

**THE LEGAL FRAMEWORK FOR MANAGING  
THE INVASION OF GA-RIBA WETLANDS  
BY POPLAR PLANTS, GA-RIBA VILLAGE,  
SOUTH AFRICA**

by

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**SUPERVISOR: Prof T Scheepers**

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## **DECLARATION**

I declare that mini dissertation hereby submitted to the University of Limpopo, for the degree of Master of Philosophy in Environmental Law & Management has not previously been submitted by me for a degree at this or any other university; that is my work in design and in execution, and that all material contained herein has been duly acknowledged.

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## ABSTRACT

According to the Ramsar Convention of 1971, Wetlands are areas of marshes, firm, peatlands or waterlogged. They are either natural or artificial. They have water that is static or flowing, fresh, brackish or salty and include areas of marine water with the depth, which at low tides does not exceed six meters.

Wetlands are regarded as important ecological components of the natural environment because of their richness and ability to support life. Wetlands essentially catch, clean and preserve any water. They are able to reduce the severity of drought and floods by regulating a stream flow. They also control erosion and provide habitat for many different plant and animal species. Wetlands also serve as valuable source of water, fish and grazing for livestock. They are important nesting grounds for birds. Wetland resources are also known to be of socio-economic importance because they provide materials for furniture and craft's work

Ga-Riba wetlands are very important for the community of Ga –Riba because they provide them with food such as fish and birds. Some of the community members make baskets, hats and mats using wetlands grass. They also make pottery using clay from the wetlands. During winter the wetlands are used as areas where traditional initiation for Ga-Riba girls is performed. Some people own fields within the wetlands on which they cultivate vegetables, maize and other crops. They also use wetland as grazing areas for their domestic animals such as cattle and goats.

The Ga-Riba wetlands are being invaded by one of the alien plant called *Populus alba L* (Poplar). This type of alien plant, like other alien plants disturbs the ecological stability of the wetlands. Findings of the tests conducted on soil and water indicated that Poplars are changing the nature of the soil and the water of the wetlands. Vegetation survey showed that, wetlands had less vegetation than they were supposed to.

With regard to legal instruments to control the invasion of wetlands by alien plants, findings showed that there are insufficient legal instruments which can be utilized.

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## TABLE OF CONTENT

Declaration .....	(ii)
Abstract.....	(iii)
Acknowledgements.....	(iv)
Table of Content.....	(v-vii)

### Chapter one: Introduction

Background to the Research Problem.....	1
1.1 Ecological Setting of the Area.....	3
1.1.1 Location.....	3
1.1.2 Physiography.....	6
1.1.3 Climate.....	6
1.1.4 Hydrology.....	6
1.1.5 Biodiversity.....	6
1.1.6 Population and settlement.....	6
1.1.7 Land use.....	7
1.2 Statement of the Research.....	7
1.3 Identification and Delineation of the Research Problem.....	7
1.4 Research Objectives.....	8
1.5 Research	
Assumption.....	8
1.6 Summary.....	8

### Chapter 2 Research Design

2.1 Research Methodology.....	9
2.2 Summary.....	10

### Chapter 3 Literature Review

3.1 Nature of Undisturbed Wetlands.....	11
3.1.1 Location.....	11
3.1.2 Adaphic Factors.....	11

3.1.3 Hydrological Characteristics.....	12
3.1.4 Plants and Animals.....	12
3.2 Significance of Wetland.....	13
3.2.1 Functions of Wetlands.....	13
3.2.1.1 Flood Reduction and stream Floor Regulation.....	14
3.2.1.2 Ground Water Recharge and Discharge.....	14
3.2.1.3 Water Purifications.....	14
3.2.1.4 Erosion Control.....	14
3.2.1.5 Biodiversity.....	15
3.2.2 Values of Wetlands.....	15
3.2.2.1 Livestock Grazing.....	15
3.2.2.2 Fibre for Construction and handcraft Production.....	16
3.2.2.3 Valuable Fisheries.....	16
3.2.2.4 Water Storage.....	16
3.2.2.5 Productive Agricultural Land.....	17
3.2.2.6 Education and Tourism.....	17
3.3 Factors Affecting Wetlands.....	17
3.3.1 Alien Plants Invaders.....	18
3.3.2 Causes of Alien Plants Invasion.....	21
3.3.2.1 Drainage and the Production of Crops and Planted Pastures.....	21
3.3 Summary.....	23
<b>Chapter 4: Data Collection, Analysis and Interpretation</b>	
4.1 Types of Data Collected and Requirement.....	24
4.1.1 Data on Soil pH.....	24
4.1.2 Data on Vegetation.....	24
4.1.3 Data on Soil nutrients.....	24
4.1.4 Data on Water pH.....	24
4.1.5 Data on Soil moisture.....	24
4.1.6 Data on Legal Framework in Managing the Wetlands.....	25
4.2 Data Analysis.....	25
4.2.1 Data on Vegetation.....	25

4.2.2 Data on Tree Life Forms.....	26
4.2.3 Data on Shrubs Life Form.....	28
4.2.4 Data on Grass Life Form.....	30
4.2.2.1 Data Interpretation.....	32
4.3 Soil Survey.....	32
4.3.1 Data on Soil Moisture.....	32
4.3.2 Data Interpretation.....	33
4.4 Data on Soil nutrients.....	33
4.4.1 Data Interpretation.....	34
4.5 Data on Water pH.....	34
4.5.1 Data Interpretation.....	35
4.6 Data on Legal Framework.....	36
4.6.1 Data Interpretation.....	36
4.6.2 Summary.....	36
<b>Chapter 5 Legal framework and findings</b>	
5.1 Legal Framework.....	38
5.1.1 The Republic of South Africa Constitution.....	39
5.1.2 National Environmental Management Act.....	40
5.1.3 Conservation of Agricultural Resources Act.....	40
5.1.4 National Water Act.....	41
5.1.5 National Environmental Management Act: Biodiversity Act.....	41
5.1.6 Common Law.....	43
5.1.7 Customs.....	43
5.1.8 Regulation in terms of Conservation of Agricultural Resources Act.....	44
5.2 Relevant Cases.....	45
5.3 Findings.....	46
5.4 Summary.....	47
<b>Chapter 6 Recommendations</b>	
6.1 Alien Plant Species Control.....	48
6.2 Wetland Rehabilitation.....	49
6.3 Education and Awareness.....	50
6.4 Legislations.....	50
References.....	52-59
Appendix I.....	60-61
Appendix II.....	62

# Chapter 1

## 1.1 Background to the research problem

“Wetland” refers to the interface between terrestrial ecosystem and aquatic systems which is swampy or marshy in nature. A wetland is one of the significant ecological components rich in biodiversity in the form of plants, animals and micro-organisms. Wetlands include areas that are inundated or saturated by surface or ground water. They are generally swamps, marshes, bogs<sup>1</sup>.

Wetlands are found under a wide range of hydrological conditions, mostly in acidic soil. The result is acidic soil characterized by an absence of free oxygen. This environment consists of plants called hydrophytes or wetlands plants specifically adapted to the reducing environmental conditions presented by such soils. There are species which survive well in this type of environment such as Cattails, Bulrushes, Sedges, Arrowhead, Water lilies, Blue flag, and Floaters like common duckweed and Pondweed, are all adapted to the acidic nature of wetlands<sup>2</sup>.

Wetlands are known for their significance in supporting life. They provide habitat for plants mostly those that are adaptable to survive in acidic soils. Wetlands provide habitat for animals such as fish, frogs, snails, birds and micro-organism such as bacteria since they are rich in nutrients. They acts as a giant sponge which absorbs excess water during floods, reducing impacts of floods to human beings, infrastructure and vegetation.

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1. (<http://en.wikipedia.org.za/wetlands> ecology,2006)

2. (Miller, 2002)

They also provide food for human beings in the form of fish and birds, and they are rich in raw materials in the form of sedges, which people harvest and utilize in making products such as mats, hats and baskets. These products are then used at homes, and some of them are sold which boost the economy of the area and support people financially. Some of the raw materials are used as building material such as ridges and sedges to make huts (traditional houses)<sup>3</sup>

Most of the wetlands are facing the problem of invasion by invading plants. These types of plants are not native / indigenous, they originate from another country. Invading plant which are common in South Africa are Pines, Blue gums, Poplar, Wattle and Weeping Willow. Most of the alien plant invaders in South Africa are brought in the country for various reasons such as timber, ornamental and medicinal purposes. Some of these plants are brought to the country unintentionally e.g. their seeds fall into ships, which were transporting people from other countries like Australia to South Africa where they fall from the shoes of people to the soil. In the soil they start to germinate and spread all over the country. The most common reason why alien plants are brought to South Africa is for ornamental purpose. Plants such as Jacarannda, Poplar, Weeping willow and Syringa are used in the gardens and streets to decorate the area.

These plants have a tendency of spreading rapidly and invade the area. As they spread they outcompete the native vegetation in the area by consuming a lot of nutrients and sunlight since they grow very quickly. These plants like to invade areas where there are sufficient water. They consume a lot of water in a manner that other vegetation existing in the area end up dying of thirst, as time goes native vegetation where the are invader plant get replaced by those new types of plants causing a serous ecological disturbance. The animals which were using the replaced native vegetation for habitat and food suffer and die.

3. (Adams, 1995)

Animals such as birds leave the particular wetlands to other wetlands causing over population. Animals die due to the change of environment mostly fish and frogs. When they die it affects other animals and people who were depending on them for food.<sup>4</sup>

Ga-Riba wetland is one of those wetlands facing a problem of invasion by invading plant called *Populus alba L* commonly known as the White poplar. This type of plant originated from Central and Southern Europe, Western Siberia and Central Asia. White poplar, also known as silver-leaved or silverleaf poplar is a tall tree that, at maturity, may reach 70 feet or more in height and 2 feet in diameter. The smooth, greenish-white bark becomes dark and rough on older trees. Young green or brown twigs are coated with dense woolly hair, especially near the tip<sup>5</sup>, White poplar outcompetes many native tree and shrub species in mostly sunny areas, such as forest edges and fields, and interferes with the normal progress of natural community succession. It is a strong competitor because it can grow in a variety of soils; produce large seed crops, and resprouts easily in response to damage. Dense stands of white poplar prevent other plants from coexisting by reducing the amount of sunlight, nutrients, water and space available. This plant seems to grow best in full sun habitats such as fields, forest edges and wetland fringes.<sup>6</sup>

This research focused is on finding out if there are sufficient legal tools that will help in mitigating and reducing the problem of alien plant invaders in Ga-Riba wetlands.

## **1.2 Ecological Setting of the Area**

### **1.2.1 Location**

Ga-Riba wetlands are situated at Ga-Riba Village in the Limpopo Province of South Africa, about 75km from Polokwane and 35km from Burgersfort in the Tubatse Local Municipality within the Greater Sekhukhune District Municipality. It is located at S 24°32' 996" and E 30°13' 329" coordinates.

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4. (Cunning, 2001)

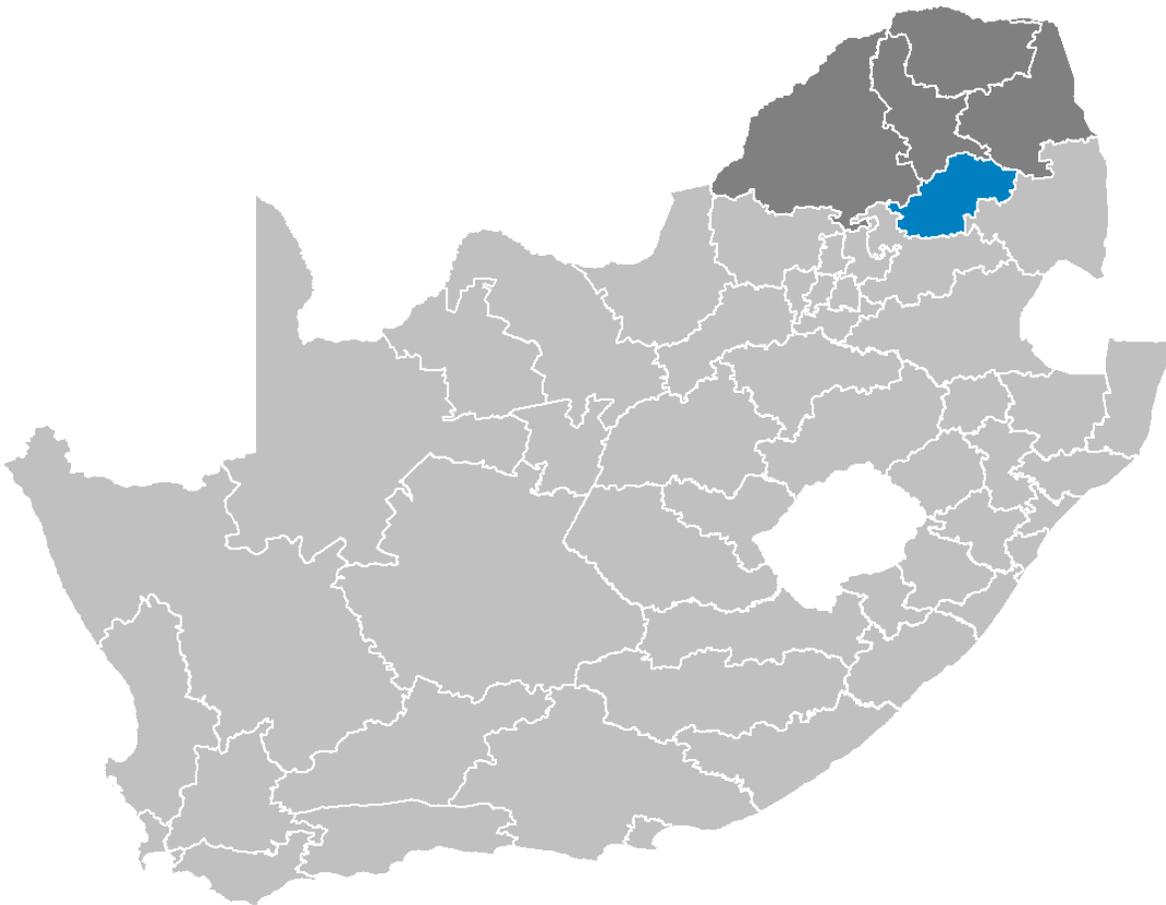
5. (Miller, 2002)

**Figure 1.1 A map of South Africa showing Limpopo Province and Sekhukhune area (Ga-Riba wetlands)**

**Legend**

Limpopo Province

Sekhukhune area



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7. (<http://www.conservationtreaty.org/index.html>, 2001)

**Figure 1.2 A picture showing Ga-Riba Wetlands on the north**



**Figure 1.3 A picture showing Ga-Riba Wetlands on the south**



### **1.2.2 Physiographic**

Ga-Riba is located between the Chuenis Mountains where the hills and the slopes protect valleys. The wetlands are situated on the valley between the undulating slopes. On the east, the Sekhukhune Escarpment overlooks the Steelpoort River valley which rises to over 1800m.

### **1.2.3 Climate**

The Temperature ranges from 16°-18° during winter and 20°- 35° in summer. The area is characterised by warm winter and hot summer. Ga-Riba area is semi arid, and the rainfall is only experienced during summer, from September to April and is about 300mm to 500mm.

### **1.2.4 Hydrology**

The study area consists of the main stream which gives rise to Sterkboom river, a perennial river which flows north wards of the wetland joining the Steelpoort river, which becomes Olifants river moving towards Mpumalanga.

### **1.2.5 Biodiversity**

Ga-Riba wetlands are rich in biodiversity of animals such as birds, fish and insects. With regard to plant there are less in the wetlands, reeds; grasses and poplar dominate the area.

### **1.2.6 Population and settlement**

Population in the Ga-Riba wetlands ranges from 20 000 to 40 000. It is dominated by females and children. Most of the people are unemployed and illiterate. Poverty in this area is high. People still depend on traditional resources like fish, wild animals and wild plants to survive.

### **1.2.7 Land use**

Agriculture is the main land use activity dominating the study area. People have small vegetable gardens surrounding the wetlands. Grazing is one of the commonly practised type of land use, Donkeys, Cattle and Goats graze in the wetlands, since it is rich in palatable vegetation of as sweet grass. Some of the grass and reeds are collected as building material and for making reeds baskets, hats and mats.

### **1.3 Statement of the Research**

The research investigates the legal framework in managing the invasion of Ga-Riba wetlands by alien plant invaders. It focuses on finding out how white poplar caused disturbance on the wetlands and what those impact were. The research also investigates if there are laws that can be used in managing Poplars in the Ga-Riba wetlands.

### **1.4 Identification and Delineation of the Research Problem**

Most of the wetlands are destroyed by alien plant invaders which had replaced natural vegetation and absorbed a lot of water causing the Ga-Riba wetlands to dry. The wetlands are facing problem of invasion by alien plant invaders called White Poplar which are spreading rapidly, and they have already taken about 12 hectares of wetlands. In terms of law to be utilized in mitigating the problem. The seems to be insufficient laws focusing on alien plant invasion.

## **1.4 Research Objectives**

The objectives of the research are;

- To find out the cause of the Poplar invasion and to investigate their impact on the wetlands
- To investigate the extent of the Poplar plant invader on the wetlands.
- To identify the legal framework which can be used to manage the conservation process of wetlands
- To find out if there are remedies measure to be used to reduce the invasion problem.

## **1.5 Research Assumption**

Human activities such as excessive fishing, cultivation, over grazing, removal of soil for composting and removal of vegetation (sedges) cause ecological disturbances of wetlands. Natural factors such as drought and fire can also cause a negative impact on wetlands. In this research it is assumed that negative impact on wetlands is caused by Poplar plant invader. The other causal factors such at human activities, time and climatic change are held constant.

## **1.6 Summary**

The chapter introduced the problem of the research and discussed laws to protect the Ga-Riba wetlands from alien plant invaders. The objectives of the research were outlined as well as the significance of conducting the research. The ecological setting of the area was shown with reference to the location, physiography, climate, hydrology, biodiversity, population, settlement and land use.

## Chapter 2

### 2.1 Research Methodology

This chapter reveals the operational plan or the blue print of the research. It works as a guideline on how the research was conducted. It shows the methods applied to conduct this research such as qualitative approach, quantitative and mixed research<sup>8</sup>. This research was conducted through both quantitative and qualitative approach. Qualitative approach was adopted through the use of secondary material such as books, journals, newspapers and internet materials. Other materials included information from previous researches or studies related to this research. These were utilised to find out the background of the research problem. Primary data in the form of field observations and Scientific Laboratory tests was collected and analysed.

The area of the wetlands invaded by Poplar was used as the Experiment and the area of the wetlands not invaded by Poplar was used as control. Water samples and soil samples were collected from both Experiment area and Control area. To get information on vegetation, different plant life forms were investigated in the wetlands looking at the abundance of a particular plant in each life form. Secondary information about the wetlands (abundance of wetlands vegetation) was used to compare the state of abundance of vegetation in Ga-Riba wetlands and how wetlands vegetation is supposed to be.

Interviews were conducted on relevant community members of Ga-Riba village, such people include people from the royal Riba family. This was done in order to acquire historical information about Ga-Riba wetlands, landuse practice in the wetlands and the significance of wetlands in the community. Relevant officials working with issues of wetlands and alien plant invaders were interviewed. Officials from the Department of Agriculture, Department of Economic Development, Environment and Tourism as well as those officials from the Department of Water affairs and Forestry.

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8. (Adams, 1995

Field observation on wetlands was conducted to determine the status quo from the environmental point of view and to investigate on the impacts of the Poplar on the wetlands ecology. An investigation on the legal position, which included finding out legal provisions related to the issue of the invasion of wetlands by alien plants invaders in South Africa, was compared with other countries. The investigations further looked at the relevant cases and precedence's relevant to this research. Recommendations on how the problem of Poplar at Ga-Riba wetlands could be controlled or reduced were also made at the end of the research.

## **2.2 Summary**

The chapter outlines the methods applied when conducting this research. Both qualitative and quantitative approaches were used. In qualitative approach primary data was collected through field observations in which the study area was visited several times and scientific laboratory tests were conducted on the data collected.

## Chapter 3

### Literature Review

#### 3.1 Nature of Undisturbed Wetlands

##### 3.1.1 Location

Wetlands are the transitional environments. In spatial context, they lie between drylands and open water at the coast, around lakes and rivers or mires draped across the landscape.<sup>9</sup> In an ecological context, wetlands are intermediate between terrestrial and aquatic ecosystems.

Kotze (1996) also says that wetlands are mostly found where the water movement is reduced and characteristically they are found in bottomland positions with gentle slopes giving rise to poorly drained conditions where water is retained in the soil. However, wetlands occur in other positions, including: foot slopes; midslopes, in small areas where ground water discharges; and valley heads, where ground water may also be discharging.

##### 3.1.2 Adaphic factors

Wetlands are anaerobic resulting to waterlogged soils, which inhibits the decomposition of organic matter by anaerobic micro-organisms. An anaerobic bacterium decomposes organic matter in the soil. Sometimes soils become acidic, this conditions help to preserve organic matter. Plants die, sink in, and are covered with other dead plant matter which are then decomposed by micro-organisms and sometimes it makes peat. Peat is composed mainly of partially decomposed organic matter with more than 50% carbon. Peat consists mainly of the stems and roots of sedges and reeds, animal remains, leaves, dead trees, fruit and pollen, all of which are in almost the same state that they were in hundreds or even thousands of years ago. Thus, we find that wetlands soils, often referred to as hydric soils, are generally grey in colour<sup>10</sup>.

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9. (Henderson, 2002)

10. (Hugo, 2004)

### **3.1.3 Hydrological characteristics (wetland hydrology)**

The term “wetland hydrology” includes all hydrologic characteristics that are periodically inundated or have soils saturated at some time during the growing season. Areas with event characteristics of wetland hydrology are those where the presence of water has an overriding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions respectively. Wetlands slowly retain surface water providing water storage and shoreline stabilization. Water storage refers to their ability to temporarily retain heavy rain, surface water and floodwaters. Different wetlands have different storage capacities, depending upon their size, depth, frictional resistance, shoreline shape, and position within a watershed<sup>11</sup>

### **3.1.4 Plants and Animals**

There are different types of vegetation found in wetlands. Wetlands plants are adapted to live in anaerobic, acidic conditions, and contribute to the acidification of the water. Although there are no plants that are endemic to peatlands, there are several that are characteristic of this habitat. Peatland vegetation includes sedges, reeds, bulrushes, swamp forest trees, herbs, orchids, shrubs and ferns.

Wetlands are usually places where there is much plant growth because of the abundance of water and nutrients in the soil. Plants are responsible of providing food and shelter for animals. There are many different plants and animals that depend on wetlands, and without the habitat that wetlands provide, they would not be able to survive. Wetlands support submerged plants such as pond weeds, floating plants such as pond lily and emergent’s such as cattails, sedges and ferns and trees.<sup>12</sup>

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11. (<http://www.agis.agric.za/agisweb/wip> , 2008)

12. (Hammer, 1997)

Wetlands plants have the ability of growing very tall within a very short space of time. This helps to increase air spaces, which allows increased movement of gases within the plant. Mckelvin *et al* 1987 agrees with Kotze that wetlands plants provide food and shelter for fish and animals. Wetlands-dependent animals include: muskrat, moose, bobcat and rabbit. Eagles, ospreys, hawks, egrets, herons and kingfishers are just a few of the birds that live in wetlands. The high biological productivity of wetlands makes them very important ecosystems not only to the plants and animals that directly depend on them for food and shelter, but to human beings as well.<sup>13</sup>

Wetlands support spectacular concentration of wetlands-dependent wildlife, such as the more than 2 million shore birds visiting either the Banc d'Arguin national park in Mauritania and Wadden Sea in Northern Europe, or the 20,000 black lechwe antelope that inhabit the Bengweulu Basin in Zambia. They also support charismatic species such as hippopotamus, shoebill stork and jaguar. Wetlands may be individually recognized for their endemic species, such as Lake Tanganyika, with 1,470 animal species, 632 which are found in that lake only, and the Amazon River which boasts of estimated 1,800 endemic species of fish.<sup>14</sup>

### **3.2 Significance of the wetlands**

#### **3.2.1 Functions of wetlands**

The recent rise in awareness of the importance of wetlands has much to do with an enhanced appreciation of their many positive, ecological and environmental functions.<sup>15</sup>

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13. (Kidd, 1997)

14. (Williams, 1990)

15. (Kotze, 1996)

### **3.2.1.1 Flood reduction and streamflow regulation**

Wetlands spread out and slow down water moving through the catchment because of the characteristically gentle slopes of wetlands and the resistance offered by the dense wetland vegetation. By slowing down the movement of water and detaining it for a while, wetlands act like a sponge, which reduces floods prolonging streamflow during low periods.

### **3.2.1.2 Ground water recharge and discharge**

Wetlands may have an influence on the recharge or discharge of ground water, where recharge refers to the movement of surface water down through the soil into the water table and discharge refers to the movement of ground water out of the soil surface.<sup>16</sup>

### **3.2.1.3 Water purification**

Wetlands are natural filters, helping to purify water by trapping pollutants, where they do this by removing the sediments, excess nutrients, heavy metals, diseases-causing bacteria, viruses and synthesized organic pollutants such as pesticides. Thus, the water leaving a wetland is often purer than water, which enters the wetland.<sup>17</sup>

### **3.2.1.4 Erosion control**

The wetland vegetation reduces erosion through its resistance to water, thereby slowing down the flow of water. The slower the water flows, the lower its erosive effect to the soil. The roots of wetland vegetation bind the soil and deposit silt to the wetland floor; this prevents soil from being washed down stream, which reduces the erosive power of water.<sup>18</sup>

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16. (Wyatt, 1995)

17. (Kotze, 2000)

18. (Walters et al, 2000)

### **3.2.1.5 Biodiversity**

Wetlands are usually places where plant growth is high because of the abundance of water and nutrients in the soil. The plants in return provide food and shelter for animals. There are many different plants and animals that depend on wetland and without the habitat that wetlands provide they would not be able to survive.<sup>19</sup>

### **3.2.2 Values of wetlands**

The term values and functions in relation to wetlands are often used interchangeably though they are not synonymous because functions describes what a wetland does, irrespective of any beneficial worth assigned by human beings while a value is subjective interpretation of the relative worth of some wetland process or products. Values can be positive or negative or they can be high or low. Wetlands are also valuable in ecological services; there are many ecological services that wetlands provide.<sup>20</sup>

#### **3.2.2.1 Livestock grazing**

Wetlands especially temporally or seasonally waterlogged areas, may provide valuable grazing-lands for domestic or wild grazers. In the early growing season and during droughts when grazing reserves are low in the surrounding veld (Rangeland) wetlands continue to produce a lot of grazing. Permanently wet marsh areas turn to have lower grazing value because most mature marsh plants are unpalatable, and the excessive wetness may stop animals from getting into the wetlands. Utilization needs to be sustainable if the wetlands are to maintain their value for grazing as a land use<sup>21</sup>

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19. (Kotze, 2000)

20. (Hammer, 1997)

21. (Kotze, 2000)

### **3.2.2.2 Fibre for construction and handcraft production**

Wetlands plants have been used for thousand of years, providing valuable materials for products such as mats, baskets and papers. There are several plant species that are suitable and used extensively such as rush and sedges. Handcraft production from harvested wetlands plants has many benefits as a development option in poor communities: it makes use of local traditional skills, it has the potential for immediate cash returns and, by increasing the financial benefits to local people. It increases the incentives not to destroy the wetlands thereby contributing to the conservation of natural habitats. However, harvesting needs to be sensitive to the functioning of the wetlands.<sup>22</sup>

### **3.2.2.3 Valuable fisheries**

Although the value of wetlands for fisheries varies greatly, flood plain wetlands and estuaries are typically valuable in the production of fish for human consumption. Many sea fishes in South Africa spend some early phases of their lifecycle in estuaries, and fresh water fishes such as barbel are found in the wetlands.<sup>23</sup>

### **3.2.2.4 Water storage**

Because water is stored in wetlands, they provide sites for the supply of water for domestic and livestock use as well as for irrigation, hence the presence of wetlands present good sites for water collection.<sup>24</sup>

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22. (John, 2000)

23. (Kotze, 1996)

24. (Kotze, 2000)

### **3.2.2.5 Productive agricultural land**

Wetlands soils are potentially productive; however, the anaerobic conditions associated with wetlands exclude most commonly grown crops except for those specially adapted once. Some wetlands are useful for timber production. Timber plantations have high impact on the water storage function of wetlands because a lot of water is lost by the trees through transpiration.

### **3.2.2.6 Education and tourism**

Wetlands are optimal areas for environmental education because of the facility with which importance scientific principles can be demonstrated and observed. The basic principles of ecology, succession, trophic levels, food webs and nutrients and energy cycling are more easily studied in wetlands. In Coroyote Hills Regional Park, a large wetlands complex is used solely for recreational and educational opportunities as well as providing storm water treatment for Fremont, California.

Wetlands are also good places for birds watching, as large numbers of birds are often attracted to wetlands, with many of them only found in wetlands. Wetlands add to the diversity and the beauty of the landscape.

## **3.3 Factors Affecting Wetlands**

Although wetlands occupy a very small percentage of earth's surface, they are amongst the landscapes that are facing different threats. Most of the human activities can easily damage wetlands. Farming activities like ploughing and overgrazing cause soil erosion, which increase the sediments in water.<sup>25</sup>

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25. (Glazewski, 1998

The chemicals in fertilizers end up in water and killing aquatic plants and animals. The construction of houses, roads, bridges and dams can change the way in which wetlands function. Industries and household effluent and street runoff also deposit harmful chemicals into the water. Regular burning can destroy the wetlands in the long run. All the factors mentioned above can have a negative impact on the wetland but this research only focused on the alien plant invaders (Poplar).<sup>26</sup>

### 3.3.1 Alien plants Invaders

Alien plants invaders are one of the greatest threats to the ecological and economic well being of the wetlands around the world. They have been hitting the headlines for decades as the enormity of their effects is better understood and the cost of their control or eradication assessed. Recent estimated annual economic losses from these plants in just five countries illustrate the extent of the problem: Brazil- 50 billion US Dollar; India- 117 billion US Dollar; South Africa- 7 billion US Dollar; United Kingdom- 12 billion US Dollar; USA- 137 billion US Dollar. They have far-reaching impacts on the ecosystem function and species diversity is not in dispute- more contentious is the struggle to find effective, affordable management solutions.<sup>27</sup>

The introduction of non-native plants has caused many problems in fresh water ecosystems throughout the world. Classic examples are *Eichhornia*, *Pistia* and *Salvinia*, natives of South America, which are now found throughout the tropics, shading out native plant species, deoxygenating the waters below their mats and blocking rivers and canals.<sup>28</sup> *Russian olive* and *Canada thistle* are one of the plant species recorded in the wetlands of the North Boulder Valley Management Area.

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26. (Van der Watt, 1999)

27. (DEAT, 2004)

28. (Maitland and Morgan, 1997)

There are few *Russian olives* in the area; however, *Canada thistle* is widespread and dense. Two of these plant species occur in large herbaceous wetlands that have been fenced and excluded from grazing.<sup>29</sup>

*Russian olive* and *Canada thistle* are some of the plant species recorded in the wetlands of the North Boulder Valley Management Area. There are few *Russian olives* in the area; however, *Canada thistle* is widespread and dense. Two of these plant species occur in large herbaceous wetlands that have been fenced and excluded from grazing.<sup>30</sup> In Africa, alien plant species are found throughout most of the major water systems and, where they become invasive, cost millions of dollars to control. Herbicides and mechanical control can bring some relief, but biological control has worked well in some places.

In Zimbabwe, the eastern highland grasslands were invaded by Australian *Acacia* and *Pinus* species, outcompeted and native species such as *Restigo*, *Erica* and *Protea* species.<sup>31</sup>

In Nairobi, Kenya –the introduction of alien animals such as *critter* and other foreign plants has caused serious damage to wetlands. The foreign species including some that have arrived by accident could also harm fragile African economies by killing off native plants and animals.

Kotze (1996) posist that the invasion of exotic species such as *Lantana camara*, *Acacia saligna*, *Acacia Cyclops*, *Sesbania punicea*, *Azolla filiculoids*, *Eichhornia crassipes* and *Nicotiana glauca* in wetlands in Southern Africa replaced native species. The plantation of alien plants for economic reasons near and within the riparian zones of the Ngwaritsan River caused primary threats to the health of the riparian habitats and vegetation.

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29. (Maitland and Morgan, 1997)

30. (DEAT, 2004)

31. (Geldenhuys, 1996)

Many wetlands in South Africa mostly in Mpumalanga and Limpopo Provinces have been invaded by alien plants. The major problem plants include Eucalyptus and Pinus species which consume a lot of water. *Populus alba L* is also a common plant species in this country. They are changing water levels in wetlands and out-competing indigenous wetland plant species.<sup>32</sup>



Figure 3.1 A Picture showing *Populus alba L*

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32. (Rosenberg, 2003)

### 3.3.2 Causes of alien plants invasion

#### 3.3.2.1 Drainage and the production of crops and planted pastures

When wetlands are converted to cropland, most of their indirect benefits are lost, especially if the wetland is drained. Drained wetlands are less effective at regulating stream flow and purifying water because the drainage channels speed up the movement of water through the wetlands. Drainage increases the danger of soil erosion by concentrating water flow and thus increasing the erosive power of the water. The hydrological changes resulting from drainage have negative effects on the soil such as reducing moisture.<sup>33</sup>

Adding fertilizers and pesticides further reduces the effectiveness of the wetland in purifying water. The impact of cultivation can be reduced if practices characteristic of low input/traditional cultivation are followed.<sup>34</sup>

In China, about 30% of lakes and 60% of wetlands have disappeared over the last 40 years as a result of conversion to agricultural land and expansion of deserts.<sup>35</sup>

In Central and Southern America, nearly a fifth of the wetlands identified as internationally important are threatened by cultivation of crops and forest plantations. A large proportion of the rest are liable to a wide range of other deleterious impacts.<sup>36</sup>

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33. (Sinthumule, 2001)

34. (Kotze, 1996)

35. (Maitland and Morgan, 1997)

36. (Williams, 1990)

Agricultural reclamation includes activities such as drainage, in-filling, construction of dykes, and also cultivation. Lowering of water levels may result in an increase in carbon dioxide emissions but a reduction or even cessation of methane emissions. However, methane emissions from drainage ditches can be significant. Agricultural reclamation also results in wetland fragmentation, which can affect other wetland functions such as providing shelter to some animals and plants.

In Florida, bayhead wetlands are a form of seepage swamps, which are forested wetlands characterized by saturated soils rather than periodic inundation. Many of these systems have been drained and converted to agricultural uses. Many of the classic bayhead or baygall wetlands formed where groundwater seeped along the fringe of the Lake Wales ridge in South-central Florida. Most of these wetlands were cleared and converted to grow high value agricultural crops, such as caladiums and gladiolas, on the rich muck soils formed under these wetlands.<sup>37</sup>

Coastal wetlands in Egypt and Tunisia and freshwater wetlands in Sudan are also under increased threat of production of crops and planted pastures. Freshwater ecosystems found in lakes, rivers and wetlands may be the most endangered ecosystems of all. In Burkina Faso an increased intensity of wetlands use has been observed in the past two decades. Since the 1970s, planted maize, sorghum, rice and market garden vegetables are preferable planted on wetlands. As human population increased and rainfall decline, cultivators have moved down the wetlands to exploit the more productive and stable wetlands.<sup>38</sup>

In northern Nigeria, wetlands are now the sites of extensive market gardening with regional concentrations of different cash crops. Intensive cultivation of vegetables is practised in wetlands at Kano, Zaria and Kaduna.<sup>39</sup>

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37. (Machael, 1991)

38. (Unep, 1998)

39. (Scoones and Sinthumule, 1990)

Most of South African subsistence farmers in some areas plant their crops in the nutrient-rich peatlands. In inter-dune peatlands, there is no interference with the structure, and the wetland itself is not drained. When the garden plots are abandoned for new sites, they are reclaimed by natural vegetation, and the only damage is that a small amount of surface peat is oxidized. Considerably more damage is inflicted in peatlands that occur along rivers and streams. Here, subsistence farmers drain the peatlands, which causes long-lasting damage to their structure. Damaging or degrading peatlands affects the water quality and quantity in rural Kwazulu-Natal and reduces the ability of the peatland to act as a biomass resource, medicinal resource and agricultural substrate. Where swamp forests occur, vegetation is cleared and peat is removed. In Maputaland, swamp forests are severely damaged by careless subsistence farmers.<sup>40</sup>

### 3.3 Summary

Wetlands are defined in this chapter as between the terrestrial and aquatic ecosystems. The significance of wetlands is revealed. The capability of wetlands to support life by providing habitat for some animals such as rabbits, providing food for some animals such as birds.<sup>41</sup> It provide shelter for human beings in a form ridge from wetlands which is used as raw material for construction purpose. With regard to economy wetlands supports small business by providing raw materials for making products such as hats, mats, baskets and chairs. There are people who still depend on fish and birds from the wetlands to survive, people who are poor and unemployed. Wetlands serve as a supporting system to prevent flood, store water, purify water and reduce erosion. All the above factors show that wetlands are a very important part of the environment. There are various factors that are affecting the wetlands and causing them to degrade such as over grazing, poor methods of cultivation, alien plant invaders and removal of peat. This research only focuses on alien plant invaders and other factors are held constant. G-Riba wetlands are of the wetlands affected by the problem of White poplar.

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40. (Musetsho, 2002)

41. (Fuggle and Rabbie, 1983)

## **Chapter 4**

### **Data Collection, Analysis and Interpretation**

#### **4.1 Types of Data Collected and Requirements**

Data on soil and water were collected from the study area on both the area without White poplars and the other area covered by White poplars, Data on vegetation was collected through field observation on both areas and data on legal framework was collected through reading books, internet, legislation (acts and policies), maps, journals and through interviews.

##### **4.1.2 Data on vegetation**

Vegetation acts as a conspicuous element and by merely looking at it, most of the information can be found. This type of data was necessary to find out the life forms, density and abundance of wetlands plant species. The presence and absence of both native and non-native plant species were investigated as they were crucial in assessing the extent of the invasion.

##### **4.1.3 Data on soil nutrients**

This type of data was required in order to find out if Poplars had an impact on the soil nutrients of the wetlands.

##### **4.1.4 Data on water pH**

This data was required in order to find out about the status of water quality in the wetlands by looking at the condition of wetlands and by measuring soil pH.

#### 4.1.5 Data on soil moisture

This type of data was required to see if the invasions of wetlands affected soil pH and moisture.

#### 4.1.6 Data on legal framework in managing wetlands

This type of data was important and aimed at find out if there were sufficient legal instruments in place to solve the problem of invasion by alien plants of the Ga-Riba.

### 4.2 Data analysis

#### 4.2.1 Data on vegetation

The classification scheme identified five (5) classes which were used as the baseline data since there was no control site due to the extent of the wetlands.

**Table 4.1** Braun-Blanquet's Classification Scheme on Plant Species' Abundance.<sup>42</sup>

<b>Class</b>	<b>Description</b>
Class 1	Rare species, they have very sparsely distribution (1-20%)
Class 2	Species occurring occasionally in a given unit area (21-40)
Class 3	Species frequently encountered but they are not numerous (40-60%)
Class 4	Species frequently encountered which are relativelyof numerous quantity (61-80%)
Class 5	These are the most dominant (in terms of abundance) in a given area (81-100%)

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42. (Kempster, 1985

#### 4.2.2 Data on tree life forms

**Table 4.2** Data on frequency and abundance of trees in Ga-Riba wetland.<sup>43</sup>

Scientific Name	Tally	Frequency (Percentage)	Frequency Class
<i>Ficus sycomorus</i>	IIII II	7 (19%)	Class 1, rare species
<i>Ekebergia capensis</i>	IIII	5 (13%)	Class 1, rare species
<i>Sclerocarya birrea</i>	IIII I	6 (16%)	Class 1, rare species
<i>Bridelia micrantha</i>	IIII	4 (11%)	Class 1, rare species
<i>Parina curatelifolia</i>	II	2 (5%)	Class 1, rare species
<i>Syzigium cordatum</i>	IIII I	6 (16%)	Class 1, rare species
<i>Poplar</i>	IIII IIII IIII IIII IIII	25 (65%)	Class 4, Species frequently encountered and they are in relatively numerous quantity
<i>Ficus natalensis</i>	IIII	4 (11%)	Class 1, rare species
<b>Total</b>		<b>36 (100%)</b>	

Table 4.2 above indicates that eight (8) tree species were found. The most dominant tree species was *Poplar alba l* . The frequency of these trees shows that most trees fell under class 1. This means that they are rare in that wetland and they were sparsely distributed. This tended with conform to the developed analytical model of undisturbed wetland, which show that trees are fewer in wetlands.

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43. (Kempster, 1985)

**Table 4.3** Data on frequency and abundance of trees.

<b>Scientific Name</b>	<b>Tally</b>	<b>Frequency (Percentage)</b>	<b>Frequency Class</b>
<i>Ficus sycomorus</i>	IIII II	7(26%)	Class 2, occasional species
<i>Ekebergia capensis</i>	III	3(11%)	Class 1, rare species
<i>Sclerocarya birrea</i>	IIII	4(15%)	Class 1, rare species
<i>Bridelia micrantha</i>	III	3(11%)	Class 1, rare species
<i>Parina curatelifolia</i>	I	1(3%)	Class 1, rare species
<i>Syzigium cordatum</i>	IIII	5(19%)	Class 1, rare species
<i>Ficus natalensis</i>	III	3(11%)	Class 1, rare species
<b>Total</b>		<b>26(100%)</b>	

Table 4.3 above indicates that seven (7) tree species were found in the wetland. Here there is only one tree species falling under class 2. The other tree species fall under class 1. The overall results of tree species conform to the analytical model.

### 4.2.3 Data on shrubs life form

**Table 4.4** Data on frequency and abundance of shrubs

Scientific Name	Tally	Frequency (Percentage)	Frequency Class
<i>Psidium guajava</i>	IIII III	9(24%)	Class 2, occasional species
<i>Annona senegalensis</i>	III	3(8%)	Class 1, rare species
<i>Lantana camara</i>	IIII IIII II	12(32%)	Class 2, occasional species
<i>Dichrostachys cinerea</i>	III	4(10%)	Class 1, rare species
<i>Ricinus communis</i>	II	2(5%)	Class 1, rare species
<i>Bauhinia galpini</i>	III	4(10%)	Class 1, rare species
<i>Senna didymobotrya</i>	III	3(8%)	Class 1, rare species
<b>Total</b>		<b>37(100%)</b>	

The data given in table 4.4 indicates that seven (7) shrub species were found. The frequency statistics shows that 5 out of 7 shrub species fell under Braun-Blanquet frequency-abundance class 1 and only two shrub species fall under class 2. The majority, (71%) of these shrub species were the alien invasive; These included *Psidium guajava*, *Annona senegalensis*, *Lantana camara*, *Ricinus communis* and *Dichrostachys cinerea* that were considered the worst encroacher. The data shows that most of these invaders occurred in higher frequency. This means that there were high chances that these invaders might bring the changes to the wetland ecology.

**Table 4.5** Data on frequency and abundance of shrubs

<b>Scientific Name</b>	<b>Tally</b>	<b>Frequency (Percentage)</b>	<b>Frequency Class</b>
<i>Psidium guajava</i>	IIII IIII I	11(23%)	Class 2, occasional species
<i>Annona senegalensis</i>	IIII	5(10%)	Class 1, rare species
<i>Lantana camara</i>	IIII IIII III	13(28%)	Class 2, occasional species
<i>Dichrostachys cinerea</i>	IIII I	6(13%)	Class 1, rare species
<i>Ricinus communis</i>	II	2(4%)	Class 1, rare species
<i>Bauhinia galpini</i>	IIII I	6(13%)	Class 1, rare species
<i>Senna didymobotrya</i>	III	3(6%)	Class 1, rare species
<b>Total</b>		<b>46(100%)</b>	

Table 4.5 above indicate that result indicates that 7 shrub species were found. The frequency statistics shows that 5 out of 7 shrub species which fell under Braun-Blanquet frequency-abundance class 1 and only two shrub species fall under class 2 (*lantana* and *psidium*). The majority (71%) of these shrub species were the alien invasive which include *Psidium guajava*, *Annona senegalensis*, *Lantana camara*, *Ricinus communis* and *Dichrostachys cinerea* which is considered the worst encroacher. The data shows that most of these invaders occur in higher frequency. This means that there are high chances that these invaders might bring the changes to the wetlands ecology.

#### 4.2.4 Data on grass life form

**Table 4.6** Data of frequency and abundance of grass life form.

Scientific Name	Tally	Frequency (Percentage)	Frequency Class
<i>Phragmite australis</i>	IIII IIII IIII III	18(23%)	Class 2, occasional species
<i>Cyperus fastigiatus</i>	IIII IIII IIII II	17(22%)	Class 2, occasional species
<i>Typha capensis</i>	IIII IIII	9(11%)	Class 1, rare species
<i>Andropogon appendicularis</i>	III	3(4%)	Class 1, rare species
<i>Kylinga erecta</i>	II	4(4%)	Class 1, rare species
<i>Sporobolus airoides</i>	III	4(5%)	Class 1, rare species
<i>Panicum dregeanum</i>	IIII IIII IIII II	17(22%)	Class 2, occasional species
<i>Hyperhemia hirta</i>	IIII IIII	9(11%)	Class 1, rare species
<i>Pennisetum macrourum</i>	II	2(3%)	Class 1, rare species
<b>Total</b>		<b>80(100%)</b>	

Table 4.6 above indicates that there were nine (9) wetland grass species found whose frequency was 80. This shows that grass species was the most encountered life form in that wetland. According to the analytical model of undisturbed wetland, grass species are supposed to be the first dominant life form in wetland ecosystem. Braun-blanquet classification scheme shows that for the life form to be dominant, it has to be in class 5 (81-100%). In the table above, only 3 wetland plants fell under class 2 (21-40%), which does not conform with the model because grass supposed to be the most dominant.

**Table 4.7** Data of frequency and abundance of grass life form

Scientific Name	Tally	Frequency (Percentage)	Frequency Class
<i>Phragmite australis</i>	IIII IIII IIII IIII IIII	25(23%)	Class 2, occasional species
<i>Cyperus fastigiatus</i>	IIII IIII IIII IIII IIII I	26(23%)	Class 2, occasional species
<i>Typha capensis</i>	IIII IIII IIII II	17(15%)	Class 1, rare species
<i>Andropogon appendicularis</i>	II	1(5%)	Class 1, rare species
<i>Kylinga erecta</i>	II	2(1%)	Class 1, rare species
<i>Sporobolus airoides</i>	III	3(1%)	Class 1, rare species
<i>Panicum dregeanum</i>	IIII IIII IIII IIII III	23(21%)	Class 2, occasional species
<i>Hyperrhenia hirta</i>	IIII IIII IIII IIII III	23(21%)	Class 2, occasional species
<i>Pennisetum macrourum</i>	II	2(1%)	Class 1, rare species
<b>Total</b>		<b>112(100%)</b>	

Table 4.7 above indicates that there were nine (9) wetland grass species found and their total frequency was 112. This shows that grass species was the most encountered life form in that wetland. According to the analytical model of undisturbed wetland, grass species are supposed to be the most dominant life form in wetland ecosystem. As indicated above, Braun-blanquet classification scheme shows that for the life form to be dominant, it has to be in class 5 (81-100%).<sup>44</sup>

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44. (Kempster, 1985)

#### **4.2.2.1 Data interpretation**

This data of vegetation shows that the condition of the wetland with regard to vegetation life form had degraded; there was less abundance of plants in all life.

#### **4.3 Soil Survey**

Soil samples were acquired from the area invaded by Poplar (experiment) and the area without Poplar (control), Samples were acquired by digging holes up to 2cm down and soil samples were collected in bags and carried to the laboratory to test pH and moisture

#### **4.3.1 Data on soil moisture**

Weights of soil samples from both the control and experiment were measured and recorded. To confirm the results each sample was measured three times. After measuring soil sample were heated using an oven until red hot samples were removed and allowed to cool down and they were measured again and recorded. To get the actual results, the first sample results before heating was used to subtract the second results after heating and the then actual results were recorded in grams. This data was analysed by comparing the actual moisture content results on soil from experiment and control. To get actual amount of moisture in the soil, the formula  $(W1 - W2) \times 100 / W1$  were applied, the measurements which was recorded after the heating were subtracted from the measurements before heating to get actual percentage of moisture in the soil. The percentages were added to get averages of both soil samples from experiment and control.

#### 4.8 Table showing moisture contents of soil from the experiment and control

Sample no (Experiment)	Before	After	Actual	Sample no (Control)	Before	After	Actual
1	300g	280g	20%	1	320g	200g	37.5%
2	370g	330g	11.8%	2	310g	211g	31.9%
3	320g	310g	3.1%	3	223g	201g	9.8%
4	311g	298g	4.1%	4	300g	223g	25.6%
5	317g	308g	2.8%	5	379g	209g	44.8%
6	290g	283g	2.4%	6	302g	200g	0.6%

#### 4.3.2 Data interpretation

The results indicate that the soil from Experiment area had less water as compared to the soil from control which had high moisture. This means that Poplars absorb a lot of water from the soil as compared to the indigenous vegetation.

#### 4.4 Data on Soil Nutrients

Two pots A and B were filled with soil samples which were collected from both the area invaded by White Poplars (Experiment) and the area not invaded by White poplars (Control). The pots were bigger than 150ml in volume. The soil was filled up to 140ml in both pots to give space for irrigation and the plants were of the same age. The two pots were then placed in a green house where factors responsible for growths were at their optimum. After two weeks the results were analyzed and compared looking at the degree of nutrients on the growing plants.

**4.9** Table indicating growth and health condition of plant growing on soil from experiment and control

<b>Plant characteristics</b>	<b>Pot A (Experiment)</b>	<b>Pot B (Control)</b>
Leaf size	Small	Large
Leaf colour	Yellow	Green
Stem size	Thin	Wide
Buds	Two buds	Four
Growth height	Short	Tall
Root system	Poor	Good

**4.4.1 Data interpretation**

The plant on the pot filled with soil from the Experiment was not growing well and unhealthy indicating nutrients deficiency in soil as compared to the plant in the pot filled with soil from the Control which was growing fast and was healthy indicating high nutrients in the soil. Therefore Poplar used more nutrients than other native plants in the wetland.

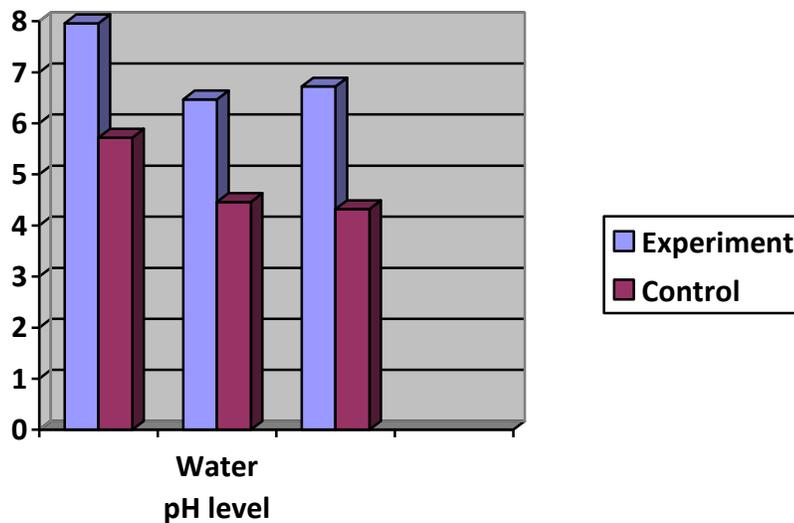
**4.5 Data on Water pH**

Three water samples were collected from the different areas of experiment and other three were collected from different areas of control. To analyze water samples a pH meter was calibrated using 7.00 buffer and 4.00 so that it became stable and give valid results. An Electrode was place in the first sample and the results were recorded. An electrode was then rinsed with distilled water before it was placed in the second sample, so that the results of the first sample did affect the results of the second sample. To confirm the results each sample was tested three times.

**4.10** Table showing pH levels in water sample from experiment and control

Sample no	Water pH (Experiment)	Sample no	Water pH (Control)
1	7.96	1	5.72
2	6.47	2	4.46
3	6.72	3	4.32

**4.11** Graph showing water pH levels for water samples from Experiment and Control



#### **4.5.1 Data interpretation**

The pH level of water from the area invaded by White Poplars (Experiment) was higher than that of water from the area not invaded by Poplars (Control), indicating that the availability of Poplars had an impact on water from the wetlands.

## **4.6 Data on Legal Framework**

The data were acquired through interviews, internet, books and relevant legislation. Officials from the National Department of Environmental Affairs and Tourism, the Provincial Department of Economic Development, Environment and Tourism, the Department of Agriculture and Department of Water Affairs were interviewed. To analyze this data desktop investigations were conducted, looking at other countries legal frameworks with regard to control of alien plants on the wetlands. The results from desktop investigations (Control) and the results from the interviews were compared (Experiment).

### **4.6.1 Data interpretation**

There is fewer and insufficient legislation focusing on the issue of alien plants on wetlands in South Africa, even though there are environmental legislations such as the National Environmental Management Act.

### **4.6.2 Summary**

This chapter showed types of data and their significance in this type of research. Data were collected in the area in Ga-Riba wetlands area where White poplars existed (alien plant invaders) and on the area where White Poplar (alien plant invaders) did not exist. Data on vegetation dwelt on three life forms. Through analysis and interpretation of data it was found that, there were less vegetation on both life forms in the area where there was invasion and more vegetation on both life forms where there was no invasion. Data on soil moisture were compared after analysis and interpretation, and it showed that soil from the Experiment had less soil moisture than the soil from control. Data on soil nutrient showed that soil from the experiment had fewer nutrients than the soil from Control. Data on water pH showed that, water from Experiment was acidic while water from Control was neutral. Data on legal frame work showed that legal tools which could be applied to solve problems were insufficient. Other tools like the Integrated Development Plan (IDP) did not address issues of alien plant invaders or environmental conservation nor restoration of wetlands, which means the issue of alien plant invaders on the wetlands were not taken seriously.

## Chapter 5:

### Legal Framework and Findings

#### 5.1 Legal Framework

Recommendation 6.1 of the 1996 Ramsar Meeting encourages the protection of wetlands world wide. Of the 778 Ramsar Sites (as at December 1995) 75 are peatlands<sup>45</sup>. Ramsar has succeeded in protecting large wetlands like Neilsvlei. But when it comes to small wetlands like Ga-Riba wetlands, Ramsar is not achieving its goal to protect wetlands. Ga-riba wetlands are one of the wetlands not protected by Ramsar and it might not be protected for a very long time since it is not even listed as one of the wetlands that are going to be considered for Ramsar protection.

The Food Security Act of 1985 includes a swamp buster provision that made farmers eligible income-support programs if they convert wetlands and plants commodity crops on them.<sup>46</sup> This Act encourages the destruction of wetlands. They are used as an alternative or relief for food scarcity. Ga-Riba wetlands were supposed to be protected but were being utilized for grazing cattle and cultivation of vegetables as a part of poverty relief projects funded by government through the department of Agriculture.

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45. (Ramsar, 1971)

46. (Cowan, 1995)

The Land and Water Conservation Fund Act of 1965 make a provision for funds to be used to purchase natural areas such as wetlands. Large areas of wetlands were purchased and utilized for agriculture. This legislation helps people to recognize the variety of benefits associated with wetlands rather than focusing on how wetlands can be utilized sustainably.<sup>47</sup> People are interested in the benefits they can receive rather than the wellbeing of the wetlands.

In some countries wetlands are regarded such an important commodity that laws are enacted to protect a particular wetland. In Mexico the Coastal Wetlands Planning, Protection and Restoration Act was passed in 1990, which primarily focuses on the protection of Louisiana wetlands.<sup>48</sup>

South Africa is as signatory to convention on Biodiversity which was adopted in Nairobi and signed by 150 countries at Rio Summit. This convention ensures that animals and plants are used sustainable including those in aquatic environment wetland.<sup>49</sup>

The New Partnership for Africa Development (NEPAD) recognizes that regions environmental base must be nurtured while promoting the sustainable use of its natural resources, this environmental initiative targets eight sub-themes for priority interventions: combating desertification, wetland conservation, invasive alien species control; coastal management, global warming, cross border conservation areas, environmental governance and financing. This environmental initiative has led to the development of environmental action plan which ensures that developments are environmentally sustainable.<sup>50</sup>

In South Africa there are fewer laws which can be used in managing invasion of wetlands by alien plants. Such laws are as follows;

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49. (Maimela, 2003)

50. (Messina and Conner, 1998)

### **5.1.1 Constitution of the Republic of South Africa, 1996 (Act no 108 of 1996) (The Constitution)**

In terms of section 24(a) every person has the right to an environment that is not harmful to his/her health or well-being, and to have the environment protected for the benefit of present and future generations.<sup>51</sup> The above can be achieved by reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development. Section 24(b), on the other hand imposes a duty on the state to take steps to protect the environment. The subsection also grants individuals a justifiable right that the state cannot employ measures which could be considered retrogressive in relation to the protection of the environment. In this situation every person at Ga-Riba Village has the right to have their wetlands protected, conserved through legislations e.g by-laws and other measures.

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51. (Constitution, 1996)

### **5.1.2 The National Environmental Management Act, 1998 (Act No 107 of 1998)**

Principles of National Environmental Act, 1998 (Act No 107) (NEMA) section (4)(a)(i) states that sustainable development requires the consideration of all relevant features including the following; the disturbance of the ecosystems and loss of biological diversity are avoided, minimized and remedied.<sup>52</sup>

### **5.1.3 The Conservation of Agricultural Resource Act, 1983 ( Act No 43 of 1983) (CARA)**

Section 6 (1) (l) provide for control of weeds and alien plants invaders by land users, which means land users have the responsibility to control alien plant invaders in their yards even if they do not plant them or introduce them intentionally.<sup>53</sup> People of Ga-Riba who are using the wetlands for stock grazing and cultivation should control the White Poplar on the wetlands since they are the land users<sup>54</sup>.

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52. (National Environmental Management Act, 1998)

53. (Conservation of Agricultural Resources Act, 1983)

54 (Regulation 7: Conservation of Agricultural Resources Act, 1983)

#### **5.1.4 The National Water Act, 1998( Act No 36 of 1998) (NWA)**

Section (2)(g) National Water Act,1998(Act No 36) state the purpose of this act which is to ensure that the nation s water resources are protected, used, developed, conserved, managed and controlled in ways which take in to account amongst other factor-protecting aquatic and associated ecosystems and their biological diversity. Ga-Riba Wetlands is one of the aquatic ecosystems protected by NWA

Section 151(1) of the National Water Act provides that no person may unlawfully and intentionally or negligently commit any act or omission which detrimentally affects or is likely to affect a water resource. Any person contravening this section is guilty of a criminal offence. It is therefore possible to institute criminal proceedings against an offending landowner or land user. In a case between the Department of Justice v Noordhoek, the department of Justice won the case because alien plant invaders are known to consume a lot of water and can impact on water resource. Keeping them is an offence as provided by section 151 (1) of the National Water Act.<sup>55</sup>

#### **5.1.5 The National Environmental Management Biodiversity Act, 2004(Act No 10 of 2004) (NEMBA)**

Section 3 of the act fulfills the rights contained in section 24 of the Constitution, by ensuring that the state through its organs that implement legislation applicable to biodiversity, must-

(a) manage, conserve and sustain South Africa's biodiversity and its components

(b) implement this Act to achieve the progressive realization of those rights.<sup>56</sup> Through investigations it was discovered that, only Greater Sekhukhune District Municipality had a draft Integrated Development Program (IDP) which had a section focusing on environmental issues. In this draft IDP environmental issues such as clearing of alien are prioritized in such a way that, it was identified as one of the key focuses for projects to be implemented as poverty relief projects.

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55. (National Water Act, 1998)

56. (National Environmental Management, Biodiversity Act, 2004)

The IDP provide for the project funded by National Department of Environment and Tourism (DEAT) in collaboration with the municipality for clearing of alien plants at Vaalbank in Marble Hall. (Greater Sekhukhune Distict Municipality).<sup>57</sup> Tubatse Local municipality does not have any environmental responsibility as part of their Integrated Development Program (IDP), which means there is no compliance with both the constitution and biodiversity Act.<sup>58</sup> Due to non compliance of the two above- mentioned act, Ga-Riba wetlands is still facing problem of alien plants. The community of Ga-Riba has got the right to take the Greater Tubatse Local Municipality and The provincial Department of Economic Development, Environment and Tourism to court to seek remedy on their environmental right which is being infringed by above mentioned departments as provided by section 24 of the Constitution.

According to Section (2) (a) All organs of state in all spheres of government must prepare an invasive species monitoring, control and eradication plan for land under their control, as part of their environmental plans in accordance with section 11 of the National Environmental Management Act. This must form part of their integrated development plans. Duties in terms of subsection (2).

(b) The invasive species monitoring, control and eradication plans of municipal. Provincial Department of Economic Development, Environment and Tourism, Greater Sekhukhune District Municipality and Greater Tubatse Local municipality do not have Environmental Plan as provided by National Environmental Act section 11 which makes it difficult to consider environmental issues on their day to day activities.

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57. (Greater Sekhukhune District Municipality, 2nd Draft IDP, 2008-2001)

58. (Greater Tubatse Local Municipality, IDP, 2004-2005)

### **The Traditional leadership and Governance Amendment Act, 2003(Act No 41 of 2003)**

According to section (4) (h) it is one of the functions of traditional councils to promote the ideals of co-operative governance, integrated development planning, sustainable development and service delivery. Riba tribal Authority should alert Tubatse Local municipality about the problem and they should work together to solve the problem.<sup>59</sup>

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59. (The Traditional Leadership and Governance Amendment Act, 2003)

### 5.1.6 Common Law

There are laws which impose a legal duty on land users to control invading alien plants.

These laws include the following:

(i) The common law relating to neighbours

The common law is the law developed by the courts as opposed to laws that are written in an act of parliament. A principle has been developed in terms of the common law relating to neighbours and nuisance in terms of which the owner of land may not use his/her land in a way that it impacts on the use and enjoyment by other land owners of their land. This is based on the Roman law principle *sic utere tuo ut alienum non laedas* but it is also contained within the concept of ubuntu.

If a landowner breaches the common law rule relating to neighbours and nuisance an aggrieved party may approach the courts for an order compelling the landowner to remove the cause of the nuisance. This is normally done in the form of an interdict.<sup>60</sup> The members of the community of Ga-Riba and some of the government officials e.g. officials from the Department of Economic Development, Environment and Tourism, the Department of Agriculture and the Greater Tubatse Local Municipality knows about the problem of alien plants invaders in Ga-Riba wetlands. To protect the wetlands the officials and the community members should have initiated a program to reduce the problem e.g cleaning up campaign to cut and uproot the White Poplar.

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60. (<http://www.LegalDocs>, August 2000)

### 5.1.7 Customs

In many African countries there are traditional customs which are set in order to protect environmental aspects such as wetlands. Wetlands are sacred areas where rituals are performed and because of that they are restricted from the public. Restriction from the public protects the wetlands from many problems such as pollution and alien plant invasion. Ga-Riba wetlands used to be protected by these traditional customs.

According to section (4) (i) of The Traditional leadership and Governance Amendment Act, 2003(Act No 41 of 2003) traditional council should promote the indigenous knowledge systems for sustainable development and disaster management. The chief and its tribal council should encourage the community to practice indigenous method when using wetland resource e.g. traditional method of cultivation, fishing, clay harvesting and grass harvesting.

According to the community members, people were restricted to enter the centre of the wetlands, but only royal people were allowed to enter and to perform rituals and initiations for girls. Cultivation and cattle grazing were not allowed since the wetlands were sacred. Due to civilization traditional customs are no longer considered, people access wetlands freely and there is no control with regard to utilization of wetlands resources.

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61. (The Traditional Leadership and Governance Amendment Act, 2003)

### **5.1.8 Regulations in terms of the Conservation of Agricultural Resources Act 43 of 1983**

To implement the CARA various regulations has been promulgated; Regulation 7 states that no land user shall utilize vegetation in vleis, marshes or water sponge or within the flood area of 10 metres horizontally outside the flood area in manner that causes or may cause deterioration of or damage to the natural agricultural resources. Alien plants invaders are listed into categories 1, 2 and 3 so that they can be identified easily. White Poplar is listed under category 2 and its control measures are listed under section 15 b (8) (9) of the regulations are follows:

(8) A land user shall control any category 2 plant that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.

(9) Unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.<sup>62</sup>

These provisions stated by the regulations focus mainly on the legal land users like farmers and ignoring those pieces of land not owned by individuals like wetlands which makes it difficult to enforce this act. In areas like Ga-Riba wetlands the title holder is the state, but the authority is with the Chief Riba and Tubatse Local Municipality. The regulations should have considered those areas, so that implementation and enforcement of the act would be easier.

Provinces have engaged themselves in trying to implement section 24 of the Constitution. Provincial policies are promulgated e.g. the Limpopo Environmental Act, which focuses on the protection of the environment as a whole. Local environmental aspects such as endangered animals and plants are protected by this act and it has succeeded in that because species of great significance to the province were being destroyed e.g Marula tree is now protected by this act, When it comes to wetlands. This act does not mention any thing with regard to their protection even though there are wetlands in the province.

The Greater Sekhukhune District Municipality in collaboration with the Department of Environment and Tourism has designated one of the poverty relief projects in to alien plant

invader clearing project. In this Project an area invaded by alien plants will be identified and clearing will be done.

Greater Tubatse Local Municipality does not have by-laws with regard to management of alien plants in the wetlands. This kind of problem was not even included in the Integrated Development Program for the municipality which means was not considered as important.

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62. (<http://www.arc.agric.za/home.asp>, wetlands invasions, 2006)

## 5.2 Relevant cases

In a case between Department of Justice v Constitutional Development (the department) through the Ukuvuka Campaign together with the City of Cape Town and Working for Water programme, joined forces to take land-users in Noordhoek to court for having invasive alien plants on their properties. The court decision was in favour of the department and its partners.

In Western Cape. Two land owners have been taken to court in terms of the Conservation of Agricultural Resources Act which compels land owners to get rid of class one or the most seriously invasive aliens. If the precedence is not with land owners then, the government will be setting an example and ensuring that people comply with legislation.<sup>63</sup>

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63 (<http://www.conservancies.org/news.htm>)

### 5.3 Findings

Findings of the interview from the community shows that the wetlands were big in extent before the Poplar existed. According to Mr David Chuene, a member of the community, Ga –Riba Wetlands used to have a high diversity of species than the manner it is. It used to have a lot fish in different species, small insects, frogs, birds and snakes. Wetlands supported the community through its diversity. A lot of people used to catch fish in the wetlands which they used as food and some of the people even sell fish to get some income. There were a lot of sedges (wetland grass) which were used for grazing cattle, cows and goats. These sedges were also used as building material to make thatched houses. Most of the people at Ga-Riba are poor and they depended on wetlands to survive. Most of these people used to have fields in the wetlands on which they cultivated maize, vegetables and fruits. The results of the scientific investigations indicated that the existence of White poplar in the wetlands had caused ecological disturbance. The water quality of the wetlands had degraded in a manner that due to its acidic nature it might not be suitable for human consumption in the near future. Soil survey indicated that soil is losing moisture and nutrients due to White Poplars and other alien plant available in the wetlands. Soil had also become acidic due to existence of White poplars, which is replacing other native plants.

Lack of nutrients and moisture is causing the wetlands to have fewer plant life forms than it was suppose to have. Fewer plant life forms had lead to lack of habitat and breeding grounds for many animal species causing them to be fewer and fewer. According to Mr Chuene there were few birds and fish in the wetlands than before. If nothing is done Ga-Riba wetlands will not have animals and plants but only Poplars and eventually it would dry.

There are few legislations focusing on the issue of alien plants on wetland in South Africa. Even though there are environmental legislation to protect the environment, they are focusing on other issues like pollution and environmental impact assessment. The issue in question is not given enough consideration. Only few lines of environmental legislation cover management of alien plant invaders which makes it difficult to implement and enforce. This means that the legal tools to be used in managing invasive plants in the wetlands are insufficient.

The Greater Tubatse Local Municipality did not have by-laws with regard to management of alien plants in the wetlands. This kind of problem was not even included in the Integrated Development Program for the municipality which means it was not considered as important.

#### **5.4 Summary**

The Section 24 of the Constitution provide for the protection of the environment as the right of the people of South Africa through policies and other measures. Most of the policies which address the issue of alien plants invaders focus on other issues, The National Water Act address the issue, but only under section 2 and 3. The other sections focus on water issues. Therefore it becomes very difficult for the authorities to monitor and enforce compliance. There is no policy looking specifically on the protection of the wetlands against alien plant invaders. There are few court case with regard to the problem because this problem is not regarded as important as other environmental problems e.g. pollution because available legislation does not have criminal or civil abilities in which a person found guilty in the courts of law can be prosecuted.<sup>64</sup>

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64. ([http://www.dwaf.gov.za/wfw/legal/docs/doc/INVASIVE\\_ALIEN\\_PLANT.doc](http://www.dwaf.gov.za/wfw/legal/docs/doc/INVASIVE_ALIEN_PLANT.doc), 2007

## Chapter 6

### Recommendations

#### 6.1 Alien plant species control

Wyatt (1986) indicates that the first step in controlling alien plants is to identify the particular species of alien plants that are to be controlled in this case White poplar. Controlling alien plants species requires that appropriate pre-treatment, initial treatment and follow-up treatments be applied. Pre-treatment by cutting or burning may be necessary where herbicide treatment is required and the alien plants are too tall and too dense to reach. White poplars require a chemical called roundup which should be applied on the stump of the big tree which has been cut, round can also be applied to young trees by spraying on the leaves and stem.

Trees of any size may be felled by cutting at ground level with power or manual saws. Because resprouts are common after cutting, this process may need to be repeated many times until the reserves of the tree are exhausted. Girdling, which kills the tree by severing tissues that conduct water and sugars, also may be effective for large trees, especially if accompanied by application of a systemic herbicide to the cut area. A hatchet or saw is used to make a cut through the bark encircling the base of the tree, approximately six inches above the ground and deep into the bark. Girdling will kill the parent tree but may require follow-up cutting or treatment of sprouts with a herbicide.<sup>65</sup>

According to Working for Water Programe, a national strategy to manage invasive alien plants will need to consider a broad range of management actions simultaneously. For example, it should aim to eradicate invasive alien plants that are confined to small areas or just beginning to become invasive; it should consider targeting emerging invaders for biocontrol and it should seek to prioritize areas on which to focus management of the most widespread species.

## **6.2 Wetlands Rehabilitation**

When trying to rehabilitate the wetlands, it must be realized that plants that grow in wetlands and on riverbanks are vital for preventing erosion; they play a role in the purification of water, reducing the severity of floods and regulating water especially during droughts. The moment the vegetation is destroyed, these valuable functions disappear

Kotze (1996) adds that the cause of wetland erosion is most often a result of poor land management - removal of stream bank vegetation, invasion of alien plant species, excess cattle trampling, overgrazing, and flooding because of land disturbances in the upper catchment. Wetland rehabilitation is a very good process that can be highly successful and rewarding. Rehabilitation can include correcting management strategies.

## **6.3 Education and Awareness**

The finding from the interview reveals that most of the people around Ga-Riba did not understand the significance of the wetland and because of that they could not even protect it. Some of the officials from the Greater Tubatse Local Municipality did not even know that there are wetlands and few officials know but they did not see conservation of wetlands as important, therefore there is a need for education and awareness on local community and municipal officials.

## **6.4 Indigenous knowledge for sustainable development**

Traditional or indigenous methods and methods should be applied when harvesting resources such as fish, grass and soil.

These methods should also be used in all community development in the wetlands such as rotational animal grazing and horizontal cultivation

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65. (Wyatt,1986)

## 6.5 Legislation

The existing policies should be implemented e.g by developing guideline documents, Programmes on how to apply those acts or strategies can be used. Compliance and monitoring should be done and implemented by local municipality, traditional leaders and community members who are staying next to wetlands and those who are practising some form of land use such as domestic live stock grazing and cultivation.

Other policies which are specific to wetlands and alien plants should be developed with clear and more focus on the subject. The sections on penalties and offences should also be made clear and strong. The Greater Tubatse Local Municipality should develop by-laws with regard to control of alien plants in wetlands.

Implementation of legislation or a piece of legislation which provide for the protection of the environment, like section 24 of the Constitution should be taken seriously by relevant authorities like other problems such as HIV, AIDS and crime. Regulations and guideline documents should be used to implement pieces of legislation on environmental protection or conservation. Environmental legislation must be done in such a manner that they have criminal and civil ability to prosecute those found guilty. Fines or penalties should be reviewed so that perpetrators feel the consequences of non compliance.

## **6.6 Cooperative governance**

In order to come with the strategies to be used in solving the problem of Poplar alien plants in Ga-Riba wetland .Tubatse Local Municipality and Riba Tribal Authority should engage other Department such as Department of Economic Development, Environment and Tourism, Department of Water Affairs and Forestry (dwaf), Department of Land Affairs, Department of Agriculture, department of Public Works and other relevant Non governmental organization such Mondi wetlands.Working for water, working for wetlands and Expanded Public Works Programme (EPWP) are poverty alleviation programmes which hire community members temporarily to do unskilled type of labour such as clearing of alien plant and upgrading of wetlands. Through cooperative governance these programme can be implemented at Gariba wetlands solve the problem of Poplar.<sup>66</sup>

## **6.7 The use of indigenous knowledge in protecting the wetlands**

Historically the wetlands were there and the people were using them but the were protected by cultural practices which reduces access to and also give guidance on the utilization of resources such as fishing in the wetlands which was only allowed in summer and harvesting of clay which was only done by young girls. The can still be implemented by Chief and tribal authority of Ga-Riba, and community should be engaged so that those who are aware of those traditional practices can teach the other members of the community once who do not know like youth. Traditional landuse practice are being done other areas and have proven to be asuccess e.g Community Based Natural Resource Management Programme of the iSimangaliso Wetland Park Authority, communities dependent on subsistence farming in wetlands are changing their cultivation methods so that they can farm in sections of some wetlands without severely compromising their structure and function.<sup>67</sup>

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67. (<http://wetlands.sanbi.org/gunboot>: working for wetlands, 2008)

## **6.8 Other programs to protect the wetlands**

### **6.8.1 Working for Water**

Tubatse Local municipality together with Ga-Riba tribal authority can request assistance from Working for Water programme to clear Poplars from the wetlands. Working for Water is programme funded by the Department of water Affairs and Forestry to control the spread of Alien plants in South Africa. Working for water focuses on clearing of alien plants like Poplar which are nest to the river or water courses such as spring or wetlands for free. If contact they can assist in clearing Poplar at Ga-Riba wetlands without any cost from the chief or community

### **6.8.2 Working for Wetlands**

The wetlands require rehabilitations in order for it to return to its natural state. Rehabilitations job can be very costly but through working together of the Municipality, Tribal authority and other institutions, the work can be done without cost. Working for Wetlands is programme relevant to the rehabilitation work. This programme is funded by dwaf and DEAT with other institutions such Sanbi, WWF and Mondi wetlands. Working for Wetlands should be contacted and requested to assist with the rehabilitation.<sup>68</sup>

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68. (Kotze, 1996)

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## APPENDIX I

### Photographs taken from the wetlands



**Plate 7.1** Drains made for cultivation affecting the wetlands



**Plate 7.2** Areas of the wetlands invaded by Poplar



**Plate 7.3** Cultivated fields and livestock grazing in the wetlands



**Plate 7.4** Cultivation in the wetlands

## **APPENDIX II**

### **2.3 Interview questions which were asked the community members**

1. Do you know that there is a wetland in the village?
2. How was the status of the wetland before it was invaded by Poplar
3. Do you know the significance of wetland on the environment
4. What is the significance of the wetland on the community?
5. What are the types of activities that are conducted in the wetland to support community life?
6. Do you know about alien plant invaders?
7. Are you aware that Poplars are alien plants?
8. Are the any purposes that Poplar serves in the community?
9. Are you aware of the problems that Poplars are posing in the wetland?

### **Interview questions for which were asked the relevant officials**

1. What is your view with regard to the invasion of Ga-Riba wetland by Poplars?
2. What was the status of the wetland before?
3. What might be causing the problem?
4. What can be the worst scenario of invasion of Ga-Riba wetland by Poplars?
5. What can be done to mitigate the problem?
6. Is the anything that your department is doing about the problem?
7. Is the anything that your government is doing about the problem?
8. Is the anything that has been put in place to try to minimise the about the problem?
9. What is the status of the wetland know is getting better or worse?
10. Do you know of legislations dealing with this kind of problem?