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Wetlands management and conservation in Rwanda. Case study: Gikondo Wetland

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1. INTRODUCTION

Wetlands are ecosystems that provide numerous functions to the environment as well as to humans. Wetlands were internationally recognized as significant ecosystems through the Ramsar Convention of 1971, which is an intergovernmental treaty that was implemented in 1975 (www.ramsar.org). Thus, it is approximately thirty-three years since wetlands were identified as significant ecosystems to the environment. Wetlands are nonetheless a recent phenomenon in the world eco-system management map that "… are sometimes described as the kidneys of the landscape because they function as the downstream receivers of water and waste from both natural and human sources" (Mitsch and Gosselink, 2000:1). Wetlands provide valuable and countless functions to the environment including: maintenance of water quality, reduction in erosion, protection from floods, provision of a natural system to process airborne pollutants, provision of a buffer zone between urban residential and industrial segments to ameliorate climate and physical impacts for example noise, control insect population, provide habitats for fish and other organisms and produce food, fibre and fodder to name a few (Mitsch and Gosselink, 2000).

In spite of the positive role of wetlands, these ecosystems are under intense pressure from various factors that lead to their exploitation and degradation. Wetlands are exploited in both rural and urban areas, for example, through their use as dumping grounds for human and industrial waste (www.wetlands.org). In addition, some wetlands have been degraded by either reclaiming or changing the ecosystem to other land uses. Research in Canada has estimated the extent of wetland loss and degradation due to human use. The findings revealed that in the last two hundred years, approximately 14 percent of wetlands have been changed to other land-uses such as agriculture, residential complexes and industrial areas (Mulamotti *et al*, 1996).

Some countries have realized the potential of wetlands to the environment. For instance, Australia, a developed country, values wetlands for the amenity value they provide (Tapsuwan *et al*, 2007). Uganda, a developing country, values wetlands for the products they offer such as green bananas and wild fruits (Emerton *et al*, 1999). In other words, wetlands are valued for different purposes in both the developed and developing world. Rwanda is one country that has dedicated its human and capital resources to conserving and managing wetlands. Through Rwanda's wetlands conservation strategies, Gikondo wetland was identified as an important ecosystem. Yet Gikondo wetland is also home to industries that make up the Gikondo industrial area. Despite opposition from industries in the wetland, the Rwandan government has made the bold decision to relocate the entire industrial area to make way for the rehabilitation of the ecosystem. This report focuses on the policies and events leading up to this decision.

Many developing countries look to industrial development as the way forward to economic prosperity. In relocating the industrial district out of the Gikondo wetland, the Rwandan government has prioritized environmental sustainability over economic development. The case study will examine the process leading up to the Government of Rwanda's (GoR) decision to relocate the industrial area and then rehabilitate the wetland. Choosing environmental sustainability over industrial development in Rwanda was a difficult decision given the country's development priorities and the legacy of the genocide. Gikondo wetland is a special case study for other developing countries in that it shows how it is possible to conserve the environment and meet social needs (for example availability of clean water and good sanitation system).

The aim of the study is to examine the issues involved in their decision to relocate the industries out of Gikondo and the planned efforts to rehabilitate the wetland. In addition, the study will build upon the existing literature on wetland management. The goal of the study is to contribute to the growing body of

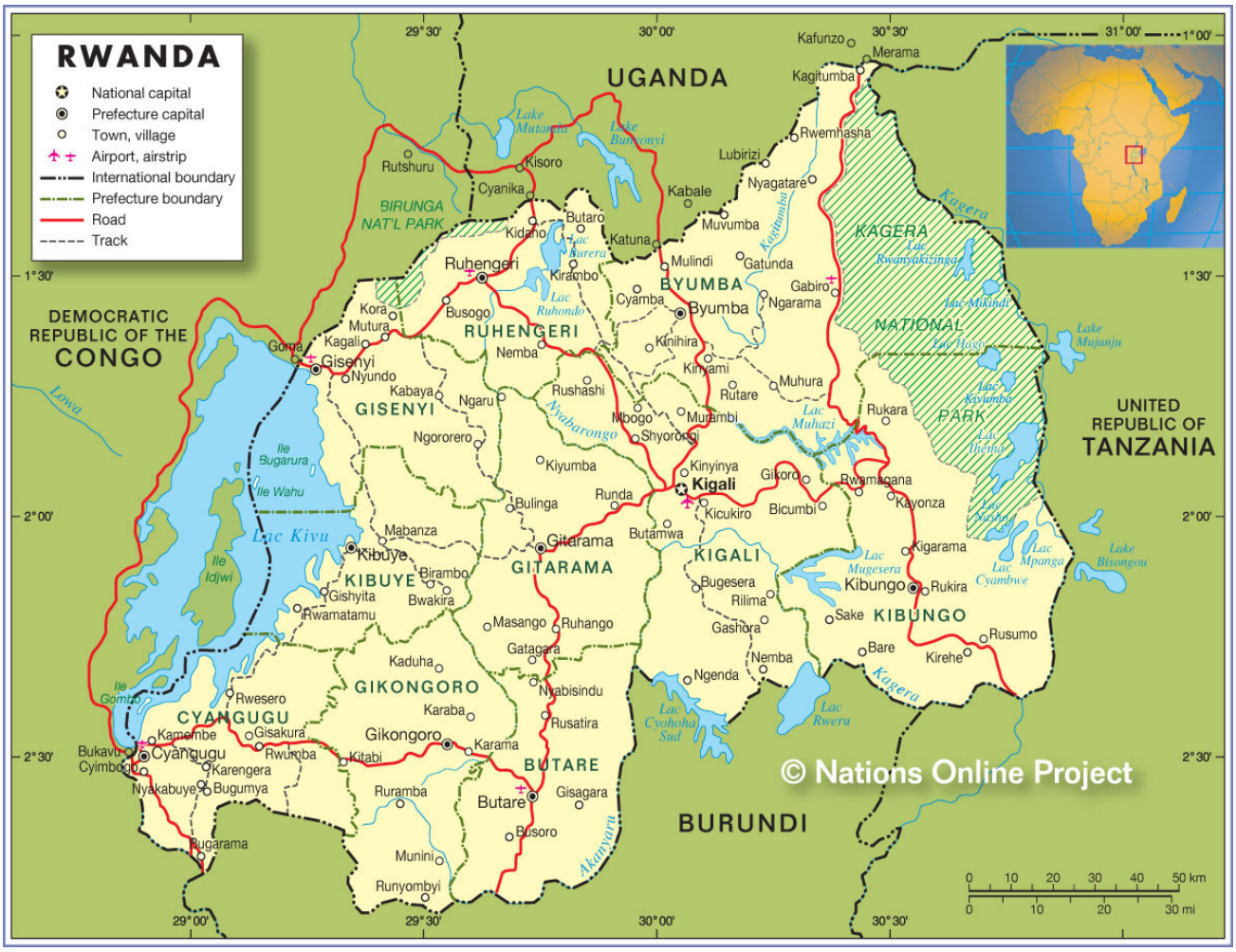
literature on wetland management and conservation in developing countries (State of the Environment in Africa, 2001, Turner, 1991). The broader goal of the study is to provide a developing country case on the problem of reconciling environmental conservation and economic development in the developing world. Through its decision to relocate the Gikondo industrial area, the Rwandan government has decided to pursue the goal of environmental sustainability potentially at the cost of industrial development. The following section introduces the study area.

1.1 Study Area

Rwanda is situated in central Africa and is a member of the East African Community. It is bordered by Uganda to the north, Tanzania to the east, Burundi to the south and the Democratic Republic of Congo in the west. Rwanda is one African country that has dedicated its human as well as capital resources to conserving and managing the country's wetlands. This is not easy in that the country is trying to rebuild itself from the tragic 1994 genocide that led to the death of approximately a million people and the severe destruction of the environment. Rwanda's key environmental challenges are: deforestation, poor waste management, misuse of wetlands, soil erosion and overgrazing[1]. Rwanda is a landlocked country with a few major water bodies for example Akagera River, Lake Kivu and Nyabarongo River (www.minitere.co.rw). These water bodies are not large enough to supply the country with sufficient water. Thus the government attaches value to the conservation and management of wetlands in order to preserve the available water. Figure 1 is the map of Rwanda including all the major provinces and the capital city, Kigali where the case study (Gikondo Wetland) is situated.

[1] http://www.rwandagateway.org/article.php3?id_article=894, 20 August 2007

Fig 1: Map of Rwanda



Source: (http://www.travelportal.info/africa/rwanda/maps).

In terms of wetland types, the country has marshes, lakes, rivers and water courses. Approximately 14.9 percent of the surface area is covered with wetlands. 6.3 percent of which are marshes while 8.6 percent are lakes, rivers and permanent or seasonal fresh water pools, such as Akanyaru, Akagera, and Nyabarongo marshes (www.minitere.gov.rw). The total area covered by wetlands in Rwanda is approximately 165,000 hectares, 92,000 of which are used for agricultural purposes. Wetland degradation in the country has been caused by the reconstruction and development of urban areas. Wetland degradation is a problem in Rwanda as a result of urban and rural activities. The misuse of wetlands in Rwanda is caused by: industrial waste disposal, brick making, use of

wetland reeds for making Rwandan traditional artecrafts, liquid wastes from urban garages for example oil plus the poor garbage disposal system in Kigali city (www.rwandagateway.org).

To combat environmental degradation, the GoR established Vision 2020 which included environmental protection and management. Vision 2020 is a developmental blue print for Rwanda and it includes all the necessary elements that will ensure economic growth for the country by 2020. The environment is given a high priority in the vision as one of the elements that will bring forth social as well as economic development (Vision 2020, www.minitere.gov.rw). The environmental objective of Vision 2020 is to build a nation in which pressure on the environment especially on land, biomass and biodiversity has been reduced and the process of environmental pollution and degradation has been reversed. In this way, the GoR hopes to achieve both economic and environmental sustainability through Vision 2020.

To ensure a sustainable environment, the GoR introduced and implemented an environmental policy which describes the wetlands policy statement as well as the strategic actions to be undertaken in terms of wetlands management. GoR introduce the Organic law and Biosafety law to support the environmental policy. The two laws are environmental oriented in that, they are used to enforce and implement a sustainable environment and avoid future environment degradation, for instance pollution[2]. The above mentioned environmental policy and environmental laws, if implemented effectively and efficiently, will ensure an overall sustainable environment not only for wetlands but also other natural resources for instance rivers and forests. In other words, this is one of the policy processes that the GoR introduced to ensure a sustainable environment. That is an environment that will lead to social, economic development.

[2] http://www.rwandagateway.org/article.php3?id_article=894, 20 August 2007

The likely effectiveness of the policies must, however, be seen in the context of recent changes in Rwanda's social and political environment. Rwanda's population increase has led to approximately 80 percent of Rwandans either living in or adjacent to wetlands. This is especially problematic in Kigali City, where land scarcity has exacerbated the problem of wetland encroachment. Even after the passing of the 2005 organic law on the environment, the majority of Rwandans still live on wetlands (*The New Times*, 16 August 2006). Thus many Rwandan wetlands especially in and around Kigali City are facing degradation, mainly due to socio-economic problems such as poverty (*The New Times*, 23 November 2006). The uniqueness of the Gikondo case study is that it is one of the few examples where a developing country facing serious socio-economic challenges has decided to physically relocate an industrial area in favor of rehabilitating a wetland. Thus the case study is a significant one in that the government is trying to rehabilitate the wetland for environmental sustainability. The environmental policy and the current Rwandan wetland policy are examples of the extent the government of Rwanda is willing to go in creating healthier wetlands for the country. Thus the study will focus on the length the government is prepared to go to conserve the country's wetlands by examining the process of relocating the industrial area from Gikondo wetland. That is what triggered the government to relocate the industrial area from the wetland and how the process is doing at present. The following section will introduce the aim, objectives and rational of the study.

1.2 Aims, Objectives and Rational of the study

The aim of the research is to explore the decision made by the GoR to choose sustainability over industrial development in Gikondo. This will be done by examining the relocation of the industrial complex away from the Gikondo wetland. The key aims are:

1. To examine the policies that led to the relocation of Gikondo industrial zone
2. To assess the process and implications of relocating the industrial area from Gikondo wetland
3. To examine Rwanda's wetland policy process

The rational for this research is to understand the decision made by the GoR to choose wetland conservation over industrial development. Particular attention will be paid to the debates in the government's plan to reallocate the industrial area from Gikondo wetland. In other words, the study will provide insight into the government's effort to preserve the existing wetlands for the benefit of the environment and the people of Rwanda.

1.3 Structure of the Research Report

Chapter two will concentrate on the literature review regarding wetlands. Firstly, a brief description of different types of wetlands will be reviewed. Secondly, values of wetlands will be discussed. Wetland degradation will also be defined at different scales. Different perspectives of wetland management and conservation including ways of conserving rural as well as urban wetlands will be discussed. In addition, Ramsar Convention will be introduced. Furthermore, Rwanda's wetland management strategies that have led to the case study will be discussed and finally introduce the case study: Gikondo wetland. **Chapter three** will discuss and examine the methodology applied in the research report. **Chapter four** provides an analysis of the policies and institutional structures that affect wetland management and conservation in Rwanda**. Chapter five** will present as well as provide the analysis of the research findings. Finally, **Chapter six** will provide future recommendations and give a brief summary of the research report.

2. LITERATURE REVIEW

2.1 Introduction

"Wetlands provide many important services to human society, but at the same time are ecologically sensitive and adaptive systems" (Turner *et al*, 2000: 8). In other words, wetlands are important ecosystems to both humans and the natural environment. However, wetlands have been exploited and this has led to loss and degradation of these natural ecosystems. Gren *et al* (1994) support this when they state that all wetlands are under threat from a variety of locally or regionally based human activities. The response to this problem has been the development of management and conservation efforts to protect or rehabilitate wetlands.

The literature on wetlands is vast and it covers a wide range of issues around wetlands management. Five themes will be discussed and reviewed in this chapter. The themes are: defining wetlands, wetlands degradation and loss, value of wetlands, different perspectives of wetlands management (paying particular attention to rural and urban wetland management), and finally the conflict between wetland conservation and development. The above themes are relevant to the case study in that they stress the significant elements that shape the management and conservation of wetlands. In addition, the chapter will focus on conservation versus development perspectives in both developed and developing countries.

2.2 Defining Wetlands

Wetlands have various elements and defining them is not a straightforward task. The Ramsar Convention has defined wetlands as "areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by shallow water" (The Ramsar Convention Manual,

4th Ed). The Convention also takes into account the following types of wetlands namely: Marine (coastal wetlands including coastal lagoons, rocky shores, and coral reefs); Estuarine (including deltas, tidal marshes and mangrove swamps); Lacustrine (Wetlands associated with lakes); Riverine (wetlands along rivers and streams) and Palustrine (marshes, swamps and bogs).

The Convention emphasizes that wetlands can be "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters" (The Ramsar Convention Manual, 4th Ed, www.ramsar.org). The above definition may include riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands (The Ramsar Convention Manual, 4th Ed). Many authors and organizations have provided different wetland definitions. For instance, the International Wetlands Conference (1982) provides an all-inclusive definition of wetlands stating that wetlands are "areas of submerged or water-saturated lands, natural and man-made, permanent or temporary, fresh water or marine". This definition would include peat bogs, grass, sedge marshes, mangroves, tidal marshes, flood plains, shallow ponds and paddy fields.

This definition was derived from a developed nation while the following one is from a developing nation, more specifically NMK (National Museum of Kenya (1991:1) cited in Ndaruga and Irwin (2006) which argues that wetlands are permanently, seasonally or occasionally waterlogged with fresh, saline, brackish or marine water including both natural and man-made areas that support characteristic plants and animals. The wetlands defined by the National Museum of Kenya include rivers, swamps, ponds, marshes, edges of oceans, lakes and finally human constructed dams. On Rwanda's case, GoR uses Ramsar's definition to define the types of wetlands in the country.

Mitsch and Gosselink (2000) state that wetlands can be defined according to three main components. First, wetlands are distinguished by the presence of water either at the surface or within the root zone. Second, wetlands often have unique soil conditions that differ from adjacent uplands. And the third component is wetlands support vegetation adapted to the wet conditions and conversely are characterized by the absence of flood-intolerant vegetation. Mathew and Fung (1987), cited in Mitsch and Gosselink (2000), state that wetlands can be divided into five distinct classes: forested bogs, non-forested bogs, forested swamps, non-forested swamps and alluvial formations. Mitsch and Gosselink (2000) also claim that a suitable wetland definition has not yet been developed especially one that proves satisfactory to all users. This is due to the fact that a wetland definition depends on the objectives and the field of interest of the user. In terms of surface area, wetlands cover a relatively significant proportion of the earth's surface: the extent of the world's wetlands is approximately 7-9 million square kilometers or about four to six percent of the land surface of the earth. An estimated fifty-six percent total wetland area is found in the tropics (2.6 million square kilometers) and the sub-tropics region (2.1 million square kilometers).

In Africa, wetlands constitute only one percent of the surface area of the continent, excluding coral reefs and seasonal wetlands. Nevertheless their importance in supporting biodiversity and human populations is becoming clear from on-going studies. Furthermore, Africa as a continent has spectacular wetlands for example, Rivers Nile, Niger, Zaire and Zambezi; Lake Chad, wetlands of the inner Niger Delta in Mali; Rift Valley Lakes (Victoria, Tanganyika, Nyasa, Turkana, Mweru and Albert); the Sudd in Sudan and Ethiopia and the Okavango Delta in Botswana (Kabii, 1996). All these major African wetlands are rich in biodiversity and unique in the values they provide for human population.

With the various wetland definitions provided one can understand the different ways developed and developing nations view wetlands. In other words, defining wetlands has aided communities in classifying different types of wetlands and the

benefits they provide given that wetlands cover a wide range of the earth's surface. In Africa, wetlands are unique and they are spread all over the continent.

Defining wetlands can help local communities and governments in providing significant policy and management measures where there has been degradation or loss of the ecosystem. In addition, defining wetlands educates the local communities especially in developing countries on how to identify significant wetlands and the values they provide thus leading to protection and management of the ecosystem in case of degradation. The following section will elaborate on the values wetlands provide to the environment and human population in general and how some values can be measured in economic terms. This can lead to wetland management and conservation.

2.3 Value of Wetlands

"Wetlands are generally thought to be among the most fertile and productive ecosystems of the worlds" (Mulamotti, Warner and McBean, 1996:1). Clearly, humankind has to first understand the value that wetlands hold for human as well as environmental stability before wetland management and conservation is initiated in any community. This will ensure proper wetland management and conservation techniques. The section will discuss the benefits and values wetlands provide and how this information can be used by developing countries to educate communities on the importance of wetlands as natural ecosystems. This section will discuss and examine different values wetlands provide in both developed and developing countries.

Wetlands in Africa are some of the most productive ecosystems in the world and in many cases they are sources of natural resources upon which many rural communities depend. These ecosystems provide food and energy, medicine, building material, dry season grazing and transportation for large human

populations (Kabii, 1996). The following are examples of the uses of biodiversity and productivity in African wetlands:

a) In Uganda people harvest *Cyperus papyrus* to make mats and baskets.
b) In Rwanda *Cyperus papyrus* is compressed into fuel briquettes with a high calorific content.
c) In the Okavango Delta roots, palm *Hyphae, Phragmites*, and palm hearts are harvested for subsistence food and wine.
d) In the Inner Niger Delta rice, millet, maize and wheat are cultivated in the highly productive soils of wetlands areas.
e) Over 600 local people are employed in tourist camps in the Okavango Delta (Kabii, 1996).

Clearly, wetlands in Africa provide numerous products that are essential for the well being Africans: for example food, fresh water and building materials to name a few. In addition, wetlands are valued for their cultural or religious significance. For instance, some wetlands are sacred entities especially to the Buddhists of Tibet. These wetlands are identified as objects of worship leading to their conservation and protection against degradation. The wetlands hold deep religious value, which cannot be easily substituted (http://ramsar.org). Religious values can therefore be a contributing factor in managing and conserving wetlands.

Mulamotti *et al* (1996) state that the value of wetlands varies from community to community. A preliminary survey of Ramsar sites found that approximately 30 percent of the sample had archaeological, religious, historical or cultural significance at both local and national level. For instance, the construction of the Coa Dam was abandoned in Portugal despite the investment of approximately 150 million US dollars. This was due to the archaeological value of the site after unearthing Paleolithic engravings. In addition, Starvns Fjord Ramsar site holds a

significant archaeological value to the people of Denmark as it is a Bronze Age site (http://ramsar.org). In these examples wetlands are valued for the historical element they hold for the surrounding community, which promotes efforts for their preservation.

The value of wetlands also includes the products that are derived from these natural resources, including rice and fish. Rice is a very important staple diet feeding approximately three billion people. Fish on the other hand, is a source of protein and a generator of income for many fishing communities. Of the eighty-two fish species in the Okavango River and Delta wetlands of Botswana nineteen species are commercially exploited for human consumption, twenty-five species for aquarium and sixteen are for fishing sports. Further, a mangrove, which is a wetland product, grows in most tropical areas. Its uses include: thatch for roofing, fibres for textile and paper making, timber for construction, fuel wood and medicines from leaves to name a few (http://ramsar.org).

As mentioned earlier, wetlands hold religious as well as cultural values to many communities. Mbereko *et al* (2007) analyzed the role of local institutions in wetland use, as well as access and management in the Zungwi vlei of Zvishavane, Zimbabwe. Vleis are wetlands that cover approximately four percent land area in Zimbabwe. The study was conducted to analyze the role of local or traditional institutions in wetland management including the benefits and values Zungwi vlei holds for the people of Zvishane communal area. The products that are derived from the wetlands are: trees, springs, sponges, reed beds and grass. There are also some tree species that produce valued fruits for example banana, mango, guava and oranges while other tree species are used as poles, crafts, firewood and sometimes medicines. Further, the Zungwi vlei also has three wells and one is held sacred by the community of Mazvihwa, the wells are used as a source of drinking water and water from the sacred well is used for performing traditional rituals. Sixty-six respondents interviewed for the study indicated the following benefits from Zungwi vlei namely: 43.9 percent grazed their livestock,

21.1 percent fetched water, 10.6 percent gathered wild fruit, 7.6 percent cultivated the wetland, 3 percent fetched worms which is a source of food and finally 1.5 percent had gardens in the wetland. In addition, Mitsch and Gosselink (2000) state that every wetland is ecologically unique which complicates the measure of its value however; values can be divided into population and ecosystem values. Population values are: animals harvested for pelts, waterfowl and other birds, fish and shellfish, timber and other vegetation harvest. Ecosystem values are: flood mitigation (reducing the danger of flooding), storm abatement (acting as storm buffers), aquifer recharge, aesthetics (non-consumptive values for example hunting, recreational fishing) and as study areas and finally used for water quality

Some wetlands hold an economic value especially due to the products derived from these ecosystems. For instance Emerton *et al* (1999) conducted a study to analyze the economic value of Nakivubo wetland in Kampala, Uganda. The study was conducted in collaboration with the East African Regional Programme's Biodiversity Economic Project and the Uganda National Wetland Programme. The study was carried out in three weeks to analyze the economic value Nakivubo wetland provides for the people of Nakivubo and Kampala. The study findings were based on the economic value of wetland goods and services. A key finding was that wetland cultivation provides a high percentage of the overall agricultural output. The products from cultivation include cocoyam, sugarcane, cassava, sweet potatoes, mixed vegetables and green bananas a main staple food in Uganda. In addition, fish farming, papyrus harvesting and brick making are major wetland values. The wetland also has non-use values for example conservation of biodiversity, cultural and aesthetic values and indirect values like ground water recharge services. Furthermore, Nakivubo wetland provides economic values to the residents adjacent to the ecosystem. Approximately 600 households near the wetland are engaged in wetland-based resource utilization activities. According to the study, the wetland provides USh 2 billion (Uganda Shillings) annually to the economy of Uganda (Emerton *et al*, 1999).

This value does not cover all the goods and services Nakivubo wetland provides to the people of Uganda. In addition, Nakivubo wetland also provides specific functions to the City of Kampala for instance acting as a water treatment and purification plant. The wetland maintains the quality of water supplied to Kampala by physically, chemically and biologically removing pollutants and sediments from the wastewater that passes by reducing the pollution load entering Inner Murchison Bay through mineralization and sedimentation processes. The wetland plants have the capacity to remove phosphorous and nitrogen, the accumulation of suspended solids, pollutants and pathogens and their decomposition by converting heavy metals from soluble to insoluble forms and dilutes effluents affected through density currents (Emerton *et al,* 1999).

Wetlands can also be valued in economic terms regardless of the goods and services they provide. Tapsuwan *et al* (2007) argue that the urban wetlands of Perth, Western Australia have increased the property value of the surrounding communities. The wetlands provide approximately sixty percent of portable water, which is extracted from ground water to the city of Perth. In addition, the wetlands provide other valuable services to the environment as well as surrounding communities for instance, the protection of water quality in rivers and streams, flood control and storm water detention, habitat for wild life and finally recreational and landscape amenities. A study was conducted to evaluate the amenity value of wetlands especially in the increase of property values in Perth. The study used a hedonic approach to value wetlands, the results found out that prices of properties near wetlands contain a capitalized amenity value for wetland proximity, when houses are sold the new buyers pay for the amenity value in form of higher house prices (Loomis and Feldman, 2003 cited in Tapsuwan *et al* 2007). The study also concluded that the existence of urban wetlands helps increase sales prices of surrounding properties. This has led to the preservation of wetlands in Perth not only for economic gains but also for environmental benefits like groundwater supply (Tapsuwan *et al* 2007). Thus, the above

mentioned examples reveal how developed countries for instance Australia value wetlands as an aesthetic resource while developing countries like Uganda or Zimbabwe value wetlands for either the products they provide or for cultural factors (the sacred well, as mentioned earlier).

Turner and Jones (1991) claim that the benefits and values of wetlands extend beyond the boundaries of the wetland itself. Some wetland classes are globally significant for instance, wetland values led to the establishment of the Ramsar Convention because of the support of important migratory fish and bird population. In order to manage and conserve wetlands effectively, humankind has to understand the different values these ecosystems provide. While some communities have known wetlands values and utilize the products, development has proved to be more compelling thus leading to wetlands degradation. According to Ramsar Convention, there is limited information on the status, ecological functioning and values of wetlands[3]. This has led to wetland degradation in many developing countries. Clearly, the value of wetlands whether social, ecologically or economically have shown considerable amount of evidence on the significance of wetlands to communities. Nonetheless, a wetland's commodity values even in monetary terms, has been outweighed by development elements especially agricultural and urban development for example in Rwanda (www.rwandagateway.org). This has led to continual wetland degradation and eventually loss in both rural and urban areas. The next section will discuss wetland degradation and loss including major wetland losses in developed and developing countries.

2.4 Wetland Degradation and Loss

"Wetland ecosystems account for about 6 percent of the global land area and are among the most threatened of all environmental resources" (Turner, 1991:59). The over-utilization and exploitation of wetlands in both developed and

[3] http://www.ramsar.org/lib/lib_handbooks2006_e02.pdf, 10 October 2008

developing countries have led to loss and degradation of these precious ecosystems. Ramsar Convention states that wetland loss is the degradation of a wetland due to conversion to a non-wetland area. For example an agricultural area, while wetland degradation is the damage of wetland functions due to human activity, for instance pollution. Wetland loss and degradation are different in that the latter can be managed and controlled using suitable wetland management techniques while wetland loss needs restoration and mitigation measures, which are expensive and complicated in terms of capital and engineering expertise, an issue that can be a greater challenge for developing countries. Mitsch and Gosselink (2000) argue that wetland loss is due to hydrological modification, agricultural and urban development, and this can be through drainage for agriculture, forestry and mosquito control, mining of peat, filling for residential, commercial and industrial development and finally filling for solid waste disposal. However, intense wetland degradation occurs due to human activities, the impact of which is: reduction of water supply directly to people, to an aquifer or another wetland; impaired water flow regulation and flood control; less recreation and tourism opportunity and decrease in socio-cultural significance (Mitsch and Gosselink, 2000).

The underlying causes of wetland loss and degradation in developing countries are: poverty, economic inequality, population increase, immigration, mass tourism, social and political conflicts and finally demands on water resources[4]. Turner and Jones (1991) analyze wetland degradation by stating that the risk of degradation has been increased by the open-system nature of wetland resources. Wetlands are also prone to damage caused by activities located in a considerable distance away from the wetland site. Wetland loss and degradation have been accelerated by the following factors: improved access to wetland zones, pressure of population growth and impacts of economic development.

[4] http://www.epa.gov/owow/wetlands/pdf/threats.pdf, 5 October 2007

Wetlands International, a nongovernmental organization and a partner of Ramsar Convention, states that wetland degradation in most parts of the world is due to improper management of natural resources thus leading to the destruction of wetlands services and products (www.wetlands.org). The continued degradation and loss of wetlands in many countries has been acknowledged by Ramsar Convention when it argues that "In spite of important progress made in recent decades, wetlands continue to be among the world's most threatened ecosystems, owing mainly to ongoing drainage, conversion, pollution, and over-exploitation of these resources" (The Ramsar Convention Manual, 4th Ed, www.ramsar.org). The majority of tropical wetlands are lost as a direct result of conversion to intensive agriculture, aquaculture or industrial use and through more gradual qualitative changes caused by hydrological perturbation, pollution and unsustainable levels of grazing and fishing activities (Turner and Jones, 1991).

The increase in wetland loss and degradation has been caused by human impacts from a range of activities including floodplain reclamation, poldering, construction of flood control structures, drainage for agriculture, excavation of peat for fuel and finally the modification and straightening of river channels in favor of navigation. Thus approximately fifty percent of the world's wetlands have been lost. In densely populated areas the problem is more severe: the densely populated regions of Europe, Asia and North America have lost or severely degraded more than eighty percent of their natural wetlands (Bobbink *et al*, 2006). China's natural wetlands have been severely degraded; the country has lost approximately 23 percent of freshwater swamps, 16.1 percent of lakes, 15.3 percent of rivers and 51.2 percent of coastal wetlands. Over one hundred years, China's total wetland loss has led to the extinction of many species including the big-head fish, estuary crocodile. phoenix-head, sheldrake and the wild david deer (Li *et al*, 2007). Wetland loss and degradation can often have multiple effects including the loss of habitat for species that depend on wetlands for survival.

Thus, many countries have realized the rate at which wetland loss and degradation is increasing leading to a range of environmental impacts.

Coleman *et al* (2008) examine the extent of wetland loss in the major world's deltas. They examined the loss according to the expansion of open water and in the conversion of wetlands by agricultural and industrial expansion. The analysis was coordinated by the NASA (National Aeronautics and Space Administration) research contract to detect changes and loss using change detection techniques on satellite images (Coleman *et al* 2003 cited in Coleman *et al* 2008). The following wetlands were examined and analyzed: Danube River, Ganges-Brahmaputra River, Indus River, Mahanadi River, Mangoky River, McKenzie River, Mississippi River, Niger River, Nile River, Shatt el Arab River, Volga River Huang He River, Yukon River and finally the Zambezi River. The Ganges-Brahmaputra River is one of the largest river systems in the world covering three countries in total. The Ganges originates from the Tibet-India border and then flows through India to Join Brahnaputra in Bangladesh. However, the river has the highest population density of all the above mentioned rivers. Georegistered satellite images from 1989 and 2001 were compared to detect changes and loss. Approximately a total wetland loss of 3507 kilometers squared was detected due to mainly conversion to agriculture and industrial use. The Nile River is the largest river system on the African continent from the major source of Lake Victoria in East Africa. A considerable amount of wetland loss has occurred mainly due to agricultural conversion. The large population density that depends on the Nile River for survival aided this. For instance the river supports many countries like Egypt, Sudan and Uganda to name a few (Coleman *et al* 2008).

Population pressure in both developed and developing countries seems to be accelerating wetland loss and degradation. This is because population pressure leads to the scramble of available land leading to reclamation of wetlands, mangrove swamps disappearing through land reclamation, fishpond construction, mining and waste disposal (Turner and Jones (1991). In Nigeria, the Hadejia

flood plains have been significantly reduced as a result of dam construction while a large part of Brazil's wetlands have been degraded by pollution. In addition, Li *et al* (2007) also describe the factors that have led to wetland loss and degradation in China. These include water pollution, biological invasion, reclamation, misguided policy and water diversion in terms of dam construction. The increasing loss of wetlands in China is due to reclamation; the country has been reclaiming wetlands for the past two thousand years. Water diversion into agricultural and industrial uses has reduced the water flow into China's wetlands. The loss and degradation of wetlands has affected many communities especially due to urban development but also in rural areas where agricultural development has taken the course.

Acknowledgment of wetland loss and degradation has led to wetland management and conservation techniques and policies in many countries for instance Rwanda. The following section will discuss wetland management focusing on both traditional and modern management techniques.

2.5 Wetland Management and Conservation

Wetland management is the only practice that can mitigate wetland degradation in developed and developing countries. However, this does not preclude wetlands from being utilized; on the contrary, wetland management promotes the partial conversion of wetlands in order to meet economic needs of societies. A balance has to be struck between the environmental functioning of wetlands and their use for livelihood purposes thus promoting sustainable wetland management[5]. Many communities and international organizations have found a way of encouraging wetlands management. For example the Ramsar Convention promotes the sustainable utilization of wetlands. As mentioned earlier, this is evident from the Ramsar strategic plan for 2003-2008; the Convention argues that the wise use of wetlands is one of the techniques that can be used in

[5] http://www.ramsar.org/lib/lib_handbooks2006_e02.pdf, 10 October 2008

developed and developing countries. Ramsar Convention describes the wise use of wetlands as the sustainable utilization of wetlands for the benefit of human kind in a way that is compatible with the maintenance of the natural properties of the ecosystem. Sustainable utilization is defined by the Convention as the human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations[6]. Thus, the Ramsar Convention uses the wise use concept as a wetland management tool for the member states and wetlands of international importance (Africa Environmental Outlook, 2002).

Developing nations, which face strong demands for socioeconomic development, are encouraged to use and conserve wetlands in a sustainable manner. Conservation is recommended to manage the rate of change in ecosystems (Turner and Jones, 1991). Although Indigenous knowledge has largely been ignored in the management of the environment, the promotion of wetland management in communities should encourage the use of local or indigenous knowledge. Dixon and Wood (2001) describe how indigenous knowledge has been integrated in wetland management policy in South-Eastern Ethiopia. The local community in Illubabor cultivated on wetlands using indigenous practices, which ensured that wetlands were not degraded. The change in national government led to the change in the Ethiopian environmental policy. However, in order to improve food security in the Illubabor region the local government later promoted the integration of local knowledge to promote and increase wetland management. In addition, the sustainability of wetland management was facilitated by traditional institutions, which were formed to ensure co-ordination and to empower wetland management activities.

Another element of the use of indigenous knowledge and traditional institutions in facilitating wetlands management has been introduced in the Mazvihwa community of Zimbabwe. As mentioned earlier, the community had the privilege

[6] http://www.ramsar.org/key_strat_plan_2003_e.htm, 27 August 2007

of utilizing the Zungwi wetland in either consuming the wetland products or in cultivation. To ensure the success of indigenous knowledge, research was conducted to analyze institutions that are associated with wetland use, access and management in communal areas of Zimbabwe particularly in Mazvihwa community. The research concluded that the local or traditional leaders regulated the use, access and management of wetlands in Mazvihwa. The traditional leaders also met with the local government to establish the best wetland management practices that suited Mazvihwa community. The chosen wetland management practices also included the integration of indigenous and modern wetland practices for instance, the sacred wetlands (Mbereko *et al,* 2007).

The use of indigenous knowledge in wetlands management is perceived to be effective in many communities. An example is the use of oral history in the rehabilitation and management in Kanyapella basin of Australia. Research was conducted at Kanyapella basin to determine the potential role of oral history in the rehabilitation of the wetland. Local history was found to improve scientific understanding and enhance policy implementation regarding the management of Kanyapella basin. In addition, oral history is perceived to be valued as an important element in incorporating local ecological knowledge in ecosystem management and rehabilitation including wetland management. Oral history was obtained from the local resource managers who provided information on hydrological as well as ecological history of the wetland. Thus, the local history gathered was integrated into the draft management plan of the wetland (Robertson and McGee, 2003). Indigenous knowledge can aid in the management of natural resources especially wetlands; after all it is human influence that has led to their degradation.

An alternative example of the use of local knowledge in wetland management is provided by Chinnak (2005) when he examines the local knowledge communities have on the management of their surrounding wetland. Oxbow Lake is situated in an urban area of Ubon Ratchathani province in Thailand; this wetland supports a

number of poor urban dwellers by providing various values and resources. However, the regional policy of the province does not protect the lake leading to degradation. Nevertheless, the study concluded that the urban dwellers have knowledge that is passed on from generation to generation-through experience especially regarding natural resources and environmental management. This is due to the fact that the Oxbow Lake is a source of survival for majority of the urban poor thus the use of local knowledge to manage the wetland for future purposes. In other words, Chinnak (2005) concludes that in order to gain better wetland management techniques, the city officials of the Ubon Ratchathani province should consider local knowledge when drafting policies regarding wetland management and conservation. Indeed, indigenous knowledge has proved to be an effective wetland management tool in many developing countries. Communities with rich tradition in terms of wetlands management have continued to use indigenous knowledge in the conservation of wetlands even in this modernized era.

Other communities have used other techniques including wetland land use policies. This has been taking place in Mauritanian wetlands. Mauritania has a diversity of wetlands and the local communities have been utilizing the wetlands for centuries using traditional knowledge. Mauritanian wetlands differ in size and in terms of the types of products they offer. There are three main types of wetlands in Mauritania namely: tamourts, gaats and oeuds. The surrounding communities have used indigenous knowledge to manage the wetlands through various practices especially through this cultural nomenclature. In other words, the basis for sustainable wetland management lies in the traditional knowledge that best understands the wetland environment, plant growth and wildlife interactions (Cooper *et al*, 2006). Wetlands provide valuable functions to the environment as well as humans especially in groundwater recharge, which leads to groundwater resources for human and ecological purposes. Thus wetland management and conservation is an essential element in maintaining this function. Schot and Winter (2006) claim that to achieve sustainable wetland

management in groundwater-surface water interactions an understanding of the function is needed in order for resource managers to be able to deal with flood mitigation, groundwater exploitation and biodiversity conservation in a more integrated and sustainable manner. In addition, the interaction of groundwater and surface water is critical for maintaining ecosystem processes in the wetland in other words they need to be considered in any resource management plan.

Clearly wetland management and conservation is the answer to many degraded wetlands in developing countries due to the fact that many local communities rely on wetlands for their basic livelihoods. The exclusion of communities in managing and conserving wetlands may lead to further exploitation leading to wetlands loss. Thus for an effective wetland management practice to take place local governments have to consider the attitudes of the local communities.

Mitsch and Gosselink (2000) state that until the middle of the 20th century, wetland management in the United States of America usually meant draining the wetland except for a few wetland managers who maintained them for hunting, fishing, waterfowl and wildlife protection. In other words “For most of recorded history, wetlands were regarded as wastelands if not bogs of treachery, mires of despair, homes of pest and refuges of outlaws and rebel. A good wetland was a drained wetland free of this mixture of dubious social factors” (Larson and Kusler, 1997 cited in Mitsch and Gosselink, 2000:612). However, wetland drainage as a management tool is no longer in usage, thus wetlands were managed for particular reasons. Stearns (1978) cited in Mitsch and Gosselink (2000) lists 12 goals for wetland management that are still applicable namely: maintenance of water quality, reduce erosion, flood mitigation, provide a natural system to process airborne pollutants, provide a buffer between urban residential and industrial segments to ameliorate climate and physical impact such as noise, maintain a gene pool of marsh plants and provide examples of complete natural communities, provide aesthetic and psychological support for human beings, provide wildlife, control insect population, provide habitats for fish spawning and

other food organisms, produce food, fibre and fodder and finally to expedite scientific inquiry.

Many communities manage and conserve wetlands for the above-mentioned factors. Wetland management also includes stakeholders working together to achieve sustainable wetland conservation. Gujja *et al* (2003) describe the management of wetlands on rooftop of the world, in the Himalayas. These wetlands are situated in the Kush-Himalayan Mountains of India. This is an important site for biodiversity conservation. With the help of WWF (World Wildlife Fund) of India, the people of the Ladakh region where the wetlands are located worked together to manage and conserve these significant natural ecosystems. Further, the WWF in partnership with the Himalayan countries that is China, India, Nepal, Pakistan, Bhutan and Tajikistan plus the Ramsar Convention on wetlands corporated and came up with agreements to manage and conserve all wetlands located in the Himalayan Mountains. The following aspects were identified in their agreements: first, the identification of suitable sites for Ramsar listings, World heritage declaration, and National protected areas; second, exchange of information and knowledge between countries on experience in conserving high-altitude wetlands; third, the development of a common methodology and identification of wetlands shared by more than one country for Ramsar designation; finally, there is increased regional cooperation in managing wetlands.

Wetland management has proved to be a significant element in the conservation and preservation of wetlands for the benefit of both the environment and human beings. Although there are different wetland management techniques, all of them lead to sustainable functioning of the ecosystem. The conversion of wetlands to other land uses has been one of the factors that lead to total wetland loss in many communities. The following section will examine the conflict between wetland conservation and development.

2.6 Wetland conservation versus development

Wetland conservation has in many cases conflicted with development goals. Wattage and Mardle (2005) analyze communities' preferences towards conservation versus development of wetlands in Sri Lanka. The analysis concentrated on Gampaha district in the west province of Sri Lanka, where wetland stakeholders were interviewed on their attitudes towards either total wetland conservation or development. Approximately eighty percent of the respondents preferred conservation to development; however, this differed in terms of spatial distribution. Wattage and Mardle (2005) concluded that stakeholders who were dependent on wetlands for their livelihoods preferred conservation to development whereas those stakeholders that did not rely on the wetland preferred development. Nevertheless, to achieve wetland conservation and urban development, a link has to be established by integrating conservation and development. This is to ensure that the wetland continues to play a positive role within the community. In addition, for wetland management practices to be effectively implemented in wetland dependant areas there is a need for educating communities on the functions of wetlands through conservation education (Ambastha *et al,* 2007).

Wetland conservation has been a priority for some communities especially in terms of reversing wetland loss and degradation, which is mainly caused by human activities, for example agricultural, urban and industrial development. The conflict between wetland conservation and development is a common phenonmenon in all countries whether developed or developing. For instance Beaumais *et al* (2007) examined the conservation of Seine estuary (wetlands) in France versus their conversion to an industrial area. In other words, the residents of Seine estuary would benefit more from converting the wetlands than conserving them. The study was undertaken to determine the economic value for converting the wetlands in to an industrial area. The study found out that more benefits would be realized in converting the wetlands into an industrial zone. The

benefits are in terms of job creation and higher income. For example, approximately €1,273 billion would be made from converting compared to only €4,66 million from conserving the wetlands.

However, the study concluded that the residents of Seine estuary were willing to conserve the wetlands instead of converting it to an industrial zone. They considered the Seine estuary to be a natural asset and in interviews 92 percent declared their preference to have the wetland conserved. At the same time, only 42 percent were willing to pay for the conservation (Beaumais *et al*, 2007). The case study reveals the struggle between wetland conservation and development. Development of wetlands offers many benefits however in the long run conservation is the best option. Further, Balmford *et al* (2002) cited in Beaumais *et al* (2007) state that conversion of wetlands to human uses does not make economic sense once external costs are accounted for. The total economic value of the intact wetlands can even exceed that of their conversion by more than 60 percent. In comparison, wetland is sustainable when compared to development whether agricultural, urban or industrial development.

Although wetland conservation has been the favored option for some countries including the study site of this research – many communities have chosen development over conservation. Heidanpaa (2002) analyzed forest economy versus conservation planning in the regions of Aunesluoma and Kuloneva in rural municipality of Karvia in Southwestern Finland. The conflict between conservation and development was caused by the introduction of a new policy called Natura 2000 in the forested region; this programme was aimed at the conservation of the forested region. The new policy led to grassroots resistance amongst the landowners who had previously benefited from developing the forest and converting the bogs (type of wetland) into agricultural activities for example planting trees. Their resistance was extreme and it included a hunger strike that lasted for at least a week. The landowners resisted the conservation of the forest due to the fact that majority of them benefited from development: the majority of

the landowners were either self employed or earned basic wages from primary production mainly from agricultural activities. In the end, the environmental officials withdrew the introduction of Natura 2000. This study shows that not all countries prefer conservation of wetlands; there are some who benefit more from converting and developing the ecosystems to other land uses. The conflict between wetland conservation and development will always be a problem for many countries whether developed or developing. Thus, for wetland conservation to take place, many elements have to be taken into consideration for example policies and benefits derived from conserving the wetlands. The following section will introduce Ramsar Convention.

2.7 Ramsar Convention

Ramsar Convention on wetlands is an intergovernmental treaty that was adopted on the 2nd of February 1971 in Ramsar, Iran. As mentioned above the treaty did not come into full force until 1975. The mission of the Convention is "the conservation and wise use of all wetlands through local, regional, and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world" (www.ramsar.org). The original purpose of the Convention was the conservation and management of wetlands primarily as a habitat for water birds. However, the Convention broadened its emphasis to include all wetlands whether in urban or rural areas. Currently, Ramsar Convention has 153 member states or contracting parties globally. The duty of the contracting parties is to designate wetlands of international importance and make sure that policies are put in place and implemented. At present, 1,634 wetlands have been designated as "Wetlands of International Importance" for special protection as 'Ramsar Sites,' that is approximately 145 million hectares or 1.45 million square kilometers of land. This is larger than the surface area of France, Spain, Germany and Switzerland combined (The Ramsar Convention Manual, 4th Ed).

Wetland management and conservation cannot be achieved without the proper knowledge of the function of wetland and the willingness of communities to conserve these ecosystems. In terms of wetland management techniques, the Ramsar Convention adopted the 'Wise Use' concept. This concept applies to all wetlands in member states including wetlands of international importance otherwise known as 'Ramsar Sites'. The wise use concept was adopted in 1987 at the 3rd meeting of the Ramsar member states in Regina, Canada. The Wise Use of wetlands is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development" (Ramsar Information Paper no.7, www.ramsar.org).

The wise use concept as adopted by the Ramsar Convention was implemented on the 5th meeting of the member states in 1993. The Netherlands government, using the 'Wise Use Guidelines' as the means of implementing the concept in all Ramsar member states, funded the project. The guidelines were meant to guide member states to fully manage and conserve wetlands. The guidelines adopted for member states are: first, to adopt national wetland policies. Secondly, to develop programmes for wetland inventory, monitoring, research, training, education and public awareness. Finally, members must take action in wetland sites to develop integrated management plans covering every aspect of the wetlands and their relationships with their catchments (Ramsar Information Paper no.7, www.ramsar.org).

The Ramsar Convention has partners that help in the conservation of wetlands. Examples are, the International Wildfowl Research Bureau (IWRB) now known as Wetlands International, World Conservation Union (IUCN), Birdlife International, and the World Wide Fund for Nature (WWF). These partners are known as the International Organization Partners (IOPs) and they signed a memorandum of cooperation with the Convention thus the partners' aid with wetland policy, legislations, advocacy, cooperation, planning, finance, site

management, casework, research and capacity building to name a few[7]. In addition to Ramsar's determination to conserve the world's wetlands, Wetlands International, which is among the International Organization Partners, is also dedicated to the conservation of wetlands. The goal of Wetlands International is "to enhance the wise use of wetlands, as they provide a basis for human survival and development" (www.wetlands.org). The wise use concept emphasizes the significance of wetlands' benefits and values in sediment and erosion control, flood control, maintenance for water quality and abatement of pollution, maintenance of surface and underground water supply, support for fisheries, grazing and agriculture, outdoor recreation and education, and climatic stability (www.ramsar.org).

Ramsar Convention has established itself to conserve and manage wetlands for the benefit of human-kind; this is one of the Convention's main principles (Ramsar Information Paper no.7, www.ramsar.org). The Convention has also managed to emphasize the importance of wetland conservation through the establishment of strategic plans. The present plan is known as the Ramsar Strategic Plan 2003-2008. The strategic plan identifies the major challenges facing wetland conservation and wise use in wetlands. The major challenges that were identified are:

- Increase in demand for water services especially in agriculture, industry and human consumption
- Climate change and its predicted impacts like droughts, storms and flooding, rising sea temperature and thawing of permafrost and glaciers
- Globalization of economic development affecting natural resource products
- Changing role of national governments through increasing privatization of services

[7] http://www.ramsar.org/features/features_iops.htm, 11/09/2007

- Increase in land-use pressures leading to continuing loss and damage to the ecological character of wetlands
- Increasing population pressure
- The need to ensure continuing political support and public interest in biodiversity issues (The Ramsar Strategic Plan 2003-2008, www.ramsar.org).

In addition, the strategic plan established the three pillars of the Convention. The first one is the wise use of wetlands. Second, is to establish a global ecological network for the list of wetlands of international importance. The third pillar is cooperating internationally in the delivery of conservation and wise use[8]. Thus wetlands management is an ongoing process and these important ecosystems need attention if they are to benefit human beings and their surrounding environment. To this end the Ramsar Convention and the IOPs have spread the awareness of wetlands especially in emphasizing their importance for both human as well as environmental stability. The Ramsar Convention has achieved much since its establishment in 1971, creating wetlands awareness throughout many countries whether developed or developing. The Convention is still working on raising wetland awareness all over the world through legislation, policy and governmental cooperation including partnerships with developing countries. Wetland management awareness has been extended to many developing countries including Rwanda where the case study is located. The following section will introduce and discuss Rwanda's wetlands.

2.8 Rwanda's Wetlands

Rwanda's total land surface area is 26,338 square kilometer with a population of approximately 9.7 million people. Rwanda is among one of the most densely populated countries in Africa; it is landlocked, has few natural resources and a

[8] http://www.ramsar.org/about/info2007-03-e.pdf, 11/09/2007

very small industrial base that makes a small impact in the country's economy.[9] Nevertheless, relative to the limited natural resources available, Rwanda has a considerable amount of wetlands. Marshlands are the most common type of wetlands in Rwanda covering 165,000 hectares. Currently 94,000 hectares of marshlands are exploited for either agricultural activities or developmental purposes for instance building of residential areas (Kanyarukiga and Ngarambe, 1998). Rwanda's environment is facing intense pressure mostly caused by increasing population growth, which is expected to double within the next twenty-five years.[10]

Wetlands exploitation has been taking place in the country for many years. In other words, the development of wetlands is still the remaining alternative in response to the increasing population pressure. The use of wetlands in Rwanda is due to the wetlands large water reserves, lower erosion risks and natural fertility. Yet wetlands also have the potential to be used by communities to work together especially after the 1994 civil war. In short, wetlands management and conservation can be one of the factors that will contribute to reconciliation (Kanyarukiga and Ngarambe, 1998). The Government of Rwanda (GoR) has embarked on the management and conservation of wetlands as natural ecosystems that are significant and vital for the development of the country. Although wetlands constitute a small percentage of the country surface area, these natural resources are essential for the livelihoods of local communities. Kanyarikiga and Ngarambe (1998) elaborate on Rwanda's wetlands by classifying them according to the surface area they occupy, the type of vegetation cover they have, utilization and the stages of development (Table 1).

[9] http://www.un.org/specialrep/ohrlls/dc/LDCs/profiles/rwanda.htm?id=046, 15 October 2008
[10] www.metropolismag/cda/Dory.php?artid=304, 15 October 2008

Table 1: Classification of Rwanda's wetlands according to the surface area

Category	Surface	Form of management
Very small marshland	Less than 20 ha	By the same users, little or no participation of a governmental organization.
Small marshland	Between 20 and 50 ha	Management on the Commune level or by a group of users.
Middle marshland	Between 50 and 100 ha	By the commune or by a regional project or special project.
Big marshland	Between 100 and 500 ha	
Very big marshland	More than 50 ha	One or several development projects and sub-division of its management in several units.

Source: Kanyarukiga and Ngarambe, 1998.

In terms of vegetation cover, Rwanda's wetlands have four types of vegetation. First, the papyraie, this type of wetland is characterized by abundant water and the vegetation of Cyperus Papyrus thus containing water throughout the year. Second is the Cyperus Latifolius, this type of vegetation cover has less water usually below the soil surface which is suitable for cultivation especially during the dry season. Third, Shrub-like vegetation, this vegetation rarely supports any water however there is availability during rainy seasons. There is also ferns and tall grass. Fourth type is Pastures; this is whereby the river meanders through narrow valleys that serve as pastures during the dry season. The utilization and development stages of Rwanda's wetlands can be distinguished into four categories. First, big peaty marshlands in East and North of Rwanda. Difficult drainage conditions limit the development of these wetlands. Second, there is limited utilization of the wetland. Cultivation only takes place during rain shortage and on hillsides. Third, the wetland is exploited for both pastures and crop production. Fourth, an intensive utilization of the wetland takes place especially

for agricultural production. Plus there is no management of the wetland thus leading to degradation (Kanyarukiga and Ngarambe, 1998).

The above mentioned wetland classifications and categories describe Rwanda's wetlands in terms of vegetation cover. In other words, the wetland stages in Rwanda show case the way local communities utilize and exploit wetlands. The GoR has identified four major wetland complexes that are the most critical ecosystems connecting the smaller wetlands in the country. The four ecosystems are: Kamiranzovu wetland in Southern province, Rwerumugesera wetland in the Eastern province, Rugeziruhondo wetland in Northern province formerly shared between Ruhengeri and Byumba provinces, and finally Akagera wetland also in the Southern province formerly shared between Kibungo and Umutara provinces.

The integration of the above mentioned wetlands will be implemented with the help of the World Bank. This will be through the National Wetland Conservation Program for 2002-2030, which will be shared among the National Commission for Development and Reform, the Ministries of Finance, Education, Environment and natural resources and Agriculture (www.rwandagateway.gov.rw). The government has recognized wetlands as vital ecosystems, which have to be managed and conserved for the benefit of the people of Rwanda. The identification of wetlands as strategic resources by GoR is due primarily to the scarcity of fresh water in the country. In other words, healthy wetlands will aid the delivery of fresh water. Vision 2020 the blue print for development in Rwanda also identifies wetlands as significant resources. The vision states that the major problem in environmental sustainability in Rwanda is the imbalance between the population and the natural resources. This leads to deforestation, depletion of biodiversity, erosion and landslides, pollution of waterways and the degradation of fragile ecosystems for instance wetlands (Vision 2020, Government of Rwanda). The next section will explore how these values have been exploited to create intense wetland degradation in the country. The section will also discuss the root causes of wetland degradation in Rwanda.

2.8.1 Wetlands Exploitation in Rwanda

Rwanda is a small country that has moved from devastation into building for sustainable development. However, this is not an easy task especially after the 1994 genocide. The civil war brought total destruction of the society including the environment, social, economic and political spheres. The displacement and movement of people during and after the genocide led to increased pressure on the natural ecosystems. The genocide diverted attention from environmental management and conservation to emergency issues for example resettlement, shelter and food security (Government of Rwanda, 2006). Nevertheless, the current government has acknowledged the importance of natural resources especially wetlands in the development of the country. The Government of Rwanda in collaboration with UNDP (United Nations Development Programme) and UNEP (United Nations Environmental Programme) conducted a study to analyze and examine wetland exploitation in particular Rugezi wetlands, which are among the largest wetlands in the country. The study found that there are approximately 580,000 hectares of wetlands in Rwanda and that only 165,000 are exploited. At least fifteen percent of GDP (Gross Domestic Product), which is derived from agriculture, is expected to be from the utilization of wetlands (Government of Rwanda, 2006).

The study used Rugezi wetlands as an example to demonstrate the utilization of wetlands and how this wetland has been exploited, therefore leading to wetland degradation. Rugezi wetlands are situated in the Northern and Southern Provinces. Part of Rugezi wetlands covers the Kamiranzovu wetland, which was identified by the government as one of the four major wetland complexes. In short, Rugezi wetlands are shared between the former provinces of Ruhengeri and Byumba. The wetlands were used as prime examples to demonstrate the importance of wetlands as they are one of the major sources of water for both Lake Victoria and the White Nile (Helpage Rwanda, 2004 cited in Government of

Rwanda, 2006). The value of Rugezi wetlands derives from the potential for providing hydroelectric power and tourism. Increased degradation of Rugezi wetlands led to the shortage of water levels in the major lakes that supply the hydro power that is Lake Bulera and Lake Ruhondo. The decrease in water level has had a huge impact on the energy delivery in Rwanda thus leading to a negative economic impact. In other words, electricity shortage has impacted negatively on businesses and industries resulting to the purchase of personal generators. This has led to increase in food and product prices thus an economic issue for the country. In an interview with the former State Minister of Lands and Environment Mrs. Hajabakiga, the minister states that the majority of Rwanda's wetlands are used to generate hydro-electric power. However, with the continual wetland degradation in the country the GoR was forced to use approximately 35.8 million Francs to purchase generators to substitute for the loss of power in the country (Government of Rwanda, 2006).

At the same time, Rugezi wetlands are the home for approximately sixty percent of the world population of the Grauer's Swap-Warbler (*Bradypterus Graueri*) an endemic bird species that is threatened by wetland degradation. The total population of the species is estimated to be approximately 10,000 birds. The birds can also be found in Southwestern Uganda and the Democratic Republic of Congo. Degradation of Rugezi wetland has had an impact on the birds, which leads to a decrease in tourism potential for the country. Not only has the degradation of Rugezi wetlands impacted negatively on the environment but also on the livelihoods of the people using it for instance, the transport system, food production including the loss of fish species like Claris *liocephalus* and cichlid fish *(Haplochromis*) (Government of Rwanda, 2006).

The study concluded that Rwanda's wetlands if used appropriately could have a positive effect on the economy of the country. Using Rugezi wetlands as the example, the study analyzed different elements the wetlands provided to the local community before degradation occurred. The elements are: agriculture (that

is the crops derived from the cultivating the wetlands), fishing, water for domestic use, livestock fodder, clay for pottery making, grass for thatching and wild goods (that is fruits, vegetables, animals and medicines to name a few) (Government of Rwanda, 2006). Table 2 is an example of the crops derived from Rugezi wetlands and the average income per year in Rwandan franc

Table 2: Annual Income from Different Crops

Crops	Average Income Per Year (Rwandan Franc)
Beans	5,265
Sweet Potatoes	4,484
Irish Potatoes	32,669
Maize	14,460
Rice	0
Vegetables	2,718
Soja	0
Sorghum	12,008

Source: Government of Rwanda, 2006.

Due to the economic benefits Rugezi wetlands provide for the local communities, conservation of the ecosystem is an important goal. Also, the secondary literature discussed in chapter 2 suggests that communities who benefit economically from wetlands tend to ensure management and conservation of the ecosystem (Cooper *et al*, 2006). However, with the continued degradation of the ecosystem the economic benefits have decreased leading to fewer benefits to local communities. The degradation of the wetland, and the declining benefits that go to communities, creates a situation where is more likely to be transformed for development, rather than sustainable development.

Rugezi wetlands are not the only marshlands that are beneficial or valuable to the country. The majority of the Rwanda's wetlands have different economic and social benefits. Rugezi wetland is one of the examples among many that shows the value wetlands provide. Nevertheless, with ever increasing population pressure, Rwanda is faced with intense wetland degradation that eventually

leads to social and economic impacts. Rwanda has experienced wetland exploitation, which has led to intense wetland degradation. Wetland degradation in the country is due to many factors including population pressure (www.rwandagateway.org). Wetland degradation in Rugezi wetlands led to a number of negative factors for example the loss of hydrological and ecological function, alteration of hydrological balance, drying up and compaction of peat, loss of water purification function and the fluctuation of water level to name a few.

The case study of Rugezi wetland is significant in that the GoR realized its potential as a source of hydroelectric power *and* as a tourist attraction. The intense degradation of the wetland led to the government responding by protecting the ecosystem before any loss took place (Hategekimana and Twarabamenye, 2008). The case study shows how it is possible to use wetlands in a sustainable manner.

Wetland degradation in Rwanda has been due to reclamation of wetlands to expand agricultural production, sedimentation, overuse of natural resources for instance over fishing, over grazing and negative farming practices and finally pollution from industrial, agricultural and domestic sources. Nonetheless, the root causes of degradation in many of the country's wetlands are: lack of wetland protection and management regulation; poverty and population pressures; shortage of land and inadequate land use policies and the lack of awareness of wetlands function and value (Government of Rwanda, 2004). The continual degradation of wetlands in the country has led to the government taking action before wetlands are degraded. Thus, the GoR with the help of REMA (Rwanda Environmental Management Authority), have embarked on the mission of saving wetlands through wetland management and conservation practices. In other words, the study of Rugezi wetlands highlights the significance of wetland values to the local communities. However, degradation has increased due to underlying factors like population pressure. Not only has wetland degradation led to intense environmental pressure in Rwanda, it has also triggered the GoR into identifying

wetland management and conservation measures. The following sub-section will discuss and examine the case study: Gikondo wetland.

2.8.2 Case Study: Gikondo Wetland

Gikondo wetland is located in the southern part of Kigali city. The wetland is connected to the Nyabugogo wetland system. Both wetlands form a system that is interconnected and runs through to the Nyabugogo-Akagera basin. The wetland system is a source of domestic water for Kigali City thus management and conservation of the wetland is crucial. Gikondo wetland is a special case in that the wetland is situated in an industrial complex comprising many factories and industries. This is a classic example of the pressure felt by many developing countries in terms of deciding between development and sustainability. In this case, the GoR is trying to ensure social development for instance delivery of clean water and overall environmental sustainability by rehabilitating Gikondo. However, the challenge is great in that the wetland is situated on an industrial complex that employs many workers especially women (Twesigye and Mulisa, 2003). Nonetheless, the industrial complex has polluted the wetland, from the effluents discharged from the industrial area which lead to the Nyabugogo-Akagera wetland complex eventually ending up in Lake Victoria the largest Lake in the East African bloc comprising of Uganda, Kenya and Tanzania. In other words, the GoR has chosen environmental conservation over development for Gikondo wetland.

Kigali city is divided into three districts namely: Gasabo, Nyarugege and Kicukiro. Gikondo wetland is situated in Northwestern part of Kicukiro district. Figure 2 is the map of Kigali City showing all the three districts of the city and their respective towns.

Fig 2: Map of Kigali City



Source: www.kigalicity.gov.rw

2.9 Summary

Wetlands as natural resources have various functions and values they provide, however, defining a wetland is not an easy concept. Many organizations and authors have come up with different definitions. Nevertheless, wetlands have proved to be important ecosystems to the natural and human environment. With the ever-increasing human population, the natural environment has suffered intense degradation including wetland loss. Wetland degradation and loss has occurred in many countries sometimes leading to the unrecoverable loss of this

ecosystem. Authorities and communities have come to realize the benefit wetlands provide to their basic survival thus the introduction of wetland management and conservation. With all of the problems facing developing countries, including most importantly that of poverty, some have embarked on wetland management to stabilize the environment. Rwanda being a small country with social, economic and environmental issues has focused on wetland management as an element that can lead to a sustainable environment and in decreasing majority of the social and economic issues the country is facing. In other words, the government has chosen wetland conservation over industrial development.

3. METHODOLOGY

3.1 Introduction

As mentioned the introductory chapter, the aim of the study is to explore the decision made by GoR to choose sustainability over industrial development in Gikondo wetland. The methodology used to gather information was qualitative research method. This type of method was chosen due to the fact that the research involved the use of interviews, government documents, policy documents and news papers. As mentioned earlier, the Gikondo industrial complex has numerous industries and factories that are still in operation. The government owns majority of the industries while few are privately owned. The following section will discuss qualitative research method.

3.2 Qualitative Research Method

Qualitative research method is used as a means to gather data. This type of research method refers to meanings, concepts, definitions, characteristics, metaphors, symbols and descriptions of things (Berg, 1995). Qualitative research paradigm has roots in cultural anthropology and American sociology (Kirk and Miller, 1986 cited in Creswell, 2003). The intent of qualitative research is to understand particular social situations, events, roles, groups or interactions (Locke, Spirduso and Silverman, 1987 cited in Creswell, 2003). According to the Human Science Research Council (1988), qualitative methodology is humanistically oriented in that the goal is to construct an explanation from the situational world of the subject (in this case it is the interviewee). In addition, the research objective in a qualitative design method is explanatory and descriptive (Halfpenny, 1979 cited in Human Science Research Council, 1988). The methods of data collection that are used in qualitative research are: open-ended observations, interviews, documents and other materials for instance sounds, emails, scrapbooks and other emerging forms. The qualitative methods can be in the form of text (words) or images (pictures) (Creswell, 2003).

The strength of qualitative research method is that one is about to gather in depth information from subjective point of view (Creswell, 2003). Although immense information is gathered, this type of method is subjective providing limited information. One of the main weaknesses of this type of research method is the use of subjective information (interviews) however this weakness was supplemented by using recorded data from government documents and policy papers.

Qualitative research method was chosen due to the fact that the research is based on subjective analysis, government documents and studies conducted. As mentioned above, qualitative research method is humanistically oriented. In other words, the aim is to construct an explanation from the situational world of the subject. The following interviewees were selected for the research namely, Hajabakiga (Former State Minister for Environment), Theobald Mashiga (Environmental Coordinator in REMA) and finally Alice Kuradusenge (Industrial Coordinator in MINICOM). The reason for choosing the above mentioned respondents was their immense background on Gikondo wetland and the industrial area.

Minister Hajabakiga was among the first environmental ministers to highlight Gikondo industrial area as an environmental issue. She brought up the issue with the GoR however the impacts of the industrial area had not be studied and recorded. Mr. Mashiga was the first environmental coordinator in REMA (Rwanda Environment Management Authority) the government institution established by the GoR to follow up environmental activities and issues in the country. Miss Kuradusenge, is in charge of industrial development in the ministry of commerce and industry (MINICOM), her main job is to advise and aid industries in Rwanda. The following section will discuss and examine how the data gathered was analyzed. Below are some of the interview questions:

a) What was the reason behind the relocation of Gikondo Industrial area?
b) The former government built an industrial area on a wetland; did they know the natural resource existed?
c) Rwanda is still trying to come to terms with the industrial and environmental destruction caused by the 1994 genocide, why is the GoR advocating for environmental conservation over economic development?
d) Rwanda is a small and landlocked country, the industries in Gikondo provide products and employment, what will happen when relocation takes place?
e) Where will the new industrial area move to?
f) Did the GoR of Rwanda consult with the private industrial owners about the management and conservation of Gikondo wetland?
g) Did GoR consult the owners about the decision to relocate the industrial area?
h) Who came up with the decision to relocate the industrial area and rehabilitate Gikondo wetland?
i) Did the GoR conduct any scientific study to prove the claim that Gikondo wetland is polluted by the industries?
j) What happens to the people living the new industrial area?
k) After the successful relocation of Gikondo industrial area, how will the GoR rehabilitate the wetland?

As mentioned above, government documents such as Rwanda draft wetland policy, Rwanda's Vision 2020, REMA Gikondo wetland documents (comprised of the studies carried out to determine the impact of pollution in Gikondo wetland) and Kigali Industrial Environmental Management Project document to name a few.

3.3 Data Analysis

The data obtained from the interviews and documents was analyzed using content analysis. Content analysis helps researchers to examine artifacts of social communication. These can be in written documents or transcriptions of recorded verbal communication for instance interviews (Berg, 1995). According to Holsti (1968:608) cited in Berg (1995) content analysis is "any technique for making inferences by systematically and objectively identifying special characteristics of messages". That is messages in documents and interviews using direct quotes or description of particular events, looks at similarities and differences and finally gives data meaning, translates and makes them understandable (Neuman, 2005). The data analysis that was applied in the research was descriptive, discussing the similarities and differences of wetland policies, analyzing studied conducted by GoR and individual researchers and government documents and finally translating them.

The sources of data used to gather in-depth information on the relocation of the industrial complex were interviews and published and unpublished documents. The interviews were unstructured and open-ended to gain a better understanding of the whole relocation process. The interviews were held to get a view of the GoR and the reasons behind the relocation of Gikondo industrial area. In addition, the documents gathered as a form of data were policy documents, official reports, published and unpublished government documents plus public newspapers from both Uganda and Rwanda.

3.4 Summary

The chapter discussed qualitative research method, the strengths and weaknesses and the reasons for using this type method. In addition, the chapter introduced the interviewees and why they were chosen for the research report. As mentioned earlier, qualitative research method takes into account people's

views, opinions and experiences. The relocation of Gikondo industrial area from the wetland was not an easy task taking into account Rwanda's economic capacity. The Government would have chosen to invest and boost the industrial sector however they decided to conserve the environment. The only of research method that would capture this kind of information is qualitative analysis.

4. POLICY AND INSTITUTIONAL FRAMEWORK AFFECTING WETLAND MANAGEMENT AND CONSERVATION IN RWANDA

4.1 Introduction

"Wetlands have been lost inadvertently because of policy interventions which have been badly coordinated or poorly designed" (Turner, 1991:59). Thus, sustainable wetland management is not possible without a proper wetland policy in the country. One of the main factors in Rwanda is that there are several policies that hinder the management and conservation of Gikondo wetland. In terms of the institutional framework, wetland management has been delegated to several ministries and departments (Twesigye and Mulisa, 2006). The chapter will discuss the perspectives of different policies affecting the management and conservation of Gikondo. In addition, the impacts of the wetland draft policy on the management and conservation of wetlands.

4.2 Rwandan Wetland Policy (Draft)

Rwanda is a developing country with little human capacity especially in terms of wetlands management. However, with the help of international environmental agencies, GoR has realized the potential of wetlands which has led to the development of a wetlands draft policy. The draft policy is known as "National policy for wetlands conservation and management" (Government of Rwanda, 2003). This is the first wetland policy in the history of Rwanda after the 1994 genocide. The general objective of the policy is to "promote conservation and sustainable management of Rwandan wetlands in order to maintain their ecological functions and uses for the welfare of the present and future generations" (Government of Rwanda, 2003:61). Furthermore, the general objective is divided into specific objectives that have to be fulfilled if wetlands management is to be realized in the country. The specific objectives are: to ensure maintenance of the Rwandan wetlands ecological, cultural, recreative,

aesthetic and scientific functions and uses, to promote participation of communities and local authorities as well as other partners for management and sustainable utilization of the wetlands, to ensure that policies, programs and sectorial legal frameworks contribute to wetlands conservation and wetlands sustainable management, to ensure that national capacities, judicial frameworks and appropriate institutions are implemented for the effective conservation of the wetlands. The broad goal is therefore to sensitize the Rwandan Population on the wetlands importance in order to acquire their commitment in favour of conservation and rational utilization of the wetlands and finally to promote regional and international cooperation for conservation and sustainable management of the wetlands (Government of Rwanda, 2003:62). The draft policy was established to be a guiding tool before the final policy is formulated. That is, the draft policy will be discussed and revised by the relevant wetland management agencies and will be used as a guiding tool in formulating and implementing the final wetland policy.

The draft policy also focuses on the restoration of degraded wetlands. The policy stresses that degraded wetlands have brought about negative effects on the biological diversity leading to soil degradation and the reduction in water resource quality and quantity (as has occurred in Gikondo wetland). The policy also points out the strategies to be adopted on degraded wetlands for instance to identify wetlands whose values have been diminished or degraded, to establish rehabilitation plans for the degraded wetlands which go hand in hand with programs or plans of Provinces and Districts, to have partnerships involving Provinces, Districts and neighboring communities as well as beneficiaries of the wetlands to rehabilitate and to take any necessary measures to prevent eventual wetland degradation (Government of Rwanda, 2003).

The wetlands draft policy is an important breakthrough in that the document recognizes the benefits and values wetlands provide to the people of Rwanda. In addition, the policy identifies the different ministries and institutions that are

responsible for policy implementation. However, the policy implementation is distributed among several institutions making it difficult for cooperation and collaboration among them. The following are the ministries and institutions responsible for wetlands management implementation as mentioned in the draft policy that is, Ministry of Land, Environment, Forestry, Water and Mines (MINITERE), Ministry of Agriculture and Animal Forestry (MINAGRI), Ministry of Infrastructure (MINIFRA), Ministry of Local Administration, Information and Social Affairs (MINALOC), Ministry of Education, Science, Technology and Scientific Research (MINEDUC), Ministry of Commerce, Industry, Investment promotions and Cooperatives (MINICOM), Decentralized Administrative structures for example the districts of Kigali City (MVK) that is Gasabo, Nyarugege and Kicukiro districts and the Rwanda Environment Management Authority (REMA) (Government of Rwanda, 2003).

As mentioned above, the ministries and institutions are among the many that were identified to implement the draft wetland policy. Nevertheless, the draft policy has faced problems in terms of implementation due to the fact that there are several ministries and institutions responsible for wetland management. Identifying different agencies and ministries in the implementation of wetland management and conservation is a classic problem in environmental management and planning in developing countries (Twesigye and Mulisa, 2003). This can create major problems and hindrances when the final wetland policy is established and implemented into action.

According to Twesigye and Mulisa (2003), the wetland draft policy cannot be a guiding tool for the final wetland policy due to the division of responsibilities among different institutions. There are some factors that can be realized if the draft policy is used as a guiding tool for the development of a final wetland policy. First, an inadequate coordination and collaboration among the different institutions, this is also due to lack of appropriate institutional arrangements for engaging all responsible stakeholders in wetland conservation and management.

Second, there is a lack of or inadequate access to information usually in expertise knowledge in wetland management and inadequate capacity for policy analysis and monitoring. The procedures are, moreover, not clear or non-existent. Thirdly, frequent transfer of senior officials in the institutions has led to people working on ad hoc basis as institutional memory is eroded as officials are abruptly transferred). Fourth, there is a lack of skilled personnel in government ministries and local governments. Finally, budget constraints have hampered development plans and implementation of conservation measures.

The different institutions have little capacity especially in terms of wetlands management expertise. However, REMA (Rwanda Environmental Management Authority) is the only institution that has the minimal capacity to delegate wetlands management and conservation. REMA was established as an environmental institution in 2005 under Article 65 of the Organic Law[11]. The institution came into being after the alarming degradation of the environment accelerated by population pressure on land, soil erosion and pollution especially water pollution in majority of the country's resources. The following are some of the responsibilities of REMA as the main institution concerned and responsible for the country's environmental management. That is, to coordinate and regulate environmental management in Rwanda, to advise the GoR on policies, strategies and legislation related to the management of the environment including international conventions, treaties and agreements, to render advice and technical support to organizations engaged in natural resource management and environmental conservation, to undertake research, investigations, surveys and other relevant studies related to environmental management, to undertake and promote environmental education and public awareness, to establish and operate national environmental information system for sound environmental management, to foster cooperation between the government, local authorities, private sector and the civil society in environmental management and finally to

[11] No. 04/2005 of 08/04/2005. Organic Law determining modalities of protection, conservation and promotion of environment in Rwanda.

establish committees responsible for conservation and protecting the environment at the provincial, district, town, municipality, sector and cell levels[12].

REMA has been working in stabilizing the Rwandan environment and merging with sustainable development. The draft policy does not mention REMA as the leading environmental agency. This has created confusion on the institution that has the power to delegate wetland management. To understand the problem of delegating various ministries and agencies in wetland management, the next section will review the existing policies and laws that hinder and affect the management and conservation of wetlands.

4.3 Review of the Policies and Laws Affecting Wetland Management

The policies and laws affecting wetland management and conservation in Rwanda are mainly on the provincial and district or sector level. In addition, there are policies that are national for example the National Environment Protection and Management. This is the national environmental policy that was implemented in 2003 to combat the accelerating environmental degradation in the country after the 1994 genocide. The policy advocates for the protection of ecologically sensitive area. Furthermore, the policy also stresses the inclusion of environment education in school curriculum, private businesses, public agencies and civil structures. Policy implementation within different institutions is hindered by negative impacts for example a weak civil society and private sector (MINECOFIN, 2005 cited in Twesigye and Mulisa, 2006). The environmental policy adheres and advocates for the overall protection of the environment. In addition, other policies and laws have also been affected by the plan to relocate Gikondo wetland especially the policies concerning industry, land tenure, water and sanitation.

[12] www.commissiemer.n/ncea/reportworkshoplakekivu/8%20Mashiga.ppt, 14/09/2008

The following are the policies and laws that are affected by wetland management in Gikondo. Firstly, the land policy, this policy concentrates on land tenure and administrative issues in order to improve market transactions, land ownership and use. In the case of Gikondo wetland, the policy advocates for land titling and zoning according to particular land uses. Although established, the land policy has not been implemented into action thus leaving public lands unprotected for instance natural wetland. Secondly, is the land law; this law can also be implemented at district level under the decentralization structure. In other words, the law when implemented into action (still in draft) will give the district officials the power to acquire or expropriate land in public interest through compensation. This will empower the local authorities to acquire land for resettling the people Gikondo industrial area displaced. However, at present compensation has not yet been made to the people of free trade zone whereby the industrial area has been relocated to.

Thirdly, is the Industrial policy and investment code; MINICOM (Ministry of Commerce, Trade, Industry and Promotional Investment now known as the Ministry of Trade and Industry) and RIEPA (Rwanda Investment and Export Promotion Agency) are the two institutions delegated by the GoR to manage the industrial establishments and investments. The former government did not adhere to environmental considerations in terms of the industrial area. This led to pollution in the industrial zone and the wetland nevertheless, RIEPA has established new rules and regulations regarding industries whereby the factories will be required to hand in an environmental assessment on how the industries are going to manage and protect their surrounding environment. Fourthly is the Water and Sanitation sector policy; the current sector policy on water and sanitation does not take into consideration water protection in the industrial area. In addition, waste and effluent management are not addressed in the policy thus affecting the new industrial base in the free trade zone. Fifth is the decentralization and local government development; otherwise known as the decentralization policy that came into effect in 2000 gave local authorities the

power to independently plan and finance service delivery activities. Through the policy, the officials can cooperate to avoid conflicts and empower them with new and appropriate skills for environmental management. This policy can be effective during the rehabilitation of Gikondo wetland. Nonetheless, the law has brought about new conflicts between different sectors leading to slow delivery services especially in implementing environmental management principles.

The sixth one is social protection; this is known as the social protection policy, which concentrates on gender and vulnerability. The policy focuses on homeless people and vulnerable groups (genocide survivors) while neglecting environmental protection. The people living in Gikondo hill slopes have no access to clean water and sanitation thus leaving them with the option of using the polluted water from the wetland springs. Further, the residents are vulnerable plus majority are women. In addition, majority of the workers in Gikondo industrial area also happen to be women. In a nutshell, the policy affects rehabilitation of Gikondo especially in terms relocating or resettling the vulnerable people and finally the Regional and International agenda; Rwanda's industries and environment are influenced by regional as well as international organizations for instance African Union (AU) and the East African Community (EAC). The institutional capacity in Rwanda is low in terms of implementing the regional and international strategies regarding industrial and environmental management (Twesigye and Mulisa, 2006:15-17).

The above-mentioned policies and laws affecting Gikondo wetland and the overall industrial-environmental nexus lack basic information especially in terms of implementing environmental conservation. In short, there are some major gaps in the existing policies even with statements of environmental conservation. Without policy implementation many of them remain statements of intention. There are factors that need to be included in majority of the policies and laws in order to implement environmental management and conservation. First, the water resources; there is no law on water resources management even in the

new Organic Law (2005). The second is the technological and scientific Research; there is little or no technological or scientific research initiatives mentioned in majority of the policies (industrial policy) especially in terms of establishing environmental sound technology in industries. In addition, lack of technical skills and access to finance hinder development in implementing environmental management in majority of the industries. Thirdly, the urbanization and settlement policies; these policies do not take into account the plight of the urban poor for instance in service provision, housing, labour rights and social security. While majority of the urban poor in MVK are either engaged in casual or informal sector (World Bank, 2002 cited in Twesigye and Mulisa, 2006).

Fourth, is the social protection law; the social protection policy concentrates mostly on homeless people thus, more has to be emphasized on empowerment, mobilization and viable strategies for improving social security, accessible and affordable financial services; according to MINECOFIN (2004) and MINICOM (2002) cited in Twesigye and Mulisa (2006), lack of affordable credit and financial institutions in the country acts like a bottleneck to sustainable industrial development. Furthermore, there is no strategy to improve access to domestic and international capital finance by local industries. In other words, without the financial means the Rwandan industrial base will increase without investing in cleaner production mechanisms thus leading to increase in pollution even after relocating the industries to the free trade zone. Finally is urban agriculture; the current agriculture policy does not take into account pollution prevention measures from agricultural fertilizers and chemicals in urban areas. As mentioned in chapter four, pollution in Gikondo is also caused by agricultural practices in the hill slopes. In a nutshell, the agricultural policy has to consider all pollution sources and come up with management strategies to combat them especially in urban areas (Twesigye and Mulisa, 2006).

The majority of policies lack coherence making it difficult to implement them into action. While some policy statements are not operational due to lack of

legislation and cooperative institutional arrangements (Twesigye and Mulisa, 2006). Further, there are some weaknesses within the overall policy and institutional framework regarding environment and conservation in many sectors of the economy. The next section will concentrate on the policy weaknesses affecting wetland management.

4.4 Policy and Institutional weaknesses

The weaknesses that affect Rwanda's policy and institutional framework have been in existence and some inherited from the former Governmental structure before the 1994 genocide. Nonetheless, the weaknesses are still affecting the present policy and institutional structure. Below are some of the major weaknesses faced by several policy institutions especially ones that are concerned with wetland management;

a) Coordination: this is a major weakness in many policy structures for instance water, wetlands, mines, lands and forestry are all under one ministry that is MINITERE. This limits the ability of the institution to manage the sectors (for example water, wetlands, and lands to mention a few) properly. As mentioned above, wetlands management is also divided within several institutions for instance MINECOFIN, MINAGRI, MINIFRA and MINALOC, these institutions are not well coordinated to work together with the main ministry MINTERE or even REMA. In a nutshell, there is no cross-sectional collaboration within ministries in planning and policy implementation
b) Lack of Information: this is evident in the policy formulation process in many ministries and environmental institutions (REMA). This is mainly due to the little or no quantitative information, which limits and constrains policy analysis and eventually the decision-making process. The lack of information is among the major weaknesses that face majority of the

country's institutions eventually leading to weak policy formulations and sometimes no implementation

c) Weak policy analysis and monitoring: this relates to all the above-mentioned policies that affect the rehabilitation of Gikondo wetland. Monitoring is very weak especially in wetland management that is delegated to several ministries and institutions for instance REMA and MINITERE
d) Stakeholder Involvement: there is little or no stakeholder involvement or participation in terms of policy formulation. For example, the relocation of the industrial area and rehabilitation of Gikondo wetland affects many stakeholders yet very few were consulted during the process especially the poor who live on Gikondo hill slopes (Twesigye and Mulisa, 2006).

With the above-mentioned weaknesses, there are some elements needed in order to improve the country's wetland policy and institutional framework. Below are some of the factors if formulated and implemented can have a huge positive impact on the current wetlands management system namely: formulating a wetlands law that builds protection of the existing wetlands in the country. In addition, the list of wetlands that are protected should be gazetted, their land titles secured and wetlands management should be delegated to one institution for instance MINITERE; raise wetland awareness through media and environmental education; environmental issues of different sectors for example trade, industry, infrastructure and tourism should be incorporated into policies to ensure smooth cooperation between sectors in terms of environmental management; environmental management and protection should be the responsibility of MINITERE with the help of REMA and implement environment laws for instance the Organic Law (2005) and the Draft Wetlands Policy (2003) through regular monitoring and inspection

The identification of the above mentioned factors will aid in fulfilling the gaps in the current environmental policies however they will require joint cooperation

between ministries, REMA, MVK, districts, private sector, local communities and relevant institutions (Twesigye and Mulisa 2006: 20-21).

4.5 Summary

Wetland management and conservation in many developing countries has not been implemented due to a lack of a wetland policy and poor implementation structures. The chapter focuses on the policy and institutional structures that affect wetland management and conservation in Rwanda. The policies reviewed portray a poor organization structure in Rwanda, including highlighting some major weaknesses. One main element portrayed in the wetland draft policy is that there are various institutions delegated with wetland management thus leading to overlapping of responsibilities with different agencies and ministries. In other words, the wetland draft policy will not be effective due to fact that several different institutions are overlapping in terms of wetland management. REMA should take full responsibility of implementing an effective wetland policy and supervise other institutions that maybe affected by wetland management. Wetland policy and institutional framework is very significant for any country to implement and realize wetlands management and protection. This chapter not only highlights the issues involved in policy formulation but also lack of knowledge and capacity in the country in terms of wetland management. Policies always look good on paper however actual implementation is always a problem. Before the final wetland policy is formulated, the GoR should ensure proper coordination is implemented in all institutions concerned with wetland management. From the chapter's discussion, wetland policy is complex and needs to be negotiated thoroughly before any implementation takes place. In a nutshell, GoR should concentrate on solving wetland policy structure before relocating Gikondo wetland; this will lead to a better rehabilitation structure of the wetland. The following chapter will discuss the management and conservation of Gikondo wetland.

5. MANAGEMENT AND CONSERVATION OF GIKONDO WETLAND

5.1 Introduction

The management and conservation of wetlands has become an important focus of current environmental strategies in many developing countries. As mentioned earlier, the GoR has identified Gikondo wetland as a crucial ecosystem that is interconnected through many tributaries. Gikondo wetland flows into the Nyabugogo River, which is one of the main tributaries of Nyabarongo River. Nyabugogo and Nyabarongo Rivers are all situated in Kigali City however, Nyabugogo flows outside the city into Akanyaru River that forms the great Akagera River flowing into Lake Victoria (Rugege, 2006). The chapter will examine and discuss the management and conservation of Gikondo wetland as one of the main wetland strategies a developing country has used to ensure a sustainable environment. The chapter will trace the steps that have been taken to identify Gikondo wetland as polluted and degraded and how this has affected the GoR decision-making. Although the management and conservation of Gikondo wetland has taken place, the physical relocation of the industrial area has not yet occurred. The next section will discuss the overview of Gikondo wetland.

5.2 Overview of Gikondo wetland

Gikondo wetland is a small ecosystem that has experienced continual degradation due to industrial as well as human pollution thus affecting the water resources that are connected to the wetland. In a personal interview with REMA's representative, Mr. Mashiga, he stated that Gikondo wetland was an essential resource to the country especially in supplying fresh water to the City of Kigali (MVK) and neighboring provinces (Mashiga 2007). Gikondo wetland has been degraded by the physical presence of the industrial area whereby the industrial effluent flows directly into the wetland. Mr. Mashiga also noted that the government did not know of the degradation until the assessment of the Lake Victoria Environment Management Project (LVEMP). The East African

community initialized the project in 1995 to assess and examine the sources of pollution to Lake Victoria. One of the sources was traced to Gikondo wetland through Akagera River. The LVEMP project was therefore the first to identify Gikondo wetland as polluted and degraded. This led REMA as the environmental entity in Rwanda to embark on saving Gikondo wetland from total degradation and loss (Mashiga, 2007).

The management decision taken by REMA and the GoR was to physically relocate the industrial area away from the ecosystem in order to make way for rehabilitation. This description of events was confirmed by Mrs Hajabakiga (former State Minister of Lands and Environment, cabinet reshuffled in 2008). In a personal interview with her she stated that the only option was "to relocate all the environmental unfriendly commercial structures situated in Gikondo industrial area" to make way for the rehabilitation of the wetland (Hajabakiga, 2007). However, a study had to be conducted to provide conclusive scientific evidence that Gikondo wetland was polluted and degrading. Thus, REMA in collaboration with KIEM (Kigali Industrial Environment Management) conducted a study in Gikondo wetland to get clear results on the environmental status of the wetland. Evidence of pollution could be used to support the relocation of the industrial area from the wetland. The next section will discuss the sources of pollution to Gikondo wetland.

5.3 Sources of pollution to Gikondo wetland

As mentioned earlier in the literature review, wetland loss and degradation is caused by many factors plus they vary from one region to another. Rwanda being a developing country with little emphasis on the environment, wetland loss and degradation accelerated affecting a majority of the country's wetlands. According to Mashiga (2007), Gikondo wetland has been degraded beyond recognition especially by the presence of the industrial area. In addition, there are some other factors that have had a huge negative impact on the wetland.

There are three main factors that have contributed to the degradation of Gikondo. First, Gikondo is located in a low-lying area and is surrounded by densely populated homesteads on adjacent hills slopes. The majority of the homesteads are informal settlements with poor sanitation system that pollute both surface and groundwater. Due to the wetland's location, the pollution always finds its way to the low lying wetland thus creating pollution and further degradation to the ecosystem. A second source of pollution is the use of pit latrines and septic tanks in Kigali. The majority of households and commercial enterprises use this form sanitation. During the 1994 genocide, pit latrines were used as burial grounds thus causing further environmental degradation. The number of pit latrines has increased especially in Kigali where the population has doubled since 1994. Due to the heavy rainfall and porous soils, the liquid waste from the pit latrines flows into the wetland ending up in the Nyabarongo River system. The waste from the city is not treated and due to run-off some of the pathogens flow into the wetland (Mashiga, 2007). Below is an example of a pit latrine commonly used in Rwanda (Plate 1).

Plate 1: Modern Pit latrine



Source: http://www.travelblog.org/Photos/1689987.html

A third source of pollution is the industrial area that is situated on the wetland itself. The industrial buildings are built upon the wetland. This is a serious problem in that the majority of the untreated industrial wastes are released directly into the wetland. Gikondo industrial area is home to a number of industries that manufacture plastics, mattresses and tobacco to name a few. Table 3 provides examples of the industries located in Gikondo wetland and the products they manufacture.

Table 3: Examples of Gikondo Industries and their respective Products

Industries	Products
Sigma Coat Paints	Color Paints
Rwanda Foam Sarl	Chemical Products
Adma International Limited	Biscuits
Rotassairwa	Plastics
System Aluminum and Glass Rwanda	Glass and Aluminum
Sorwamin	Mineral Treatment
Bandag	Pharmaceuticals
Pneurwa	Pharmaceuticals
Inyange	Dairy Products

Kuradusenge, 2007.

The untreated waste released into the wetland has had a negative impact on the regeneration function of the natural resource. Some of the industries release heavy metals especially from the aluminum industries thus leading to further degradation of Gikondo. Even with the negative impacts of Gikondo industrial area, industrialization is among the key strategies of the GoR for achieving Vision 2020. However, the industrial base remains weak and uncompetitive. The manufacturing firms are small while the larger industries are engaged in

production of primary products for instance coffee, tea, cement, tobacco and soft drinks. Furthermore, the industrial area employs a small percentage of the country's population compared to other sectors (Twesigye and Mulisa, 2006). This has given the GoR more leverage while negotiating with the industrial owners about relocation of the industrial area from the wetland. In other words, even though industrialization is a key strategy for the GoR Vision 2020, this cannot take place at the expense of the environment.

According to the Ministry of Finance and Economic Planning (MINECOFIN) (2004) cited in Twesigye and Mulisa (2006) approximately sixty-five percent of the country's industries are situated in Kigali implying that the industrial base employs majority of city dwellers while also contributing to a larger proportion of the urban environmental problems for instance water and air pollution. Thus the government through the Ministry of Lands, Environment, Forestry, Water and Mines (MINITERE) and REMA called upon the relocation of Gikondo industrial area to make way for the conservation of the wetland. This is not an easy task in that the industries are a source of income to a majority of city dwellers. In addition, REMA had to clarify some factors before relocating the industries for example socio-economic factors that are attached to the industrial area. On the other hand, the government also had the task of allocating an alternative area whereby the industries will be moved to (Hajabakiga, 2007). All these processes were lengthy, tiring and time consuming. However, the government had the will and power to change the country's environment, a new environmental strategy for a struggling developing country. For relocation to be justified by REMA and MINITERE, some processes had to be conducted to get scientific proof that Gikondo is degraded (Mashiga, 2007). The first process was to identify the threats to Gikondo wetland and how these particular threats can be dealt with. The sources of pollution to Gikondo could not justify the relocation of the industrial area, REMA as the environmental institution had to establish evidence of pollution in the wetland. The following section will examine the evidence of pollution in Gikondo wetland.

5.4 Assessing pollution in Gikondo wetland

Gikondo industrial area has been in existence since the 1960s after Rwanda's independence from Belgium. The GoR approached an inter-agency group of UN-HABITAT (United Nations Human Settlement Programme), UNEP (United Nations Environmental Programme) and UNDP (United Nations Development Programme) to identify and propose an industrial environment management framework for Gikondo wetland. The framework would assess and analyze the threats to the wetland. The framework established three basic actions plans: first, to create a foundation for sustainable industrialization in Rwanda through the cleaner production application. Second, to develop a detailed socio-economic and environmental assessment of existing industries. This would form the basis of a draft report, which would in turn serve as the basis for stakeholder strategies and action plans to support sustainable industrial development. The third action plan was to ensure that the outputs of the stakeholder consultations would guide institutional and policy regimes targeted to enhance national capacity for industrial environment management framework (KIEM, 2006). The joint collaboration between the GoR and the inter-agency environmental groups officially established KIEM in 2002 under the response of a ministerial order to assess and generate responses to the pollution of Gikondo wetland. The following sub-section will introduce the KIEM and how this study led to the evidence of pollution in Gikondo wetland

5.4.1 Kigali Industrial-Environment Management Project (KIEM)

REMA's wetland management plan for Gikondo started with the initial stage of identifying the main sources of pollution to the wetland. This process was established by KIEM (Kigali Industrial Environmental Management) project under the Ministerial order of 2002. Ministerial order of 2002 was established due to the continual degradation of Gikondo wetland. The Ministry of Environment (MINITERE) in collaboration with REMA established the KIEM project to examine

the threats to Gikondo wetland especially due to the presence of the industrial area. The industries in Gikondo are still in operation even though their output is low (Hajabakiga, 2007). Further, GoR supported the project in regards to Vision 2020 in terms of sustainable industrialization and urban environmental management (Twesigye and Mulisa, 2006). Thus the main objectives of the project are to generate responses to excessive pollution in the wetland, to intervene to national industrial-environmental challenges using Gikondo industrial park as an entry point and finally to develop a framework for sustainable industrialization in Rwanda.

KIEM project has three components that had to be carried out in order for the objectives to be fulfilled. The first component is to enhance industrial environmental management capacity through cleaner production. Secondly, to assess and act upon the ecological and socio-economic study, action plan proposals and validation and lastly to implement action plans and a capacity building phase (KIEM, 2006).

As mentioned earlier, the first component in assessing Gikondo wetland is to create a foundation for sustainable industrialization in Rwanda through the Cleaner Production (CP) application. The CP application used a pilot project of nine industries, however only five industries were able to implement this strategy namely Inyange, Utexrwa, Sakirwa Industries Ltd, Sulfo Rwanda Industries Ltd and Rwanda Leather Industries. The Cleaner Production (CP) application provides significant contributions to industries in terms of waste management and efficient environmental management plans. The main activities include: promotion of efficient utilization of production inputs to maximize production outputs; promotion of waste reduction and minimization of pollution; pollution prevention strategies, for example re-use, recycle and treatment to name a few; promotion of environmental protection, enhanced productivity, eco-products for diversified market penetration; and finally sustainable industrial growth (KIEM, 2006).

The pilot project was established under the Ministry of Commerce (MINICOM) in joint cooperation with United Nations Industrial Development Organization (UNIDO). The project focused on training Rwandan industries to adopt CP concepts that promote efficient energy use and reduction in waste generation thus leading to sustainable industrialization. The CP project will be achieved through trained workshops, factory audits and eco-benefits programme practices. The Uganda Cleaner Production Center (UCPC) will also provide technical support. The main outputs are to benefit participating industries and establish a proposal document for Rwanda Cleaner Production Center (KIEM, 2006).

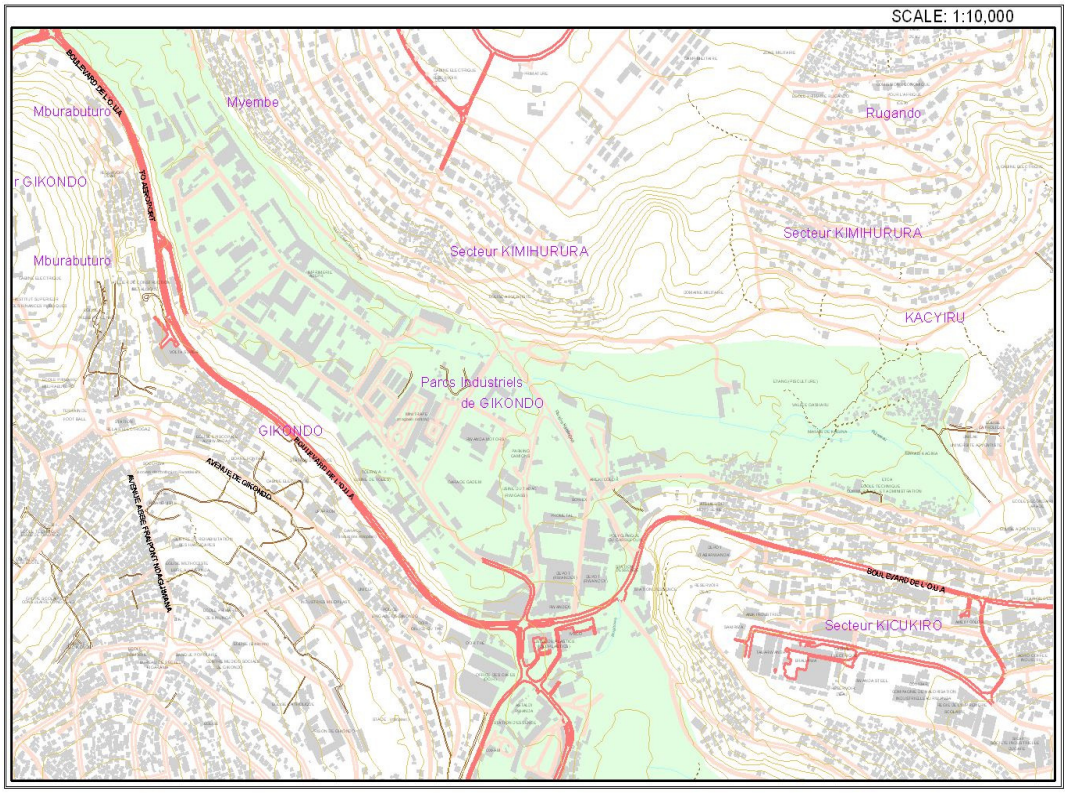
The Rwanda Cleaner Production Center was established in 2002 but will only be implemented in 2008; the center will run for three years ending in 2010. The pilot project carried out on the industries mentioned above showed successful results whereby there was a reduction in waste materials thus a decrease in pollution to Gikondo wetland (*New Times, 16 November 2007*). The CP pilot project trained the operating industries on how to adopt to cleaner production mechanisms using the Gikondo industrial area as an entry point. This was to equip the industrial owners with industrial environmental management concepts that can also be used when the industries have been relocated. The second component of the KIEM project is the biophysical analysis of Gikondo wetland. The ecological assessment was conducted by mapping out the wetland and scientifically testing the water and soil from the site. REMA had to provide evidence showing that the wetland is being polluted by the presence of the industrial park. The next sub-section will examine and discuss the biophysical analysis of Gikondo wetland.

5.4.2 Biophysical Analysis of Gikondo wetland

The ecological analysis was the second stage in identifying the evidence of pollution in Gikondo wetland. This process was conducted by REMA in collaboration with KIEM and the aim was to produce scientific results that

Gikondo was polluted and degrading. The analysis used two focus areas that is: (i) in situ permeability which examined the impact of infrastructure on water flow and (ii) water and soil analysis using physical, chemical and microbiological factors. The presence of physical infrastructure in Gikondo wetland (construction of industrial and other commercial structures) has led to the following negative impacts: reduction in groundwater recharge, increase in soil erosion, decrease in flood control, reduction in water filtration and purification and pollution (KIEM, 2006). Below is a map of Gikondo industrial area. The industrial area is built upon the wetland.

Figure 3: Map of Gikondo Area



Source: KIEM, 2006

Furthermore, (Plate 2) portrays the extent of water pollution in Kigali City (MVK) mainly due to the Gikondo industrial complex. The polluted water affects the

urban poor who have no option but to utilize the water for their day-to-day basic needs

Plate 2: Polluted water near Gikondo wetland



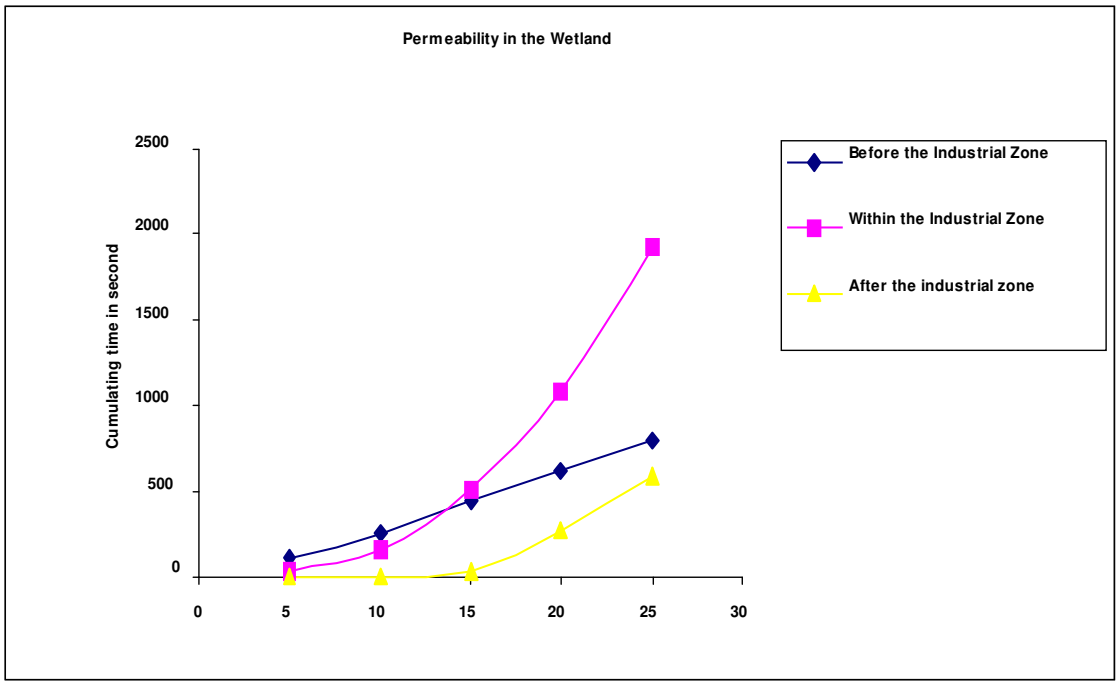
Source: KIEM, 2006

Pollution near Gikondo wetland is evident by the colour of the water. The water has two different colours mainly dark brown due to the soil colour and black colour which is the result of chemicals and oils from the industrial area.

Construction of any infrastructure on the wetland means that there will be additional soils, ballasts and compaction. The buildings in the industrial area led to the compaction of the soil thus resulting to a decrease in water percolation

rate. Figure 4 is the permeability analysis conducted by the KIEM project in 2006 to analyze water flow in Gikondo.

Figure 4: Permeability Analysis in Gikondo wetland



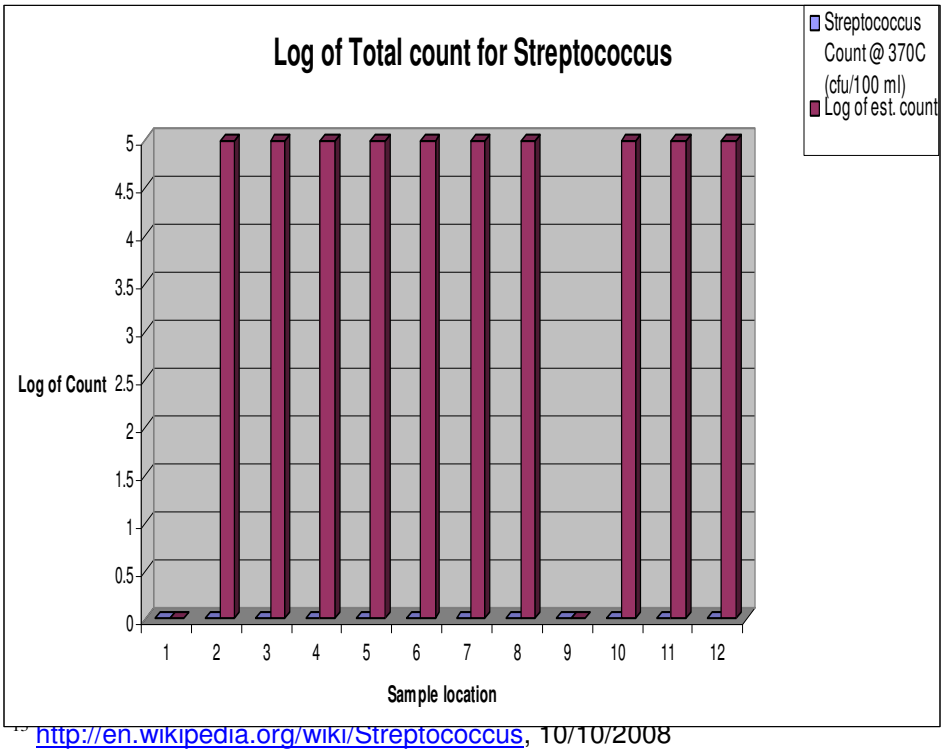
Source: KIEM, 2006

The graph illustrates in situ permeability in Gikondo wetland as one of the components of the ecological analysis. The study was conducted to analyze the impact of infrastructure on water flow, by using the permeability analysis to showcase how infrastructure has impacted negatively to the water percolation rate leading to less water reaching groundwater. The first stage estimates the water permeability rate before the industrial area was built; twenty-five liters of water flowed approximately within two thousand seconds. This data was an estimate taking into account Gikondo wetland as a natural ecosystem. The second stage analyzes the water flow rate during the existence of the industrial area; the time of water percolation has decreased to eight hundred seconds. The final stage is a projection of permeability after the removal of the wetland

however; the permeability rate is still low. This is due to the fact that the infrastructure for instance roads, drainage and pavements are still present leading to the decrease in permeability rate. Clearly, the permeability analysis shows that the water percolation rate has been affected by the presence of the industrial buildings in short leading to reduction in groundwater recharge (Mashiga, 2007). The permeability analysis of Gikondo showed how the industrial buildings and infrastructure have affected the ecosystem's natural function that is groundwater recharge.

The final focus area in terms of ecological analysis of the wetland was the microbial analysis whereby the study looked at the presence of streptococcus. Streptococcus is a genus of spherical gram-positive bacteria that causes diseases like meningitis, bacteria pneumonia, endocarditic and narcotizing fasciitis[13]. The following graph shows the streptococcus count at different sample sites in and around Gikondo wetland.

Figure 5: Streptococcus Analysis of Gikondo wetland



1. Source Kagina
2. Behind UNILAK
3. Source Rugando
4. Entry Industrial Park
5. Exit Industrial Park
6. Beyond Japan One Love
7. Kinamba
8. Kabakene
9. Source Kabakene
10. Exit Gikondo wetland in Gasyata
11. Exit Gatuna road wetland
12. Confluence of Gatuna and Kikondo towards Nyabugogo

[13] http://en.wikipedia.org/wiki/Streptococcus, 10/10/2008

Source: National University of Rwanda, 2006 cited in KIEM, 2006.

The streptococcus analysis of the wetland showed a log count of 5 except for sample locations of Kagina and Kabakene. Water with a streptococcus log count of more than 4 is not fit for drinking even when treated. According to REMA, the study used the log count of five as the highest level. As illustrated in the graph, the count was higher than 5 in some areas showing that the water in Gikondo wetland is unfit for drinking and thus polluted (KIEM, 2006). In addition, the fecal coliform count, which shows the presence of fecal substances in the water, was also analyzed. According to Mashiga, the fecal coliform count of the sample sites showed the same results as the streptococcus analysis. The log count of all the sample sites were above the log count of 5 which means that the water was unfit for drinking, thus polluted. The ecological analysis of Gikondo gave REMA the power to declare the wetland polluted and called for the relocation of the industrial area. Nevertheless, the ecological analysis alone could not hold ground on the relocation of the industrial area in other words a socio-economic analysis had to be conducted. The following section will discuss the relocation process in detail.

5.5 The Relocation Process

The ecological and socio-economic analysis established that Gikondo wetland was polluted. Following the results of the analysis REMA stated that, “It is crucial to immediately halt further construction or development in the wetland” (KIEM, 2006). The evaluation of the wetland was presented by REMA with the help of the Ministry of Lands, Environment, Forestry, Water and Natural Resources (MINITERE) during a cabinet meeting in 2006. The presentation also included pollution prevention strategies, the relocation process and future action plans that will be undertaken after the relocation process has been completed. The pollution

prevention measures include the following factors. First, the City of Kigali (MVK) and the industrial operators are to adopt technologies to prevent further pollution to the wetland. Second, MVK in collaboration with the Ministry of infrastructure (MINIFRA) is to establish a sewage treatment plant. Third, MVK in partnership with MINIFRA, Ministry of Trade and Industry (MINICOM) and the Ministry of Agriculture (MINAGRI) are to develop a management plan to combat all the sources of pollution to the wetland especially in the industrial area and MVK. Finally, to prevent further pollution to Gikondo, MVK in partnership with REMA and MINITERE will come up with a long-term pollution management strategy (KIEM, 2006).

The cabinet meeting declared Gikondo wetland as a unique ecosystem to the country's water resources and a decision was taken to relocate the industrial area away from the wetland. This was the beginning of a battle between the GoR and the industrial owners. The relocation process was a lengthy one; this also included compensation money for the industrial owners and allocating a new industrial base in Kigali City (Mashiga, 2007). As mentioned earlier in the literature review, the conflict between wetland conservation and development is a common phenomenon in many countries whether developed or developing. Gikondo wetland is a classic example of this type of conflict whereby the GoR has chosen wetland conservation over development of the industrial zone. As Hajabakiga notes, "the industrial zone contributes a large proportion of pollution to the wetland while the industries have a less economic contribution to the economy of Rwanda" (Hajabakiga, 2007). Relocation of the industrial area will decrease pollution in Gikondo wetland as well as pave the way for conservation of the ecosystem. The relocation process will affect many stakeholders especially the ones that depend on the industrial base for economic and social benefits and the residents near the wetland. Table 4 shows the main concerns of the stakeholders as observed by Twesigye and Mulisa during their study Gikondo wetland including the observations and issues that have risen up regarding the relocation of Gikondo industrial area (Twesigye and Mulisa, 2006**).**

Table 4: Stakeholders and the concerns of the Relocation process

Actors	Interests/ Assets	Main Concerns	Observations & Issues for debate
Industrialists	Factories (plant & machinery); land	Fear of inadequate compensation or no compensation given past history with MVK; likely loss of business; skepticism about possibility of finding suitable land for relocation of businesses;	MVK carried out previous evictions & made compensations without involving or consulting the affected stakeholders. Existing laws are not clear about compensation. However, a new law on Expropriation and compensation is being drafted, and is expected to stipulate conditions for expropriation & modalities for compensation.
Other commercial entities (garages,)	Small-scale businesses around the valley feel they might loose strategic yet cheap & convenient business locations.	Losing business (premises & market) in the relocation process; inadequate compensation for the property.	MVK carried out previous evictions & made compensations without involving or consulting the affected stakeholders. Existing laws are not clear about compensation. However, a new law on Expropriation and compensation is being drafted, and is expected to stipulate conditions for expropriation & modalities for compensation.
Settled poor communities	Farm lands; houses; employment within the valley; water	Loss of livelihoods – settlers on the valley hillsides are employed within the industries; loss of land rights especially those regarded as "illegal" settlers; proximity to city.	Issue of legal Vs legitimacy;

MVK & districts	Implementation of the City development master plan; local revenue from industrialists;	The land & decentralization laws have granted districts autonomy but Institutional weaknesses at lower levels likely to undermine effective implementation.	Under the new local government laws, responsibilities in land administration & revenue collection are shared. But the law needs to be backed by special institutional arrangements if the current impasse between MVK & districts is to be resolved. New structures for land administration are being developed.
REMA	Promoting environmentally sound & sustainable industrialization.	- Institutional capacity gaps including lack of adequate tools & human resources for regular environmental monitoring & awareness raising. Forging partnerships with sectoral actors.	Need to adopt the approach that encourages dialogue & self-policing mechanisms, as command and control measures are both costly & unsustainable. The challenge is putting in place appropriate incentives for industrial & other actors to actively promote environmentally sound practices.
Ministries (MINALOC, MINITERE, MININFRA, MINICOM,)	Sectoral performance	The restoration process will require a lot of funding –how will this be mobilized? Are sufficient arrangements in place for post-industrial relocation process management?	Sectoral integration approach could be a more cost-effective way to achieve the restoration process; Dialogue needs to enlist active participation of all affected stakeholders. But does the FRSP effectively represent all industrialists?
Donors: UNDP, UNHABITAT, UNEP	Ensuring environmentally sustainable industrialization, as part of progress towards national targets & MDGs.	- insufficient national & local capacity for implementation of environmental laws; - addressing pro-poor options ensuring that the affected poor are not left out in the debate.	There is commitment to support the environmental sustainability goals but the strategy & framework for intervention & monitoring is not yet clear. Need to secure donor commitments to the relocation exercise, particularly in support of the poor.

Source: Twesigye and Mulisa, 2006.

The table above discusses the concerns of different stakeholders who are directly or indirectly affected by the GoR decision to physically relocate Gikondo industrial area in order to rehabilitate the wetland. GoR had to convince the affected stakeholders of the benefits of rehabilitating the ecosystem instead of operating a non-profitable industrial area as mentioned earlier by Hajabakiga when she argued that the industrial area is not contributing economically to the country. Nonetheless, REMA had the backing of the government and a decision was taken to industrial area especially after providing evidence of pollution and degradation in Gikondo (Twesigye and Mulisa, 2006). The section below will discuss the compensation procedures and plans.

5.6 The Compensation Process

The relocation process was the only visible element the GoR agreed upon in the 2006 cabinet meeting whereby the whole industrial area would be physically moved to another location and the wetland rehabilitated. However, this was not an easy process in that the industrial owners were not willing to move their businesses without compensation (Mashiga, 2007). The first stage of the relocation process was to compensate the industrial owners and the residents of the new industrial area.

The GoR entered into a compensation agreement with the industrial owners, while REMA established a relocation plan. REMA also established and set out conditions for the relocation and compensation procedure for instance: the proposed compensation rates of two hundred dollars per square meter (East African Standard) to be verified by MINICOM; approximately 9,000,000 dollars will be paid to all the industrial owners and occupants; MVK will officially inform all the occupants of Gikondo wetland of the relocation process; Ministry of Finance and Economic Planning (MINICOFIN) will establish a fund with the help of REMA and its development partners, the fund will be used to compensate the

industrial owners; MINICOM and MINICOFIN will recover the costs of the alternative site by the sale of operational space to local traders and investors (REMA, 2006).

REMA's relocation plan was used as a guiding tool by GoR while in the negotiations with the industrial owners. The negotiations came to an end in June 2007 when the government struck a deal with the industrial owners and an alternative site was allocated. The alternate site is situated near the free trade zone in Gasabo district (see map of Kigali in introductory chapter). The site was originally a residential area with approximately 556 inhabitants. The GoR held extensive meetings with the residential owners to convince residents to relocate to another area to make way for a new industrial area. The GoR and the residents of the new industrial area agreed upon a compensation of 1.9 billion Rwandese francs (FRW) thus a new alternative site was obtained. The new industrial site is capable of accommodating all the industries from Gikondo wetland. In other words, for the relocation process to be successful, GoR had to financially compensate the industrial owners as well as provide an alternative site for a new industrial base. The compensation process was successful but only after a three-year battle between GoR and industrial owners (The New Times, 5 June 2007). At present, the government is looking at cooperating with different international environmental agencies to help with the rehabilitation of Gikondo wetland (Hajabakiga, 2007). Although the industrial owners have been compensated and a new industrial area obtained, the industries have not yet moved.

5.7 Summary

The chapter discussed the management and conservation of Gikondo wetland. Particular attention is paid to the different stages in determining the extent of pollution in Gikondo. In addition, the chapter also examines the relocation and compensation processes. The study concluded that Gikondo wetland is polluted

and affecting the country's water resources. The main source of pollution in Gikondo was found to be the industrial area built upon the wetland. Rwanda has taken a dramatic step to conserve the country's wetlands by proposing to relocate the industrial area in order to conserve the wetland. However, the actual physical relocation of the industrial has not yet taken place. The management of Gikondo wetland is a unique example of a wetland management strategy. REMA in collaboration with the MINITERE have worked extra hard to conserve Gikondo including banning new development activities on the wetland (Mashiga, 2007). As Hajabakiga points out, Rwanda needed a tough wetland management strategy if the country is to experience a sustainable environment for the present and future generations (Hajabakiga, 2007).

6. CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

Wetlands management is one of the main environmental tools used by many communities to combat wetland degradation and loss. The study examined and discussed the management and conservation of Gikondo wetland which is located in an urban area that is City of Kigali (MVK). The study concentrated on different elements that lead to wetland management including an introduction to the case study. The process of rehabilitating and conserving Gikondo wetland is still in progress therefore there are some factors that have not been fulfilled for example the physical relocation of the industrial area and rehabilitating the wetland. In other words, the case study examined the entire process of managing Gikondo including the wetland policy and institutional structure. This chapter will discuss different recommendations that can be applied in the case study and will provide conclusions. In addition, wetland management practices in developing countries will be explored and how these strategies can be adopted for the Gikondo context. The next section will examine wetland management as an environmental tool particularly in developing countries.

6.2 Wetland Management as an Environmental Tool

Wetland management has not been successful in many developing countries that prefer socio-economic development over wetland conservation. This is due to the fact that communities have little knowledge about the value and benefits wetlands provide. Maltby supports this when he states that; “wetlands are among the world’s most important environmental resources yet remain some of the least understood and most seriously abused assets. Of all global ecosystems, wetlands are posing some of today’s most contentious, difficult and politically sensitive environmental questions” (Maltby, 1990:9).

Another example that has been successful in implementing wetland management is the sustainable wetland management programme in the Illubabor region of Southern Ethiopia. Sustainable wetland management is the balance between biological concerns that favor protection of wetlands and socio-economic and equity needs of community members that prefer conversion of the wetlands. In a nutshell, sustainable wetland management trucks a balance between management and utilization of wetlands. In addition, the programme also describes the factors that affect sustainable wetland management in Illubabor region. They are divided into two categories: first, ecological meaning size of the wetland, land use and size, water flow characteristics, soil type and natural vegetation types. And secondly, socio-economic: degree of food insecurity in the community, market orientation in the community, previous history of wetland utilization, population density surrounding the wetland and degree of community organization for natural resource management.

The above-mentioned factors affect management of wetlands for instance like in the Illubabor region leading to exploitation of natural resources. Sustainable wetland management has proved to conserve wetlands as well as benefit the local community socially and economically (Abbot and Hailu, 2001). Wetland management in many developing countries has been the key to managing and conserving wetlands, thus this has also been applied to Gikondo wetland. Although wetland management can be applied in different ways for instance using Oral knowledge or in other words indigenous knowledge and the Wise Use concept, Gikondo wetland is a unique study whereby wetland management has been in the form of relocating an entire industrial area to make way for the physical rehabilitation of the resource. The above mentioned wetland management strategies (Use of Indigenous knowledge, Wise Use concept and Sustainable wetland management) can also be applied in the future management of Gikondo wetland.

However, the management of Gikondo wetland has been a long process from identifying the sources of pollution to relocating the industries from the wetland and eventually rehabilitating it (wetland) to its natural state. The next section will discuss the gap between wetland degradation to management and conservation.

6.3 Wetland degradation to management (Gikondo wetland)

The policy and institutional framework affecting Gikondo wetland builds the gap between policy and implementation. However, the draft wetland policy is not yet implemented while the other policies that affect the conservation of wetland for example the land and water policies are not fully implemented to work together with the draft policy. In addition, the institutions that are responsible for wetland management are weak and are not well coordinated to work together for the management of Gikondo wetland. This is one of the major hindrances to the rehabilitation of Gikondo. In short, little will be achieved if the wetland policy in Rwanda is not well implemented into action. Lack of coordination has been a bottleneck to the management and conservation of wetlands in Rwanda. This issue extended to management of Gikondo wetland. GoR is advocating for wetland conservation however this is not applicable in reality. Chapter 4 highlights, examines and discusses the policy implications and institutional weaknesses of wetland management in Rwanda. The underlying issue here is not only lack of coordination in institutions to execute the policies but also other factors such as differing interests, capacities and perspectives.

Gikondo wetland was identified as a polluted resource by REMA through the KIEM project, which focused on the cleaner project in the Gikondo industrial area. The KIEM project conducted a study (chapter five) that focused on identifying the main sources of pollution to the wetland. The results revealed extreme pollution in water and soils in the Gikondo valley. The main sources of pollution to Gikondo were found to be the industrial complex for instance the physical infrastructure and drainage pavements, City of Kigali (MVK) was also

found to pollute the wetland through the poor sanitation systems for example pit latrines and finally the residents of the Gikondo hill slopes were also contributing to the pollution. In addition, scientific evidence from the testing of water and soils of Gikondo valley also portrayed that the wetland was polluted by the evidence of substances for example metal and organic pollutants. In other words, the KIEM project gave REMA the power to call for the relocation of the industrial area. MINITERE and the former State Minister of Lands and Environment also supported the relocation process. In short, GoR had the backing of the main environmental ministries and REMA (main environmental institution in Rwanda) (Mashiga, 2007).

This is a huge step for a developing country to take in order to conserve their natural resources. As mentioned earlier, some developing countries struggle to choose between either development or conservation of wetlands. Nonetheless, some developing needs outweigh conservation needs especially whereby there is increase in population with little or no arable land for agriculture or settlement. Settlement in wetland areas is a common phenomenon in some urban areas of developing countries. For instance, the relocation of Yanze residents from the Yanze wetland occurred, Yanze wetland is shared between Nyarugege, Gasabo and City of Kigali (MVK). The residents were a threat to the conservation and management of the wetland thus the move to relocate (New Times, 18 February 2008). This is the same concept that was applied for Gikondo wetland; the only difference is that an industrial area occupied the wetland instead of people.

The relocation process of Gikondo wetland was a lengthy one, whereby negotiations had to take place before the physical relocation of the industries. The negotiations included compensation for the industrial owners and allocation of land where the industries will be relocated. Nevertheless, the relocation process had many stakeholders who were affected by the rehabilitation of Gikondo wetland. The Table 4 shows the different stakeholders and how they were affected by the relocation of the industrial area and rehabilitation of Gikondo

wetland into its natural state. This is a positive step by a developing country whereby the conservation of the environment was chosen other than developing industries that pollute natural resources (Gikondo wetland). The next section will discuss the recommendations and conclusion.

6.4 Recommendations

The following recommendations are for the future management and conservation of Gikondo wetland. The recommendations have been drawn from the official documents for instance the Rwanda wetland draft policy (2003) and the KIEM (Kigali Industrial and Environmental Management) project (2006). Below are the recommendations, namely;

a) GoR in collaboration with the Ministry of Environment (MINITERE) and REMA should draw up a National Wetland Policy which points out the necessary procedures to be applied in the implementation of the policy into action
b) MINITERE and REMA should identify the institutions that are responsible for the management and conservation of wetlands and how these institutions can collaborate with each other and work together especially in managing Gikondo wetland
c) REMA and MINITERE should cooperate in educating the people of Rwanda especially the urban poor about the benefits and values wetlands provide. REMA can cooperate with the Ministry of Education (MINEDUC) in implementing environmental education in the national school curriculum
d) The City of Kigali (MVK) should work together with REMA and MINITERE in managing Gikondo wetland especially after the relocation of the industrial area. This can be in the form of informing the residents of Kigali of the benefits of rehabilitating Gikondo

e) Rwanda being a member of the Ramsar Convention can ask for donations from international environmental agencies for the rehabilitation of Gikondo wetland
f) MVK, REMA and MINITERE should work together to ensure that there is no pollution in the Free Trade Zone where the industrial area is be relocated to
g) REMA and MINITERE should adopt and implement the Cleaner Production project introduced by the KIEM in all the industries in Rwanda to ensure less industrial pollution
h) Although the industrial owners have been compensated, REMA has to ensure that the physical relocation of the industrial area takes place within a specified period of time in order for rehabilitation to take place
i) City Council of Kigali, REMA and the Ministry of Health should cooperate to ensure proper sanitation in the country especially in urban areas
j) REMA and MINITERE should be apply other wetland management strategies in Gikondo wetland after rehabilitation has taken place for example the Wise Use Concept

The recommendations when applied can be useful for the future management of Gikondo wetland further; they can also be applied for the management of other wetland resources in the country. The following section will explore the conclusion.

6.5 Conclusion

The management and conservation of wetlands in Rwanda has only been explored after the 1994 genocide. The new democratic government has pledged to reverse the environmental damage caused by the war. In other words, the GoR has chosen wetland conservation over development of the industrial zone. However, for a developing country with many social and economic problems, the environment has been in the background for many years. The establishment of

REMA, the first of its kind in Rwanda has identified many environmental issues in the country one of them being the degradation of wetlands. The management of Gikondo wetland is one of a kind, whereby an entire industrial area has been relocated to rehabilitate an ecosystem. This has led to many issues for instance relocating the residents of Gikondo hill slopes, compensating the industrial owners and allocating a new industrial complex. Although the management of Gikondo is a positive step to reversing environmental damage in the City of Kigali, the policy and institutional capacity in Rwanda is still very low.

The research report highlights factors that led to the decision to relocation Gikondo industrial area. The research contributes immense information from the academic world (definition of wetland, wetland values, wetland conservation versus development). In addition, the research has examined and discussed in detail GoR decision to relocate the industrial area in need for wetland conservation. This research report not only portrays the lengthy process of wetland management (policy and institutional) but also what the GoR went through to ensure wetland management takes place. With the increasing economic crisis and lack of employment, majority of developing countries have not taken into consideration the importance of natural resources. This case study is a unique wetland management strategy that has been applied in a struggling developing country to ensure rehabilitation, management and conservation of a natural resource.

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