 1998:2010). The IMP also forms the framework within which all the other planning components are developed in KwaZulu-Natal. *Local Community* means any group of people living or having rights to interests in a distinct geographical area.

The KZN province has a population of more than 2 million people, growing at approximately 2,5% per annum and most people living in this province are disadvantaged, with 75% of all individuals living in poverty (Chutter, 1998:24). In excess of 80% of the inhabitants in these areas are economically inactive, in excess of 12% earn less than R12,000 per annum and just over 4,5% earn more than R10 000 per annum (Chutter, 1998:30). Low levels of education are encountered in these areas with approximately 37% of the population having received primary education, slightly over 14% having received secondary education, 4% with matric, and just over 1% having received tertiary education (Acocks, 1988:39).

The communities of KZN depend on natural resources. The most profoundly impacted resource is surface water for consumption, basic domestic use (washing and bathing), irrigation of subsistence crops and watering of subsistence livestock herds (Chutter, 1998:24:75). The watercourses are also utilised for waste disposal (solid wastes, urban and domestic refuse) as well as water-borne waste disposal (sewerage and industrial effluents) (Donovan, 1988:198). The priority of the government of KZN seems to be aimed at poverty alleviation, service delivery (provision of piped water, sanitation, and refuse management), provision of electricity, job creation, basic education and housing (INR, 2003:28).

The increasing population in KZN puts pressure on the government to control poverty and the high dependence on natural resources (Schultz & Watson, 2002:84). The government needs to limit survey points for regular monitoring of ecosystem health, poor formal infrastructure and unplanned development. Impoverished communities place great pressure on environmental resources through a lack of formal refuse disposal and sanitation, resulting in the informal dumping of refuse waste that most often occurs within wetland and drainage lines (Mosai, 2004:90).

4.7. Cost Benefit Analysis of Spatial Features in the iSimangaliso Wetland Park

iSimangaliso Wetland Park is the third largest protected area in the world and situated on the east coast of KwaZulu-Natal (Guyer, 1997:218). It consists of diverse ecosystems (wetlands,

terrestrial and marine) contained in the Park and provides important habitats for a large number of species, including those that are rare, threatened and endemic (Guyer & Pollard, 1997:220). The iSimangaliso Wetland Park harbours the last remaining subtropical area containing its original diverse components of wild plants and animals on the south eastern coast of Africa, and one of the last remaining in the world (Grundling, 1998:215).

The iSimangaliso Wetland Park is widely regarded as an important economic asset with significant underdeveloped tourism potential. The tourist attractions within iSimangaliso include spectacular mountain ranges, wetlands, plains and bush land, coastline and marine reserve (Herbert, 2001:335). The Park will also attract tourists in Africa with coral reefs, dolphins, Humpback Whales, sea turtles and some 250 fish species (Alzue, 1998:15). There are miles of fine beaches with clear warm-water seas, large inland lakes, estuaries, rich bird-life, marine-life and more than 3,000 plant types (Alzue, 1998:14).

The Lake St Lucia Estuary is the wetland ecosystem's most notably under considerable threat from the hydrological imbalance brought about by human activities, such as sugar cane and forest plantations, particularly along the Umfolozi River catchment (Schultz, 2002:89). It comprises a dynamic and complex set of interconnected systems, in need of medium to long-term sustainable management of the floodplain, river mouth and estuary, as well as related socio-economic development options. The volume of water in the Lake St Lucia system has started to diminish and the salinity has increased, with a consequent deterioration of the ecological conditions due to such imbalances (Kelbe & Germishuysen, 2010:125).

There is a risk of incompatible future land uses in the iSimangaliso Wetland Park which currently enjoys comparatively good levels of ground protection. It is however at risk from future incompatible changes in the use of land, natural resources such as mining and non-native forestry plantations (Clark, 1989:100). A wide range of natural resources is harvested by communities living in and around the Park – some of which are not permitted and regulated, including marine (such as mussels and fish), estuarine (crabs and fish), forests (such as Lala Palm and wood for building, fuel wood and carving), grasslands (such as for cattle grazing) and wetland species (such as incense) (Chikanga, 2004:98). In view of the relatively large population of rural poor that live in the vicinity of the iSimangaliso Wetland Park, it is of vital importance to proactively address their needs and aspirations for improved employment and livelihood opportunities in ways that are compatible with conserving the park's rich biodiversity and other important natural values.

4.8. Conclusion

The related modelling of spatial features of afforestation, water resources and the Wetland Park would make it easier for the government of South Africa to make decisions on how to develop future policies. The modelling will assist with making plans about managing afforestation and water resources and in planning how the Wetland Park will be used by future generations. South Africa is in a challenging position of providing enough water to meet basic human needs. It will be wise for the country to plan the future use and status of water; hence researchers will use modelling exercises in order to determine the future use of water resources.

CHAPTER 5: STUDY AREA

5.1. Introduction

The shift of South African politics after 1994 has created another dimension to aspects of life for South Africans in terms of politics, economics, social life and religion (Management of Water Resources of Republic of South Africa, 1996:28). ISimangaliso Wetland Park is an international heritage site and consists of protected areas (Mucina et al., 2006:660). The transition period draws the communities into the centre of every aspect. Whatever activities were undertaken, it should be beneficial to the local communities. The iSimangaliso Wetland Park is operating in an environment that needs to ensure that the local communities are benefiting socially and economically (White Paper DSR, 1994:45).

That the local communities are to benefit does not mean that they should be passive or merely receive or accept hand-outs; communities should be actively involved and able to express their perceptions regarding the development of their communities. The physical settings of iSimangaliso Wetland Park were presented in two ways: relative and absolute locations. It is also defined in a topical form by using the following words: geographical and geomorphological, climatological characteristics, natural tourism activities, demographics, hydrological features and environmental conservation.

5.2. Relative Location

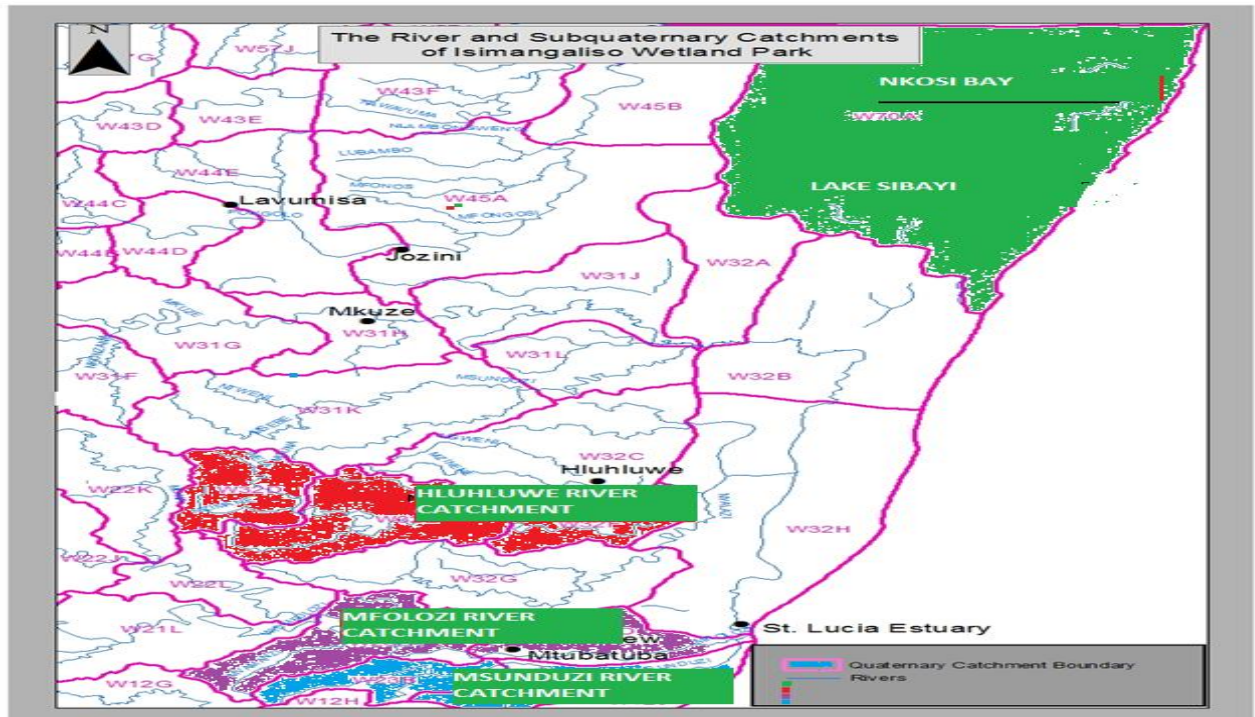


Figure 1: Source: Project3/user9/iSimangaliso Wetland Park/river catchmen

This research project will lead to the production of accurate results by determining how informal afforestation impacts the river flow in the iSimangaliso Wetland Park. The above map, Figure 1, shows river catchments and sub-quaternary areas on which the research is focused (**shaded in colour on the map**).

5.3. Absolute Location

Table 2: Detailed study area of iSimangaliso Wetland Park

River Catchment	Co-ordinates	Sub-Quaternary Catchment
1. Kosi Bay Estuaries River Catchment	S= 260 56' 10.39"	W70A
	E= 320 50' 50.74"	
2. Lake Sibaya River Catchment	S=27 ⁰ 21' 44.84"	W70A
	E= 32 ⁰ 40' 49.72"	
3. Msunduzi River Catchment	S=28 ⁰ 30' 10.19"	W23B
	E=32 ⁰ 07' 15.46"	
4. Hluhluwe River Catchment	S= 28 ⁰ 06' 41.74"	W32E &W32D
	E= 32 ⁰ 09' 16.21"	

5. Mfolozi River Catchment	S= 28 ⁰ 23' 55.79"	W23A &W23D
	E=32 ⁰ 02' 19.01"	

Table 2 indicates the exact area of the study in which the research will take place. It shows co-ordinates and sub-quaternary catchments.

5.4. Geography and Geomorphology

The iSimangaliso Wetland Park consists of topographic areas and a variety of ecosystems that attract more tourists to visit. The landscape areas in the iSimangaliso Wetland Park were flat with a few scattered, not much taller, hill Mountains. Most of the regions also consist of sandy soils. The areas North of Mapelane and South of the St Lucia Estuary consist of coral reefs, woodlands and coastal forests (Taylor, 1991:2). In the areas around Hluhluwe town the soil types are Loamy soil.

5.5. Climatological Characteristics

The climate of the study area is tropical with average summer temperatures (September to April) ranging from 21⁰ to 25⁰ C and winter temperatures ranging between 14⁰ C and 21⁰ C (Kelbe, B. & Germishuyse, 2002:112). The humidity average is 55% in the winter and 90% in summer (DWS, 2009:4). The average rainfall for the region varies between 450 mm and 800mm per annum, with approximately three-quarters of the rain falling in the warm summer months between October and March (DWS, 2009:34). Frosts are rare due to the moderating influence of the Indian Ocean (DWS, 2009:52).

5.6. Natural Tourism Activities

iSimangaliso Wetland Park will consist of a variety of ecosystems and natural habitats that provide an astounding diversity of species. The species of the area are supported by lakes, lagoons and grasslands. There were tourist activities in the iSimangaliso Wetland Park such as fishing, boating, and scuba diving to hiking, horse riding, game viewing, and whale and bird watching (Mathieson, A & Wall, 1982:105). iSimangaliso Wetland Park was the most popular fishing destination, lending it to rock and surf fishing, kite fishing, spear fishing, estuary fishing and sea fishing (Byrd, 2007:20). There were plenty of accommodation options ranging from camping to private game lodges, as well as hotels, flats and chalets in the nearby town of St Lucia (Taylor, 1991:36).

5.7. Demographics of the study

The languages that dominate the area are Xitsonga, IsiZulu and siSwati (Gumede, 2003:41). The people living in rural areas in the iSimangaliso Wetland Park are faced with higher levels of

poverty, low levels of literacy and the highest level of unemployment (Gumede, 2003:29). The area also needs improvement in meeting basic needs such as providing more clinics, more schools, clean water and transport facilities (Mosai, 2004:98). The poor infrastructure of transport facilities has sealed off the rural areas from their commercial potential. The community members will generate their profit on agricultural practice such as sugar cane, subtropical fruits, vegetables, citrus, poultry, forestry and cattle farming (Taylor, 1991:37).

5.8. Hydrological Features

The hydrologic system in the iSimangaliso Wetland Park is dominated by three types of coastal water systems such as Lake St Lucia, Kosi Bay and St Lucia River (Scott et al., 1998:200). Lake Sibayi is the largest freshwater lake in South Africa and assists in sustaining a variety of aquatic species and animals. The iSimangaliso Wetland Park is washed by a system of river catchments such as Mkuze, Mzinene, Hluhluwe, Nyalazi, Mpate Mfolozi and Msunduze. North to South these are the Mkuze, Mzinene, Hluhluwe, Nyalazi and Mpate (Mucina et al., 2006:700). The Mfolozi and Msunduze rivers in the South enter to the sea mouth of Lake St Lucia.

These rivers are seasonal, flowing during the wet summer months and are reduced to isolated pools and seepage through bed sediments in winter (Taylor, 1991:39). All of these rivers are responsible for the moderately dense vegetation cover of the wetland and watercourses that are mostly shaded by forest and shrub vegetation.

5.9. Environmental Conservation

The natural environment of the iSimangaliso Wetland Park is experienced as being impossible to conserve without putting the needs of the people who live in that environment at the centre of its conservation strategy (Dawson, 2002:45). iSimangaliso Wetland Park represents a new model for Protected Area development and management in Southern Africa (Mbongwe, 1998:37). The Protected Area development and management Model will include the needs of the local communities of iSimangaliso Wetland Park (Van Lill et al., 1980:130). The vision of the iSimangaliso Authority is to balance the conservation of the ecological and cultural wealth of the area with equitable and sustainable use of its natural and cultural resources (Mucina et al., 2006:699).

Alongside agriculture, tourism was recognised as the lead economic driver of the iSimangaliso Wetland Park (Merriam, 1998:40). Tourism development generates benefits based on iSimangaliso's natural and cultural wealth, bringing economic empowerment and job creation to neighbouring communities (Mathieson & Wall, 1982:110). iSimangaliso stimulates tourism in the

area and in the region as a whole, creating many business opportunities and jobs. In the international status it is recognised as a World Heritage Site with the help of government to market South Africa as a tourism destination and to raise money from international donors for social and economic development (Stamp, 2002:90).

5.10. Conclusion

The physical setting of the area was presented in this chapter. The environmental conservation history of the area was explained to highlight the economic situation of the area. The natural physical relief of the area was discussed to indicate whether the area is flat or mountainous. Facilities that were available in the area were also identified and the average climate was estimated.

CHAPTER 6: DATA ANALYSIS AND INTERPRETATION

6.1. Introduction

The completed questionnaires were collected from the respondents and the data were analysed and interpreted. The study focused on the iSimangaliso Wetland Park only specifically on the following river catchments: Kosi Estuary, Lake Sibayi, Msunduzi, Hluhluwe and Mfolozi river catchment. The registered lawful water use in the iSimangaliso Wetland Park, verified in WARMS data and Verification and Validation of Existing Lawful Water Use (V&VELWU) data, indicated 54.4 million Cubic metres per annum (m^3/a), which were lawful for the entire catchment. The use of Satellites data and Remote Sensing during the study survey indicated that 5,937 hectares (ha) of the afforestation was depicted as unlawful water use, otherwise the Stream Flow Reduction caused by the unlawful or informal afforestation in the iSimangaliso Wetland Park is 2,820,464 Cubic Metres (m^3).

The results of the study analysis and interpretation were introduced by defining the status of the Reserve Determination for the river catchments, namely Kosi Estuary, Lake Sibayi and St Lucia Estuary (Hluhluwe, Mfolozi and Msunduzi). The Hluhluwe, Mfolozi and Msunduzi are the river catchments that feed water into the St Lucia Estuary. The Hluhluwe, Mfolozi and Msunduzi influence the availability of water in the St Lucia Estuarine. The results of the Reserve Determination for St Lucia Estuarine automatically defined the PES and the REC of the Hluhluwe, Mfolozi and Msunduzi river catchments.

6.2 Reserve Determination Analysis

The Surface and Ground water Reserve determination study was also undertaken in order to establish the water availability status (refer to the study below):

1. Kosi Estuary

The Kosi estuarine system is unique in South Africa, since it is a series of connected estuarine lakes; Kosi system falls within the iSimangaliso Wetland Park – a UNESCO World Heritage Site. During a survey the Kosi estuarine system was subdivided into four channels and four lakes (see Figure 2).

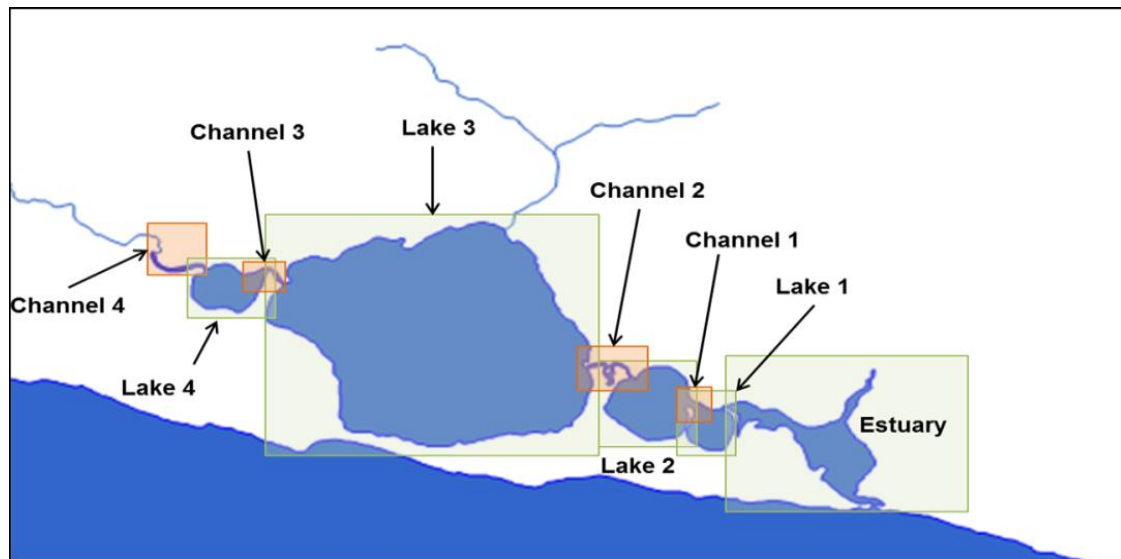


Figure 2: The Kosi Bay Reserve determination (Surface Water Reserve)

Source: ISimangaliso Wetland Park Kosi Bay Reserve determination study by means of RDM in 2014 (Surface Water Reserve).

The Kosi Bay Estuarine falls within the PES of A/B category and REC of A Category. The Kosi Estuary is on a negative trajectory of change due to the following increasing human population in the surrounding areas: increase of direct resource abstraction and use (e.g. fishing, mangrove harvesting, crab collection) commercial fishery, which places additional pressure on the system (Scott & Smith, 1997:150). The current water usage (abstraction and forestry) has increased the probability of mouth closure, which will hold severe consequences for the biodiversity of the system (Scott & Smith, 1997:148). Taking into consideration the ecological importance and the conservation requirements, the REC for the Kosi Estuary is an A Category.

1.1 Groundwater Reserve for the Kosi Estuarine Lake Catchment

The Groundwater Reserve Determination indicated that no further allocation of water for afforestation in the Kosi Bay Estuarine will take place due to the current allocation being exceeded; the Reserve is required to maintain a minimum water level of EWR (see Table 3).

Table 3: The Kosi Bay Reserve determination (Ground Water Reserve Determination).

System	Present State Category	Resource Category	Baseflow Mm3/a	BHN Mm3/a	Recharge Mm3/a	Reserve %Recharge	Reserve required to maintain minimum water level/ Surface Water EWR	Current use Mm3/a	Allocable Mm3/a
Kosi estuarine lakes	II (C)	Fair	18	0.88	37.1	50.8	18	20.4	None

Source: ISimangaliso Wetland Park Kosi Bay Reserve determination study by means of RDM in 2014 Ground Water Reserve.

2. Lake Sibayi

Lake Sibayi was subdivided into five zones: Main Basin, Northern Arm, Western Arm, South-Western Basin and Southern Basin during survey. Lake Sibayi falls within the iSimangaliso Wetland Park (see Figure 3).

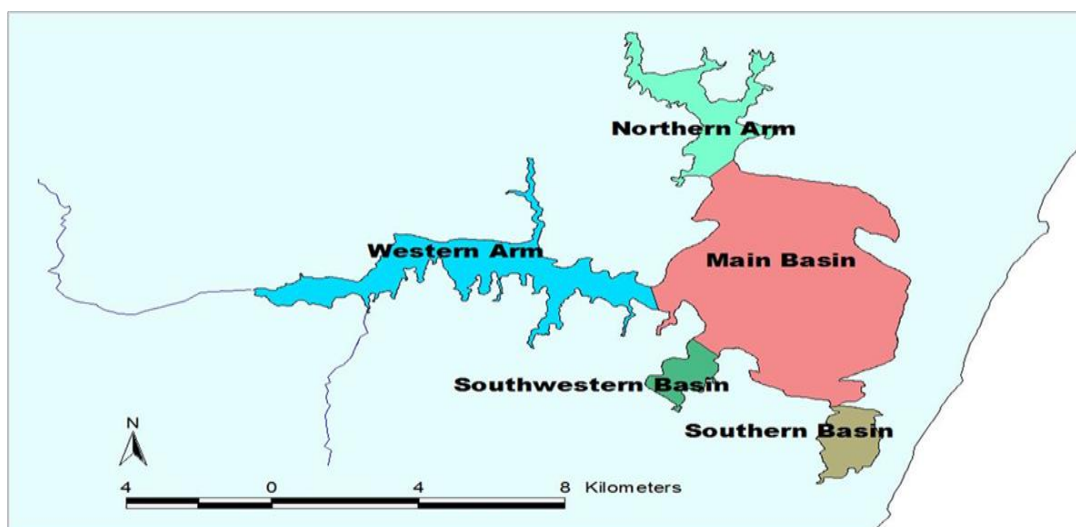


Figure 3: The Lake Sibayi Reserve determination (Surface Water Reserve Determination)

Source: ISimangaliso Wetland Park Lake Sibayi Reserve determination study by means of RDM in 2014

The Lake Sibayi Reserve currently a PES of B/C and REC of B/C category. The PES and REC of the Lake Sibayi indicated that the status of the reserve was on equilibrium state, which means no further allocation of water in the catchment **see Table 4).**

Table 4: The PES & REC for each EWR zone for Lake Sibayi (Surface water Reserve determination)

Zone	PES	REC
Main Basin	B/C	B/C
Northern Arm	B/C	B/C
Western Arm	B/C	B/C
Southwestern Basin	B/C	B/C
Southern Basin	C	B/C
Whole lake	B/C	B/C

Source: ISimangaliso Wetland Park Lake Sibayi Reserve determination study by RDM in 2014

2.1 Groundwater recharge for the catchment

The Groundwater Reserve Determination for Lake Sibayi indicated that there was no further allocation of water for afforestation in the Lake Sibayi Reserve because the current allocation indicated that the Base flow of 39 Mm³/a is equal to the Reserve required to maintain a minimum water level of approximately 39 Mm³/a (see Table 5).

Table 5: The Lake Sibayi Reserve determination (Ground Water Reserve Determination).

System	Present State Category	Resource Category	Baseflow Mm ³ /a	BHN Mm ³ /a	Recharge Mm ³ /a	Reserve %Recharge	Reserve required to maintain minimum water level/ Surface Water EWR	Current use Mm ³ /a	Allocable Mm ³ /a
Lake Sibayi	II (C to D)	Fair	39	0.61	63.7	62	39	24	None

Source: ISimangaliso Wetland Park Lake Sibayi Reserve determination study by means of RDM in 2014 Ground Water Reserve.

3. St Lucia Estuary (Hluhluwe, Mfolozi and Msunduzi River)

The Lake St Lucia estuary system is the largest estuary in the country, encompassing more than 50% of the total estuarine habitat area (Scott & Smith, 1997:141). The St Lucia estuarine system receives water from the Mfolozi, Hluhluwe and Msunduze river catchments (see Figure 4).

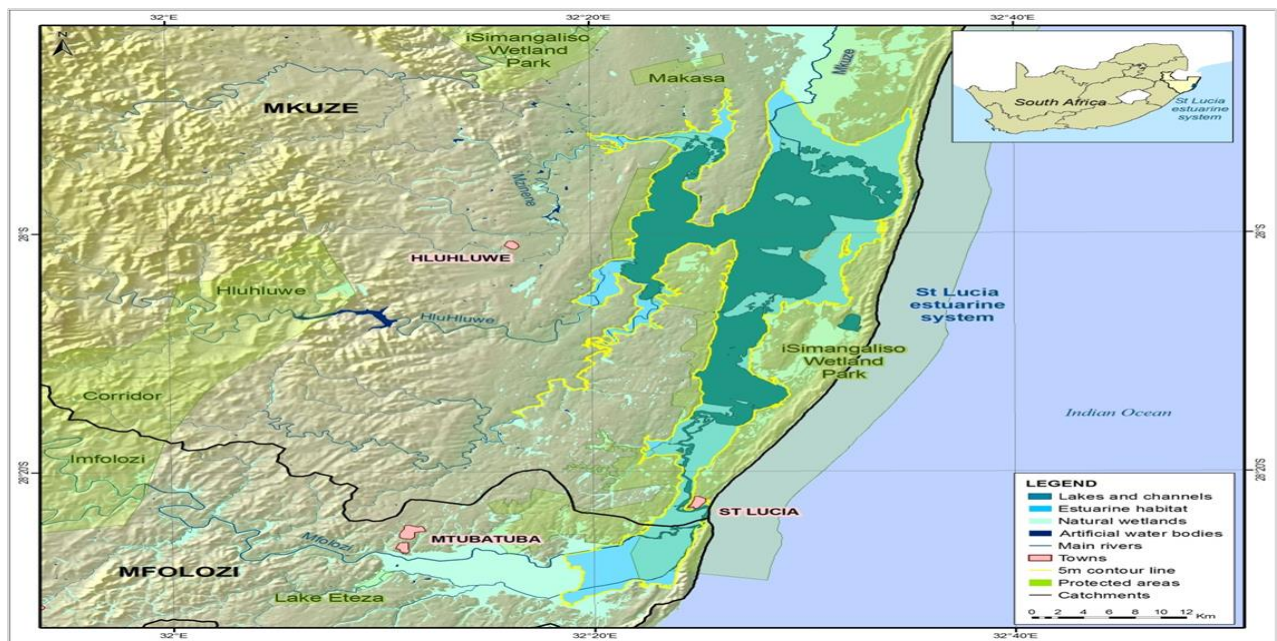


Figure 4: The St Lucia Estuarine System Reserve determination (Surface Water Reserve Determination)

Source: iSimangaliso Wetland Park St Lucia Estuarine Reserve determination study by RDM in 2014.

The St Lucia Estuarine System currently falls within a PES category of C and the REC is A. The PES and REC of the St Lucia Estuarine System indicated that the status of the reserve had already been affected if the REC is A as the PES is C. The catchment needs to be improved by managing the informal afforestation in the St Lucia Estuarine. According to the results of the Surface Water Reserve Determination in the catchment, no water is further allocation to the catchment.

The reserve determination results portrayed above indicate that the iSimangaliso Wetland Park is stressed, which means no further allocation of water for Stream flow Reduction Activities. The desktop analysis by using Satellite maps and Validation and Verification indicated that 5,937 hectares of afforestation was practised informally or unlawfully in the iSimangaliso Wetland Park. The aim of this study was to determine the sustainability challenges for informal plantations in iSimangaliso Wetlands Park: impacts and perceptions. In conclusion, the Ground and Surface Water Reserve Determination indicated that no water is available in the catchment for any forestry practice for the entire catchment.

6.3. Analysis of Biographic characteristics

The collected data relating to the biographic characteristics of the respondents play an important role in reflecting the personal attributes of the local communities of iSimangaliso Wetland Park. These respondents varied widely in respect of personal attributes ranging from gender, age, marital status to level of education. It was anticipated that the analysis of these demographic selected and socio-economic attributes and opinions would offer a better understanding of awareness of the role they play in influencing the various research statements and questions. Some questions relate to the perceptions and impacts of local communities to grasp the management practices and their benefits from forestry activities.

In this section the data was presented in the same order as it appears in the attached questionnaire (Appendix-A) which respondents were requested to complete. The section investigated the personal background and characteristics of the respondents interviewed in the study area. The demographic variables were analysed in terms of absolute frequency and frequency percentage (see Table 6).

Table 6: Biographic characteristics of Respondents (N = 100)

VARIABLE	SUB-VARIABLE	ABSOLUTE FREQUENCY	FREQUENCY PERCENTAGE
Gender	Male	34	34%
	Female	66	66%
Total		100	100%
Age	10-20	3	3%
	21-26	3	3%
	26-30	3	3%
	31-35	4	4%
	36-40	3	3%
	41-45	8	8%
	46-50	14	14%
	Over 50 years	62	62%
Total		100	100%
Marital Status	Single	22	22%
	Married	76	76%
	Divorced	2	2%

Total		100	100%
Level of Education	Grade 1	2	2%
	From grade 9-10	18	18%
	Grade 8	41	41%
	From grade 11-12	14	14%
	Tertiary	25	25%
Total		100	100%

6.3.1 Gender

The reason for the inclusion of gender as one of the variables in the questionnaire was to determine whether males or females perceive informal afforestation practices in the study area differently. This state of affairs could be attributed to the fact that women participating in the study often happened to act more responsibly in the study area than did men. It was noted that the majority of women were married parents and they would have liked to be exposed to more opportunities in the study area.

When analysing the gender variable for the total sample it was found that about 66 percent were females and 34 percent males. The question of gender has become important in the South African democracy, particularly with reference to female participation in forestry practice. The females were in the majority in participating in the questionnaire survey, and the distribution of gender among the local communities of iSimangaliso Wetland Park revealed that about 66 percent of respondents were females. This distribution suggested that more female members were prepared to participate in the survey. This was supported by the fact that females generally dominate the rural and semi-rural populations in KwaZulu-Natal.

6.3.2 Age

The issue of age was included in the study to determine what age group happens to influence perceptions and participation in the practice of forestry activities. The age distribution reported in Table 7 revealed that there was bias towards the senior adult age groups. The senior adults aged (50+ years) comprised the majority (62%) of the respondents to the questionnaire. The age group between 46 and 50 years was the second largest among the respondents (14%), whereas (8%) of the group aged 41 to 45 years and those between ages 31 and 35 years (4%) were the third and fourth largest groups respectively that responded to the questionnaire. The

young adults aged between 36 and 40 years constituted the fifth largest group (3%) with regard to responses, those aged between 26 and 30 years made up 3%, those between 21 and 26 years comprised (3%) and 10 and 20 years response (3%) to the questionnaire. The age distribution could suggest that the local communities were relatively poor as they were made up of more less-educated individuals. In conclusion it should be noted that the age variable in the study area revealed the dominance of the older age groups of over 50 years.

6.3.3 Marital Status

Marital status plays an important role in South African Black communities because it gives powers and privileges to other partners. It was therefore from that perspective that the marital status was included in the study – it does have some influence on the forestry practice patterns in the Forestry Charter. What is shown in Table 7 is that the majority (76%) of the respondents were married. The respondents who indicated that they were single accounted for (22%) of the respondents and (2%) of the respondents were divorced. It should be noted that the number of old-age groups who were interviewed dominated as the majority of the responders.

6.3.4. Educational Level

The education variable tends to influence the socio-economic status of the respondents in the participation patterns in forestry activities. Torkildsen (2005:25) maintains that the type of education, the length of education and educational attainment are closely related to upbringing class, occupation, income and other related factors. Education has a positive influence on individuals' forestry participation and organisations' management practices. It is noticeable that in Table 7, the majority of the respondents (41%) indicated that they had attained an educational level that reaches grade 8. The second largest number of respondents (25%) indicated that they had received educational at tertiary level. The third largest number of respondents (18%) indicated that they had received educational up to grade 10. The fourth largest number of respondents (14%) indicated that they had reached an educational standard of grade 12. Very few of the respondents (2%) indicated that they had received education up to grade 1 level.

The reason why the majority of respondents have had received a level of education equal to tertiary education and below perhaps is that many of the people in the area could not attend tertiary institutions, mainly as a result of financial constraints.

6.3.5. Employment

It is generally known that one of the aspects that bring income into the local communities in the study area is employment. During the interviews all the respondents (100%) indicated that they were unemployed, consequently they generated income by selling timber after harvesting.

6.4. Community awareness of the importance of forestry practice in the study area

Understanding forestry industry and awareness of how it works was an important prerequisite for the improved development and promotion of timber delivery and the forestry industry. Forestry as an industry brings both economy and costs to host communities (McIntosh et al., 2002:23). The benefits include: provision of employment opportunities as it is a labour-intensive industry; generating a supply of needed foreign exchange; increased incomes; spreading development; improved quality of life related to a higher level of income; and improved standard of living. What is important is that the iSimangaliso Wetland Park local communities need to understand the working of forestry practice and its benefits.

The iSimangaliso Wetland Park authorities, Department of Water and Sanitation, Department of Agriculture Forestry Fisheries, Sappi, Mondi, KZN Wildlife, Department of Economic Development, Tourism and Environmental Affairs, Amafa AkwaZulu-Natali, Tribal Authorities and District Municipalities could play a significant role in ensuring that the local communities within their jurisdictions enjoy benefits by engaging in forestry development and promotion. Practised forestry should be appreciated as a beneficial human activity, if understood by local communities. A well-understood forestry activity usually has many social and economic spin-offs. In this regard, the respondents were requested to indicate their level of awareness of the importance of practising afforestation before they apply for a Water Use Licence within the context of the iSimangaliso Wetland Park.

A significant majority of respondents (64%) indicated that they were completely unaware that to plant Eucalyptus, Wattle and Pine trees, they need to first apply for a Water Use Licence. On the other hand, only 36 percent of the respondents indicated that they were aware that before planting afforestation one needs to apply for a Water Use Licence from the Department of Water and Sanitation (**see Figure 5**).

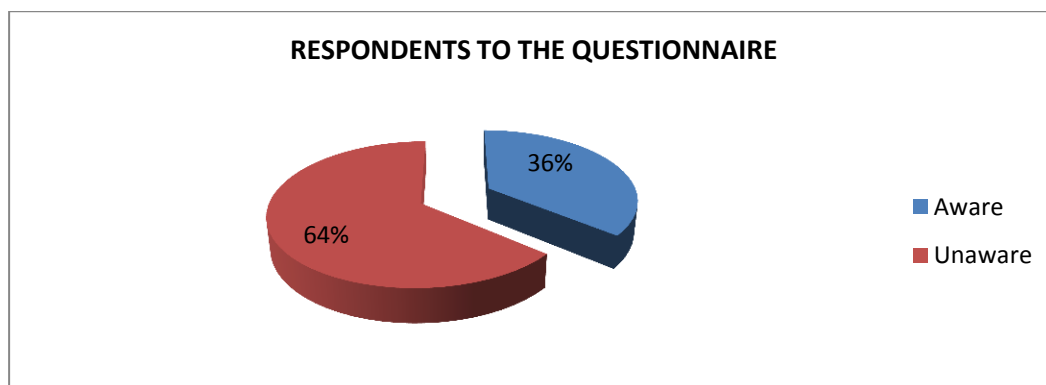


Figure 5: The respondents who knew that to practise afforestation (Eucalyptus, Wattle, and Pine) one needs to apply for a WUL before planting

As can be concluded from details presented in Figure 5, the majority of the members of the local communities in iSimangaliso Wetland Park were made aware, by officials from Department of Water and Sanitation, of their obligation to apply for a WUL prior to planting.

6.5. Perceptions of Local Communities regarding the impact caused by afforestation practices in the study area.

The survey determined the levels of understanding of the local communities in the iSimangaliso Wetland Park with regard to how afforestation impacts water resources. It therefore was of vital importance to categorise respondents percentage-wise. The respondents in the study area were requested to indicate whether the community was adequately participating in forestry initiatives and what the impact thereof was. Figure 6 demonstrates the various levels of the understanding reflected by the communities regarding the impact caused by afforestation.

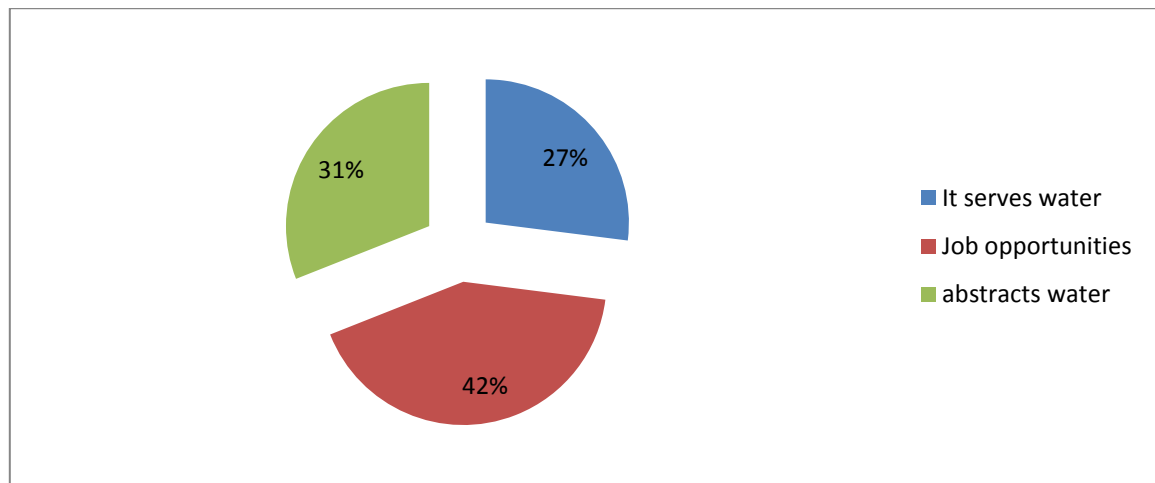


Figure 6: Perceptions of the respondents of local communities regarding the impact of afforestation in the study area

Practising afforestation, for instance of Eucalyptus, Wattle and Pine, would abstract a huge amount of ground and surface water. The responses, as illustrated in Figure 6, indicate that (42%) said the impact of afforestation on water resources was that it created job opportunities. This misconception indicated the need for capacity building and awareness of the impact of afforestation on water resources. 27% of the respondents responded that practising afforestation will serve water to water resources. This poor understanding among the participants further indicates that all Affected and Interested Parties (A&IP) need to come on board to educate the local communities of iSimangaliso Wetland Parks. Only 31% responded saying that afforestation abstracts more water.

6.6. The status of Water Use Licences in the study area

In terms of Section 40 of the National Water Act, 1998 (Act 36 of 1998) any person wishing to practise afforestation needs to first apply for a Water Use Licence in terms of Section 21(d) water use (Engaging on Streamflow Reduction Activities). Figure 7 indicates that 50% of the respondents indicated that they were not in possession of a Water Use Licence but have already planted Eucalyptus in their field. 49% of the respondents intended to plant Eucalyptus. Only 1% of the respondents were practising afforestation after having received a Water Use Licence from Department of Water and Sanitation.

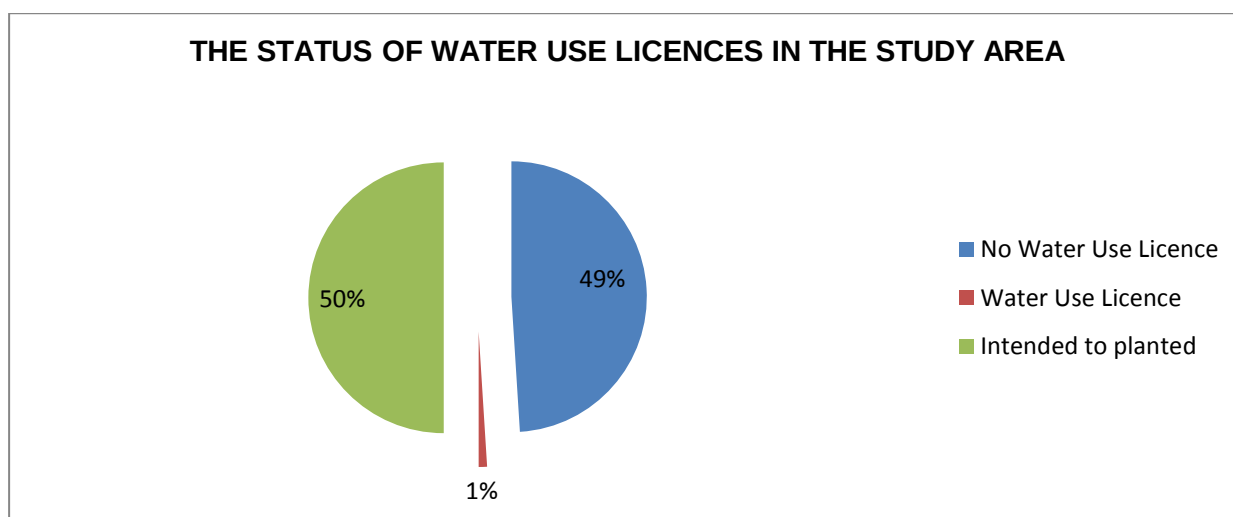


Figure 7: The status of Water Use Licences in the study area.

It should be understood, based on the results reflected in Figure 7, that the local communities in the iSimangaliso Wetland Park were practising formal or informal afforestation. All existing trees that were discovered during the survey were validated and verified before being declared unlawful water use, by utilising Topographical maps 1:50000, WARMS and GISAP against Lawful Water Use (see Figures 8 and 9).

Table 7: Summary of hectares with hydrological impacts caused by informal Afforestation in the study area

River Catchment	Quaternary	Unlawful Afforestation (Eucalyptus) (ha)	Reduction in % per River Catchment	Volumetric reduction (m ³ /a)
Kosi Bay and Lake Sibayi	W70A	3854	64.9	1730446
Mfolozi	W23A & W23D	971	16.4	549586
Hluhluwe	W32E & W32D	1004	16.9	487944
Msunduzi	W23B	108	1.8	52488
Total		5937	100%	2820464

Table 8: Summary of the hydrological impacts caused by Lawful or Formal Afforestation in the study area.

River Catchment	Quaternary	Lawful Water use (Eucalyptus) (ha)	Reduction in % per River Catchment	Volumetric reduction (m³/a)
Kosi Bay and Lake Sibayi	W70A	4648	23.1	2086952
Mfolozi	W23A & W23D	10971	54.6	6209586
Hluhluwe	W32E & W32D	639.1	3.2	310603
Msunduzi	W23B	3848.5	19.10	2470737
Total		20106	100%	11077878

6.7. The determination of Lawful/Formal Versus Unlawful/Informal Water Use with a view to maintain the water level in the iSimangaliso Wetland Park

As depicted in Figure 8, the survey determined that too much unlawful afforestation was taking place in the iSimangaliso Wetland Park. Most of the participants in the survey (64.9%) who practised afforestation were those from Kosi Bay and Lake Sibayi who used water unlawfully (see Figure 8), whilst the Lawful use in the Catchment was practised by 23.1% of the respondents, as depicted in Figure 9. The Reserve maintains a minimal water level of 39%, which means no additional allocation of water in the catchment. The unlawful afforestation in the Kosi Bay and Lake Sibayi will worsen the situation.

As can be derived from Figure 8, the lawful water use in the Mfolozi River Catchment was 54%, and the unlawful water use 16.4%, which amounts to more than the minimal water level of (25%) maintained by the Reserve, which means no additional water allocation to any development in the catchment.

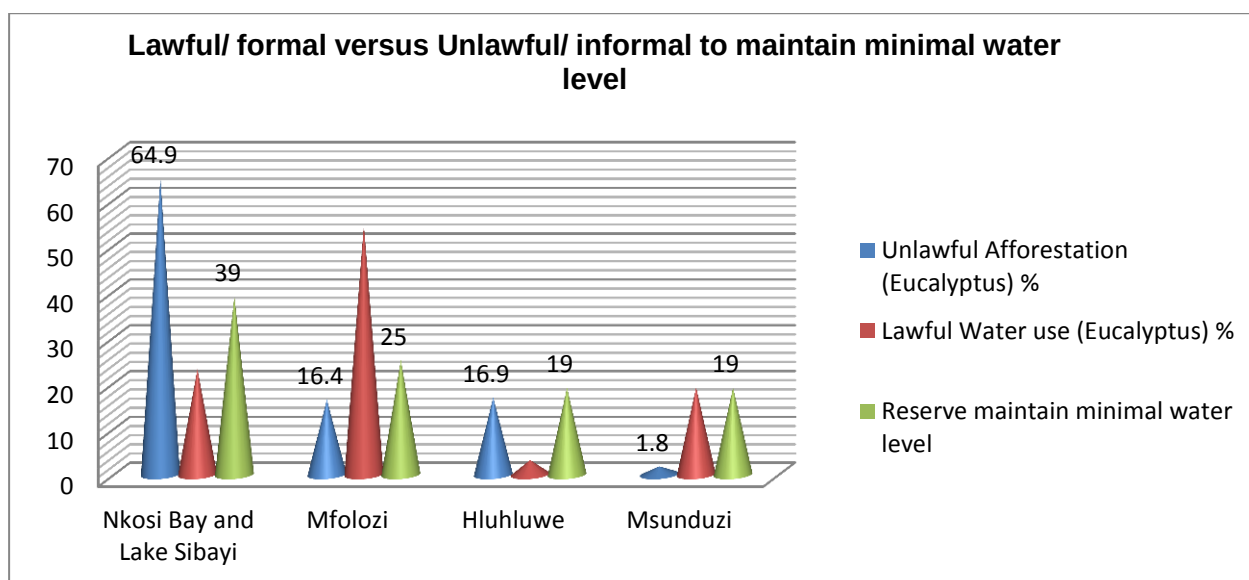


Figure 8: Summary of the Lawful Versus Unlawful Water Use to maintain the water level in the iSimangaliso Wetland Park

Figure 8 depicts the formal or lawful water use in the Hluhluwe River Catchment as being 32%, and the unlawful water use as being 16.9%, lessening the reserve needed to maintain the minimal water level of 19%. The 0 yield of the Hluhluwe dam will enable the Department to stop issuing Water Use Licences to the inhabitants of Hluhluwe river catchment. This means no additional water allocation to any development in the catchment since the reserve maintains a minimal water level of 19%, which is on equilibrium for lawful water use (3.2%) and the reserve maintains a water level of 19%.

Figure 8 reports that the Msunduzi River Catchment's formal water use in the catchment is 19.1% and the unlawful water use is 1.8%, which adds up to more than the reserve needs to maintain the minimal water level at 19.1% with inclusion of the informal or unlawful water use practised in the catchment. This means no additional water allocation to any forestry development in the catchment.

6.8. Reasons for the local communities to practise informal afforestation

Figure 9 reflects that the survey had determined that various reasons surfaced for the local communities of iSimangaliso Wetland Park to practise informal afforestation. Most people practising afforestation indicated the following reasons: 69% said they practised informal afforestation because they do not know where to apply for a licence. 28% of the respondents indicated that they were practising informal afforestation due to the delay of the Water Use Licence Assessment process followed by the Department of Water and Sanitation.

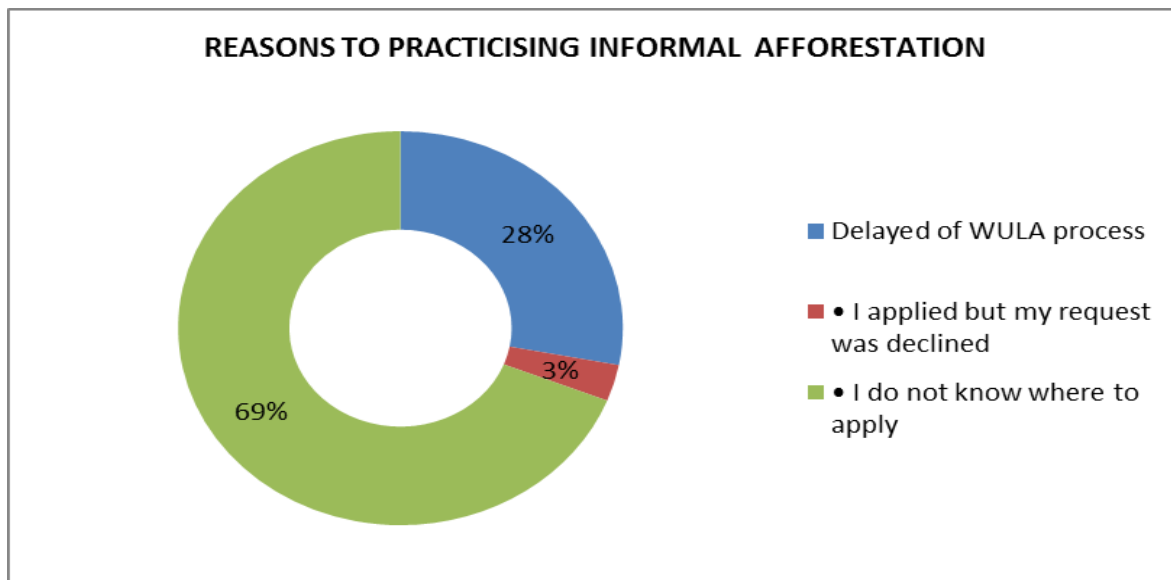


Figure 9: Reasons for practicing informal afforestation in the iSimangaliso Wetland Park

3% of the respondents during the survey as depicted in Figure 9 indicated that they practise informal afforestation because they had applied in 2001 at the Department of Water and Sanitation but that the Department had declined their request. They tried to plant other crops but they failed because the soil of the area was suitable for afforestation.

6.9 Companies that provide seedlings to Unlawful or Informal Water Users

The Memorandum of Understanding (MoU) among Government and Industries indicates that the companies that sell seedlings have to make sure that the buyers need to produce a water use authorisation (permit, Water Use Licence or Registration Certificate) before they buy. During survey the respondents, especially those for people who were practising unlawful afforestation indicated that they buy seedlings from Sappi and Mondi (**see Figure 10**).

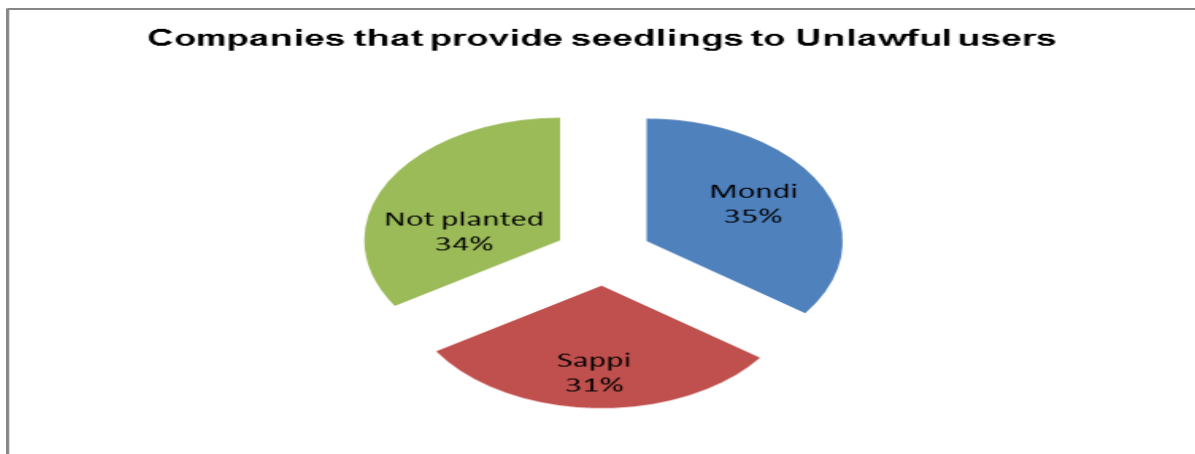


Figure 10: The reasons for the local communities to practise unlawful or informal Afforestation

Figure 10 shows that the survey had determined that the local communities of iSimangaliso Wetland Park buy seedlings from different forestry industries. 31% of the respondents indicated that they buy seedlings from Sappi industries, 35% buy it from Mondi and 34% had not yet planted their seedlings but during the survey they prepared to plant. Mondi and Sappi does not comply with the requirement of the Memorandum of Understanding that the buyer of seedlings first has to provide the Water Use Authorisation before Forestry companies may sell it.

6.10. Is practising informal afforestation user-friendly or not?

According to Figure 11 the respondents were divided into two groups. One group indicated that it is user-friendly to practice informal afforestation, whereas the second group said that it is not user-friendly to our water resources. 76% of the respondents indicated that practising informal afforestation is not user-friendly to water resources.

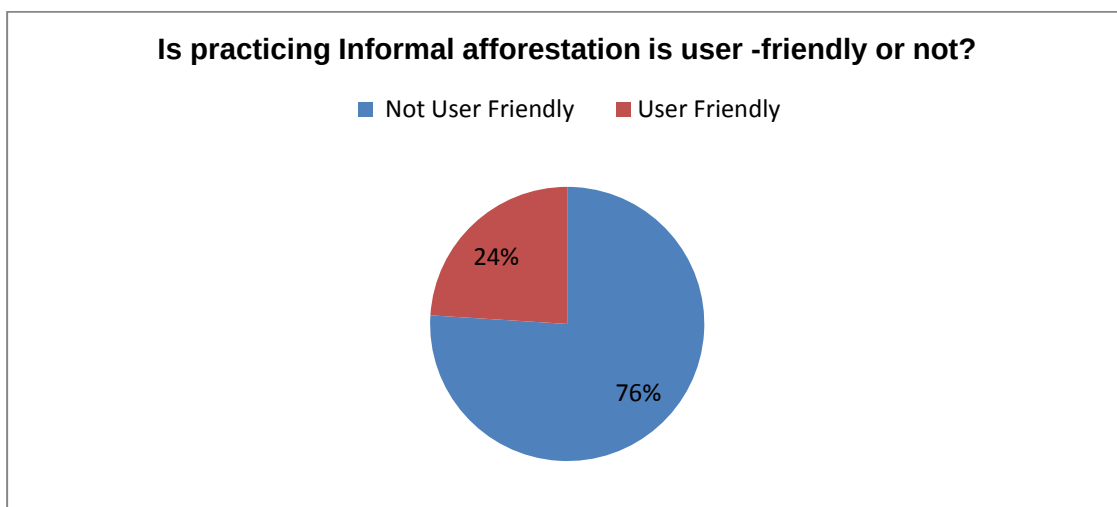


Figure 11: Is practising informal afforestation user-friendly or not?

Figure 11 indicates that 24% of the respondents indicated that practising informal afforestation is user-friendly. This is proof that a need exists for capacity building and awareness campaigns.

6.11. Improvement to minimize informal afforestation in the iSimangaliso Wetland Park

Figure 12 indicated that during the survey it was suggested to the respondents that if the Department of Water and Sanitation and other stakeholders could do capacity building and launch awareness campaigns among the inhabitants of the iSimangaliso Wetland Park, DWS could speed up the WULA process and implement alternative economic activities, the informal afforestation would be minimized in the iSimangaliso Wetland Park. 50% of the respondents, as depicted in Figure 12, indicated that the DWS must implement alternative economic activities so that they do not have to rely on informal afforestation.

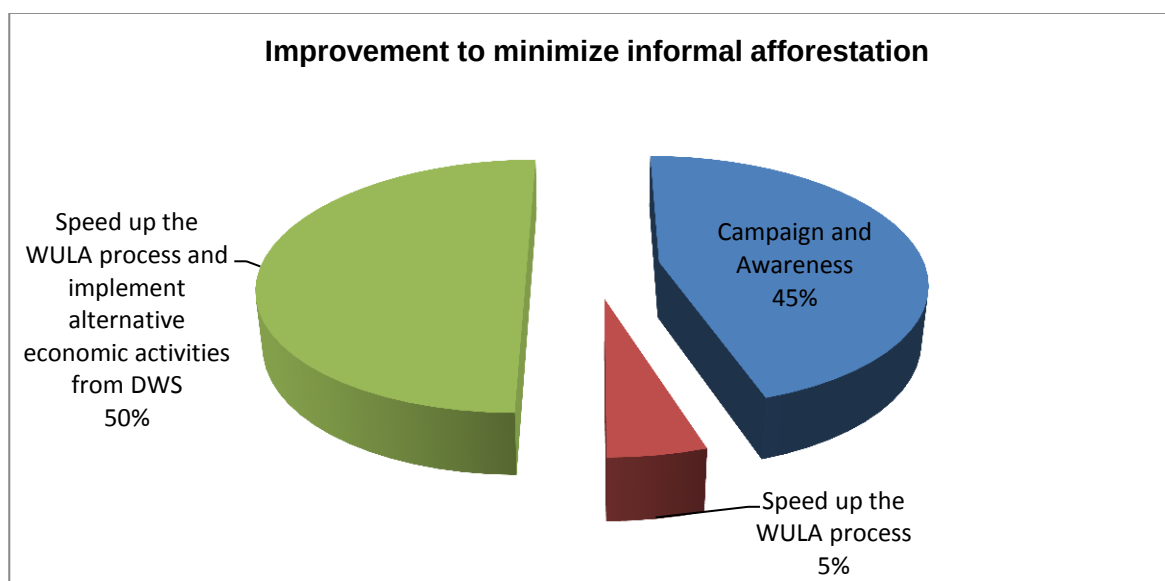


Figure 12: Improvement to minimize informal afforestation in the iSimangaliso Wetland Park

45% of the participants indicated that stakeholders must be strongly supported in their efforts to do capacity building and to launch awareness campaigns dealing with the availability of water in catchments along iSimangaliso Wetland Park. 5% of the respondents indicated that if Department of Water and Sanitation can speed up their WULA process, the informal afforestation in the iSimangaliso Wetland Park can stop.

6.12. The status of drinking water in the iSimangaliso Wetland Park

According to Figure 13 the respondents indicated that (15%) out of (5%) in the Mfolozi river catchment showed that the local communities of the area would experience a water shortage for drinking purposes. 17%) out of (3%) of the local communities along the Msunduzi River Catchment responded by pointing out a shortage of water in their river catchment. In the Lake Sibayi, the local communities indicated that no problem existed with regard to water for drinking

purposes as the respondents indicated (16%) out of (4%). It means that there was need for capacity building concerning the availability of water in the catchment.

In the Kosi Bay, 10% out of 10% of the respondents meaning the local communities living next to Kosi Bay need to be capacitated regarding the water availability in the catchment.

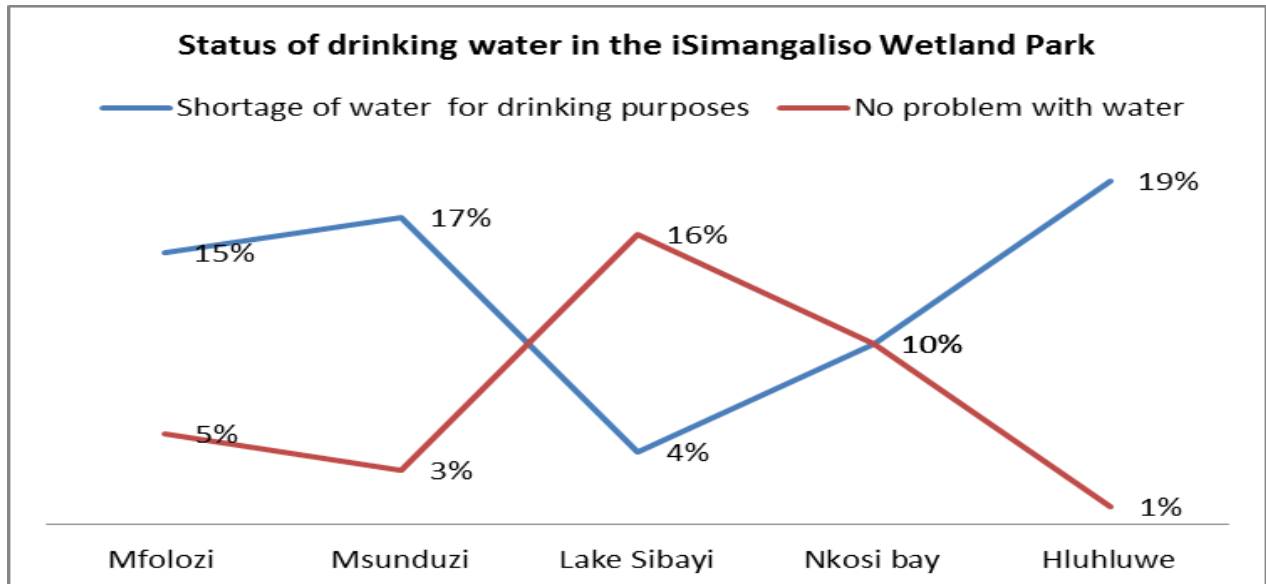


Figure 13: Status of drinking water in the iSimangaliso Wetland Park.

In Figure 13, 19% out of 1% of the respondents indicated that there was a shortage of water in the Hluhluwe river catchment, which shows that the local communities are well-capacitated regarding the water availability in the catchment. In conclusion, the local communities of Lake Sibayi, Kosi bay and Hluhluwe river catchments need more capacity building with regard to water availability in river catchments and how the planting of Eucalyptus, Pine and Wattle causes stream-flow reduction.

6.13. The future position of Water Resources in 2020 if informal afforestation is not properly managed

The overall Figure 14 shows that a significant majority of respondents (55%) indicated that they were fully aware of the fact that if informal afforestation is not properly managed, the status of future water resources would be a low surplus until 2020.

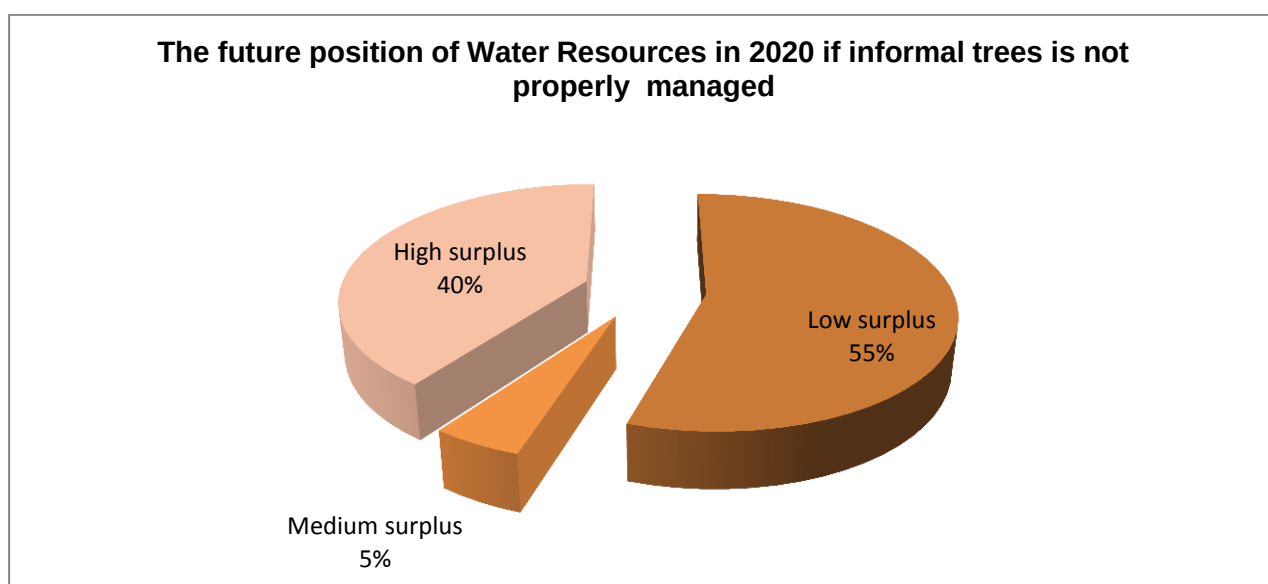


Figure 14: The future position of Water Resources in 2020 if informal afforestation is not properly managed

40% of the respondents, as depicted in Figure 14, indicated that if the informal afforestation is not managed by 2020 the water resources would be in a high surplus, which means that these respondents need to be capacitated with regard to how informal afforestation will abstract surface or ground water. 5% of the respondents indicated that if the water resources are not managed properly due to informal afforestation, there will be a medium surplus.

6.14. The rating impact of Eucalyptus, Pine and Wattle on water resources

Table 9 is an example of what was expected from the respondents with regard to their ratings of the impacts of Eucalyptus, Pine and Wattle on water resources. The system for the Standard Assessment Checklist (which is a South African Scoring System (SASS)), was adopted so as to synthesize the rating impact of Eucalyptus, Pine and Wattle in water resources. Table 9 guid the interpretation in Figure 15.

Table 9: Standard Assessment Checklist per Activity) according to South African Scoring Systems (SASS)

Rating	Category	Species
1	slightly harmful	Wattle
2	moderately harmful	Pine
3	extremely harmful	Eucalyptus

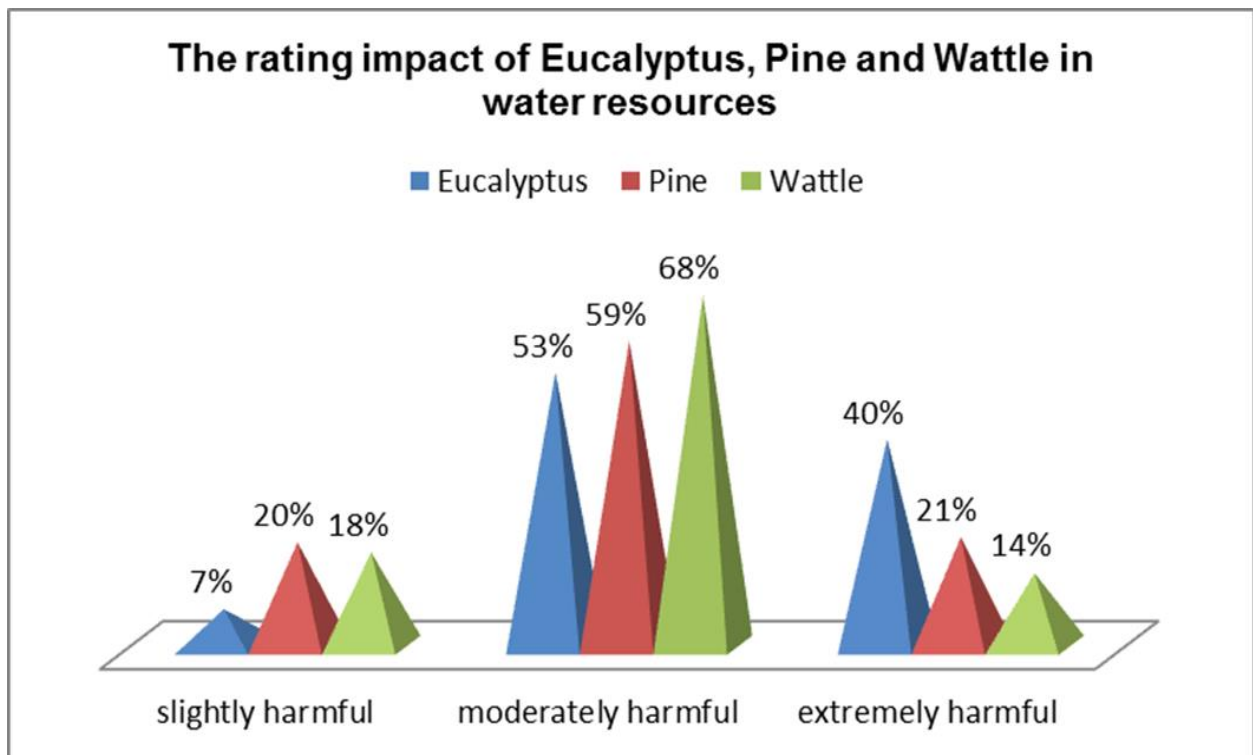


Figure 15: The rating impact of Eucalyptus, Pine and Wattle on water resources

6.14.1 Eucalyptus

Figure 15 reports that 53% of the respondents indicated that Eucalyptus has a moderately harmful impact on water resources, 40% said that it has an extremely harmful impact and 7% said that it had a slightly harmful impact on water resources. According to the results from the respondents it seems that the local communities do not have a clear understanding of which species consume large amounts of water in water resources.

6.14.2 Pine

59% of the respondents answered that the Pine trees are moderately harmful to water resources, 21% indicated that these trees are extremely harmful and 20% that they are slightly harmful. The Pine trees are moderately harmful to water resources. In conclusion it can be noted that capacity building regarding species' reduction rate needs to be done to the local communities of iSimangaliso Wetland Park.

6.14.3 Wattle

18% of the respondents indicated that the Wattle trees are slightly harmful to water resources, 14% indicated that they are extremely harmful and 68% indicated moderately harmful. The Wattle trees are slightly harmful to water resources. In conclusion, capacity building with regard

to the reduction rate of species needs to be done with the local communities of iSimangaliso Wetland Park.

6.15. Conclusion

This chapter focused on the analysis and interpretation of measures that discuss the perceptions of the local communities and the impacts of sustainability challenges of informal plantations in iSimangaliso Wetlands Park. The analysis and interpretation of data were achieved by utilising the objectives as point of departure. The demographic characteristics of the respondents (local communities) revealed the variety and at times similarity in thinking regarding their perceptions of informal plantation patterns in the study area. These conclusions lead to a number of recommendations presented in the next chapter.

CHAPTER 7: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

7.1. Summary of the study

The previous chapter contained the analysis of data collected from various respondents from the local communities in the iSimangaliso Wetland Park environment that would be focused in five river catchments, namely Kosi Bay Estuaries, Lake Sibayi, Mfolozi, Msunduze and Hluhluwe river. The chapter produced some findings relating to the objectives of the study. This particular chapter presents some of the general conclusions, recommendations and the final conclusion to the study-based chapters. Under summary the chapter reflects on the existing link between iSimangaliso Wetland Park and the neighbouring communities, mainly referring to perceptions and impacts of sustainability challenges of informal afforestation in the Park. The summary centres on the objectives of the study in view of reaching solutions to the problems stated.

The suggestions and recommendations are presented in this chapter as a possible contribution towards the formulation of strategy aimed at addressing the perceptions of the local communities and impacts of sustainability challenges of informal plantations in the iSimangaliso Wetland Park. The recommendations are expected to assist the local communities of iSimangaliso Wetland Park in progressing from practising informal afforestation to formal afforestation. The researcher is confident that the suggestions put forward will help in convincing the local communities to become more involved in the Streamflow Reduction Activities (SFRAs) practised and to ensure that the water resources around iSimangaliso Wetland Park are protected, developed and conserved in order to create a balance amongst efficiency, equity and sustainable. The results indicated that afforestation information management was lacking in the Park.

7.2. Assessment of the insights of the local communities regarding informal afforestation.

The assessment of the insights of the local communities regarding informal afforestation was discussed under the heading associated with the following objective:

OBJECTIVE 1: TO ASSESS HOW LOCAL COMMUNITIES IN THE ISIMANGALISO WETLAND PARK PERCEIVE THE PRACTICE OF INFORMAL AFFORESTATION

One of the objectives of this research inquiry was to assess the perceptions of the local communities' concerning the practice of informal afforestation in the Park. This was done to explore the insights of the local communities concerning the practice of informal afforestation. This objective was seen as the cornerstone of assessing the perceptions of the local communities concerning the practice of informal afforestation in the study area.

After analysis it came to light that the majority of the sampled community responded indicating that there were some informal afforestation practices were taking place because most of them were not in possession of a Water Use Authorisation (WUA) such as Water Use Licences, Permits and Prior 1972). The findings, amongst others, were that the majority of the respondents were unaware that practising unlawful afforestation impacts water resources.

7.2.1. Link between water resources and informal afforestation

The link between water resources and informal afforestation was discussed under the heading associated with the following objective:

OBJECTIVE 2: TO ASSESS THE REDUCTION OF WATER RESOURCES CAUSED BY THE INFORMAL AFFORESTATION OF EUCALYPTUS, PINE AND WATTLE IN THE ISIMANGALISO WETLAND PARK IN ORDER TO PROJECT FUTURE USE OF WATER RESOURCES

One of the objectives of this research inquiry was to determine the link between the water resources and informal afforestation in the iSimangaliso Wetland Park. In other words, this was to determine the abstraction caused by the practice of informal afforestation (Eucalyptus, Pine and Wattle) into river catchments such as Mfolozi, Msunduzi, Lake Sibayi, Kosi Bay and Hluhluwe river. This objective is seen to be the cornerstone of finding the interaction between water resources and the practice of informal afforestation in the study area.

After analysis, it came to light that the response of the majority of the sampled community was that some informal afforestation was taking place in the study area of approximately 5,937 hectares (ha) of the afforestation depicted as unlawful afforestation and the Stream Flow Reduction caused by the unlawful or informal afforestation was 2,820,464 Million Cubic Metres (m³).

The findings, amongst others, were that the majority of the respondents were practising unlawful afforestation which would have a negative impact on the availability of water in water resources. The factors that might contribute towards bad links in the ecosystems, especially those of iSimangaliso Wetland Park, seeing that it is promulgated by UNESCO as a world heritage site.

7.2.3 Determined the upcoming esteem of water resources

Determining the future balance of water in the study area was discussed under the heading associated with the following objective:

OBJECTIVE 3: TO PROJECT THE FUTURE STATUS OF WATER RESOURCES IN THE ISIMANGALISO WETLAND PARK

One of the objectives of this research inquiry was to project the future balance of water in the light of practised informal afforestation. It would also affect the future availability of water in the study area if, and only if, the unlawful afforestation is not properly managed immediately – in other words, if the previous and present water use caused by informal afforestation in the study area is not compared. A comparison shows that the accumulation is double that of the previous use. In addition, the respondents that were surveyed did not see any change in previous to present use.

7.3 GENERAL CONCLUSIONS REGARDING THE STUDY

Under this topic the objectives which were set are related to the findings with a view to establish how outcomes matching the objectives can be improved by following up on the recommendations. The conclusions that emerged were structured on the basis of accepted objectives.

The fundamental objective of Chapter One was to establish the extent to which the local communities were aware that informal timber plantations (Eucalyptus, Wattle and Pine) have implications for water resources management and biodiversity in the study area. In this regard informal afforestation practised by local communities is seen as the core issue of the research problem, since the majority of the community members in the study area indicated that they were not aware that too much informal afforestation was taking place in the iSimangaliso

Wetland Park and also not aware of the importance of registering their afforestation with the Department of Water and Sanitation.

The objective in Chapter Two sought to discover whether the local communities were aware of how much informal afforestation was being practised in the study area. In addition, these respondents participated in afforestation activities with a view to benefit from it in the study area, specifically the iSimangaliso Wetland Park.

The objective in Chapter Three was to determine the gap in the definitions traced in literature reviews with regard to the existing information on the perceptions of local communities concerning informal afforestation in the iSimangaliso Wetland Park. In other words, this was to explore the link between the iSimangaliso Wetland Park Authority and the perceptions of local communities with regard to sharing the use of water resources.

Chapter Four's objective was to explore the availability between amongst Afforestation and Water in the long run and, in addition, to explain which models were used in order to determine these links.

In Chapter Five the intention of this research study was set out, namely to delineate and describe the study area through river catchments and sub quaternaries; hence to determine whether there were any forestry development initiatives or practices exercised by the local communities in the iSimangaliso Wetland Park.

In Chapter Six the objective was to explore the results pertaining to how much informal afforestation was being practised in the iSimangaliso Wetland Park. In other words, respondents were expected to reveal their perceptions of the existence and offerings of activities, practices and benefits in the study area. The various outcomes of this analysis suggested that several mitigation measures need to be addressed in order to minimize the informal afforestation taking place in the iSimangaliso Wetland Park. The finding was that, even though respondents were aware of the importance of afforestation in creating job opportunities in iSimangaliso Wetland Park, they were not clear about the link between the informal afforestation and water resources in the study area. Another finding of the study was that the various age groups in the study area were not supported even if they were interested in practising afforestation in the study area.

7.4. RECOMMENDATIONS

The recommendations presented here are based on the findings of the study. The findings are related to the perceptions of local communities regarding informal afforestation in the iSimangaliso Wetland Park. The findings indicated that the local communities of iSimangaliso Wetland Park were not aware that water for future afforestation in the study area was insufficient. They were also not aware that they need to apply for a Water Use Licence (WUL) before initiating afforestation. Most of them also did not know that Eucalyptus, Wattle, and Pines trees cause high reduction in water resources, especially when it is not properly managed.

This lack of knowledge among the inhabitants of this study area indicates that the government departments need to play a strong role in educating people about the link between forestry and water availability in the study area, as well as to educate people about the negative impact on water resources – especially about the negative impact caused by informal afforestation. The Government Departments and Non-Government Organisations (NGOs) need to come forward and educate people of the study area about informal afforestation. Co-operative governance among the Interested and Affected Parties (I&APs) needs to be exercised in order to introduce some alternative uses of crops so that the local communities of iSimangaliso Wetland Park can be convinced not to practise informal afforestation. Steven Mallory (2001:23) points out that the local communities of iSimangaliso Wetland Park attempted to plant various crops in previous years but they were unsuccessful due to the tiredness of soil fertility, which is why they preferred to plant forests. Forestry is foreseen to play a huge role in the future in socio-economic activity in the study area.

7.5. Conclusion

The final chapter offered a summary of the findings of this research study. These findings explained in the summary were those that formed the core of the study. These findings focused on the perceptions of the local communities informal afforestation in the iSimangaliso Wetland Park. The comments on the expression of the objectives of the study were also included in the general conclusion to confirm the validity of the investigation. After having conducted the study, the researcher made suggestions concerning the perceptions of the local communities in the iSimangaliso Wetland Park. The recommendations that were made sought to make a meaningful contribution to the investigated research problem.

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9. ANNEXURES

ANNEXURE A-MOTIVATION LETTER

October 2016

Dear Respondent

**RESEARCH PROJECT: SUSTAINABILITY CHALLENGES FOR INFORMAL PLANTATIONS
IN ISIMANGALISO WETLANDS PARK: IMPACTS AND
PERCEPTIONS.**

I am a Masters degree in Environmental Management (Environmental Water Requirement) student and I am conducting research in conjunction with the University of North West, on the above mentioned topic. The purpose of the research is to assess the sustainability challenges for informal plantations in iSimangaliso Wetlands Park: impacts and perceptions. Kindly note that your inconspicuousness is assured and all responses will be treated in the strictest confidence. We would be obliged if you could complete the questionnaire latest by October 2016.

Thank you for your willingness to contribute to the success of this research project.

Yours faithfully,

Bongani Loveous Mdluli: Researcher

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Prof Francois Retief

ANNEXURE B– QUESTIONNAIRES IN ENGLISH

Name:

Surname:

INSTRUCTIONS:

- Please answer all questions.
- Multiple-choice questions should be answered with a tick (X) in the provided box.
- The following questions will consist of 4 pages.

General information about the local communities

1.1 Where are you staying?

<i>Kosi Bay</i>		01	Lake Sibayi		02
<i>Hluhluwe</i>		03	Mfolozi		04
<i>Msunduzi</i>		05			

1.2 How long have you been staying in this area?

<i>1-5 years</i>		01	5-10 years		02
<i>10-20 years</i>		03	Over 50 years		04

1.3 Gender

<i>Male</i>		01	Female		02
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1.4 Age

14-20		01	21-25		02	26-30		03	
31-35		04	36-40		05	41-45		06	
46-50		07	Over 50		08				

1.5 Marital status

Married		01	Single		02	Divorced		03	
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1.6 Race

<i>African</i>		01	Indians		02
<i>Whites</i>		03	coloureds		04

1.7 Educational level

Grade 8 -1		01	Grade 9-10		02
Grade 11-12		03	Tertiary Education		04

To assessing how local communities in the iSimangaliso Wetland Park, perceive the practice of informal afforestation.

1. Are you practising any afforestation? **Y/N**.....

1.1 If Yes, provide type of species, hectares and co-ordinates

Type of Species		Hectares	Co-ordinates	
Eucalyptus			S E	01
Pine			S E	02
Wattle			S E	03

2. For how long have you planted your trees?

1month - 1 yr		01	2yrs – 7yrs		02
8yrs-41yrs		03	Over 42yrs		04

3. You have any Water Use Authorisation (WUA)? **Y/N**

4. If **Yes** provide the type of WUA?

Water use licence		01	Prior 1972		02
Water Use Registration Certificate		03	No Water Use Authorisation		04

5. Are you aware that before you plant timber you need to apply a Water Use Authorisation from Department of Water and Sanitation? **Y/N**

6. If **Yes**, who was / is assisting you to know that information?

Person from Sappi		01	Person from Mondi		02
Official from DAFF:Forestry		03	Person from Forestry South Africa		04
ANY:.....		05			

7. Who provide you with seedlings?

.....

8. Are you aware that if you plant timber without any Water Use Authorisation from Department of Water and Sanitation that forests take as informal afforestation? **Y/N**

9. If yes, why were you not applying for a Water Use Authorisation?

Not know where can I apply		01	Delayed of Water Use Authorisation process		02
I apply but decline my request.		03	I apply not respond from DWS		04

10. Do you think that to plant informal afforestation it is sustainable to water resources, how?

.....

11. Are you satisfied with this afforestation in the area? Y/N.....

12. What are the things that you most like about the plantation of timber?

.....

13. What are the things that you least like about planting timber in this area, why?

.....

14. In your opinion what needs to be improved in the plantation of informal afforestation in order to achieve sustainable water resources in this area?

.....

15. Do you think that the informal afforestation is user friendly, sufficient or unstable to the water resources of this area?

.....

16 . Afforestation (Eucalyptus, Wattle & Pine) has a high impact on water resources, you are requested to tick the type of species and rating by using the scale below choosing which degree of harm timber has on water resources : 1= harmless, 2=slightly harmful, 3=moderately harmful, 4=harmful, 5=very harmful, and 6 extremely harmful.

Activities	Rating(Scales)						Comments if applicable
	1	2	3	4	5	6	
Eucalyptus trees reduction to water resources							
Wattle trees reduction to water resources							
Pine trees reduction to water resources							

To assess the reduction of water resources that is caused by the informal afforestation of Eucalyptus, Pine and Wattle in the iSimangaliso Wetland Park in order to project future use of water resources.

17 Are you practicing any informal Afforestation? Yes/No

.....

18 Complete the ff. table by choosing the species that you have already planted in your site, that is informal:

Activities	Tick √ species already planted	Ha
Eucalyptus trees		
Wattle trees		
Pine trees		

To project the future status of water resources in the iSimangaliso Wetland Park.

19 What difficulties do you experience in drinking water most of the times?

.....

20. What do you think about the future position of water resources in your area in the year 2020, if the rate of informal afforestation is not managed?

Low surplus		01	Medium surplus		02
High surplus		03			

21. If you compare the previous and the present status of water resources, what is the degree of change and grade it by using a percentage % given in the table below:

Percentage%	Previous use	Present use	Future use	reason for change
10-50				
60-80				
90-100				

ANNEXURE C-IMIBUZO NGESIZULU

Igama:.....

Isibongo:.....

Okumele ukwenze:

- Ucelwa ukuba uphendule imibuzo
- Uyacelwa ukuba ushaye isiphambano (x) esikhaleni esinikeziwe bese unikezela ulwazi oludingekayo ubhale lapho kudingekke khona.
- Lemibuzo inamakhasi ayisithupha.

Ukuthola ulwazi kubahlali bendawo.

1.1 Uhlala kuphi?

Kosi Bay		01	Lake Sibayi		02
Hluhluwe		03	Mfolozi		04
Msunduzi		05			

1.2 Unesikhathi esingakanani uhlala kulendawo?

1-5 Weminyaka		01	5-10 Weminyaka		02
10-20 Weminyaka		03	Ngaphezulu ka 50 Weminyaka		04

1.3 Ubulili?

Owesilisa		01	Owesifazane		02
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1.4 Iminyaka?

14-20		01	21-25		02	26-30		03	
31-35		04	36-40		05	41-45		06	
46-50		07	Over 50		08				

1.5 Isimo somshado?

Oshadile		01	Ongashadile		02	Abahlukene		03	
----------	--	----	-------------	--	----	------------	--	----	--

1.6 Uhlanga luni?

Ungum-Afrika		01	UngumNdiya		02
<i>UngumLungu</i>		03	Ungu Mkhiladi		04

1.7 Izinga lemfundo

<i>Kusukela ku 8 kuya ku 1</i>		01	Kusukela 9 kuya ku10		02
<i>Kusukela 11 kuya ku 12</i>		03	Imfundo ephakeme		04

Ngifuna ukuthola ukuthi abantu abahlala eSimangaliso Wetland Park, bakucabanga kanjani mayelana nokutshala amahlathi angena mvumo.

1. Ulitshalile ihlathi? **Yebo noma Cha**.....

2. Uma uthi **Yebo**, Nginike inhlobo yesihlahla, I-ehha yendawo oyitshalile nanokuthi ikuphi nendawo

Uhlobo lwesihlahla		I-ehha	Ikuphi nendawo	
Ugamu			S E	01
Uphayini			S E	02
Uwatela			S E	03

3. Usunesikhathi esingakanani uwutshalile?

<i>Inyanga kuya onyakeni</i>		01	Iminyaka emibili kuya eminyakeni eyiskhombisa		02
<i>Isishaga lolunye kuya emashumini amane nanye weminyaka</i>		03	Ngaphezulu kwamashumi amane nakunye weminyaka.		04

4. Unayo imvume yokutshala amahlathi? **Yebo noma Cha**

5. uma uthi Yebo, ngicela ungitshengise ukuthi unanhlobo yini?

<i>Unelayinsense</i>		01	Wawutshalile ngaphambili kuka1972		02
<i>Unesitifiketi sokuthi ihlathi lakho libhalisiwe emnyangweni</i>		03	Noma ihlathi lakho alibhalisiwe ndawo emnyangweni		04

6. Unalo yini ulwazi lokuthi ngaphambi kokuba utshale ihlathi kumele ucele imvume emnyangweni weZamanzi nokunakekela kwendle? **Yebo noma Cha.**

7. Uma uthi **Yebo**, ubani owakusiza ngolwazi?

<i>Umuntu wakwa Sappi</i>		01	Umuntu wakwa Mondli		02
<i>Umsebenzi wakwa DAFF:Forestry</i>		03	Umuntu wakwa Forestry South Africa		04
<i>Omunye:.....</i>		05			

8. Ubani onisiza ngenhlanyelo yokutshala ihlathi?

.....

9. Uyazi yini ukuthi ukutshala ihlathi ngaphandle kwemvume okumele uyithole emnyangweni weZamanzi noku nakekelwa kwendle, lelo hlathi lithathwa njengelingekho emthethweni? **Yebo noma Cha.**

10. Uma uthi Yebo, wawungayiceli ngani imvume kuqala?

<i>Kungoba ngangingazi ukuthi icelwa kuphi</i>		01	ngayicela yathatha isikhathi eside ingabuyi emnyangweni		02
<i>Ngayicela</i>		03	Ngayicela kwangabuya		04

banganginika emnyangweni			lutho eMnyangweni		
-------------------------------------	--	--	--------------------------	--	--

11. Uyacabanga yini ukuthi ukutshala ihlathi ngaphandle kwemvume kwenza kulimale izingoje zamanzi esesinazo bese kuthi abantu abasazozalwa bengabe besakwazi ukuthola amanzi? Uma ucabanga kungenzeka kanjani?

.....

12. Wenelisekile ngendlela amahlathi emanengi ngayo kulendawo? **Yebo** noma **Cha**

.....

13. Iyiphi into ekwenza uthande kakhulu ukuba khona KwaMahlathi kulendawo?

.....

14. Iyiphi into eyenza ukuthi amahlathi ungawathandi kakhulu kulendawo, awuyisho?

.....

15. Ngokubuka kwakho yini okumele yenziwe lapha ukuthi kuthuthukiswe izinga labantu abatshala amahlathi nga phandle kwemvume ukuze kucatshangelwe abantu abasazo zalwa kulendawo?

.....

16. Uma ucabanga ukutshala ihlathi ngaphandle kwemvume kungaba wubungani, kwenelisekile noma kuyahambisana yini nezingoje zamanzi akulendawo?

.....

17. Ukutshala (uGamu, Watela & uPhiyini) kwenza ushintsho olukhulu ezingojeni zamanzi, uyacelwa ukuba uthikhe ibhokisi (✓) lapho ubona khona ukuthi uhlobo ngalunye luwadla kangaka nani amanzi ezingojeni: 1= harmless, 2=slightly harmful, 3=moderately harmful, 4=harmful, 5=very harmful, and 6 extremely harmful.

Izinhlobo	Rating(Scales)						Comments if applicable
	1	2	3	4	5	6	
UGamu uyawadla amanzi ezingojeni							
U Watela uyawadla amanzi ezingojeni							
U Phayini							

uyawadla amanzi ezingojeni							
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Ukuthola ukuthi bazuzani ngokutshala amahlathi kulendawo?

18. Yini eyenza ufune ukutshala ihlathi?

Ukungabi komsebenzi	bikho		01	Ukwehlisa ledlala	izinga		02
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19. Ikhona inzuzo uma unjale ihlathi na? **Yebo** noma **Cha**

.....

20. Uzuza kanjani/ iyiphi inzuzo oyitholayo?

Ukuthi abantu bendawo bethole umsebenzi ngoku baqhasha		01	Amathuba okuthuthuka kosomabhizinisi abancane		02	Ukuba ulwazi lethu esinalo siyakwazi ukuthi silusebenzise nosomboni abakhulu .		03
---	--	-----------	--	--	-----------	---	--	-----------

21. Iyiphi inkampani ethenga izingodo zenu?

Sappi		01	Mondi		02
Any		03			

22. Malini imali oyitholayo uma usudayisile?

.....

23. Uma ucabanga ngokwazi kwakho ukutshala izihlahla ngaphandle kwemvume kuwukuluza noma ukuzuza ezingojeni zamanzi?

Ihlathi elingenamvume lenza izingoje zamanzi ziluze		01	Ihlathi elingenamvume lenza izingoje zamanzi zizuze.		02
--	--	-----------	---	--	-----------

Uma uthi Ihlathi elingenamvume lenza izingoje zamanzi ziluze, kanjani?

.....

Uma Ihlathi elingenamvume lenza izingoje zamanzi zizuze, kanjani?

.....

24. Uma ucabanga kukhona yini ushintsho olwenziwa ukuba khona kwamahlathi, (kaGamu, Watela kanye no Phayini) ezingojeni zamanzi njengase mfuleni, emaxhambozini, kumalekisi, kumaponzi, kumaswampu, nakuma esitshwarizi?

Yebo noma Cha.....

25. Uma uthi yebo, kanjani

Tick √

Izinhlobo	Wadla kancane	Uwadla kakhuhlwana	Uwadla kakhulu
Gamu			
Watela			
Uphayini			

Ukuthola ukuthi izihlahla ezingenayo imvume (uGamu, uPhayini kanye no Watela) seziwadle kangakanani amanzi eSimanagaliso Wetland Park.

26. Unalo yini ihlathi elingena mvume? Yebo noma Cha.

.....

27. Qedela isikhala esikuletafula elilandelayo ufake uhlobo lwesihlahla ositshalile

Uhlobo lwesihlahla	Thikha √ uhlobo lwesihlahla ositshalile	I ehha
Gamu		
Watela		
U Phayini		

Ukuthola ukuthi izingoje zamanzi ziyobe zingakanani eminyakeni ezayo lapha eSimangaliso Wetland Park.

25. Yibuphi ubunzima enihlangabezana nabo mayelana namanzi okuphuza lapha eSimangaliso Wetland Park?

.....

26. Ucabanga ukuthi izinga lezingoje zamanzi liyobe linjani ngo 2020 uma kuqhutshekwa zingabhekelwelwa izihlahla ezingenamvume?

Low surplus		01	Medium surplus		02
High surplus		03			

27 Uma ubuka eminyakeni eyendlule kanye namanje ucabanga ukuthi ziyobe zinjani izingoje zamanzi, tshengisa ushintsho ngokusebenzisa I phesenti% onikwe lona kuyithebuli:

Iphesenti %	Iminyaka eyadlula	Unyaka esikuwo	Unyaka ozayo	Isizathu esenza kube noshintsho
10-50				
60-80				
90-100				