SPATIAL INFORMATION SHARING TO ENHANCE LOCAL BASED MANAGEMENT

an analysis of Institutional and organizational aspect of Lake Naivasha as a Ramsar site

INE FAUZIA

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Spatial information sharing to enhance local based management

an analysis of Institutional aspect of Lake Naivasha as a Ramsar site

by

Ine Fauzia

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Thesis Assessment Board

Chairman	: Prof. Dr. A. van der Veen (ITC)
External examiner	: Dr. M. Skutsch (Twente University)
Internal examiner	: Ir. L.M. van Leeuwen (ITC)
Supervisor	: Prof. Dr. Ir. A. de Gier (ITC)
	Drs. R. Becht (ITC)

INTERNATIONAL INSTITUTE FOR GEO-INFORMATION SCIENCE AND EARTH OBSERVATION
ENSCHEDE, THE NETHERLANDS

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Abstract

Strong institutions and adequate information have crucial position in applying wise use management of wetlands. As urged by Ramsar Convention and its guideline, contracting parties need to assess their capability in managing wetland from institutional aspect.

This study is to review the institutional aspect of wetland management system as part of Ramsar convention implementation contracting parties. Lake Naivasha is chosen as study case due to its status as a Ramsar site with dense human activities.

By using institutional analysis along with stakeholder analysis, the institutional framework of Lake Naivasha management is identified. Overlapping mandate and administrative area of government agencies are hampering the implementation of wise use management. There is no agency acts as coordinating body for all the actives agencies and organizations.

Data sharing is selected as a strategy to overcome the overlapping agencies. Two organizations are selected as study case to identify possibility of sharing data. They have big chance to perform data sharing, and it will needs strong motivation for both of the organizations to share their data. There is a need for further study to get sufficient information in data sharing within the area.

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1. Introduction

1.1. The Ramsar convention and wise use of wetlands

It has been more than 30 years since the wise use of wetlands principle was introduced to the international community by the Ramsar convention in 1971, but the loss of wetlands still continued. Wetlands throughout the world are considered by many to be of little or no economic value, or even at times to be of negative value (Turner et al., 2000). This condition has put wetlands into low priority in the decision making process, suffering from economic pressures and poverty, and disintegrated management (Armitage, 2002; Sitorus, 2002; Turner et al., 2000). The Ramsar Site Database shows the main threats to wetlands. In 1999, 84% of Ramsar-listed wetlands had undergone or were threatened by ecological change. The most widespread threats being drainage for agriculture, settlement, and urbanization, pollution and hunting (Ramsar Convention Secretariat, 2000; UNEP, 2004). It seems that the convention has not effectively change the misconception on wetlands as wastelands.

The Ramsar Conference of the Contracting Parties (COP) always tries to improve the convention and its tools to be more effectively applicable. As adopted in the 9th Conference of the Contracting Parties (2005) of the Ramsar Convention, the wetlands wise use principle is defined as “maintenance of their ecological character, achieved through the implementation of ecosystem approach, within the context of sustainable development”. This definition is the third change of “wise use” definition of the convention. Those changes were asked by contracting parties to the Convention’s Scientific & Technical Review Panel (SRTP) in order to ensure that the definition is in line with the rapid development of terminology in natural resource conservation context (Ramsar Convention Secretariat, 2007b).

The delivery of the conservation and wise use of wetlands, in line with the commitments embodied in the Ramsar convention, entails (Ramsar Convention Secretariat, 2007d):

a) establishing the location and ecological characteristic of wetlands (baseline inventory)

b) assessing the status, trends and threats to wetlands (assessment);

c) monitoring the status and trends, including the identification of reductions in existing threats and the appearance of new threats (monitoring); and

d) taking actions (both *in situ* and *ex situ*) to redress any such changes causing or likely to cause damaging change in ecological character (management).

To monitor the implementation of the wise use of wetlands, contracting parties shall submit a periodic report concerning the status of wetlands, which is included in the Ramsar list. This monitoring and reporting the conservation status of designated Ramsar sites and other wetlands will provide an indication of the success of the Ramsar Convention as an international treaty and its mechanisms to achieving wetland conservation and wise use (Ramsar Convention Secretariat, 2007d).

A convention of contracting parties will be discuss the reports, to find out any wetlands

degradation or success story in managing wetlands, and pull some lesson learn for assisting the parties to improve their performance.

The convention secretariat issued a series of Ramsar handbooks for the wise use of wetlands to assist those who involved, directly or indirectly, the implementation of the convention. The handbooks are grouped into three big themes, which what they called convention pillars: 1) Wise Use, 2) Ramsar sites designation and management, and 3) International cooperation.

The toolkit is set, but how it could help the convention to reach its goals depends on the implementation at national level of the contracting parties. As a soft-law, the Ramsar convention can not force the contracting parties to implement the guidelines.

1.2. Lake Naivasha Ecosystem – a Ramsar site and local management

Lake Naivasha is one of the most featured examples in East Africa designated as Ramsar site. It was designated as Ramsar site in 1995. Since then many international agencies concerned with environment are active in the area around it. The purpose is the conservation of the surrounding environment and the lake itself.

As an ecosystem, the lake composed of biophysical and socio-economic elements where they interact and interlinked with each other. The lake is a source of fresh water in the region and has no outlet. It gets its supply of fresh water from monsoon and perennial rivers as well as by ground water recharging. Papyrus (*Cyperus papyrus)* forms the dominant vegetation in the lake shore. The lake provides a safe haven, foraging, and breeding ground for resident and migrant bird species, as well as other wildlife such as the Hippo (*Hippopotamus amphibious)*, Waterbuck (*Kobus defassa)* and Buffalo (*Syncerus caffer)*. Over 400 avian species found within the area *(Koyo, 2005).*

In the socio-economic part, the lake is dense with human activities. The Ramsar report for Lake Naivasha (Kenya Wildlife Service, 2005) stated a number of economic activities within and around the lake, which includes: tourism, urban development, agriculture, irrigation, commercial and subsistence fishing, sewage treatment/disposal, and harbour. Those activities are affecting not only to the economic development and social condition of the area, but also gave impact to the lake environment characters, such as land use change, decreasing papyrus swamps, and the increase of fresh water utilization.

One of the economic activities around the lake is organized commercial farming especially floriculture, which has been growing since 1980, and nowadays has become a major export industry in the area. The farms around the lake are doing commercial production of flowers and vegetables on a large scale which requires large scale use of the natural resources of the area. Farms use lake water as a prime source of irrigation. Boreholes are also used in some farms as a source of irrigation especially in the farms located on the off-lake side.

Floriculture has been growing since 1980, and nowadays is major industry in the area. As a high labour-intensive industry, floriculture gives employment opportunities and attracts people to the area. The human population of the town of Naivasha has increased very much after the horticulture industry came into the area, i.e., from 7000 in 1969 to 115,500 in 1989, 175,500 in 2002, and a predicted number of some 214,500 inhabitants in 2008 (Enniskillen, 2004; Rural Planning Department, 2002).

Local community groups are also active in the area. The spatial scales of their interest area can vary, but are mostly concentrated around the lake. One group can be mentioned as the most

active local organization, initiated by land owners around the lake, namely the Lake Naivasha Riparian Association. It has composed a management plan in 1995 for the lake, in order to maintain the balance between wildlife, its ecosystem, and economic activities in the area. The plan is important to keep in view the commercial use of natural resources of this ecosystem on a large scale and their monetary value as an economic good.

Based on the management plan, in 1996 the Lake Naivasha Management Committee (LNMC) was formed to implement the plan as a result of Naivasha's stakeholders meeting. The committee was delegated the mandate to implement the Management Plan of Lake Naivasha. The Committee consists of representatives of government, national and international non-government stakeholder organization, wetlands direct user groups, and representative of the local community.

In 2004, the LNMC was formally gazetted by the Minister for the Environment and Natural Resources, bestowing the LNMC the official mandate for managing the lake environment (IUCN/LNRA, 2005). The committee became an ideal picture about collaborative management between both government and non-government organizations, operating on local as well as international level. But the effort stopped due to court a challenge to the Lake Naivasha Management Plan by one party who did not feel represented by the committee and was not included in planning of Management Plan.

As a representative of the government, there are some agencies active in the area with their specific roles/objectives such as the Kenya Wildlife Service a government parastatal body to manage wildlife and natural parks, the Forestry Department under the Ministry of Environment and Natural Resources, the Fisheries Department under the Ministry of Livestock and Fisheries, and the Naivasha Municipal Council as the local administrative authority. These organisations are working in the area according to their departmental guidelines to achieve their organisational objectives. The guidelines and policies determine their role in economic, social, and environmental development of the area. This includes the determination of their responsibilities and authority which may or may not be overlapping with each other. These could also be overlapping with the interest of the other mentioned organisations.

1.3. Problem statement

To realize the wise use management as required by the convention, reliable information on wetlands related aspects is needed. But lessons learned from wetlands management practices of contracting parties show a different capability of each country in implementing the convention, especially their readiness to institutionalize the convention into national practice on wise use (Ramsar Convention Secretariat, 2007b). This process covering the system of rules, decision making processes, and programmes give rise to social practices, assign roles to the participants in this practice, and guide interactions among the occupants of the relevant roles (Nass, Bang, Eriksen, & Vevatne, 2005)

The facts that Lake Naivasha has various environmental functions made it fall into different sectoral authorities, as well as the socio-cultural and economic function for adjacent community. This condition leads to overlapping authorities between sectoral governmental agencies where there is no body to coordinate the activities among the different agencies, each having different interest and priorities. Due to this condition, wetlands information is also scattered.

It is understood that the lack of coordination and data sharing between governmental agencies has hampered the wetlands management where it needs a comprehensive management

approach.

1.4. Research objectives

The general objective of this research is to review the institutional aspect of Lake Naivasha management system as part of Ramsar convention implementation by the Kenya Government.

The general objective is divided into specific objectives:

- To review and assess the existing institutional and organizational setup which is related to the management and conservation of wetland
- To identify key problems in information sharing among the organizations and other stakeholders, and ways to improve it, especially the role of spatial information based systems

1.5. Research questions

To achieve the objectives, the following research question will be addressed:

1. To review and assess the existing institution and organizational setup which is related to management of wetland
    a. Who are the stakeholders of wetlands? Which are the active organizations of this area?
    b. What is the organizational setup related to wetlands?
    c. How the interests of different stakeholder are represented in institutional setup of wetland management?
2. What are the key problems in information sharing among the organizations and other stakeholders and ways to improve it, especially the role of spatial information based systems
    a. What is the required information for major organization actives in the area
    b. How is the information flow between these organizations?
    c. To what extent does the existing information flow support information sharing between stakeholders?
    d. How a spatial data could improve information sharing for wetland management?

1.6. Thesis structure

The thesis will divide into three parts. Part one is background information, contains:

- Chapter 1. Introduction, presents the objectives and research questions;
- Chapter 2. Theoretical framework, focused on the concept of wetlands management under Ramsar framework; and
- Chapter 3. Methodology, presents the characteristic of the study area and the methods used in the research.

Part two is the review of institutional and organizational framework of Lake Naivasha

management, contains Chapter 4 containing institutional framework of Lake Naivasha conservation and options in enhancing Lake Naivasha conservation, relation and information flows between organization and stakeholder.

Part three is the analysis of data sharing possibility to enhance the effectiveness of conserving ecological characters and developing socio-economic existence, including the needs of spatial information and its role in managing Lake Naivasha.

The thesis will be closed by conclusion, and recommendation.

2. Theoretical Framework

2.1. General aspect of institutional analysis in wetlands wise use

There are two principal meaning of institution. In management and organization theory, an institution refers to a role or organization (Goldsmith, 1992). In economics and sociology, an institution is a set of conventions, policies or legislation which regulate social behaviour, in detail it covers decision making process and programs give rise to social practise, assign roles to the participant in this practice, and guide interactions among the occupant of the relevant roles (Goldsmith, 1992; Matsaert, 2002; Nass, Bang, Eriksen, & Vevatne, 2005). This research has tried combining both background theories, by including the institution as rule to explain existing situation and the institution as a role to enhance the existing situation.

To summarize, the institution consist of legislation/rules as a basis to act and react; an object of the rules; a mandate which is designated to a person or organization to implement the rules; and a boundary up to where the rules should be applied (Dodman & Koopmanschap, 2005; Eakin, 2005; Quinn, Huby, Kiwasila, & Lovett, 2006; Turner et al., 2000). Institutional analysis is used to identify the relation between these aspects, to analyse the effectiveness of current institutions in achieving its objectives; and to overcome problems and to fulfil requirements from the changes of its environment (Nass, Bang, Eriksen, & Vevatne, 2005; Tai, 2007).

Wetlands are realized as multi-resources ecosystem, where multi-actors involved in natural resources utilization and management in different level of intensity. As a common pool resource, most of world's wetlands suffer from overuse and destruction. National government agencies are frequently unsuccessful in their efforts to design effective and uniform sets of rules to regulate important common-pool resources across a broad domain (Varughese & Ostorm, 2001).

2.2. Institutions as indirect drivers change

The Ramsar Handbook 1 state that national wetlands policies, laws, and institution are "indirect drivers change" of the ecosystem services. For this reason, as asserted on the convention statute, the Ramsar contracting parties have an obligation to conduct law and institutional review to ensure that these are in line with the wetlands wise use obligation. Why is the review is important to the wise use implementation?

Specifically, the purpose of this review is to identify institutional measures, as well as legal measures, which constrain wetlands conservation and wise use and to support the development of positive legal and institutional measures for wetland conservation and wise use (Ramsar Convention Secretariat, 2007c). The constraint could include:

1) conflicting sectoral policies, laws, taxes, and institutional priorities
2) weak or incomplete laws applicable to wetlands
3) land tenure an resource use regimes which undermine wise use
4) poor design or operation of wetland administrative authorities

5) jurisdictional constraints on ecosystem management of river basins and coastal areas

6) absence of effective monitoring procedures, enforcement and remedies, and

7) lack of provisions for compensation for lost wetland habitats or functions

(Ramsar Convention Secretariat, 2007c)

At least an institutional construction for natural resources management should feature an overview of current international regime, principles and tools in international law which could shape regional and national frameworks. The structure of a national framework should have the ability to consider complex scientific issues in legal context, tools and factors of national legal measures and procedure to prevent or minimize environmental degradation, and the mechanisms for compliance, accountability and responsibility in environmental management (Hannam, 2003).

As the first priority, the recommendation shows the legal and institutional measures which contribute to the loss of wetlands, recommend the removal or take an action to reduce the negative impact of the legal and institutional measures. The second priority of recommendation considers the enhancement of legal and institutional measures effectiveness. The last priority regards the identification and prioritizing areas where new legislative or economic instrument should be developed.

Ostorm (2001) argued about the effectiveness of rule changes will lead to improvement. Even though the statement was regarded to the appropriator in the common pool resources, in my opinion the statement still can be related to the whole actors of the wetlands. It is true the changes will not give any effect if it not accompanied by the changes of institutional surrounding.

The consensus will rise between the actors and the authority towards the new rules and develop new institution, if the actors show attributes below:

1) Salience: the actors are dependent on the resource system for a major portion of their livelihood or the important activity

2) Common understanding: actors have a shared mage of how the resource system operates and how their actions affect each other and the resource system

3) Low discount rate: actors use a sufficiently low discount rate in relation to future benefits to be achieved from the resource

4) Trust and reciprocity: actors trust one another to keep promises and relate to one another with reciprocity

(Varughese & Ostorm, 2001)

Some wetlands management is counted to be successful after involving the other actors in to different level of wetlands management, planning, monitoring, and evaluation. Involvement of local actors in resources management is known as participatory management.

This management approach did not overlook the prior user of wetland, but it tried to include the other actors interest into wetland management planning, utilize the local knowledge supported by available science in wetland management planning implementation, and involved the other actors in join monitoring. Since the indigenous people may have been the sole managers of wetlands for many centuries, The Ramsar guidelines prefers to use the “acknowledging and strengthening” their management role than “involvement” per se (Ramsar Convention Secretariat, 2007b).

The joint management is not limited to the wetland site. Sometimes it is needed to broaden the planning and management into broader area and context, regarding the interconnected environmental services and functions as an ecosystem (Millennium Ecosystem Assessment, 2005). It is important to ensure that the planned site takes into account the external natural and human-induced factors and their influence on the site itself; also to ensure that the management objectives for a site are taken into account in the wider planning process (Ramsar Convention Secretariat, 2007a). Integrated water resources management (IWRM) is one example of the elaborated management in ensuring the wetland wise use implementation, involving different governmental agency and organization and other stake holders.

2.3. Organization culture for wetlands wise use

Most of the Ramsar wetland site are under governmental organization management, which have different working cultures, depending on the governmental system. Culture relates to the value and norms in the organization, which are reflected in organization or individual behavior. Regarded as a process, culture is a learned response, shared by members of a group; passed to new members and/or organization (de Man, 2007; Man, 2002).

A government organization (GO) operating under centralized governmental system tends to be more passive than an organization working under an autonomous system. The GO under centralized governmental system has a high bureaucratic setup, affected by hierarchical authority. The organization under this system tends to be less initiative, has limitation in broadening alternative to implement the plan since decision making authorities are under central government.

GOs under an autonomous system or decentralization system have different working cultures. The GO under this system tends to be more creative, because the system forces the organization to take their own decisions. Characteristic of the system is to distribute decision making closer to the point of action.

The cultural elements can be used to indicate the success of wetland management, e.g.: power distance/bureaucratic system, lack of creative and innovative staff, and lack of information flows, including the openness of the organization towards new inventions and trends. The openness factor affects the organization ability in facing changes, both inner and outer. The subject brings out the concept of organizational learning, which can be used to understand how and organization adapts to its environment. There are four elements in the concept of organizational learning, which are (Hendriks, 2000):

- an organization may learn about its product or services (output)
- the organization may learn about the transformation task and process involved in producing these (the transformation of the input)
- the organization may learn about the state of the organizational system, organizational workforce, characteristics of the workforce, etc
- the organization may learn about the environment of the system

2.4. Co-management and information sharing for wetlands wise use

Co-management can be considered as response to sectoral policy and overlapping authorities. Wetland practices management has been giving evidence, that participatory management or join

management could increase the effectiveness of conservation effort.

Since wetland management involves various stakeholders at different levels, the type of joint-management needs to consider a collaborative development and sharing of a geographic database to support the planning and management by standardized information and data, reducing redundancy and duplication, maintaining quality control. On the other hand the information can be used as basis source for Ramsar requirements as mentioned above.

Known data sharing varies from manual exchange of digital data and access privilege policies, to fully shared distribution data and information (Nedovic-Budic & Pinto, 1999). The benefits of data sharing are reduction in cost; promulgate savings, improved data quality, and highest returns on investment. Beside benefits, developed sharing data system encountered obstacle and facilitator, which are (Campbell & Masser, 1995; Nedovic-Budic & Pinto, 1999):

1) variations in priorities between participants
2) difference in the ability to exploit information system facilities
3) differences in the level of awareness and spatial data handling skills, and
4) agreements over access to information, leadership, data standards, equipment, and training

Furthermore some obstacles on both institutional and technical aspect are added. These are: lacking common data definition, formats, and models; differences in data quality; and networking costs; institutional disincentive; historical and ideological barriers; power disparities; different risk perceptions, technical complexity; political and institutional culture; etc (Nedovic-Budic & Pinto, 1999).

Nedovic-Budic and Pinto's (1999) explain the coordinated information system development and database sharing in a construction which include context, motivation coordination mechanism (structure, process, and policies), and outcomes.

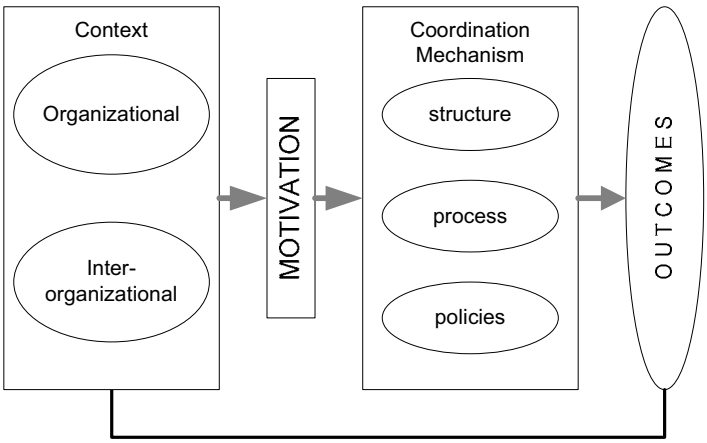

Figure 2.1 Data sharing and coordinated information system development

The framework relates several important concepts:

- to understand the multi-participant information system context have to do with the intensity

and quality of interorganizational relationships, interorganizational interdependence, resources, structure, stability, culture, politics, and leadership.

- motivation for interorganizational information system activities ranges from economic and socio-political to technical arguments.
- Coordination mechanism are manifested through established interorganizational structures, process, and policies
- The outcome of interorganizational information system activities can be assessed using a number of criteria including: efficiency, effectiveness, decision-making impact, societal equity, and public service.

2.5. Ramsar information requirements

The general aspect of Ramsar convention implementation by contracting party is discussed slightly in the introduction part. It comprise of baseline inventory, assessment, monitoring, and management of wetland.

Wetland baseline inventory provides information on ecological characteristic of the wetlands, which cover the physical and ecological features and the socio-culture-economic value of wetlands. The information will become base information in monitoring and managing the wetlands. In this stage, the contracting party define the wetlands boundary and baseline condition of the ecological characteristic for monitoring purpose on suitable scales (Ramsar Convention Secretariat, 2007d, , 2007g).

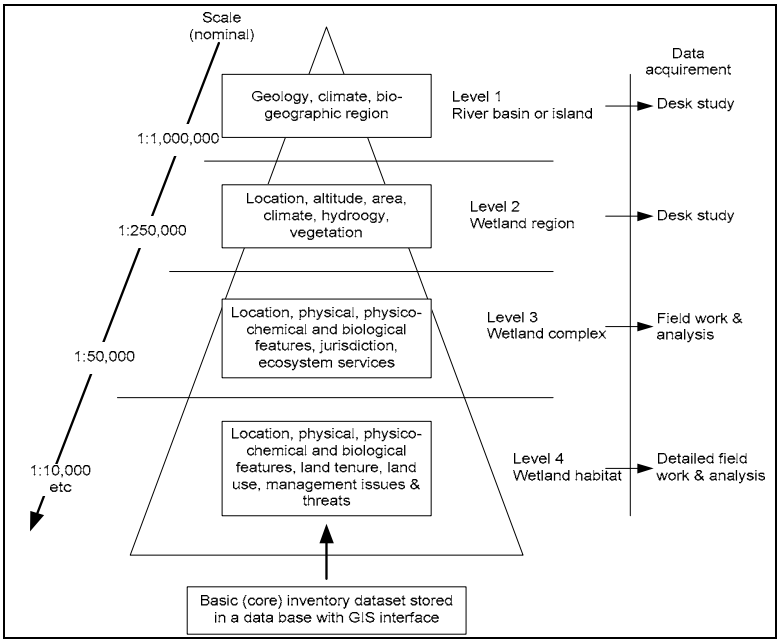

Figure 2.2 Hierarchical approach to wetland inventory and data acquirement (Ramsar Convention Secretariat, 2007g)

The collected data should be stored in chosen method. As a general rule, the chosen inventory methods should ensure that the required data can be obtained within the limitation imposed by the terrain, resources, and time period available (Ramsar Convention Secretariat, 2007g). Ramsar guidance encourages the use of geographic information system for managing spatial data, with awareness that low-cost GIS platforms are increasingly available and widely-used (Lowry, 2006; Ramsar Convention Secretariat, 2007g).

Further, the contracting party needs to do wetland assessment from risk and pressure. On this matter the convention guidance encourage the use of environmental impact assessment for any project or development plan within and surround wetland area. The study covering interrelated socio-economic, cultural, and human health impact both beneficial and adverse (Ramsar Convention Secretariat, 2007f).

2.6. Reporting obligation

Stated on the convention, every party should report any changing of ecological characteristic. The report is to be discussed in the coming conference of the parties from the reporting year. This document becomes indication of success and failure of wetlands management, not only for the contracting party, but also for the Ramsar convention as an international treaty and its mechanism for achieving wetland conservation and wise use (Ramsar Convention Secretariat, 2007d). These ecological characteristic changes are included in the following box:

Box 2.1 Wetlands ecological characteristic

Processes are changes or reactions which occur naturally within wetland ecosystems. They may be physical, chemical or biological.

Functions are activities or actions which occur naturally in wetlands as a product of the interactions between the ecosystem structure and processes.

Functions include flood water control; nutrient, sediment and contaminant retention; food web support; shoreline stabilization and erosion controls; storm protection; and stabilization of local climatic conditions, particularly rainfall and temperature.

Values are the perceived benefits to society, either direct or indirect, that result from wetland functions. These values include human welfare, environmental quality and wildlife support.

Products generated by wetlands include: wildlife resources; fisheries; forest resources; forage resources; agricultural resources; and water supply. These products are generated by the interactions between the biological, chemical and physical components of a wetland.

Attributes of a wetland include biological diversity and unique cultural and heritage features. These attributes may lead to certain uses or the derivation of particular products, but they may also have intrinsic, unquantifiable importance.

(Ramsar Contracting Parties, 1996)

3. Methodology

3.1. Study area

Lake Naivasha has been chosen for study area due to its status as a Ramsar site, internationally important wetlands based on Ramsar Convention criteria. The lake falls into four of eight criteria to be considered internationally important wetland, which are ("Ramsar", 1971, with 1982 and 1987 amendment):

- contains a representative, rare or unique example of a natural or near natural wetland type
- supports vulnerable, endangered or critically endangered species or threatened ecological communities
- supports populations of plants and/or animal species important for maintaining the biological diversity of a particular biogeography region
- supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse condition

The second reason is because the lake supports various human activities happening around it as well as in its catchments area directly or indirectly. It acts as a common pool for community surrounds, and has important position in supporting national economy.

The third reason is because the lake falls under the jurisdiction of various government agencies. Currently there is no nodal agency to coordinate the activities among different agencies and scattered wetlands information.

Those conditions made the area suitable as a study case in spatial information sharing study to support wise use management as urged by Ramsar Convention.

3.1.1. Bio-physical characteristics

Lake Naivasha basin is covering 30,000 ha approximately. It lies on the floor of the Reef Valley, 80 km Northwest of Nairobi with geographical coordinates longitudes $36^0$22'E and latitude $0^0$46'S, with elevation is 1890 above sea level (asl) (Koyo, 2005).

The lake is surrounded by extinct or dormant volcanoes. Its water is supplied from Malewa and Gilgil rivers that flow from the Aberdare Mountains in central Kenya. The Lake has no surface outlet. The combination of underground outflow and sedimentation of salts keeps the lake fresh (Koyo, 2005).

The area is fringed by Acacia woodlands, with papyrus (*Cyperus papyrus*) fringed in the shore, with variable areas of submerged macrophytes such as *Potamogeton* sp., and Water Hyacinth (*Eichhornia crassipes*). The lake supports a diverse waterbird community, with more than 80 waterfowl species regularly recorded during censuses, with 400 avian species in total (Koyo, 2005).

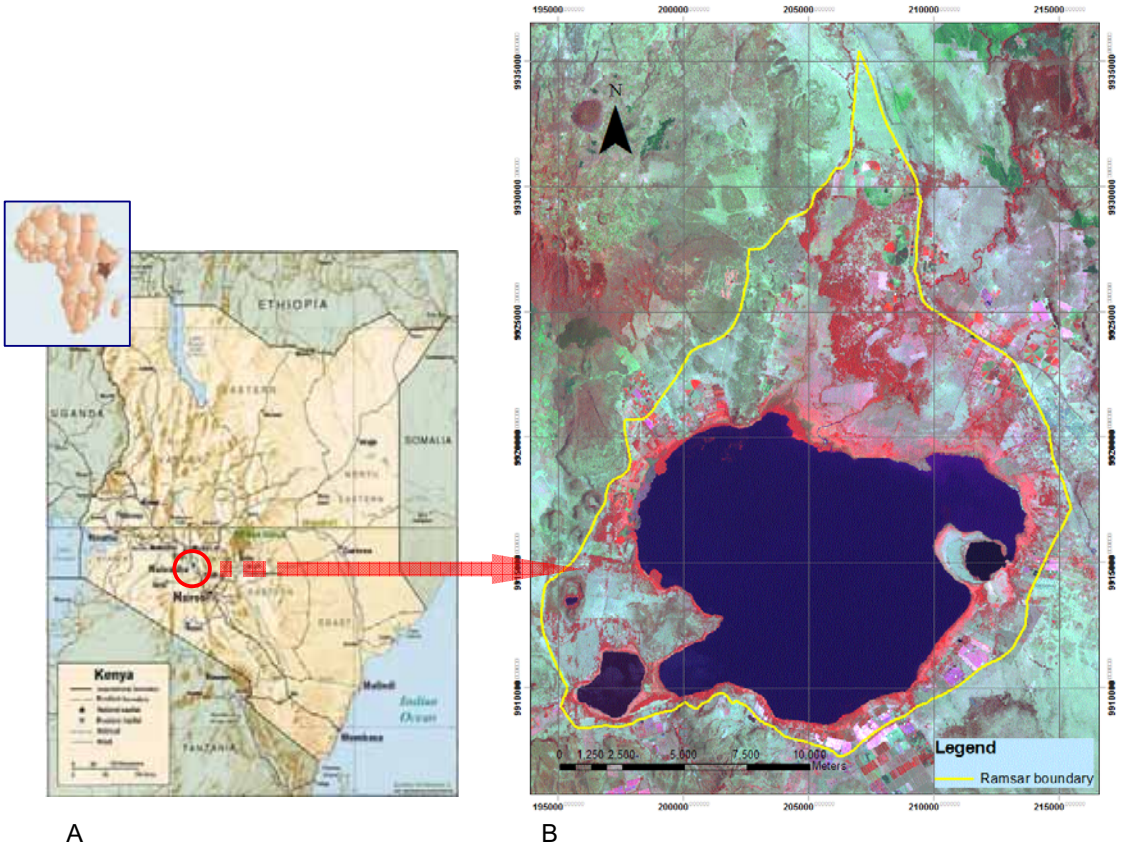

Figure 3.1 Kenya map and Ramsar boundary of Lake Naivasha, Kenya (source: African Studies Center, 2002; Economic Commission for Africa, 1998; modified from ITC data base)

3.1.2. Social and culture value

The lake falls in Naivasha Municipality administrative area, Rift Valley Province. The lake has high socio-culture value, not only for the local community but also for national importance. Summarized from Lake Naivasha Ramsar Information Sheet (2005), the lake has following social and culture value:

Its biodiversity make the lake popular for eco-tourism. There are tourist class hotels, campsite, and wildlife sanctuaries, boating facilities, sport fishing, and bird watching.

The other economic activities are horticulture production which supports 75% of Kenya's production on cut flower export; beef and dairy production; and fisheries with annual production is 150 tonnes.

Nomadic Maasai pastoralist uses the lake for watering their livestock, when they are in the area enroute to the alternate pasture regions. Private residences are found around the lake, also community residential areas such as the KenGen housing estate and Karasani trading centre, as well as employee residential areas constructed by the agriculture farms.

The lake is supplying fresh water for thousand peoples who live around the lake, for domestic purposes, as well as irrigation for surrounding farms. On the other hand, the municipal use the lake to discharge their sewerage. The Kenya Power Generating Company (KenGen) operates a geothermal power plant to the south of the lake and utilizes the lake's water. The plant

contributes 45 MW to the national grid.

3.2. Research methods

The research was conducted in three phase.

3.2.1. Fieldwork Preparation

In this phase, information was gathered about Ramsar convention, the implementation of the convention at national level, particularly in Kenya, background information on Lake Naivasha, its management and conservation effort. The information was gathered from journal article, previous ITC students' research, and other relevant reports. All this information depicted the institutional setting and key issues related to Lake Naivasha management.
Based on collected information, a preliminary list of stakeholders was made and a questionnaire was prepared. Stakeholders are selected based on their interest and their importance to wetland management.

3.2.2. Data Collection

Exploratory Rapid Appraisal

Exploratory Rapid Appraisal (ERA) provides a broad brush approach to learn about a place or investigating a general topic for the first time, done by open discussion and dialogue on the term of interests and short excursion to the field (Messerschmidt, 1995).

ERA was held in the first week of field work to obtain a general picture of the area concerning the main stakeholder, natural resources and livelihood types. It involved group excursion of ITC faculty, local supporting staff and ITC fellow students from multidisciplinary background.

ERA was conducted through short excursion to lower catchment and upper catchment of Lake Naivasha. At the lower catchment, the group visited large and small farmers around the lake, game parks owned by individual and government agency, and organizations active in the area. At the upper catchment, the group visited a community that self-dependent for their daily needs; national parks; and streams where Lake Naivasha gets its water source.

The result of this appraisal is used by individual to decide further exploration to get the detailed information about specific issues.

Interview

The interviews were conducted using a semi informal method called Topic-focused Interview. It was using interview checklist specifying issues and topic as interview guideline. Interviews were conducted with the representatives of the main stakeholders. The respondent was selected on the basis of their involvement and experience (Groenendijk, 2003). It refers to their perspective on:

- Their part in the management of Lake Naivasha
- Lake Naivasha management planning and policy, and its impact to socio-economic activity surround the lake
- Interaction with stakeholder
- Existing and potential conflict between stakeholder

This approach has advantages of great flexibility in asking questions and probing; responsive to new data presented by a respondent which could be crosschecked with prior knowledge of

interviewer; interview guide ensures all required information will be collected; topic can be fully explored; and allows interviewer to obtain personal reactions and observe inconsistencies of data that may be needed to clarify (Groenendijk, 2003).

To get a better understanding of any response from the respondents, the interviews were being recorded by electronic voice recorder, with their prior consent. Out of 24 interviewees in total, there was only one respondent who refused to be recorded. The recording made it possible to recheck the interviews.

Related document collection

Related documents such as government policies, laws, and project reports were being collected from research centre, related governmental agencies, and other organization offices.

3.2.3. Data Analysis

Analysis identify and review the institutional setup of the Lake Naivasha conservation as a Ramsar site and the possibilities about information sharing between government organizations and other stakeholders to enhance the performance of current management of the lake.

Institutional analysis is performed to identify direct and indirect law and policies of Lake Naivasha conservation, overlapping authority and mandate of related organization and governmental agency, and their information needs to perform their activities (Rudd, 2003). The analysis emphasizes the problems on interorganizational relations due to different priorities, working culture, and spatial levels. The analysis results are spatially visualized through maps generated using geographic information system and remote sensing technologies.

Stakeholder analysis is performed to identify stakeholder based on their interest with the lake, the effect of their activities on the lake, and how their interests are being facilitated in current institution framework of Lake Naivasha management. This approach is used to assess pattern interaction between the stakeholders, and its result is used as an element to strengthening information flows in Lake Naivasha management (Rudd, 2003). The analysis was conducted by identifying and listing stakeholder, updated from the preliminary list of stakeholder; and assessing stakeholders' attributes through stakeholders classification matrix and its interpretation (Groenendijk, 2003).

The analysis emphasizes the potential problem in data sharing due to different priority, working culture, and spatial levels. Further, the role of spatial information based system is analysed to solve the problems upcoming in data sharing because of neglecting the spatial dimensions of information.

SWOT analysis is conducted to identify strong and weak points of the two organizations as internal aspect in supporting/conducting data sharing; and opportunities and threats which come from their environment (Man, 2002).

SWOT analysis creates consensus among stakeholders in reaching strategic priorities for using major strengths and opportunities to tackle major weaknesses and threats. It contributes to ownership of and commitment to the process of strategy formulation and further action planning. Basically the analysis following these steps: external and internal analysis, followed by generating alternative strategic, and formulation of strategic choice (Groenendijk, 2003).

- External analysis takes into account the actual situation as well as possible trends and development and its effect to the organization performance.

- Internal analysis, takes into account the strength and weaknesses of the organization that critically determine its performance
- Alternative strategies combining the strengths, weaknesses, opportunities, and threats in order to gain numbers of alternative strategies that may form the basis for further strategy formulation
- Formulation of strategic choice

4. Result

4.1. Lake Naivasha designation

Kenya ratified the Ramsar convention in 1990. As one of the Ramsar convention contracting parties, Kenya has an obligation to designate at least one of its wetlands for inclusion in a list of wetlands of International Importance and to formulate and implement a planning of wise use of wetlands in their territory.

Wetlands in Kenya cover between 2% and 3% of the country's surface area (EAWLS, 2007). Those wetlands have number of roles in the socio-economic of the country, provide many of ecological services, and have high bio-diversity. Aware on those benefit, up to 2005, the government of Kenya had designated five of its wetlands to be included into the list, which are Lake Nakuru, Lake Naivasha, Lake Bogoria, Lake Baringo, and Lake Elmenteita (The Ramsar Convention Secretariat, 2000).

Common problems faced by these areas are: natural resources degradation, social problems, overlapping authority, and fragmented management (Becht, Odada, & Higgins, 2006; EAWLS, 2007).

Lake Naivasha was designated a Ramsar site in 1995, the second wetland that was designated by Kenya government into the Ramsar list. The interesting part of this designation is the process of the designation, where the initiative of proposing the wetlands into the Ramsar list was came from a community based organization, Lake Naivasha Riparian Association (LNRA).

Since 1926, LNRA was formed by land owner around the lake. The Association had an agreement with the Kenyan Colonial Government in 1932. The agreement, known as Foreshore Rights, determined the right to use and cultivate riparian area below 1906's water level (1,892.8m asl) and prohibit any development of permanent building on it. After Kenya gained its independence in 1963, the new government formalize the agreement by act in 1963. The agreement became the basis for Lake Naivasha further preservation activity (Becht, Odada, & Higgins, 2006; The Ramsar Convention Secretariat, 2000).

The idea of lake Naivasha designation as a Ramsar site was motivated by the awareness of the decreasing condition of the lake, caused by high economic activities surround the lake, especially by the association members it self. Illegal permanent building was built by lands occupants in the riparian zone which is forbidden, but the landowners bribe the authorities to free them from the charge. To be designated as a Ramsar site means the Lake Naivasha problems will be presented before an international audience. The association expected that the designation of Lake Naivasha as Ramsar site would put sufficient pressure to overcome local corruption (IUCN/LNRA, 2005).

To disseminate the idea to others stakeholders of the lake, LNRA started an awareness-creation campaign, with technical support from IUCN, National Museum of Kenya (NMK), and the Kenya Wildlife Service (KWS). In 1995, the general meeting of LNRA agreed to propose the lake as a Ramsar site and it was able to persuade Kenyan Government to propose it at international level. In the same year, the lake was listed as a site of International Importance.

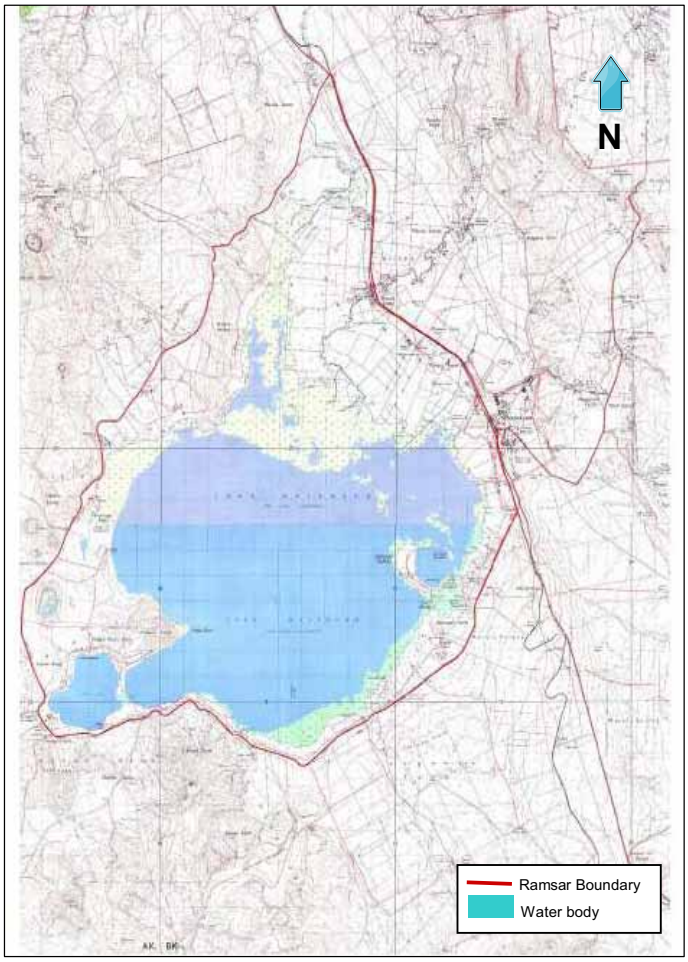

Figure 4.1 Ramsar boundary of Lake Naivasha (Koyo, 2005)

The Ramsar site of Lake Naivasha is covering 30,000 ha. The boundary mostly defined by transport network surrounding the lake. The site is the area inside the Moi North lake Road, the Moi South lake road and the railway between these, excluding any high density urban areas or industrial areas of Naivasha town (IUCN/LNRA, 2005; Koyo, 2005). The boundary is shown in Figure 4.1 as red line rounding the lake.

In line with the Ramsar convention requirement, that every Ramsar site should have a management plan, prior in 1993 LNRA started to arrange a management plan of the Lake, by hiring a private consultant to collect information on the lake. The information covered water quality and quantity status, wildlife and its habitat, economic activities, and fisheries. The consultation was funded by LNRA's members who were called for donation. Some of the collected funds were saved for future lake management committee activities.

In 1996, the Lake Naivasha Management Committee (LNMC) was formed and delegated the mandate to implement the Lake Naivasha Management Plan (LNMP), on behalf of Kenya Wildlife Service (KWS), the legal body responsible for wildlife conservation and management in

Kenya (Enniskillen, 2004; Koyo, 2005). The committee consists of government, national and international non-government stakeholder organization, wetlands direct user groups, and local community representatives, including the LNRA and the KWS it self. This co-management system has made Lake Naivasha a famous example for integrated water management.

The LNMC presently has no official status nor legal power although the process of gazetment under the Environmental Management and Coordination Act (EMCA) is well advanced, but it can influence policy decisions and measures to a certain extent (Becht, Odada, & Higgins, 2006). Each member has opportunity to influence the decision making. Overall, the most powerful stakeholder leads the policy.

At this moment the LNMC is not working due to court challenge to the Lake Naivasha Management Plan in 2004. Kenyan law allows people or parties who are not satisfied with any Government gazetment to make a challenge before the court within two months from the gazetment date. If in two month no one takes the matter to court, it is considered as agreed by everyone. Since the court challenges, there is no coordinating body to manage Lake Naivasha.

4.2. Kenya wetland conservation policy and law

The Government of Kenya (GoK) does not have a national policy on wetlands management. The attempt to formulate the policy was started in 1997 and has produced a wetlands policy draft in 2005. Now the draft is still waiting to be legitimated by the Kenya Parliament

The draft shows the GoK's standpoint about wetlands both ecological and socio-economical value. To manage and conserve the wetlands, the draft carries the wise use and precautionary principles, together with collaborative and participatory approach, and taking into account the global dimension of environmental impacts of actions and policies (MoE, 2005).

Currently, the GoK use national environment action plan (NEAP, 1994) and Environmental Management and Coordination Act (EMCA, 1999) as umbrella for wetlands management and conservation. Influenced by international movement on sustainable development, NEAP stresses the need of sustainable utilization of natural resources and environment. The EMCA seems to be overlapping with the other environment-related acts; it happens due to its nature as the umbrella of environment and natural resources management. EMCA use general terms on natural resources while the others regulate specific natural resources.

In order to achieve wetland use management, some institutional problems needs to be solved:

- Unsupported land tenure system

Land Title Act states that any land without land title falls to government's custody. On the other hand, the Government could put the unhosted land on the market. Currently, Naivasha is the only Kenyan Ramsar site which has no national park status or protected area. The site is planned as conservation area but most of land within is privately owned and government's land. This condition is presenting insufficient protection to the site.

Figure 4.2 shows the various land cover within Ramsar boundary, imply various land use and human activities that have potential in effecting the lake. It is impossible at this time to upgrade the status of the lake to full protected area. It will takes high cost to remunerate land accession

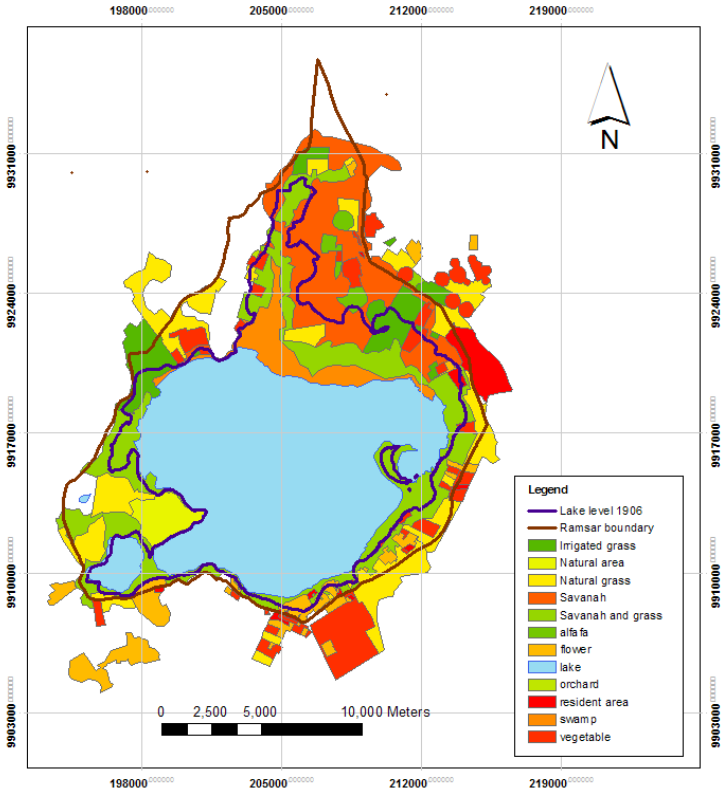

Figure 4.2 Naivasha Conservation area and land cover 2001 (source: ITC's Naivasha data base)

- Poor design of wetlands administrative authorities and jurisdictional constrain on ecosystem management

The Ramsar area falls under various agencies and organizations, namely LNRA for riparian zone, KWS at gazetted nature area, and Naivasha Municipal Council as the local authority. Other governmental agencies are found to be responsible for different lake aspect such as water, wildlife, forestry, agriculture, and socio-culture. None of them has coordinative status for lake management.

Each of reviewed acts required an establishment of new authority. This authority was intended to be leading agency on their sector; namely NEMA based on the EMCA for environment-related matters, KWS based on the Wildlife Act for wildlife conservation and management, and WRMA based on the Water Act for water-related management. The establishment leads to overlapping authority, where each sector apparently has cross-cutting aspect.

Currently, priority of NEMA in Naivasha is taxation on industrial waste and EIA for new activities which has potential big and importance impact to the lake. In the Lake Naivsha area, NEMA's authority is shrinking to industrial waste management only, whereas the agency has bigger mandate as coordinative body on environmental matters.

KWS is mandated as Kenya Government's focal point for Ramsar Convention. Its mandate includes coordinating wetland management. But currently the agency has no specific policy and plan in managing the lake.

WRMA has authority in managing the lake's water, but has no authority in managing other aspect of wetlands. WRMA has become coordinating body only for water-related matters, which is often cross-cutting with NEMA authority.

DoF has interest with water level of the lake to protect its fish stock. For this matter the agency overlapping with WRMA authority.

NMC has authority in this area as local administrative authority. The agency has authority in land use allocation.

- absence of effective monitoring procedures

The absence of effective monitoring procedures is related to the uncoordinated management of the lake aspect.

- lack of provisions to compensate for lost wetland habitat

EMCA gives sufficient provisions to prevent environment and natural resources degradation by enacting environment monitoring system. This provision could be applied for wetlands as well. 'Polluter-pays' principle is being adopted by the act, which means every offender is charged for any damage they caused to the environment and natural resources. But no provision is directly mentioned about wetland rehabilitation.

4.3. Lake Naivasha Stakeholder

Lake Naivasha stakeholder is grouped into: government agencies, community based organization, international organizational, and lake user both direct and indirect.

4.3.1. Government Agencies

- **KWS**

Kenya Wildlife Service (KWS) is a government parastatal and formally acts as administrative authority or the implementing agency of Ramsar convention of Kenya, custodian of all Ramsar site in Kenya. The service is responsible for the implementation of the treaty and expected to be consulting and cooperate with other government agencies and non-governmental organizations in order to ensure the best possible results in achieving the goals of the Ramsar Convention (Ramsar Contracting Parties, 2005).

The service has another obligation to settle wildlife-human conflict, includes remuneration of lost due to destruction or lost life by animal.

- **NEMA**

The National Environment Management Authority (NEMA) is a department under the Ministry of Environment and Natural Resources. Major functions of the body, based on Kenya law chapter 8 of 1999, are to co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects; including authority in assessing EIA report and its approval including for proposed activities related to lake or wetlands.

Related to wetlands management, the body has obligation to issue guidelines for the management of the environment of lakes and rivers. One of NEMA obligations is to examine land use patterns to determine their impact on the quality and quantity of natural resources, and

conducting survey in the field of environment.

- **WRMA**

The Water Resources Management Authority (WRMA) is one of departments under Ministry of Water and Irrigation. The major functions of the authority, based on Kenya law chapter 8 of 2002, are to receive and determine applications for permits for water use, to regulate and protect water resources quality from adverse impacts, and to manage and protect water catchments. The other function of the authority is to gather and maintain information on water resources. Based on the gathered information, the authority publishes forecast, projections, and information on water resources.

- **Department of Fisheries**

Department of Fisheries (DoF) is part of Ministry of Livestock and Fisheries Development. The core functions of the department are to manage and conserve the fishery resources, promote aquaculture development, controlling and managing fish quality and regulate fish marketing.

The department has authority to give fishing and boat license. With approval from the minister, the department may impose closed seasons for designated areas, limiting methods and fishing gears, and limiting the amount, size, age and other characteristics of fish that may be caught, landed, or traded.

- **Ministry of Agriculture**

The Ministry of Agriculture (MoA) is supported by two main departments, which are the Technical Department and Administrative Support Department. One of the ministry functions is collecting, maintaining, and managing information on the agriculture sector; and promoting market and product development. In terms of conservation, the Ministry has a strategic plan in promoting sustainable land use practices. The strategy is intended to prevent soil erosion, land degradation and pollution; also to maintain water catchments and water body.

- **Kenya Forest Service**

The Kenya Forest Service is a government parastatal organization under the Ministry of Environment and Natural Resources. The body has duty in enhancing forest development, conservation, and sustainable management. KFS is emphasizing community participation in conducting forest conservation, especially for the communities who live in and adjacent to conservation area, by establishing Community Forest Association. Outside the gazetted forest, the KFS has a farm forestry programme. The aim of the program is to minimize pressure on forest by providing alternative source of income for farmers, the program is expected to contribute in soil conservation (Kenya Forest Service, 2007).

- **Naivasha Municipal Council**

Naivasha Municipal Council (NMC) acts as local authority. Related to conservation and environment management, the local authority has power to establish and maintain woodlands and forest within its administrative territory. In the matter of public health, it has responsibility to establish and maintain sewerage and drainage. The authority also has power to subdivide any land belong to the authority and sell, lease, or dispose the subdivided plot for the purpose of factory, industrial, business or workshop sites.

Related to wetlands, those agencies have mandate as presented in Table 4.1 below. The table shows the overlapping authority and wetlands management aspect that needs cooperation

between the agencies.

Table 4.1 Government agencies mandate related to wetland management aspect

Wetland management aspect	KWS	NEMA	WRMA	DoF	DoA	KFS	NMC
site-specific							
Wetland conservation	v	v	v				v
wetland monitoring		v	v				
biological conservation	v	v					v
plant protection		v			v		
animal protection	v	v		v			
habitat protection	v	v		v			
water monitoring		v	v				
water right		v	v		v		
pollution control		v	v		v		v
land use management	v	v	v		v	v	v
indigenous right		v					v
non-site-specific							
land use management	v	v	v		v	v	v
catchment protection		v	v			v	v
pollution control		v	v		v	v	v

4.3.2. Community based organization

- LNRA

Founded in 1927, the Lake Naivasha Riparian Association (LNRA) has becomes the major actor in preserving the lake, with main purpose in managing riparian land. As stated on its Constitution and Rules, the main purpose of the association is to promote, maintain, and defend local, private and public interest in respect of land and water right; and to encourage and promote the preservation of animal, fish, and bird life on, in and around Lake Naivasha (LNRA, 1929).

Based on its constitution, every landowner around the lake is deemed to be members of the association. In practice not all land owners around the lake is registered as the association member, especially small land holder. There is misleading about the LNRA as an elite organization, since it comprise of wealthy and well educated land owner and influence member.

- LNGG

Registered 1997, Lake Naivasha Grower Groups (LNGG) is an association of commercial horticulture farmers around the Lake Naivasha and its surround. Almost every One of the association's objectives is to promote and protect the interest of the horticultural industry in this lake area. Aware that their activities could raise negative effects to the lake and its environment, the association arranged Code of Practice to be voluntarily applied by its members. The code includes the wise water management practices, safe pesticides, insecticides, and fungicides utilization, and worker safety.

To assure the code compliance, the farmers should appoint environmental officers who will responsible to control daily application of the code and government regulation related to worker safety, as farm's liaison to LNGG officer, and become link between farm management board and

worker (LNGG, 2001).

From 54 farms listed as water user in WRMA database, 24 of it are registered as LNGG members

4.3.3. International organization

- IUCN

Formerly known as International Union for the Conservation of Nature and Natural Resources (IUCN), in 1990 the Union changed its name into World Conservation Union, but still using IUCN as its acronym. The Union has mission to influence, encourage and assist societies to conserve the integrity and diversity of nature (IUCN, 2007). The Union provides scientific information to improve the understanding of human activity impact natural ecosystem, e.g. IUCN red list.

Based on Ramsar Convention 1971, IUCN acts as Ramsar secretariat or bureau, until other organization or government is appointed by majority of two-thirds of all contracting parties. The secretariat has duty to maintain the list of wetlands of international importance (Ramsar site). To update the information, the secretariat receive any information from contracting parties about changes in particular ramsar site character and forward it to all contracting parties. Further, the secretariat arranges the changes in wetlands character to be discussed at the next conference of parties (CoP).

- WWF

World Wild Fund (WWF) is world's major conservationist, with mission to conserve biological diversity by combining field based project, policy initiatives, capacity building and education work. Most of its activities are cooperate with local authority, NGO, and villagers (WWF, 2008).

In Lake Naivasha area, WWF is developing activities in reserving upper catchments and Malewa river catchments, by promoting tree planting and forest rehabilitation. To implement the initiative, WWF teams up with KFS and form community based organization in the project area. In lower-catchment, WWF supports Mirera-Karagita Project, a project which initiated by WSUP (Water and Sanitation for Urban Poor). The project's objective is to improve water quality and sanitation; including better access and cheaper water.

4.3.4. Lake User

Lake user could be divide into two large group, direct and indirect user, based on their dependency to the lake's natural resources and services (Ostorm, 1999).

Direct user:

- Naivasha resident

  Naivasha town has high demand on water for domestic use, which is 5000m^3 per day, while current supply stands at 100m^3. Naivasha municipal council and Water service providers are the major water undertakes (Physical Planning Department, 2002).

  (NMC doesn't use directly water from the lake for water supply, the reason is they don't have funds to create infrastructure). They are using borehole for water sources.

  Resident town use the lake for pleasure place, by fishing, boating, or just for enjoying the scenery.

- Farmers

  Horticulture and agriculture farms are found around the lake. Based on farm large area, farms around the lake could be grouped into large farm (> 5 ha) and small farms (< 5 ha) (Hughes, 2001). Both farms type depend on lake water for irrigation in different quantity. One large farm reported to use borehole as its water source.

  The farms have potential to effect the lake negatively, e.g. by water abstraction and agro-chemical pollution. Most of larges farm around the lake are member of LNGG. Through this group, the farms are being controlled and being pushed to apply an environmentally manner production system.

  There is no small farmer association or group in the lake area. The interviewed farmer admits that there is no restriction on agrochemical use and no elucidation from government in safe farming. Periodically, LNRA officer come to check their water use and activities in riparian land. Those farmers have problems with wild animal (e.g. hippopotamus and waterbuck) which wander on their farms and destruct their plants. The hippo come through water in the flooded farm, when the water level is high, especially in rainy season; while the waterbuck comes in dry season and eat the plants.

- Fishermen

  In early 1990s there were about 100-200 fishing boats operating in Naivasha, legally and illegally. Since the decreasing of fish stock in the lake, in 2002 department of fisheries cut the registered fishing boats which operate in the lake from 103 units to 20 units with maximum 3 fishermen per boat and 10 nets with minimum size of 4 inches. They are not allowed to fish within 300m from beach on current water level to protect fish offspring. Common fish they caught are tilapia, black bass, common carp, and crayfish.

  The fishermen registered as Beach Management Unit member, where they control each other on the application of fishing regulation, from the size of nets, illegal fishing methods, and daily caught. Beside the legal fishermen, there are around 40 illegal poachers operating daily. They don't use boat, but work in shallow water. Their activities potentially damage fish breeding and nursery ground, and their uncontrolled fishing gear could catch small fish which is not ready to be yield.

- Geothermal power generation

  KenGen is operating at Olkaria since early 1980's. Currently it has three power stations. The first one started to operate in 1981, the second one in 1982, and the last one in 1985. From this area, KenGen supplies 15% of nation demands. They use lake water for steaming and use the produced steam to drive turbines. It produces clean energy, but on the other hand it potentially raises air and water pollution, along with hazardous waste and land subsidence (Brower, 1992; Kenya Electricity Generating Company, 2003; WWF, 2005).

- Pastoralist

  Traditional Maasai Pastoralist use Lake Naivasha as one of its water source. Land privatization, and development of horticulture and tourism around the lake has limited their access to the lake and grazing land. This condition often put them in disputed with private land owner and national park authority. There are 5 access to the lake for

common and

- Tourist

  Tourism in this area relies on Naivasha's biodiversity and natural landscape. There area private and national gaming park, tourist class hotels and campsite built around the lake and limiting access to the lake for common people.

- Researcher
  The unique of bio-physic nature of Lake Naivasha and its socio-economic-culture values have been attracting researchers from multidiscipline background, both local and international. They have different motive, from academic purpose to project based research.

Indirect user:

- Commerce
  Commercial activities are concentrating in Central Bussiness District, covering 30km^2 of old town. Some commercial activities are also distributed along the main spines of the town and a number of commercial nodes which include; Karati, Kinamba, Kinungi, Karagita, Sulmac, Kongoni and Kasarani (Physical Planning Department, 2002). Identified commerce types are supermarkets, daily commodity shop, traditional market, and gas station.
- Bank and finance institution
  There are 5-6 banks in Naivasha town. They are part of national chain of bank and most of them have started operating in last 5 years. They serves local community in money saving, investation, and loans. One bank informed that 35% approximately of their clients are of farmer employees from 20 farms in Naivasha. Automatic teller machines are installed in some farms for the labours. Interviewed bank managers accepted that reason for coming is mostly the large farms as customers.
  A financial institution called Agriculture Finance Corporation, a semi public body, provides loans to 400-500 small farmers annually.

4.4. Stakeholder interest review

Stakeholder interest table is summarizing the list of stakeholders, their interest, influence, and their importance of their interest to be dealt in lake management planning. The table gives information to planner to decide lake management priority. This prioritization has influence in data and information selection to support the management planning application. Table 4.2 presents general types of stakeholders requiring information.

Table 4.2 Stakeholders requiring information on natural resources

Users	Information type								
	Water		Land		Flora		Fauna		Demo-graphic
	physc	soc-ec	physc	soc-ec	physc	soc-ec	physc	soc-ec	
KWS	✓		✓		✓		✓	✓	✓
NEMA	✓				✓				✓
WRMA	✓	✓							✓
DoF	✓						✓	✓	✓
DoA	✓	✓	✓	✓	✓	✓			✓
KFS	✓								✓

NMC	✓	✓	✓	✓	✓	✓	✓		✓
LNRA	✓		✓	✓	✓		✓		✓
LNGG	✓	✓	✓	✓	✓				
KenGen	✓	✓							
Pastoralist	✓	✓							
Farmers	✓	✓	✓	✓	✓	✓			
Fishermen	✓	✓					✓	✓	
Tourist	✓		✓		✓		✓		
Researcher	✓	✓	✓	✓	✓	✓	✓	✓	
Commerce		✓		✓		✓		✓	✓
Bank & finance institution		✓		✓		✓		✓	✓

First information presented by table 4.3 is the potential impact of stake holder interest to biodiversity and natural resources of the lake. The assessment of this attributes is based on interview and crosschecking with previous study. The potential impact is classified as: positive (+) for interest that could enhance wise use management, negative (-) for interest that could negatively impact the lake, uncertain (+/-) for interest that could impact the lake negatively in some extent but has positive aspect on the other hands.

The important of interest classification is based on how stakeholders' interest should be dealt in lake management planning and prioritized based on wise use concept (Ramsar Convention Secretariat, 2007e). The importance of interest is classified as: high (H), middle (M), and low (L).

The influence classification is stakeholder capability in influencing the lake management. It based on their power from law or formal authority, where they were given a mandate to manage any aspect of the lake; critical resources, such as expertise, money, information, equipment; and discursive legitimacy, where they have no formal authority but they can influence and give pressure to government, persuade community, and affect public understanding. (Hardy & Phillips, 1998). The influence is classified as: high (H), middle (M), and low (L).

Table 4.3 Stakeholders interest table

Stakeholder	Interest	Potential impact	Important of interest	Influence
Direct user				
Naivasha resident	water abstraction	-	H	L
	recreation	-	H	
Farms	water abstraction for irrigation	-	H	M
	sewerage disposal	-	H	
	increased revenue	-	M	
	land use	-	H	
Fishermen	access to the lake	+/-	H	M
	fish stock	-	H	
Geothermal power generation	water abstraction	-	H	H
	sewerage disposal	-	M	
pastoralist	water abstraction for livestock	-	H	L
	access to the lake	+/-	H	
	grazing area	-	M	
tourism	increased revenue	+/-	L	M
	biodiversity	+	H	
	water supply	-	L	

researcher	object assessment	+	H	H
Indirect user				
commerce	increased revenue	+/-	M	L
	commodity access	-	L	
bank & finance institution	increased revenue	+/-	M	L
	client	+/-	L	
Government agencies				
KWS	biodiversity	+	H	H
	habitat conservation	+	H	
	increased revenue	+/-	M	
	human-willife conflict settlement	+	H	
NEMA	environment quality (general)	+	H	H
	natural resources quantity (general)	+	H	
	public awareness on EIA	+	H	
	charge on waste disposal	+/-	H	
WRMA	adequate water supply	+	H	H
	increased of water use permit applicant	+/-	M	
	water balance	+	H	
	water quality	+	H	
DoF	fishstock quantity	+	H	H
	fishing monitoring	+	H	
	fish marketing	+	L	
	fish production	+/-	L	
MoA	agriculture research	+/-	H	M
	livelihood diversity	+	M	
	safe agriculture practices	+	M	
KFS	increased of forest production	-	L	M
	forest conservation	+	H	
	soil conservation	+	M	
	livelihood diversity	+	M	
NMC	Housing supply	-	H	H
	nature conservation	+	H	
	sewerage disposal area	-	L	
	land use	+/-	H	
	increased revenue	+/-	L	
Community based organization				
LNRA	nature conservation	+	H	H
	water balance	+	M	
	community awareness on conservation	+	H	
LNGG	water balance	+	M	H
	land use	+/-	L	
	safe agriculture practices	+	M	
International organization				
IUCN	biodiversity	+	H	M
	habitat conservation	+	H	
	wise use management	+	H	
WWF	biodiversity	+	H	M
	habitat conservation	+	H	
	livelihood diversity	+	H	

4.5. Major Organization Information Requirements

Figure 4.3 shows the general information flows of Ramsar reporting for Lake Naivasha status. As seen on the figure, the data sharing for Ramsar reporting happens in the highest level since there is no authorized local manager designated by government in managing Lake Naivasha.

Currently, there is neither formal information centre nor coordinating body for Lake Naivasha management. To get the required information for Ramsar reporting, beside from its own data base, KWS collected data from various organizations, mostly coming from research institution which held their research within the lake and its surrounding. KWS was assisted by LNRA to collect data at local level.

Historical reason has made LNRA known as the lake custodian and becomes centre organization for the lake conservation. Every organization which had activities in the area, in environmental or socio-economic matters, builds partnership with LNRA or just informal communication and relations. Namely IUCN, WWF, WSUP, Earth Watch Institute, Kenya Marine and Fisheries Research Institute, ITC, East African Wetland Management course have good relation with LNRA. Research and activities report are placed in the association library, and it opens for everyone.

There is a weakness to rely on data from a project or research, since they do it only for an occasion not for continuous and long term period. It's hard to find up to date information. To cover it, KWS look at the governmental agencies.

Contact with governmental agency was made by KWS through agencies headquarter. Kenyan government system is mixture between semi autonomous and decentralization. The system allows central government to give limited authority to district office as central representative at district level and local level. Most of local data is compiled at district level and being centralized at headquarter. When the required information comes at local or district office, the KWS personnel, who has mandate in collecting data, should have permission from the purposed agencies headquarter to do data collection and research. Beside for coordinative function, the bureaucracy system is intended to protect confidential data and document, as well as data ownership. Sometime personal approach is done to cut the bureaucracy, but it will be fruitful if they already have formal relations in prior time. It is not reported that KWS has to pay for the required data.

Apart from the Ramsar requirement for wetland status report, table 4.4 is presenting information requirements for routine activities of major organizations around the lake.

Based on the knowledge, obtained through the interviews and secondary data collection, the major division of information, required by various organizations and other stakeholders, is as follows: Having described the roles of the major organizations active in the area, it is important to understand their interest to assess the type of required information by these organizations. This information along with the spatial and temporal aspects of the roles of the organizations in the area is required to setup a collaborative management based on data sharing.

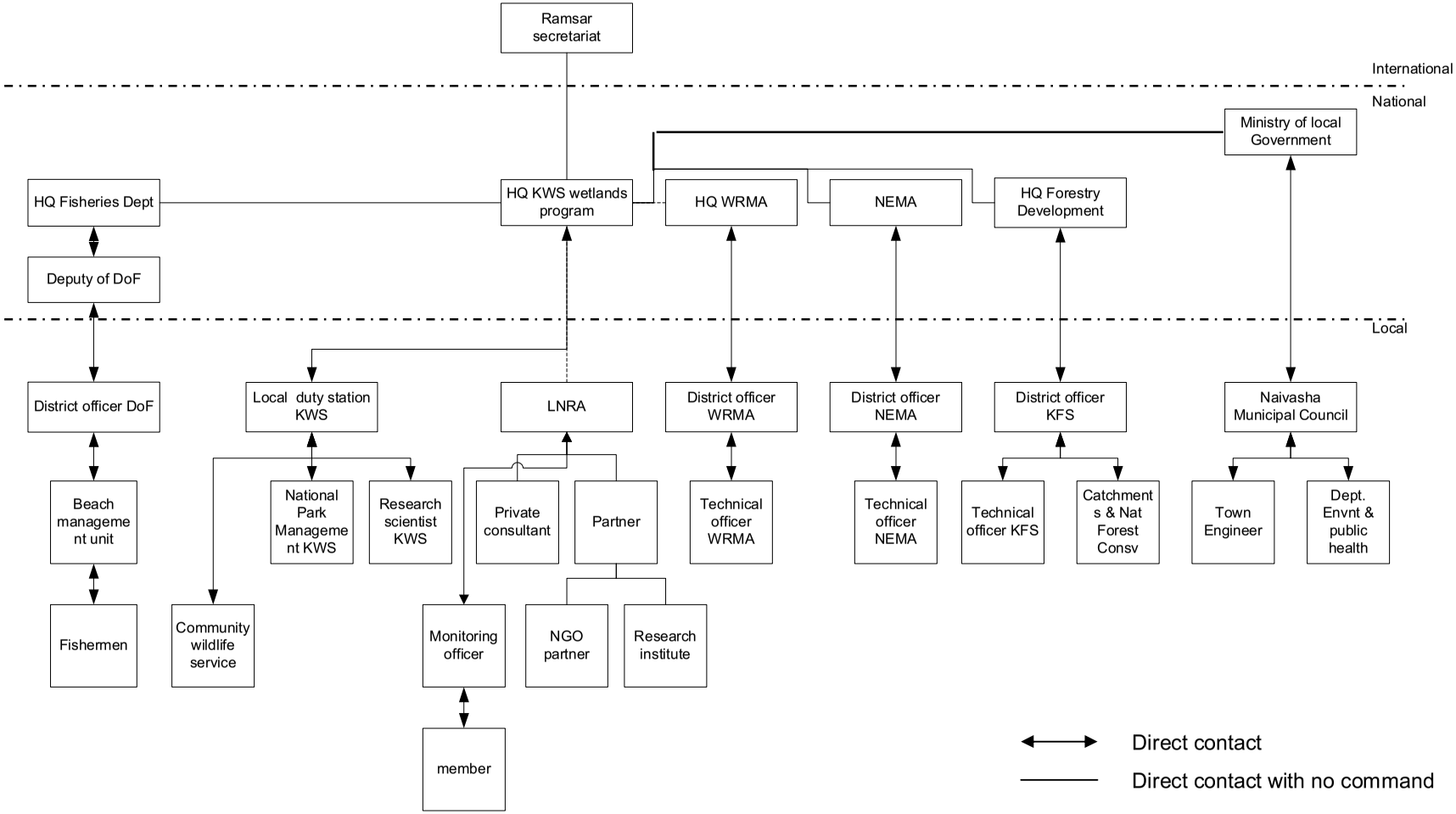

Figure 4.3 Information flow of Lake Naivasha status report

Keeping in view the scope of the present study, under the given time constraints, two major organisations are focused for further analysis, which are LNRA and NMC. These organisations are selected base on their active role or authority and difference in their setups, objectives, and also in spatial term. Both of them are local organization and have capability to influence Lake Naivasha condition through their activities and policy.

- **Lake Naivasha Riparian Association**

Having discussed in the section 3.1.2, LNRA is one of the oldest community based organisation working in the area focussing on the environmental issues. Its focus area is the riparian land around the lake. This organisation is selected for further analysis because it represents one of most active and influential community group of the area: land owner and large farmers around the lake.

Many farmers inherited their farm land while many of them have purchased it. The farms are earning huge revenues and are earning huge foreign currency to Kenya through export of their produces. The development of infrastructure such as roads, banks, new businesses is attributed to the presence of these farms. They have the capacity to influence the policy directives related to the development of the area to a certain extent.

These farmers are very active in promoting the environmental issues inside as well as outside the farms. Considering the importance of riparian land for the conservation of lake ecosystem, LNRA has mainly focused on maintaining the harmony between nature and human beings into this spatial boundary.

Spatial visualization of the Area of Interest

LNRA considers the riparian zone, it is between lake level of 1906 (1,892.8m asl) and the current water level which is fluctuate. To be able to capture changes of land cover in the riparian zone considering the 30m resolution of the interpreted images and to be in the line with the LNRA focus area, present study is considering the riparian land.

Figure 4.2 presents the land cover changes between 1986, 1995, and 2007 (Were, 2008). To show the land cover changes after the boom in the flower industry around the lake, image of 1986 is interpreted. This growth of flower farms as an organised industry has implications in many sectors around Naivasha such as more land coming under agriculture, more people coming to Naivasha for employment, more settlements coming up for their residential purposes. The image of 1995 is shown to see the changes in the area by the time LNRA had launched it management plan. Image of 2007 is shown to see any changes on the land cover which could be a possible implication of the restrictions applied after the management plan was gazetted.

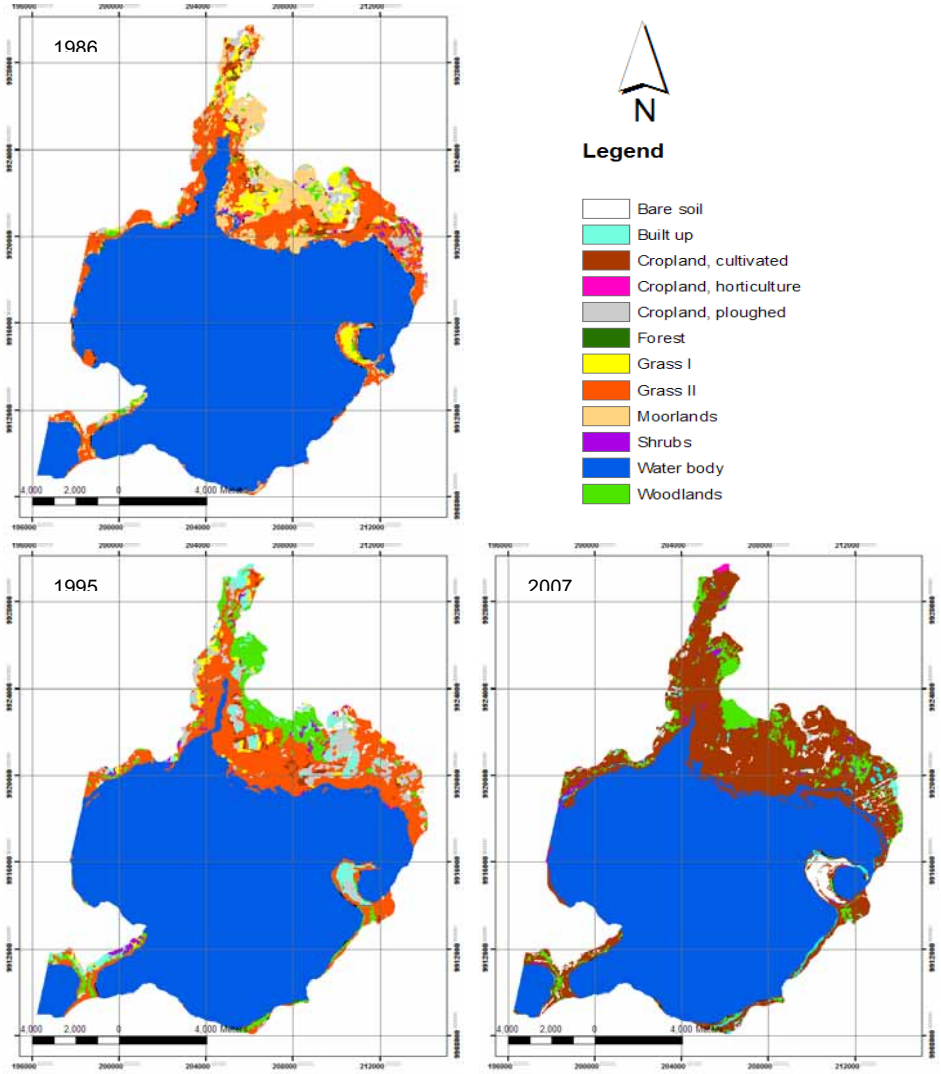

Figure 4.4 LNRA area of interest

Information related main requirements:

Considering the importance of information of various natural resources including their spatial dimension, LNRA has got involved in using the GIS and GPS products such as high resolution aerial photographs. In addition, they are cooperating with ITC project in the area for providing a scientific basis to their environmental concerns. In 2001, LNRA hired private consultant to do mapping on Lake Naivasha and its Ramsar site to support the lake monitoring and management by showing changes that have occurred in past 4 years. It is not been specified where they get the previous lake map.

Physical information on natural resources:

Water

The fluctuated water level effects the existences of papyrus bushes around the lake, as one of LNRA concern on wildlife habitat. Lake water as the prime source of irrigation in the farms, it naturally becomes a concern of any organization related to obtain information on the regular

periods about its quantity and quality issues. To meet the LNRA objectives, it needs this updated information.

Land

Considering the importance of land around the lake for the conservation of lake ecosystem, it is essential to keep a track of the land cover changes, soil, groundwater level and other aspect in this spatial extent.

Flora & Fauna

To monitor on biodiversity issues effected by the economic activities around the riparian land, it is essential for LNRA to obtain information from KWS and other established conservational organization such as WWF. The diversity of flora and fauna species is required to maintain the natural balancing process of ecosystem. Different types of trees and animals interactions for e.g. vegetation as food for animals, animal pellets serving as compost for plant growth, are required to maintain the healthy ecosystem. This is important to keep getting different ecosystem services for meeting the different requirements of different stakeholders varying from fishermen to farmers.

Economic information on natural resources

The rising price of the land can make it relatively scarce for the small farmers around the lake, which can force them to do economic activities in the riparian zone after a certain level of land use changes on their farmland. In addition, information on water cost for economic activities is required to see the potential impacts on the rate of consumption. Presently, the large and small farmers are not paying any regular water charges except one time water permit fees. During the field interviews with the government authorities, it was found that government is considering proposing water charge on the use of water for agricultural purposes. The information on such issues can provide basis for new policy directives and further to legal steps.

- Naivasha Municipal Council

Having discussed in the section 3.2.3.1, Naivasha Municipal Council (NMC) acts as local authority and government representative at local level. The activities within and condition of the municipality could effect the lake both direct and indirectly. In spatial term, NMC has authority to build drainage, do spatial planning by allocating their administrative area into specific land use, such as industrial, residential, green area, business area, public services, schools, hospital. Related to conservation and environment management, the local authority has power to establish and maintain woodlands and forest within its administrative territory. The strategic planning as NMC basis activity is coming from physical planning department under Ministry of lands and settlement. NMC can be considered as most influential organization in the area since its authority and responsibility include taking care of economic as well as physical resources of the area.

Currently, focused in the lake area, NMC is facing challenges such as lack of green park, indiscriminated dumping of waste, riparian land encroachment by agricultural activities, illegal reclamation, blockage of access corridors to the lake, and pollution to the lake. In the other area within municipality, poor spatial design becomes core of their problems, in addition to poor housing, poor waste management, and water supply in slump area (Physical Planning Department, 2002).

Spatial visualization of the Area of Interest

The left figure in figure 4.4 is showing the spatial extent of the municipality, where it covering the lake and its conservation area, and the right figure is visualization of municipality strategic development, developed by physical planning department. The spatial extent includes the area around the lake, area covered by large farms and Naivasha town. A segment of Nairobi-Nakuru highway passes through its jurisdiction area. A part of it falls outside the natural boundary of Naivasha catchment.

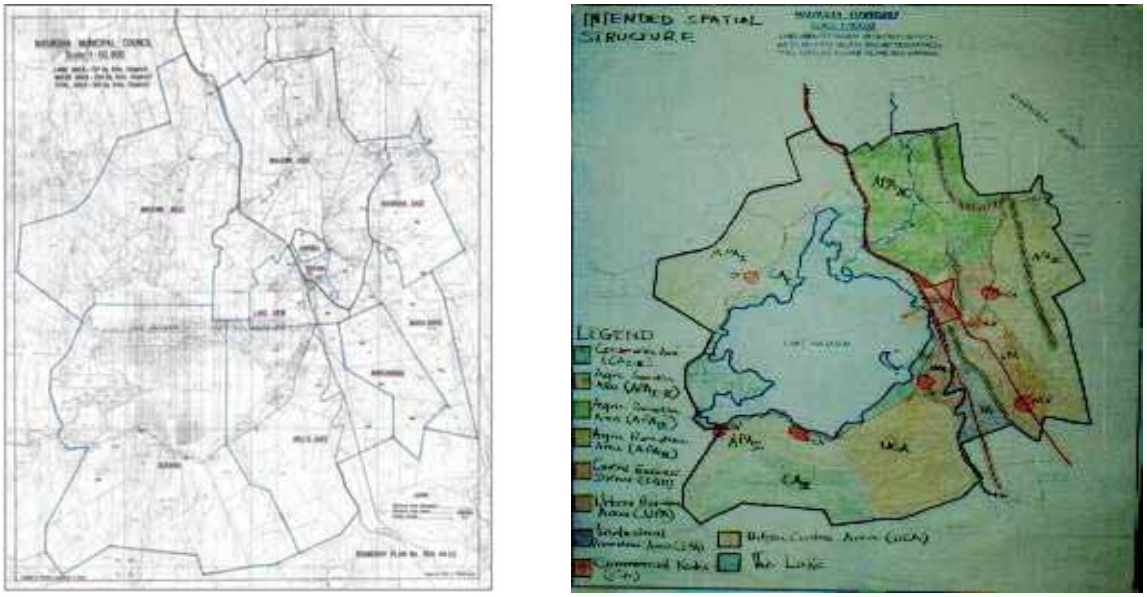

Figure 4.5 Naivasha Municipality area and its development strategy (source left map: University of Nairobi, right map: Naivasha Municipal Council)

Information requirement

NMC has several departments or sections which require spatial information for carrying out their task such as town engineer and environment and public health office. Realizing the importance of spatial information, NMC has opened up a GIS section under town engineer office. Its trained staff is using advanced GIS software such as ArcGIS for dealing with the issues of urban mapping such as plot mapping of Kihoto, Karagita and other areas in town. Most of the infrastructure including banks, residential areas, roads, are already mapped by the agency. During the interviews, administrative as well as technical staff expressed their concerns to promote use of GIS based spatial planning in NMC activities.

Physical and economic information on natural resources:

Water

For NMC, water is essential not only for irrigation, but also to meet the increasing drinking water demand, at residential area in particular. Information of fresh sources of water on surface as well as sub-surface level is required for these purposes. The information on available water quantity and quality along with its supply location is important because it affect the distribution cost of water supply in its jurisdiction.

Land

Land is a source of revenue because of the economic activities happening on it. It is also important for the physical planning of the area which requires the information on designated land use as well as present land use information. A well-informed land use policy can result in better decision making and efficient use o resources such as land for different planned activities.

Flora and Fauna

As explained in LNRA information requirements section, the diversity of flora and fauna species is required to maintain the natural balancing process of ecosystem. Presence of lake Naivasha, a designated Ramsar site, under its jurisdiction area along with the presence of environment concerned organizations such as WWF, KWS, etc, makes essential for NMC to have information about the forest cover area, wildlife species. Any economic activity related to flora and fauna such as wood cutting, tourist lodges becomes a source or revenue for the NMC.

5. Institutional aspect on spatial data sharing

5.1. Introduction

The previous chapter on data requirements of major organizations had provide information that becomes base in establishing interorganizational data sharing. This chapter is tried to discuss a social construction of data sharing as a base of interorganizational GIS practice of NMC and LNRA.

5.2. Data sharing framework

Data sharing is flow of information between two or more organizations. The arrangement of sharing range from the manual exchange of digital data and access only policies to fully share distributed or centralized GIS and databases (Nedovic-Budic & Pinto, 1999).

The following data sharing framework is taken from Nedovic-Budic/Pinto (1999), covering four component which are: context (organizational and interorganizational context), motive behind the data sharing, coordination mechanism, and outcomes.

5.2.1. Organizational and interorganizational context

Organizational matrix is presented below to compare organizational aspect between NMC and LNRA. The aspects below could affect their interorganizational relationship (Nedovic-Budic & Pinto, 1999).

Organizational aspect of NMC and LNRA

Organizational aspect	NMC	LNRA
Structure	Decentralized system	Egaliter
Objective	Municipal development	Lake Naivasha conservation along with enhancement of economic activities within the area
Particular division for conservation	Yes	Yes
Decision maker	Municipal committee	The association Committee, approved at general meeting
External influence	Central government	Other organization with Environment or Economy concern
Current priority	Road development	Water management
Funding source	- Local revenue - Central assistance	Member
Human resources (for GIS)	- 2 GIS officer under the Town Engineer office	- 1 monitoring officer
Data source	- The Physical Planning Department - The Department of Resource Surveys and Remote Sensing	- Project based data sharing - Research institute

Based on their organizational attributes, each of them has strengths and weaknesses. Decentralized system makes possible for NMC to make any decision for municipal's importance,

including the enhancement of geographic information system utilization. But it's not fully liberated, since the central government influences through its district offices for technical matters and funding source. Bureaucratic system inside the NMC it self is still influencing their speed in decision making process.

Different with NMC, LNRA has egalitarian style where every member has equal position. It is an independent association where its funding source fully comes from member. Bureaucracy is not hampering their decision making process, which means they can take quick decisions. LNRA daily management is responsibility of a committee which has authority in decision making for management and welfare of the association. The association member could ask the committee's accountability for the decisions taken in the Annual General Meeting.

As stated in its constitution, any decision taken by committee should consider member's welfare. As a community based organization and a body without having any legal authority, the committee's decision could be easily influenced by other factors, such as environmental or economic concern. Based on the conservation efforts already made by this time, LNRA's concern to the environment is beyond any doubt. But reality that most of its members are owner of the land around the lake and has considerable economics interest with its natural resources, the association priority could be changed any time.

Another factors that need to be considered in interorganizational relationship is their history in collaboration; political and social climate; frequency of communication and established communication link (Mattessich & Monsey, 1992).

There are two types of relationships between NMC and LNRA. First is relationship between government and citizens, where LNRA domiciles in Naivasha Municipality territoty. NMC involved LNRA as community based organization and stakeholder in town development planning. Second, as one of the land owner around the lake NMC is registered as LNRA members. Communication between them is not problems. Both relationships could be use as basis for them to upgrade their relations intensity through data sharing. Its possibility will be assessed in the 'coordination mechanism' part.

A politically sound matter could hinder collaboration process. Again, its related to the other member of LNRA as large farmers. Currently NMC has program to increase their revenue through putting 'Cess', a local taxation, for large farms. All this time the large farmer has been granted a facility for not paying all the commercial taxes while operating as a business unit, as government's policy to attract investment in Kenya. The policy has gained success, farming industry is boosting in this area and stimulates the local and national economic growth. On the other hand the industry attracts more people to the area, and becomes burden for the local government, where the authority needs to balance the population growth by proper housing, water supply, and sufficient social services. For this reason, NMC feels that the farms have responsibility to help the NMC by paying some taxes. NMC states that increasing infrastructure and other social services cost should be shared by large farms through a Cess of 1% over their revenue. Presently, these costs are taken care by taxes from other sources.

On the other hands, the farms claims that they are already paying several taxes to the local and central level governments that imposition of new taxes related to the social problems faced by NMC cannot be justified. For this matter, the farms are already applying the concept of corporate social responsibility in practice. In addition to raising social and economic equity for women, social awareness for environment, providing sports, education, housing and medical facilities for the employees, large farms are generously involved in many social development activities. The

Naivasha Horticultural fair trust claimed to have several such kinds of activities. These include official opening of the “Safe House” - a rescue centre for abused children, entirely built with funds raised from the fair, completion of a maternity wing at Karagita dispensary, large contribution to the Naivasha Children’s Shelter, building toilets and providing water tanks to local schools, supporting HIV Projects, the Red Cross, environmental projects, disaster relief, education projects and many other local and national charities (Naivasha Horticultural fair publication, 2007).

In case of cut flower, the objectives of associations range from lobbying for policy support, environmental conservation, maintaining standards to facilitate corporate social responsibilities (Zeng, 2006).

Apparently there is no interdependency between NMC and LNRA. Their relationship is not bigger than citizen-government, association and members.

Absence of any nodal agency with authority to control the resources of the area and their different aspects (usage, management) can lead to conflicts over such issues between the two organizations. In such critical issues, this type of nodal agency should work as the mediator to continue the dialogue between the two organizations and try to resolve it with their mutual consent. But it must be powered with an authority to give its final decision which must be agreed by the two organizations. It is essential to create faith among the different stakeholder groups of the area in the nodal agency to work as a facilitator for resolving their issues.

5.2.2. Motivation for data sharing

The motivation part is identifying any motivation that could become base for data sharing. This part includes authority and expected benefit from data sharing. The most expected benefit of data sharing from both organizations is updated data, to get a better

Both of the organizations have common interest on population growth as stated before on the previous chapter, since it has potential in giving pressure to the lake. NMC has no recent sufficient information on population growth and physical development within the municipality. In 1997, NMC had cooperation with Germany development project, and they are granted for GIS utilities. Part of Quick Bird satellite image of the Southern part of the lake was donated by Ramani Communication Ltd, a private consultant on lands survey, geo-informatics, and production.

- The NMC needs recent aerial photo and high resolution satellite to monitor physical change of the municipal area.
- The LNRA has the aerial photo utility, and do monitoring in frequency.
- LNRA needs information on land use to monitor the lake conservation.

5.2.3. Coordination Mechanism

Coordination mechanism is a strategic alliance of the two organizations. The identified strengths and weaknesses is

- Internal assessment

Based on description above, strength and weaknesses related to data sharing practices can be drawn as presented in the following table.

Table 5.1 Internal assessment

	NMC	LNRA	Existing relation
Strengths	- local authority - strong relation with other government agencies - possession on GIS utility	- Egaliter organization structure - Strong relation with research institution and NGO - Possession on GIS utility - Comprises of member with various background	- Frequent communication - Have the same objective in conserving lake Naivasha
Weaknesses	- bureaucratic/hierarchical organization structure - data user - lack of up to date data - central government influence	- data user - dynamic members → unstable policy - infrequent updated data	- political problems - different priority

- External assessment

The external assessment is presented in table below, showing the opportunities and threats to the both organization.

Table 5.2 External assessment

	NMC	LNRA
Opportunities	- The Lake has status of internationally importance - The Lake known as ecotourism destination - New investment in farming - Community involvement policy	- International organization seeking for local partner, in grassroot movement - The Lake has status of internationally importance wetland - Community involvement policy
Threats	- population growth - social problems - overlapping authority	- population growth - resentful party

Both results, of external and internal assessment, can be used to determine most suitable relation of the two organizations in information sharing. There are issues that need to be concerned during information and data sharing. The issues are grouped into five broad categories (Nedovic-Budic & Pinto, 1999):

- data – standardization
- responsibility – guidance for database development, deposition of data, database maintenance, data usage, distributions of data, user support, and decision making

  “the issues of keeping the data up to date & current becomes an independent challenge which can overwhelm the institutional apparatus with the best technical staff and the most progressive managers.”
- ownership, needs in clarify data ownership, specific & unambiguous. Vaguely defined policies could lead to many problems related to unresolved ownership issues.

  Security features, such as additional routers, firewalls, & passwords are often necessary to support the agreements on responsibility and ownerships.
- Contribution: funding of data base development & maintenance, pricing for data distribution

- incentives

Spatial data to improve information sharing

While sharing the data, it is very essential to confirm the integrity of spatial data also else it could lead to major errors in decision making. Table 5.3 presents the Naivasha population in different survey time.

Table 5.3 Naivasha Population

	Kenya 1979	Kenya 1989	Kenya 1999
Province	Rift Valley	Rift Valley	
District	Nakuru	Nakuru	
Division		Naivasha	
Location	Naivasha	Naivasha	Naivasha Town
Sublocation	N1 – Naivasha	Sokoni (Naivasha Urban)	
Males	26600	18639	
Females	23749	16834	
Total	50349	35473	4735
Households	12329	10756	
Households Density		21.04	
Population Density	45.5	125	61
Population per sq km		69.39	
Area Sq Km	1104.47	511.18	78

Source: International Livestock Research Institute

The increase in population of Naivasha has been reported by some previous studies. This fact was confirmed during the various interviews with different stakeholders such as municipal council authorities, local businessmen and Kihoto residents.

If only the data in the above table is considered as base for decision making for the area, it can lead to errors. In the table 5.3, it is necessary to confirm the area considered under location 'Naivasha' in two different censuses 1979 and 1989. If we look at the spatial information of these two locations that is the area in Sq Km, it makes clear that the above statistics are based on two different spatial units. This difference is visualized through figure 5.1. The maps legends shows the density based on the figures mentioned in table and the area highlighted in the maps. Map a) showing the census result in 1999 and the coverage area, the same of map b) and c) as result of census of 1989 and 1979. Map d) shows overlap of different census years and it shows how the censuses covered different spatial units.

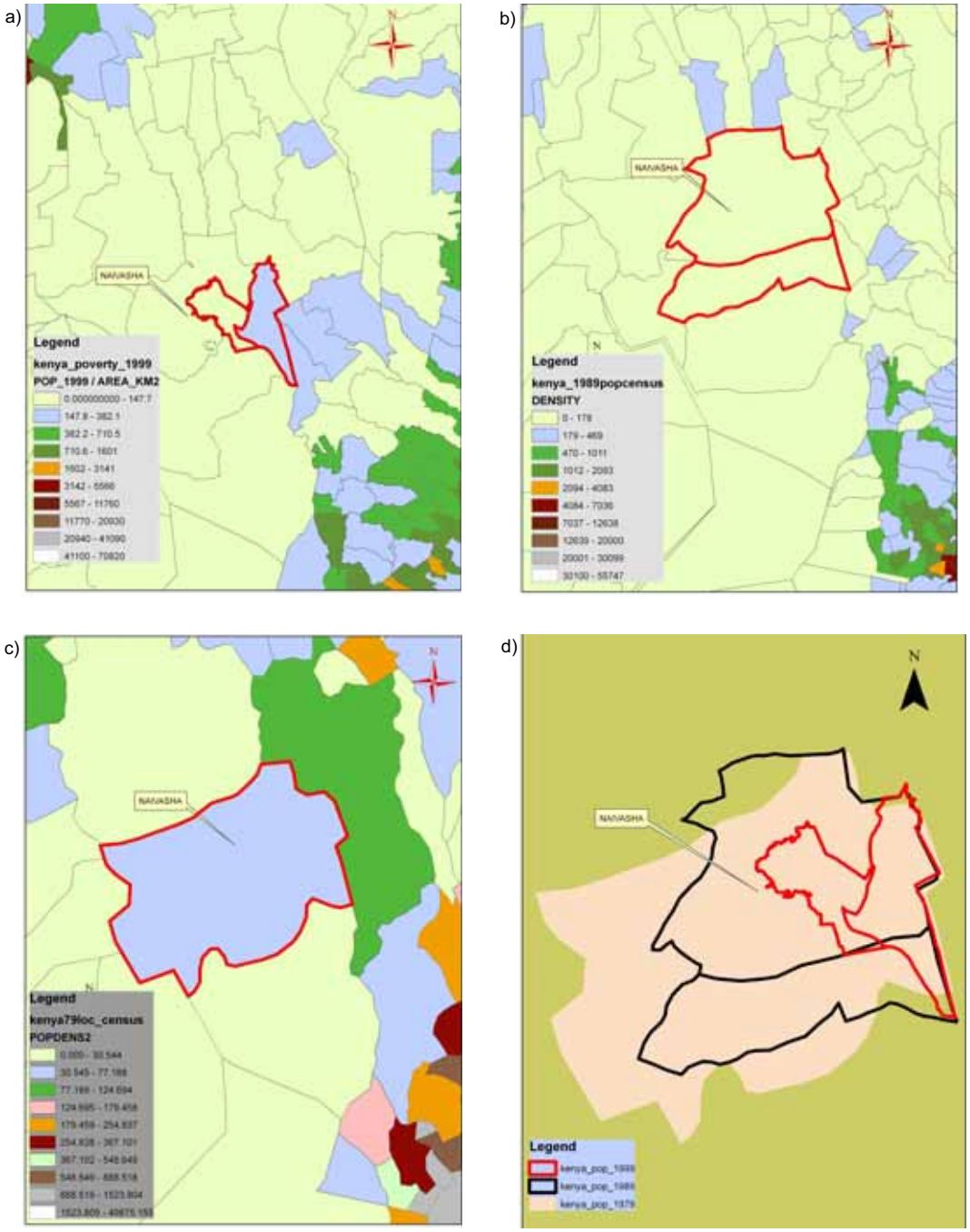

Figure 5.1 Naivasha population survey

6. Conclusion and recommendation

6.1. Conclusion

The main objective of this research is to assess the existing institutions and organizational setup which is related to wetland and to identify key problems in information sharing among the organizations and the ways to improve it, especially the role of spatial information based system. The following are the conclusions of the thesis:

- Currently the Government of Kenya (GoK) does not have a national policy on wetlands management. For the basis of wetland management, the GoK use National Environment Action Plan (NEAP 1994) and Environmental Management and Coordination Act (EMCA 1999).
- EMCA is used for general aspect of natural resources and emphasizes in pollution control. Specific aspect of natural resources is regulated by sectoral acts, namely Forestry Acts, Water Resources, Fisheries, and Wildlife management. Each of them required establishment of agencies, intended to be leading agency of their sector. The establishment leads to overlapping authority, where each sector apparently has cross-cutting aspect. The condition lead to the absence of effective monitoring procedures and related to the uncoordinated management of the lake aspect, specifically in Lake Naivasha area.
- Beside the overlapping government, community based management and international organization are active within and around the Lake Naivasha with quite similar objectives, which is environment conservation.
- The non-coordinative condition of the existing organization and government agencies leads to scattered data of the lake.
- From the two chosen organization, NMC and LNRA, by comparing the data needs of the organizations, shows similar requirements. Both of them acquired data from different source and time, but same spatial extent. For this reason an analysis is performed to see the possibility in data sharing.
- From the organizational aspect of NMC and LNRA, it is possible to perform data sharing. They have relation before, as government and citizen; and as association with its member.
- Spatial data utilization could improve information sharing. By comparing its spatial extent, the overlay map could show the correlation data with its spatial extent and prevent error on its utilization

6.2. Recommendation

- There is need a further study on the most suitable collaboration as institution for data sharing.
- Institution is a set of convention, policies or legislation which regulates social behavior. Related to wise use concept based on Ramsar Convention, It means that the institution should able to prevent and minimize wetlands degradation, and mechanism for compliance, accountability, and responsibility in wetlands management. For this reason it is needed that

a government as a contracting party of the Convention has a strong institutional setup to achieve the wise use management of wetlands.

- There is a need of cooperation between stakeholders to share its information, especially scientific information. This scientific information added with a spatial dimension, could enhance the importance of the information sharing, beyond reporting, as a data sharing collaborative effort to achieve effective wetlands management and conservation, while supporting local management initiatives.
- Regarding to institutional review, it is strongly recommend selecting an organization or governmental agency to be nodal agency in Lake Naivasha management. The agency should be powered with an authority to give its final decision in solving problems within the area.

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