Competition over water resources: analysis and mapping of water-related conflicts in the catchment of Lake Naivasha (Kenya)

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A mi abuelo Paco (Francisco Fayos Artés) que me enseñó a apreciar la tierra y sus gentes y a disfrutar con la Geografía y la Historia

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ABSTRACT

The area of Lake Naivasha is of high economic and political importance to Kenya, it presents a wide variety of economic activities around the water resources with many different stakeholders. The analysis and mapping of conflicts related to water in the Lake Naivasha basin could be useful for the existing Management Plan of the lake resources.

The objective of the research is to perform a conflict analysis of water-related issues in the catchment area of Lake Naivasha. Essential to the analysis is 'mapping' the conflicts, which consist in the systematic collection of information about them and their dynamic. The most part of the information was collected through Rapid Rural Appraisal, semi-structured interviews to representatives of the stakeholders within the catchment and existing reports on different subjects affecting water issues. Content analysis was used to analyse and quantify the results of the interviews. The conflict analysis included: analysis of the stakeholders values, research of the conflict sources, definition of a typology of conflicts, and assessment of conflict intensity from the perspective of the different stakeholders developing some indicators. Moreover a visual representation of the conflicts has been attempted through the development of some tentative "conflict maps".

The main results have been synthesised in a conceptual model which defines the hierarchy of conflicts related to water within the catchment and the relations between them. The highest in the hierarchy are the conflicts related to the lake resources (fishing), in a second place the water supply of the town and settlements, and in a third place conflicts related to activities taking place in the upper catchment. The conflicts related with water are, most of the times, mixed with other type of land, tribal, social and economic conflicts, and some emotional-historical factors in relation with the inheritance of past colonial times. Physical factors like proximity to water bodies or to forest determine the development of different types of conflicts.

Some conflicts are formed by problems not founded on scientific data, as the potential problem of siltation of rivers and lakes, and other problems are more serious than they seem and will intensify some present-day conflicts. For instance, problems of pollution of the lake due to the poor management of the sewage systems of Naivasha town and farms that can seriously affect the lake resources in a close future.

It is not possible on a medium and long term to separate the management of the lake and its ecosystem from the management of other water issues and activities within the catchment.

The availability of water resources is determined by the behaviour of the hydrological cycle at the catchment level, the alteration of any mechanism or process within the cycle directly or by affecting any of the factors of the hydrological processes will have effects in the quantity and quality of the water resources within the catchment.

The water resources of lake Naivasha are tried to be managed in a sustainable way, but other very important aspects of water within the catchment are being ignored or poorly managed, those last ones are having negative effects on the lake. Although the separation of the management of different water issues can be done at certain levels, at a higher hierarchy they converge and an integrated management at the catchment scale is required.

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Chapter 1. Introduction

This research focuses in the identification, analysis and representation of conflicts on water issues at the catchment level in the area of Lake Naivasha (Kenya). This area has a high economic relevance in the present economic situation of Kenya, since for 15 years very intensive agricultural production of vegetables and flowers in large farms has taken place around the lake. Furthermore many other economic activities where water is a common and crucial resource take place (fisheries, small farmers, pastoralists). Lake Naivasha has the particularity of being one of the few freshwater sources in the Rift Valley, in part because of this it is the centre of many conflicts due to the relations established between the different groups of stakeholders having an interest in the lake.
A wide variety of groups with different degree of development due to their characteristics and historical evolution are involved in the use of water. The catchment area of the lake includes part of what was known as the "White Highlands" of Kenya with their history as a property first of the white settlers and later reorganized for the resettlement of native population from the 60's. Also Maasai rangelands are included in the catchment area as well as a growing tourism industry around the lake.
Many investigations have been done until now about the physical and ecological characteristics of the catchment area and the lake, this research aims at first steps on the social characterization of the stakeholders, the relations between them and the main conflicts over water issues at a catchment level. The work scale and the methodology of the research imply that the approach to the subject is not in great detail.
Summarising the topic of the research is justified by these reasons:
•Water is a very important economic and social resource in the area
•There is a wide variety of users of water with apparently different interests and different powers
•There is already a Management Plan being implemented for the management of the lake that it is used as a reference and standing point for the conflict analysis
•From the geographical point of view an analysis of the interrelations between stakeholders and conflicts at the catchment level could help to manage the water resource

1.1. Objectives and research questions

The general objective of the research is:

To perform a conflict analysis on water-related issues in the catchment area of Lake Naivasha

This general objective can be subdivided in different specific objectives:
1. To identify the stakeholders related to water resources in the catchment
2. To identify and to establish a typology of the conflicts
3. To analyse the conflicts over water issues
4. To explore and apply appropriate map representations

5. To explain through a conceptual model the relations between the different conflicts and the stakeholders
6. To explore from a spatial perspective some physical and socioeconomic factors determining the conflicts

The **research questions** corresponding to each of the specific objectives are summarized in Table 1.1.

Table 1.1. Specific objectives and research questions

OBJECTIVES	RESEARCH QUESTIONS
1. To identify the stakeholders of water resources in the area	1. Who are the stakeholders in the area? 2. Which is their importance? 3. Which is their influence? 4. How are the relations between them?
2. To identify and to establish a typology of the conflicts	5. Which are the main conflicts between these stakeholders? 6. How can we define these conflicts (conflict description)? 7. What conflict types are present there? 8. Which criteria can we use to classify them? 9. How can we classify them?
3. To analyse the conflicts on water issues	10. What sources of conflict are in the area? 11. A spatial pattern of conflicts can be identified? 12. Can we hypothesize some of the physical or socio-economic factors determining the conflicts?
4. To map the conflicts on water issues	13. Which criteria can we use to represent spatially the conflicts? 14. How can they be represented?
5. To explain through a conceptual model the relations between the different conflicts and the stakeholders	15. How are the relations between the conflicts? 16. Can we synthesize these relations in a conceptual model? 17. Are the stakeholders playing a role in this model?
6. To explore some physical and socioeconomic factors determining the conflicts from a spatial perspective	18. Is there some spatial correlation between some physical and socioeconomic variables and the conflicts?

Some of the issues treated in the research are sensitive and there are many stakeholders involved, the results can not be verified with the stakeholders. The research is bounded by the *standing assumptions position of the investigation* as follows:

• The research takes the point of view of the Naivasha Management Plan, as the authority given the responsibility to manage the resources of the lake, not any other authority or any particular stakeholder

•The conflict map to be produced pretends only to show the potential spatial dimensions of the conflicts. It will not be a stakeholder map or pretend to summarize all the other dimensions and aspects of the conflicts

•The conflict map to be produced experiments with:

- •Visualization and summary of complex relationships and conflicts in the area, as
- • a potential tool for planners or conflict managers.

• It can be used to analyse the socioeconomic and physical causes of conflicts

1.2. Conceptual framework

After reviewing the concepts, as a general background knowledge, of conflict analysis and mapping, the need for conflict analysis in the selected study area is described. A reflection of the meaning of this research for the management of the resources of the area will help to understand the applicability and the meaning of conflict analysis in specific situations.

1.2.1. The meaning of conflict analysis and conflict mapping

Conflict analysis and mapping is a series of tools that can be used in the process of planning and decision making for natural resources. The failure of "standard " land use and environmental planning has led to look for new approaches that are able to overcome the types of failure. These types of failure as classified by McCall (2001) are related to failure to address "all the issues" and the "real" issues, failure to be inclusive of legitimate goals of users and managers, failure of information, failure of the methodology and failure of institutions. In this sense conflict analysis can be used as a tool of understanding the processes, needs, problems and disagreements between the stakeholders and can contribute to the planning process. As said in the UNCED Agenda 21 (1994) in relation to planning: "The basis is the recognition of different decision making levels, from the individual land user to the world community; the aim must be to maximize simultaneous achievement of those different objectives; whilst minimizing conflicts between the various stakeholders; and involving them in policy and decision making".

In the ten steps of the process of land use planning proposed by the FAO (1993) (Figure 1.1) conflict analysis could be integrated in several of these steps to facilitate and improve the planning process. Conflict analysis can be used in analyzing the problems (step 3), elaborating the options and once the plan is implemented (step 6) and it is being monitored, conflict analysis could be used in reviewing the plan (step 10).

At another level the exercise of conflict analysis can also help in a decision-making process within planning. Although this is not the objective in this research, it is important to be aware of the role of conflict analysis in this field. The model of decision making proposed by Simon (1960) is composed by three phases:

1. The intelligence or problem formulation phase. This involves scanning of the environment for situations (problems or opportunities) demanding a decision. Here data are obtained, processed and examined for clues that may identify problems or opportunities.
2. The design phase. This involves inventing, developing analyzing possible courses of action, which includes process of understanding the problem, generating solutions and test solutions for feasibility.
3. The choice phase. It involves the selection of an alternative or course of action from those available.

The conflict analysis exercise could help and improve the scanning of the environment in the intelligence phase of the model, contributing to improvements in the information acquisition and processing methods of the planning that are needed to overcome the failure of information and methodology mentioned above as some of the most important causes of failure in the standard planning.

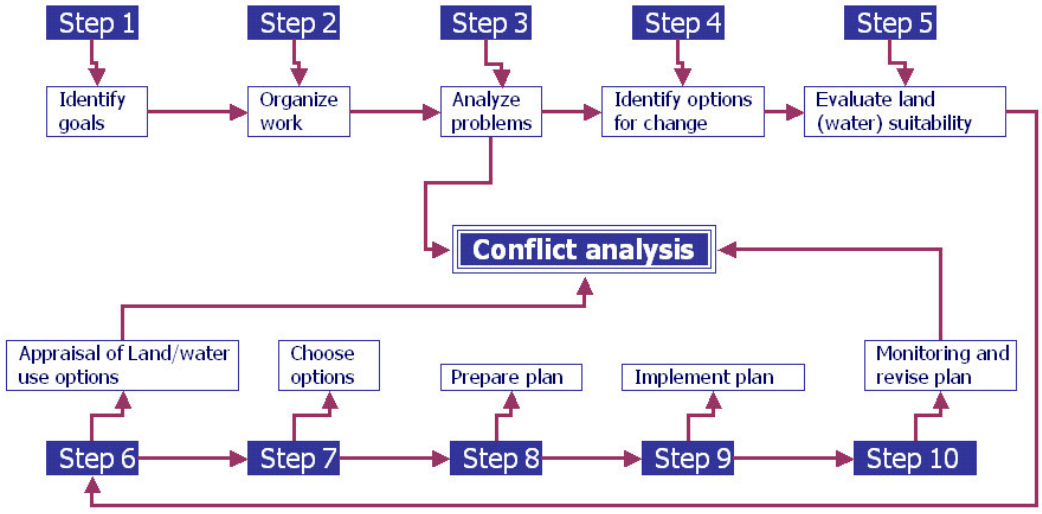


Figure 1.1 Integration of conflict analysis in the ten steps for planning proposed by the FAO (1993)

Conflicts are the visible registers of underlying differences as noted by McCall (2001). They can be defined also as disagreements on the course of action to be taken (Mostert, 1998). Conflict analysis is an essential component of current water management and can be a previous and useful step of conflict management and resolution. Conflict analysis is not the same as conflict resolution, the aims of conflict analysis are examine, analyze, understand and eventually predict conflicts as apart of overall conflict management (McCall, 2001).
Conflict analysis involves stakeholder analysis, a conceptual model of conflict analysis for example could imply the following steps:

- Conflict identification
- Inventory of conflict type
- Inventory of conflict category
- Stakeholder identification (list and classification)
- Analysis of stakeholders (attribute, importance, assumptions, interrelations)
- Inventory of conflict scale
- Inventory of conflict sources (Anatomy of conflict sources)
- Definition of conflict dynamics
- Search for values/indicators for monitoring conflicts
- Finding of stakeholder analysis (Stakeholders participation matrix)

Furthermore the concept of conflict mapping or assessment has been used as a mean of conflict analysis and it refers to the process of systematic collection of information about the dynamics of a conflict. The maps (not necessarily geographical maps) stress open-ended, participant-based data as the path to specifying conflict processes (Verplanke, 2000). This type of approach can enormously help to manage conflicts and it was introduced by Wehr in 1979 to give to the manager and conflict parties an understanding of the origins, nature, dynamic and possibilities for a resolution of a conflict. The map should contain information such as a summary description, conflict context, conflict history, conflict parties, conflict dynamics, alternative routes to solution the problems and conflict regulation potential (Verplanke, 2000). A conflict map can be used in different way but basically provides an

informed judgment in the initial phases of conflict intervention. The map can be used and discussed with the stakeholders to facilitate negotiation and can be used to materialize and demystify the conflicts.

1.2.2. Need of conflict analysis in the catchment of Lake Naivasha?

It is important to asses whether a conflict analysis is needed or not in this situation to understand better the meaning and purpose of the research. In this case two indicators were considered as very explicit when examining the need for a conflict analysis for the Naivasha catchment: first, a quick check of the Kenya media provided an important amount of news in relation with Lake Naivasha, most of these news narrated social, environmental or economic impacts as a result of conflicts between stakeholders on water issues (water utilization, water availability, water contamination etc.). Second, nowadays in the Naivasha catchment a management plan for the lake is being implemented. The Management Plan started in 1995 (LNROA, 1995) and it was reviewed in 1999, the group in charge responsible for the plan won even the Ramsar Wetland Conservation Award for 1999. However in the plan, conflict analysis and management is not contemplated, despite of the apparent existence in the past and present of conflicts concerning water issues. Thus it is an interesting opportunity to perform a general conflict analysis in the area to learn from the analysis and to assess if somehow could contribute to help the planners and decision makers.
There is already a Management Plan in the area in charge of managing the lake resources, the conflict mapping and analysis of water-related conflicts in the area will consist of two main parts: a conflict and stakeholder analysis and a visualization of conflicts (Figure 1.2). The outputs of these two parts are thought to contribute to the existing Lake Naivasha Management Plan. Following the main steps of the integration of conflict analysis in the Planning process of FAO (Figure 1.1). The conflict analysis and mapping could be used as a feedback when the Lake Naivasha Management Plan has to be reviewed or updated. Figure 1.2 shows the conceptual framework of this research in the reality of the Lake Naivasha catchment.

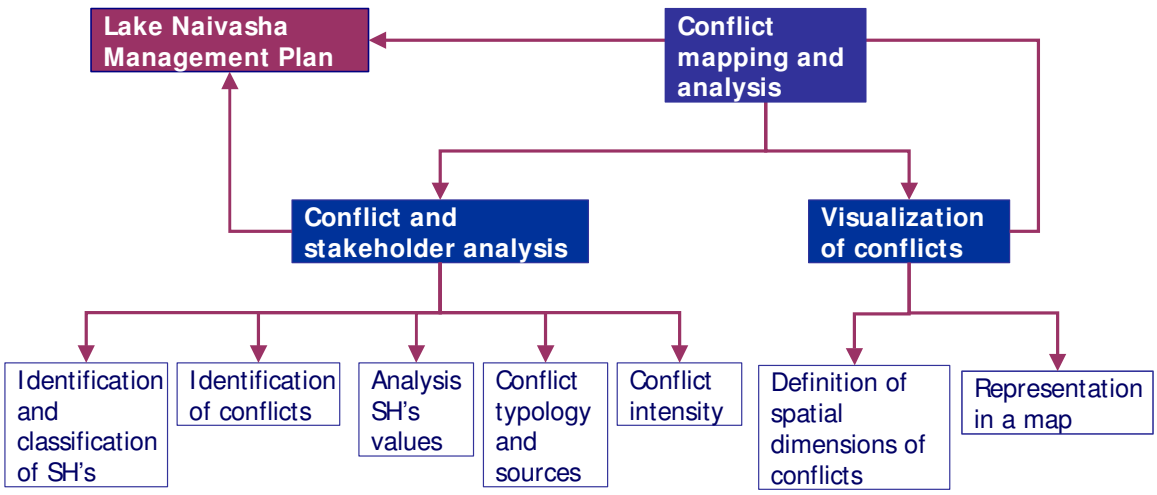


Figure 1.2. Conceptual framework of conflict analysis in the Lake Naivasha catchment

1.3. Structure of this thesis

The structure of this thesis is partially based in the model of conflict analysis proposed in chapter 1.2.1. Chapter 1 focussed in the presentation of the objectives and research questions, the justification of the research, discussed the concepts of conflict analysis and conflict mapping and evaluated the need of conflict analysis in the Lake Naivasha catchment. Chapter 2 and 3 will present the characteristics of the study area and the methods used in the research, respectively. Chapter 4 and 5 will develop a stakeholder and conflict analysis for the area, respectively. Chapter 6 will present some exploration done in the spatial visualization of conflicts. Chapter 7 is a synthesis chapter, it will construct a conceptual model of conflicts relations, it will show how the relations between conflicts and physical factors can be explored and it will discuss the main results of the research synthesising different outputs. Finally chapter 8 will address conclusions.

Chapter 2. Study area

2.1. Physical framework

The Lake Naivasha Basin covering an area of approximately 3400 km^2 is between latitudes 0°30' to 0°55' S and longitudes 36°09' and 36°24' E (UTM zone 37, boundary coordinates X_{min} 190000, Y_{min} 9907000; X_{max} 221000, Y_{max} 9934000) (Figure 2.1, Figure 2.2). It incorporates the lake, the Ndabibi Plains to the west of the lake and the Ilkek Plains immediately to the north. It is located in the Rift Valley Province, South-Western Kenya, within the administrative district of Nakuru. The basin lies about 100 km to the Northwest of Nairobi. It is accessible by the mainline of the East African railways and a major road that services the western part of the country

Lake Naivasha dominates the central part of the Naivasha basin. It has a mean surface area of 145 km^2 at an average altitude of 1887.3 m.a.m.s.l (Mmbui, 1999). The Mau escarpment on the western fringe rises up to a maximum of 3080 m.a.m.s.l with a N-NNW orientation and is over 3000 m for 36 km of its length on the western fringe of the study area. The escarpment is rugged and deeply incised with numerous faults and scarps that are prevalent. There is a rise of topography to the south towards the Olkaria volcanic cones of up to 2430 m.a.m.s.l at Olkaria Hill. The Ndabibi plains extend up to 9 km west of the lake and separate the Olkaria and Eburru volcanic complexes. To the East is the broad Kinangop Plateau that rises to a maximum altitude of 2740 m. The NNW-trending South Kinangop fault scarp (100-240 m, Darling et al., 1990) separates the plateau from the plain in a series of downthrown fault steps.

The Ilkek plains extend up to 23 km north of the lake and range in width from 13 km near Naivasha town to 4 km wide near Gilgil town. The plains slope gently southward from a maximum elevation of 2000 m in the north.

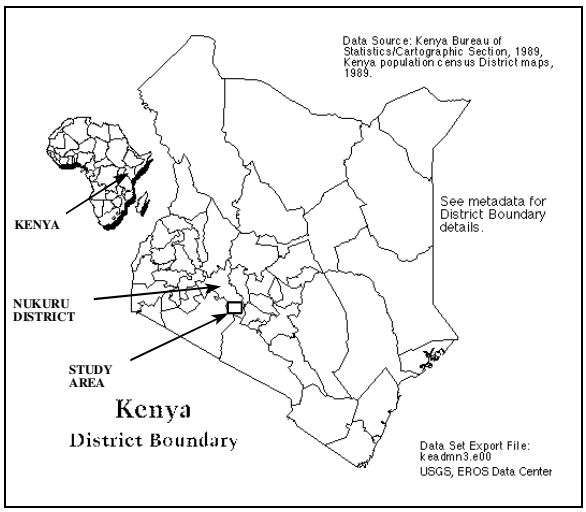


Figure 2.1. Location of the study area

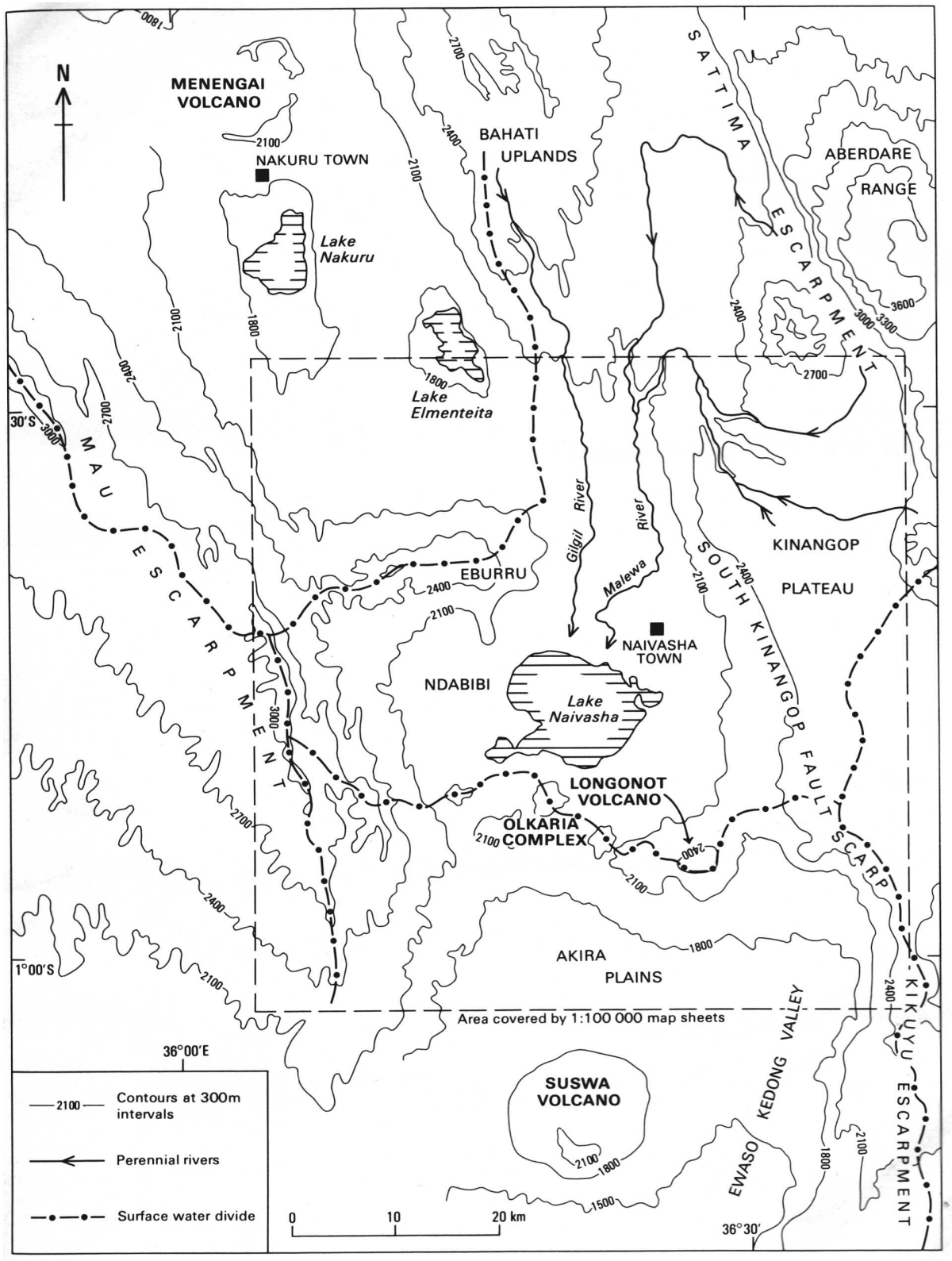


Figure 2.2. Detailed Physiographic Map of the Lake Naivasha Basin (after Clarke et al., 1990).

2.1.1. Climatic conditions

The climate is humid to sub-humid in the Highlands and semi-arid in the Rift Valley. The mean monthly maximum temperature range between 24.6°C to 28.3°C, and mean monthly minimum

temperature between 6.8°C and 8.0°C. The average monthly temperature ranges between 15.9°C and 17.8°C.

The average annual rainfall ranges from about 1300mm in Kinangop plateau (South Kinangop Njambini) to about 600mm (Naivasha K.C.C. Ltd.) in the rift floor. The Thiessen polygons map for rainfall modelled with data of 15 years is presented in Figure 2.3. The annual rainfall trends for thirty years are presented in Figure 2.4.

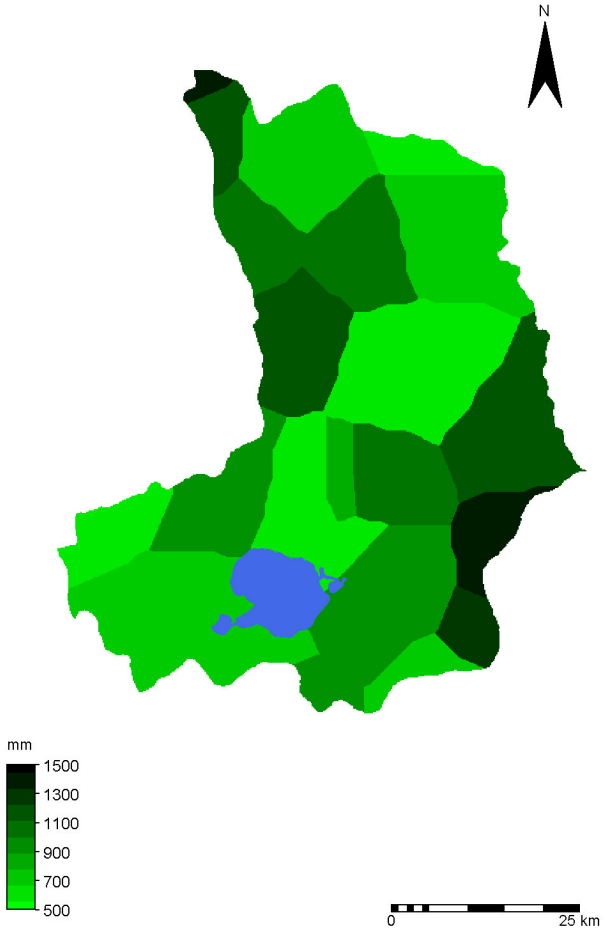


Figure 2.3. Rainfall in the catchment calculated with Thiessen polygons based on rainfall data between 1983-1995 from the ITC Naivasha database.

The rainy seasons are typically from April to May (sometimes June) and October to November. The April-May rainy season is the main rainy period, known as the 'long rains', while the 'short rains' occur during October-November.

The basin lies within the semi-arid belt of Kenya with average annual precipitation of 700. The rainfall pattern is bimodal with the main rainy period in April-May and the shorter one from October-November (Ase et al., 1986) (Figure 2.5). It is greatest along the Mau and Aberdare escarpments where it averages from 1250-1500 mm annually and is lower in valley areas where it averages about 650 mm at Lake Naivasha being noticeably a function of topography.

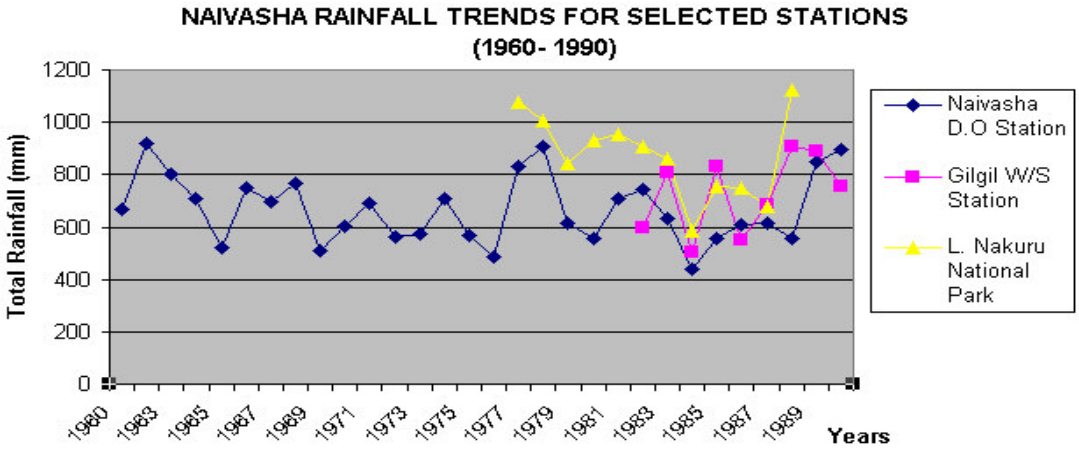


Figure 2.4. Naivasha Rainfall trends (1960–1990). (Source: Ministry of Land Reclamation and Water Development).

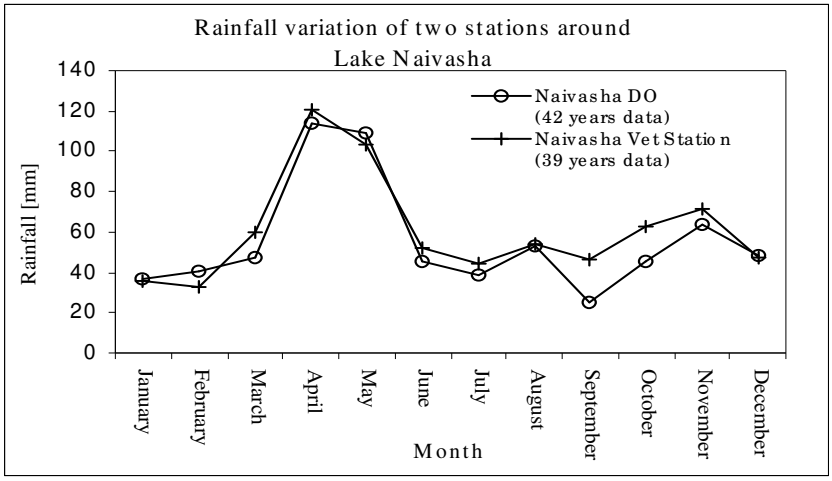


Figure 2.5. Rainfall variation of two stations around Lake Naivasha. Rainfall is bimodal with main pulses in April/ May and in November. The average rainfall on the lake for the period 1931-1960 was 608mm (East African Meteorological Dept.1966, after Ase et al., 1986).

2.1.2. Geology and geomorphology

The geology of the area is characterized by volcanic rocks and Quaternary lacustrine deposits from large ancient lakes. There are two lithologic units in the lakeshore area, lacustrine and volcanic origin. The prevailing quaternary deposit is of lacustrine origin, which largely comprises of fine volcanic ashes besides clay and silt. In addition, due to the soil erosion and deposition resulting from the lake levels fluctuations, there appeared also some coarse loamy with occasional fine gravel deposits.

Three types of landscapes can be identified in the Naivasha catchment: the Kinangop plateau, the Mau escarpment, and the Rift valley floor.

The Terrain Map Units (TMU) map created for the entire catchment by Hamadudu (1998) (Figure 2.6) synthesises quite well some of the most important geological and geomorphological characteristics. Since no geological or gemorphological maps are available yet at the catchment level the TMU is quite useful.

As mentioned above, around the lake two levels of lacustrine plains can be distinguished and a volcanic complex are present at the Rift Valley floor within the catchment. At the East of the catchment the escarpment of the Kinangop volcanic plateau follows probably a long fault. Furthermore several types of volcanic formations can be distinguished (Figure 2.6).

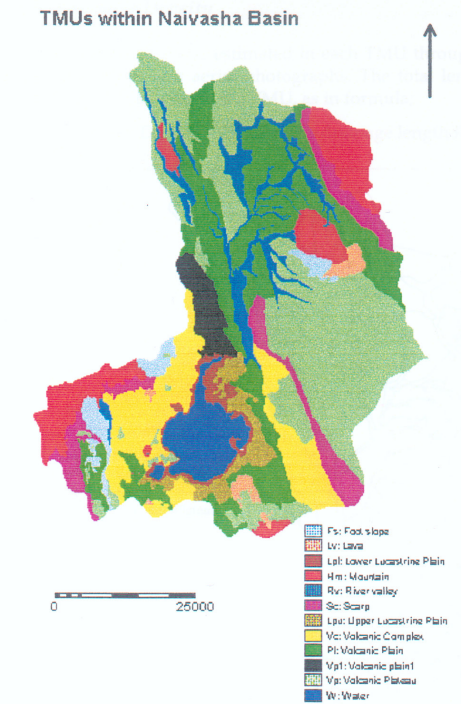


Figure 2.6. Terrain Map Units map (Hamududu, 1998)

2.1.3. Land cover

A land cover map of the catchment is presented in Figure 2.7 derived from the TM 96.

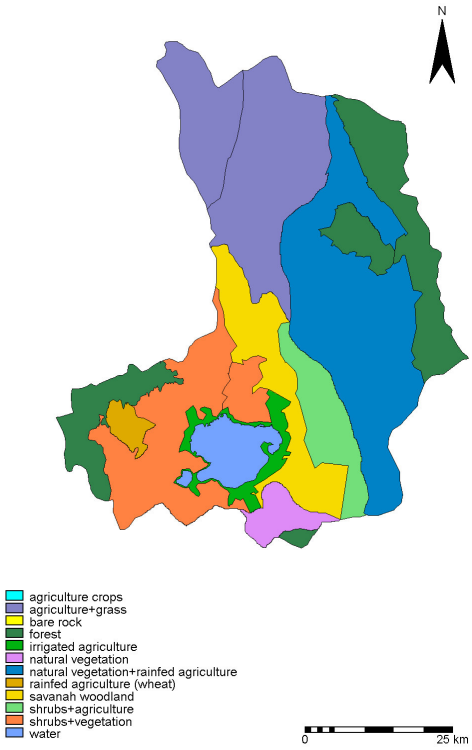


Figure 2.7. Land cover map (Source: ITC Naivasha data base)

This land cover is related to the main land uses in the catchment. It can be observed that immediately around the lake a band of irrigated agriculture exist, also on the valley floor and to the East and West side of the lake a savannah woodland and shrubs and vegetation appear in a wide area where more grazing activities take place. In the higher areas of the catchment different types of agriculture (normally rainfed) and forest cover appear.
From the land cover map it can be seen that the main landuse within the catchment is agriculture which includes irrigated crop farming (horticulture, vegetables, fruits) around the lake and mixed farming (wheat, maize, potatoes, beans and sunflowers) on the rain-fed slopes of the escarpment. Dairy farming is mainly practised on large estates on the north-eastern shores of the lake. The Southeast area of the catchment (Longonot area) is used as intensive grazing land by Maasai, as well as part of the Ndabibi plains, Moindabi area.
The low lying central parts of the catchments carry natural and semi-natural vegetation (grassland, bushland, acacia, cactus trees, savannah and shrub) that provide suitable habitat for wildlife and indigenous livestock farming. Game sanctuaries for wildlife are mainly set to the west of the area. Settlements are mainly concentrated around the main towns with a few homes within the estates and farms.
The wetlands that are found around the shores of the lake are reputable for the existence of *Papyrus* swamps. They are mainly used as indicators of hydrological regimes, modifiers of water quality and as habitats for numerous animals and birds.
The Eburru Hills, Mau, Longonot and Nyarandua escarpments are all hosts to indigenous hardwood forests that form the main watersheds of the lake basin. The bamboo forests are confined to the Nyarandua and Mau escarpments.

2.1.4. Drainage system

Lake Naivasha (145 km^2) is the largest water body of a complex of four lakes: Crescent Island (2.1 km^2), Oloidien (5.5 km^2) and Sonachi (0.6 km^2). Lake Naivasha is a fresh water lake surrounded by the alkaline lakes of Elmenteita, Nakuru, Magadi and Bogoria all distributed along the Rift Valley in Kenya. There are no known outlets, yet the water remains fresh, thus leading to suggestions of possible unique and intricate hydro-geological mechanisms involving underground seepage in this part of the Rift Valley, which account Lake's freshness. Naivasha's wetlands receive inflow from two perennial and several ephemeral streams. The catchment area is approximately 3,000 km^2. The floodplains of the two largest rivers, the Malewa and Gilgil, have a delta, which enters the lake from the north. The main lake has an average depth of four metres and a maximum depth of 16m at the submerged crater (Crescent Island). The lake water level can however vary significantly from time to time
The morphology of the Rift Valley has affected surface drainage. The drainage pattern of the catchment can be seen in Figure 2.8.

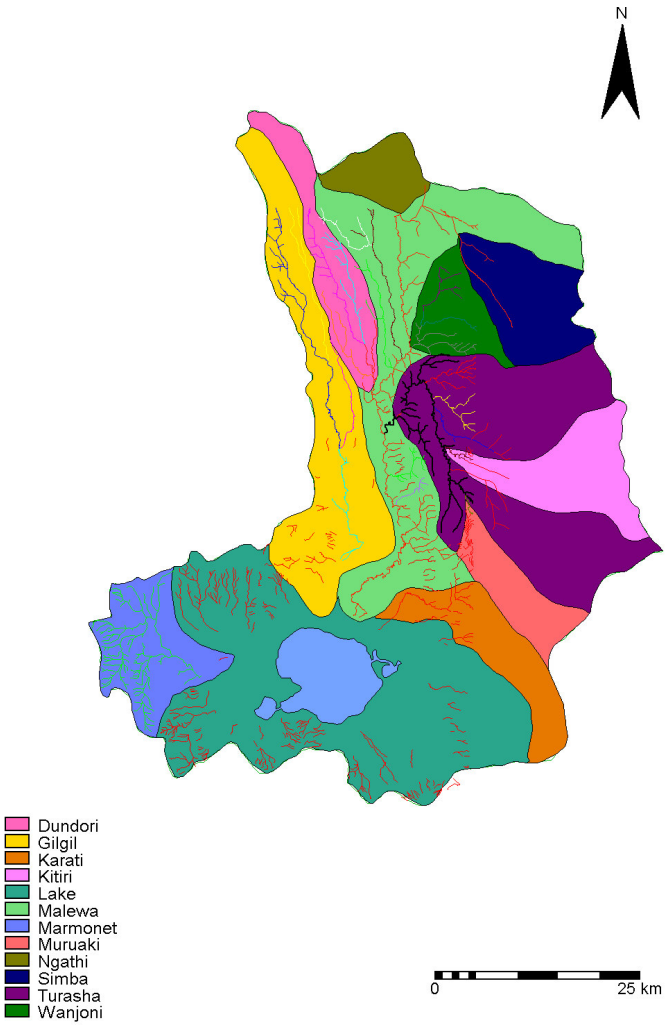


Figure 2.8. Drainage system of the Naivasha catchment (Source: ITC Naivasha data base)

There are number of rivers around the lake but only two of these have substantial flows into the lake. These are Malewa River, which is by far the most important, and the Gilgil River, which together account for 90 percent of the rive flows to the lake. Malewa river rises on the western slopes of the Nyandarua range at an altitude of 3000 to 4000 m. The small streams flow westwards and develop into four main tributaries; the Mugyutu, the Turasha, Kitiri, and Makungi. All four flow from North-South before turning west and joining the Malewa. Gilgil river's headwaters are situated in the Bahati forest where it drains a long narrow basin. The river raises at 2740 m in an area where rainfall is high at 1300 mm per annum. There are few tributaries. Karati River flows from the North and rises on the Kinangop plateau at an altitude of 2620 m where there is a mean annual rainfall of 800 mm.

The Malewa River is one of the two main perennial rivers that drain the lake and flow in a graben at the foot of the Kinangop plateau. The Malewa and Turasha Rivers have a combined drainage area of about 1,730 km^2.

The tributaries of the Turasha River (Makungi, Kitiri and Engare) deeply incise the Kinangop plateau flowing in a westerly direction. The Kinangop rivers are captured by the main Malewa River in the northeast of the basin. Further downstream the Malewa River is joined by the Turasha River and the two flow southwards.

The Gilgil River flows in a narrow basin to the north of the basin and is the second major perennial river that drains the lake. The Gilgil River has its headwaters high in the Bahati Highlands. Its main tributaries rise up to 2,772 m.a.m.s.l. and drain about 420 km^2.None of the numerous streams that incise the Eburru ridge and drain the Ndabibi Plains reach Lake Naivasha.
The evapotransporation and lake evaporation rate given by LNROA are 2141 mm and 1529 mm respectively. The abstraction loss of the lake water are mainly used for agriculture and geothermal power generating.

2.2. Socioeconomic framework

The water-related conflicts existing in the area have developed from physical characteristics and constrains and, probably also in a very big part, as a consequence of the social and economic characteristics of the region. The land use and land tenure history have gone through different phases since colonization started. This land tenure and land use history (mainly agricultural) have played presumably an important social, economic and emotional role in the development of the present-day land and water-related conflicts.

2.2.1. Review of the agricultural development in Kenya and water related issues in the last century

Very often conflicts about natural resources have an historical component related to history of land tenure or evolution of land uses. In this way it is very possible that part of the conflicts over natural resources in the Naivasha area have some aspects related to the inheritance of the land tenure and agricultural development since colonial times. The colonial period meant a disruption of African patterns of land use. The demands that the establishment of a colonial economy placed upon African society were to prove an important element in the dislocation of tenure arrangements and the deterioration of land use in the African areas of Kenya (Okoth-Ogendo, 1976). Water availability and use is very much related to agriculture in Kenya, and Kenyan agricultural sector is a very important component of its economy. Agriculture in Kenya has a dual character inherited from its colonial past and successive land reforms, this dual character can be translated and observed also in some of the conflicts on water issues that were detected in the Naivasha catchment recently. The dualism according to Senga (1976) is between small scale and large scale commercial farms and subsistence farms. The large scale commercial farms are still nowadays located in the former “scheduled areas” in which Africans were excluded from owning land before Independence. These farms market most of their output and purchase most of their inputs. The farms in the small farm subsector are in transition from a subsistence type of agriculture to a commercial type. Thus a quick review of the agricultural development of Kenya will help to understand the historical framework of present land uses that are a starting component of the present conflict situations in the area.
The agricultural development in Kenya can be classified from the beginning of XX century until the 1970s in five chronological periods according to Smith (1976):
1. From the turn of the century up to the depression years of the early **1930s** agricultural development policy was almost entirely European settler oriented, with scant attention being paid to African agriculture. About twenty per cent of the usable land area was for exclusive European use and the African natives were restricted to use the land within the African reserves. The creation of these reserves involved the “forced” migration of large sections of different tribes: Maasai, Kikuyu and Kalenjin people were removed from their ancestral lands to make way for European settlement. The “native units” were in this way created (Okoth-Ogendo, 1976).

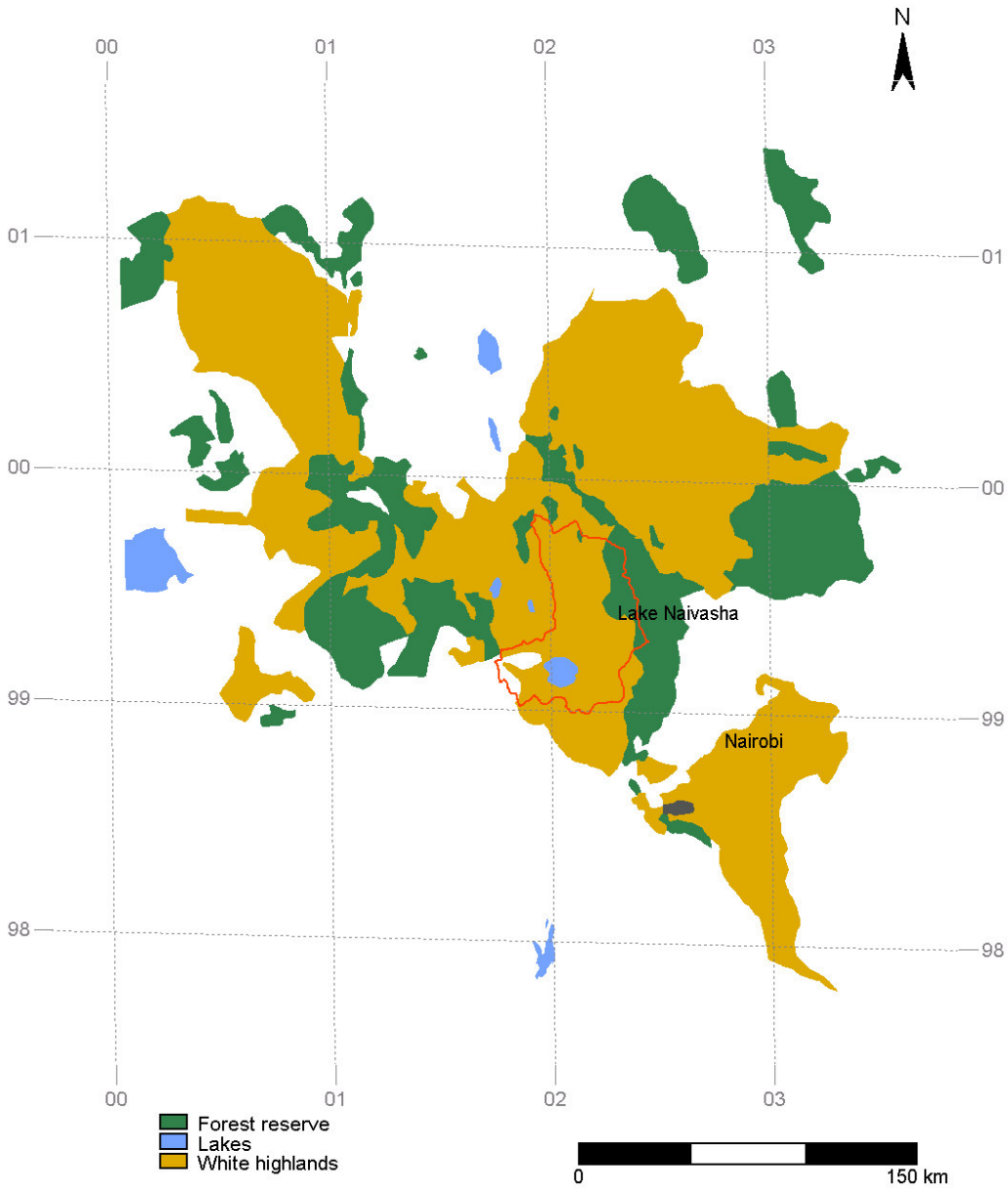


Figure 2.9. White highlands of Kenya (adapted from Morgan 1963)

2. From the early **1930s to the 1940s**, the interest of European settlers still dominated the formation of agricultural policy, although increasing attention was paid to African agriculture. During the depression years, in the European sector these was an increased demand for food production. Having constrained the amount of land available to Africans, the increased population pressure was creating landless people in some areas and causing soil depletion and severe erosion problems in other areas as the recuperative period in the shifting cultivation cycle was being truncated.

3. The **1940s and 1950s.** From 1942 it was an increase in the area under wheat, while the maize acreage stabilized. This emphasis on arable cropping aggravated the problems of soil erosion in the European areas and necessitated a change in farming systems in the post-war period. The resources available to African Agriculture increased under the Ten Year Plan started in 1946.

4. The **"Agrarian revolution of the 1950s"**. Not until the mid-1950s that sufficient economic incentives were provided to initiate a major and sustained increase in African agricultural output. The Government decided to draw up a plan for accelerated agricultural development, the Swynnerton Plan.

5. A **post-independence period**, in fact Independence brought little real change in overall strategy other than a partial redistribution of land in the former scheduled areas. In the late 1960s and 1970s a new policy started trying to involve a much larger proportion of farmers in all parts of the country in the development strategy.

The catchment of Naivasha lake forms part of what in colonial times was called the "White Highlands" (Figure 2.9). Some of these areas were later, in the years close to Independence (in the 4th chronological period according to Smith, 1976) reorganised and constituted as resettlement areas for the African natives. A quick review of the history of settlements and resettlements in the catchment can help to get a better picture of the history of resources use in the area, and thus of the availability of water that it is closely linked to land utilization. Moreover the knowledge of history of land occupation can help to understand the relations of the indigenous population with the natural resources, and as a consequence their attitudes when competition or conflicts are established around those resources.

After the construction of the Uganda Railway (it reached Nairobi in 1899 and Lake Victoria in 1901), European settlement was greatly encouraged regulated by the Crown Lands Ordinance (1902). Under this Ordinance, grants of Crown lands could be made freehold or by leases of up to ninety-nine years. Some areas were especially attractive for European settlers due to the cool climate and the absence of population over large areas (Figure 2.9). Although Indians were also interested in farming some of the Highlands, they were not so successful in their demands as Europeans (Carey Jones, 1965).

The Commisioner of Lands was not empowered to sell or lease any land in the actual occupation of the natives and further, if any grants were made which were subsequently found to contain African settlements, these settlements were deemed to be excluded from the lease so long as they were occupied. It was never contemplated that grants of land could be made to Africans, who had already selected the areas they chose to occupy and the land had been guaranteed to them by the creation of the African reserves.

The highlands consisted of a number of blocks of land, separated by African land or Forest Reserves (Figure 2.9) (Carey Jones, 1965).

Morgan (1963) classifies the highlands in fourteen regions based on a compromise between natural environmental types and the history of settlement with limits adjusted when possible to follow Agricultural SubCommittee areas (Figure 2.9). The Lake Naivasha catchment spread over three of these regions (2a, 2b and 2c in Figure 2.10).

Until the 1930s it seemed that European farming was successful, however it was still on very shaky and agronomic foundations. The plantation sector was surviving with cheap labour and without protection; both wheat growing and dairy farming were high cost and high disease risk. Much legislative and administrative action was therefore concerned with ways and means of procuring sufficient numbers of African labourers on a continuous basis (employment registration, tax on huts, restricting development of African areas: prohibiting cash crops and failing to provide essential infrastructure although Africans were being heavily taxed). Moreover the majority of settlers were relying on maize production for their main source of revenue, which were starting to create problems of soil depletion and erosion that were being ignored.

The benefits that the settlers derived were bought very much at the expense of the progress of African agriculture over the same period (Smith, 1976).

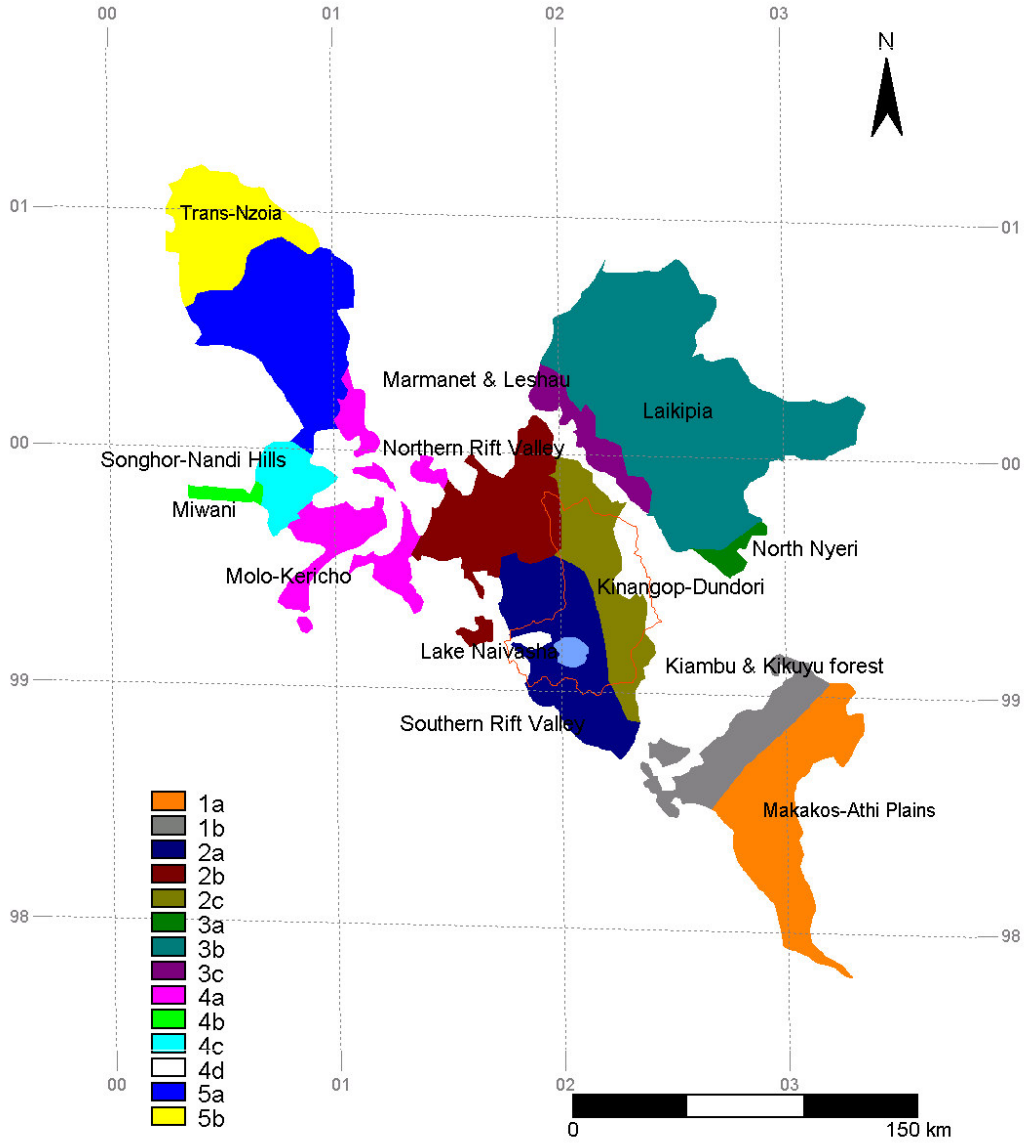


Figure 2.10. Regions of the White lands according to the land classification map prepared by Morgan (1963)

In the Rift Valley area farms were rapidly taken up between 1904 and 1906, with some pioneers, such as Lord Delamere, spending incredible amounts of money learning how to farm this unknown land. According to Morgan (1963) the floor of the Rift Valley may be divided into a southern ranching area and a northern mixed farming area. Except for riparian land around Lake Naivasha, the Southern Rift Valley (2a, Figure 2.10) was given to extensive ranching of beef cattle, or sheep on the higher areas. In the area of the Northern Rift (2b, Figure 2.10) higher annual rainfall enabled settlers to grow maize and export it by the railway to Nakuru, that was considered the capital of the "White Highlands". Agriculture progressed in this area towards a high-standard mixed farming, including crops as barley, maize, wheat, oats and sisal and some pyrethrum.

The Kinangop plateau was occupied by extensive fields of wheat and it was the major producer of barley, oats and pyrethrum in Kenya. Dairy cattle and sheep were quite important and they introduced also pigs. The Maasai were persuaded to move away from the Naivasha area because at the end of the XIX century the Naivasha catchment was enterely under the extension of the Maasai lands. They were split into two reserves, one to the North and one to the South in 1904, the Northern one was extended in 1906, but the division of the tribal lands was unsatisfactory.

The opening of the "White Highlands" to Africans took place in 1960 with the amendments of the laws that had excluded the African landownership from the area. Under the Swynnerton Plan in 1954, the Government was conducting a major revolution in African landownership and farming. The aim of this plan was "to raise productivity of the African lands, their human and stock-carrying capacity, the income and standards of living of the people, while at the same time effecting a substantial increase in the resources and economy of the colony".

The plan in theory dealt with the whole of Kenya, but in fact most of the estimated £10,800,000 were spent between 1954 and 1960 in Kikuyuland (Taylor, 1969). The bases of the plan were twofold: the first was the change of landownership from customary tenure to individual freehold. This involved enclosure and registration of existing rights (adjudication and registration processes) and, where there was an excessive fragmentation in overpopulated areas, the sorting out of scattered fragments and their re-assembly in areas around the homestead in roughly the same proportions of kind of land as was held before (consolidation process). The purpose of this was to give through individual ownership the greatest incentive to farmers to make the jump from subsistence agriculture to modern market-oriented farming for money and to bring together in viable farming units the scattered fragments that often went unused and could not be farmed economically.

The agronomic experts recommended that African land tenure should be overhauled and replaced with an alternative tenure pattern based on consolidated and individualised holdings that would facilitate proper farm planning on a mixed rotational basis. These arguments were based on an old assumption in a capitalist political economy, that is that individual proprietorship in and of itself will generate industry and enterprise. It was accepted that individualisation would involve fundamental changes in African society and might even produce landlessness and misdistribution of resources, these was thought to be "normal" stages in the process of development and inevitable. Analysts as Okoth-Ogendo (1976) questioned whether individualisation made it easier for the planners to devise more suitable plans, more realistic targets, and better implementation machinery than was possible in the pre-reform period. He concludes that the Kenyans were simply told by the colonial government that tenure reform was necessary and they believed it. The result, in his opinion, was, at most, a disruption of the social systems of many groups in the country and, at best, no appreciable change at all.

The second base was the provision on these consolidated or enclosed farms of farm plans or lay-outs, with rotational schemes, the introduction of exotic, high yielding livestock and of high-priced cash crops.

The resettlements went through some rapid metamorphoses. Figure 2.11 shows the areas affected by resettlement schemes within the Naivasha catchment. By early 1961 "peasant" schemes had been added. These provided for small holdings and the idea at the time was that they should be on the edges of the Reserves and merged with them in their administrative and social arrangements. By mid 1961 a "high density" scheme had been added. This was to provide for a lower standard for the more

over –crowded tribes, since the peasant schemes required settlers to have capital and good farming experience which the growing numbers of unemployed and landless lacked.

By mid “1962” the “high density” scheme was merged into the “million-acre” scheme.
To establish the resettlements scheme one of the first things was to prepare a land classification map. The map was a great over- simplification, since the classification can change rapidly within a mile, but it gave a general indication of where the successful settlement schemes could be mounted. It served as the starting point for planning the “million-acre” scheme. On the land classification map the soils were divided into good, medium and poor, or alternatively into land suitable for high density settlement, low density settlement and dairy-or beef- ranching areas (Figure 2.12).
The Kinangop fell into all three, from the rich lands on the edge of the Aberdares down to the high, level plains which were used by Europeans for wheat and livestock. The settlements were intended to exclude (a) ranching lands, since these were unsuitable for settlement and unlikely to produce any surplus; and, (b) plantations (coffee, tea, sisal, etc.) since these were already fully developed and their break-up would only reduce the value of production; their purchase price would be high; and they would not give any additional occupation to the land beyond the existing labour force (Carey Jones, 1965).

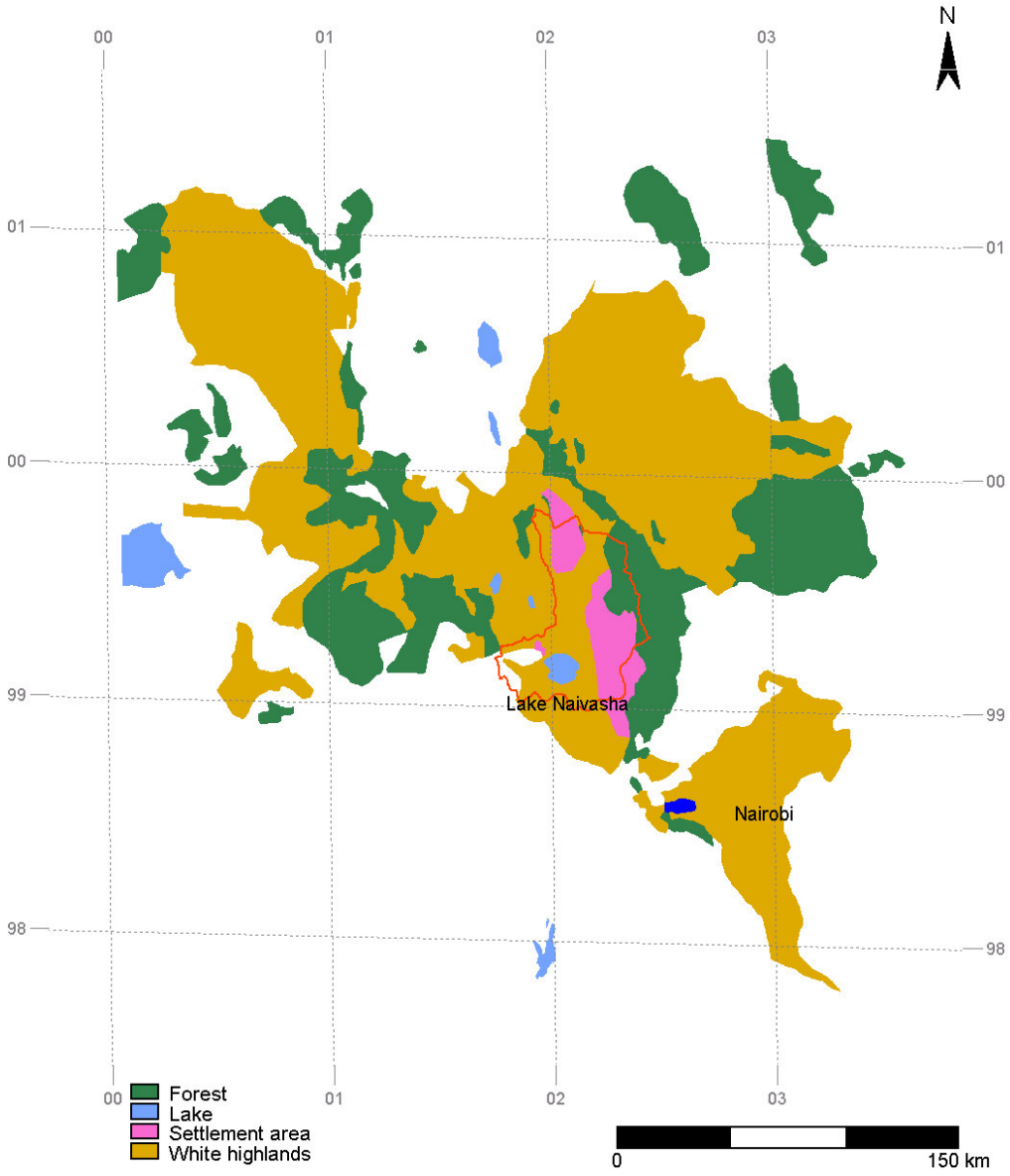


Figure 2.11. Settlement schemes up to June 1965 in the Naivasha catchment (adapted from Carey Jones, 1965).

The Kinangop area was resettled by Kikuyu, in fact, an attempt was made to see how far westwards the Kikuyu could be settled, and this area was allocated to them, up to the Rift Valley Scarp. This area included a Maasai ceremonial circumcision ground, claimed by the Maasai to be 7000 acres, which they used every seven years and which they had continued to use after the Europeans took over their land. It was impossible to provide for this in the middle of Kikuyu settlement, and to maintain unoccupied any area of land among a land-hungry people.

Also a small scheme was planned in the Eburru mountain (Figure 2.11) for mixed Masaai-Kikuyu who had established agriculture on the Masaai side of the border of the Masaai and Kikuyu tribes at Ngong near Nairobi, as it was thought that they might be accepted there. In the event it was found that the mountain's water supplies, obtained from volcanic steam jets, was insufficient to allow further development or the settlement of more than the existing Kikuyu labour force (Carey Jones, 1965).

Taking into account all the above mentioned and following Hellen (1969) the landscape of Naivasha catchment can be probably classified as African settlement scheme in the landscape classification proposed by this author. Irrigated and rainfall agriculture are present, and the policies aim at intensifying cash-crop production. As a colonial landscape inherited from the intensity of intervention of the imperial power, this type of landscape represents an extreme expression of exogenetic forces made possible by an almost total disregard of the indigenous social environment.

Concerning water issues, the controlled exploitation of water resources was one of the priorities of the Government in the 1970s that made two fundamental distinctions: rural drinking water supplies and irrigation. The bottleneck of inadequate rural water supply was first apparent in the high potential areas of the country where population pressure and agricultural development had reached the stage where improved water supplies were required to enable rural development to continue. It was recognised that an improvement in water supply would not only alleviate human suffering but would be a major input in exploiting the livestock potential of these areas (Carruthers and Weir, 1976). For these reasons the Kenyan Government started the 1974-1978 Water Plan with a major program for community water supply for rural drinking and farm use under the new created Ministry of Water Development (1974). Until that moment the competition between the different users of water had not been a significant planning issue.

However between 1969 and 1974 mutually exclusive projects had been proposed requiring a comprenhensive approach to the allocation of a not very abundant resource. At that moment the main issues were between urban and rural water needs (Nairobi Water Supply), upstream and downstream irrigation (Tana), hydropower versus downstream irrigation (Tana), game versus cattle watering (Amboseli) and industry versus urban and agricultural needs (Webuye) (Carruthers and Weir, 1976).

Following the Sessional Paper No. 4 of 1975 on Economic Prospects and Policies, there was a shift to labour intensive agriculture and basic rural infrastructure, including rural access roads and water supply. The next Development Plan concerning water was carried out between 1979 and 1983. During this second and third development plan periods, planning in Kenya was based on sectoral approach, which was characterised by the Central Government directing investments to the rural areas (Districts) through the line ministries. The Central Government financed all rural water supply projects. The districts were involved in supervision of small self-help projects mainly funded by Rural Water Development Fund. In 1983 the District Focus for Rural Development Strategy (DFRD) was launched and it meant the first major measure taken by the Government in pushing the decentralisation process into the heart of Kenya's rural development policy. It meant the

decentralization of decision making for planning and resource allocation from the national level to the district level. (Tomno, 2000).

The districts now are doing much more planning than before the introduction of the DFRD strategy, however problems like the scarcity of financial resources, the shortage of qualified personnel, the loss of original objectives and the interference of political factors are disturbing enormously the achievement of the main purpose of the DFRD which was the equitable allocation of water resources. Now at the beginning of the XXI century the needs and the economic landscape of Kenya have change substantially and the conflicts generated around the water resource are in some cases the same and in other cases different from the ones in the 1970s. Many lucrative economic activities appeared in the last 15 years around Lake Naivasha (horticultural and flower growing activities) and all of them depend enormously on the availability and the quality of water. These intensive and relatively new economic activities co-exist with traditional activities in the area such as small farming and fishing and with the non-solved problems of water supply for domestic use.

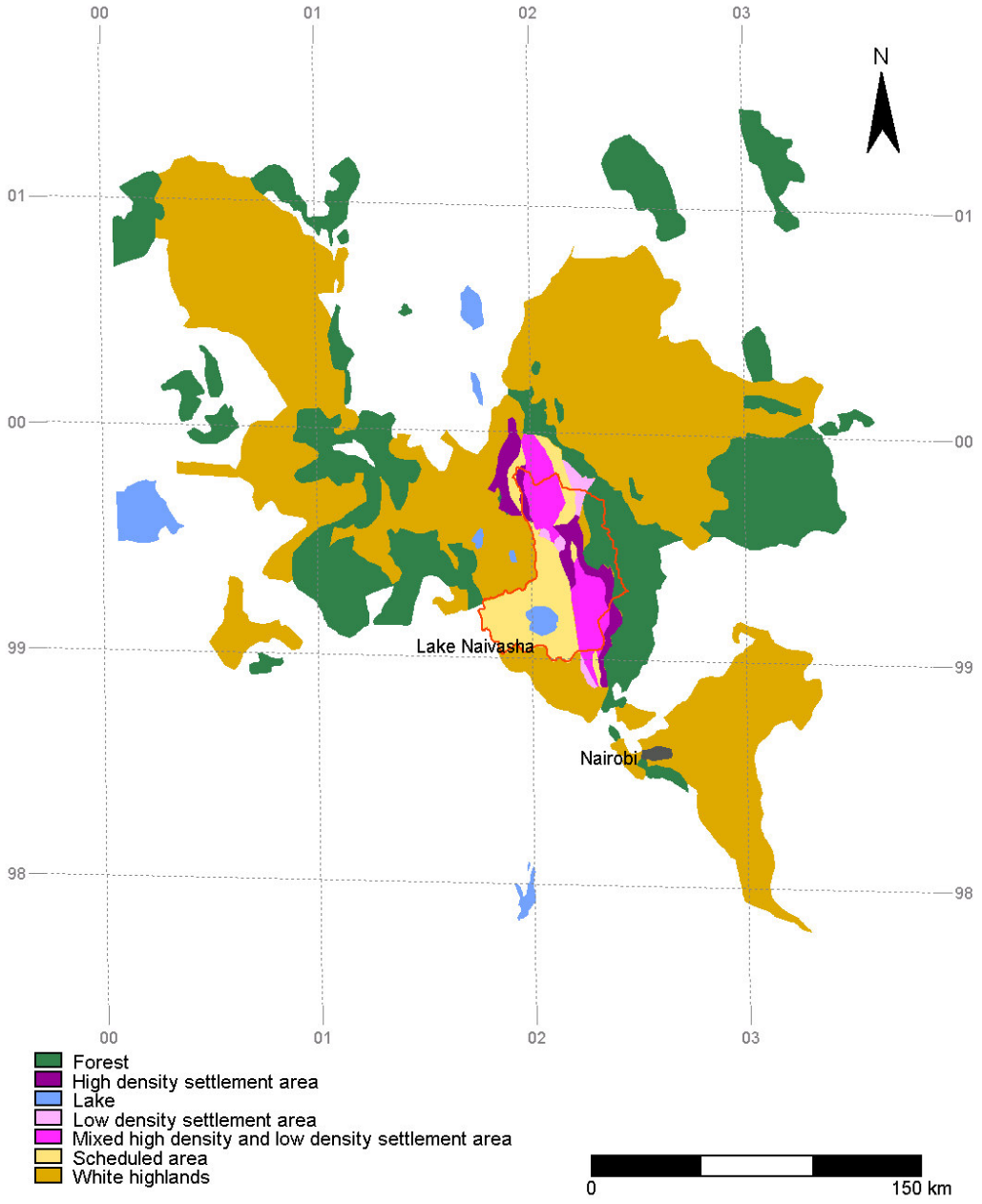


Figure 2.12. Land classification map of the settlement areas within the Naivasha catchment (adapted from Carey Jones, 1965)

2.2.2. Social characteristics of the area

The catchment area of Lake Naivasha is located partially in the administrative Nakuru district and in the Nyandarua district. Naivasha is an administrative division of Nakuru district. As estimated by LNROA in 1993, the population of Nakuru district was 846000 and the agricultural land per person was 0.68 ha. They also estimated that in the Naivasha division the population was about 150000 inhabitants without counting the inmigration due to the development of the agricultural sector around the lake. The population in the Nyandarua district was estimated at 450000. This district comprises much of the catchment area (the Kinangop plateau and the Ol Kalau Salient) with a land division estimated at 0.95 ha per person.

Besides the specialised horticultural industry of the irrigated lake areas, most agriculture is small scale, subsistence and food crop orientated. Before 1960, Naivasha Division and the area surrounding the lake was a major livestock farming area both for milk and beef. These enterprises are still present (the traditional dairy farms, more in the Northern part of the lake) but they seem less powerful since the intensive horticulture enterprises have developed around the lake (especially in the Southern part of the lake). Some of these traditional dairy farms are reorganising themselves and also introducing intensive horticultural crops.

The fishery industry in Lake Naivasha has a short history and it has been largely manipulated by man with introductions of different fish species. Before 1925 was only one fish specie in the lake that it is nowadays disappeared (LNROA, 1993). Fishing is done from canoes using monofiliament nylon nets with a regulated mesh size of 10 cm and a length of 100 m. The industry is controlled by the Fisheries Department and all fishermen are members of the Fishery Cooperative which provides marketing services (LNROA, 1993).

The fishery of Lake Naivasha is unstable and unpredictable due to associations between fish production and water levels. A high percentage of poaching exists causing a very high pressure on the fish stock.

Chapter 3. Methods

The methodological design of this study is based on analytical tools derived from the social sciences, the steps to follow are thought appropriate to the type of problem, catchment scale, and the short time available, taking into account the goal of the research (conflict analysis) that requires quite deep knowledge and overview of different physical, social, historical and cultural aspects of the area.

3.1. General methodological design: advantages and constraints

The conceptual framework of the research was discussed in Chapter 1 (Figure 1.2) and the basic idea is to perform the conflict analysis and mapping in two big and general steps which are: a stakeholder and conflict analysis and a visualization of conflicts, to contribute potentially when (if) reviewing the Lake Naivasha Management Plan. Each of these two steps comprises many steps within them and the use of many different tools.

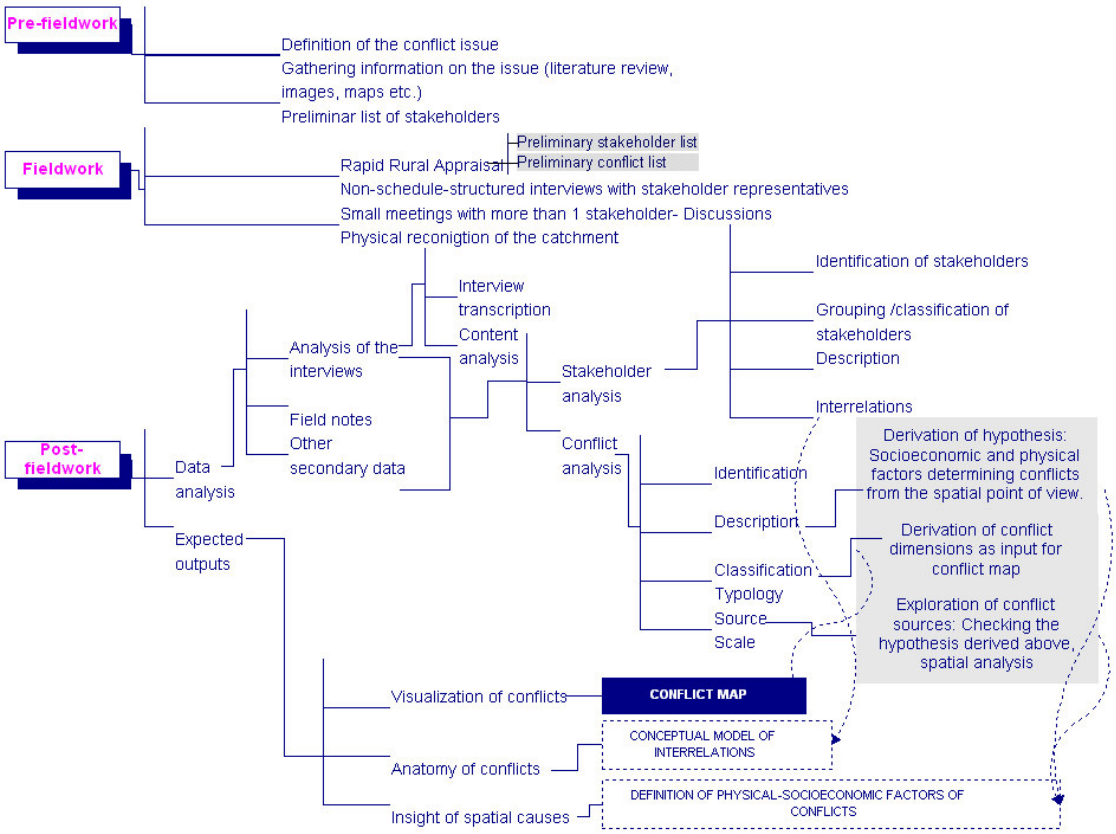


Figure 3.1. General methodological design of the research (indicating also main activities)

The research is planned in three main stages as shown in the model of Figure 3.1: the pre-fieldwork period, when the proposal is written, the first information search, the scale of work decided and a

preliminary list of conflicts and stakeholders in the study area are elaborated. In a second stage, the fieldwork is carried out, the main goal of this second period is the data acquisition with the techniques and methodology explained in the subchapter 2.2.
In a third stage, post-fieldwork, the data collected are analyzed. From the interviews performed and other secondary data (papers, existing maps and previous MSc thesis) a stakeholder and conflict analysis is done as described in subchapter 2.4. From this analysis some direct outputs or intermediate results are expected (gray boxes in Figure 3.1) that will help to conform the general expected outputs in the thesis (blue boxes in Figure 3.1). The main expected output will produce a conflict map, understood as a conceptualization and understanding of conflicts and underlying causes and factors, as well as the attempt to visualize them. In a second level, other expected outputs, at a coarser level of detail, would be the preliminary characterization and definition of a model of interrelationships between conflicts and stakeholders and the physical and socioeconomic factors determining them.
The main advantage of this methodology is its flexibility in the sense that the depth of the stakeholder and conflict analysis can be adapted to the available time and information. This is very necessary if we take into account that the research intends to get a general overview of conflicts, in a short time and with a very limited previous knowledge, where there are many parties involved in a quite big area.

3.2. Data acquisition

The data acquisition in the field takes into account the limited time available and the unfamiliarity with the study area, given that the general objective of the research implies a general inventory and understanding of conflicts at the catchment level. Therefore the fieldwork consisted of three components, the first (RRA), was also the first chronologically and facilitated the work in the other two components (field visits and interviews) that were developed parallel in time:

a. Rapid Rural Appraisal was done in order to get a general picture of the situation and facilitate the decisions to optimize the other two main tasks
b. Field visits, a field survey was done around the catchment in order to get a general view of the social and natural landscape
c. Interviews, main stakeholders were selected and contacted, interviews with them were carried out.

3.2.1. Rapid Rural Appraisal

Rapid Rural Appraisal technique (RRA) was applied in the first period of the fieldwork in order to get a general picture of the situation concerning water conflicts within the Naivasha catchment. RRA included multidisciplinary excursions in groups, individual excursions with a guide involved in water research and knowing very well the area, establishment of the first contacts and informal conversations with different representatives of the preliminary list of stakeholders. Attention was given to identifying (or confirming) the main stakeholders and how they could be grouped, understanding the social and physical environment of the area and identifying the apparent current and old conflicts on water issues.
This technique has its origin and application in rural development-related research. RRA is described as a process of learning about rural conditions in an intensive, iterative and expeditious manner or any systematic activity design to draw inferences, conclusions, hypotheses, or assessments, including the

acquisition of new information, during a limited period of time. It characteristically relies on small multidisciplinary teams that employ a range of methodological tools and techniques especially selected to enhance understanding of rural conditions in their natural context (direct observation, short questionnaire, semi-structured interviews and in depth interviews etc.), with particular emphasis on tapping the knowledge of local inhabitants and combining this knowledge with modern scientific expertise, but minimizing prior assumptions (Kachondham, 2001).
The RRA was carried out the first 5 days when a general recognition or survey of the physical and natural environment was done. The remaining 26 days were spent in the field visits and in organizing and carrying out the interviews with the stakeholders

3.2.2. Field visits

Another important part of the fieldwork was the recognition of the physical and social environment of the catchment. With that purpose, besides the interviews, some visits to different areas of the catchment were carried out, the routes followed can be observed in Figure 3.2. The objective was to optimize the resources available (time, transport, infrastructure) around the whole catchment in order to get a general picture of it.
Furthermore a high risk of the scale of the research is that due to the time and social constraints the persons reached for interviews (an important tool for data acquisition) might not be fully representative of all the stakeholders. As a consequence an over representation of some stakeholders can cause an overestimation of some conflicts and underestimation of other ones. All these factors must be taken into account when analyzing the data.

3.2.3. Interviews

In total 25 interviews were done with representatives of the main stakeholders concerning the use or management of the water resources or of other resources indirectly related to water. After the Rapid Rural Appraisal, special attention was given to the selection of the stakeholders for the interviews, trying to get a representative universe of samples distributed as evenly as possible between the preliminary stakeholder groups identified.
The type of interview carried out was a *non-scheduled-structure or focused interview* (Frankfort-Nachmias and Nachmias, 1996). This form of interview has four characteristics:

1. It takes place with respondents known to have been involved in a particular experience
2. It refers to situations that have been analyzed prior to the interview
3. It proceeds on the basis of an interview guide specifying topics related to the research hypotheses
4. It is focused on the subjects' experiences regarding the situations under study.

Although the encounter between the interviewer and respondents is structured and the major aspects are explained, respondents are given considerable liberty in expressing their definition of a situation that is presented to them. This type of interview permits the researcher to obtain details of personal reactions and specific emotions. The interviewer, having previously studied the situation, is alert and sensitive to inconsistencies and omissions of data that may be needed to clarify the problem (Frankfort-Nachmias and Nachmias, 1996).
A small recorder was use in the interviews when possible. About 50 % of the interviews could be recorded. This in fact is an enormous advantage because it allows to store first hand data that can be

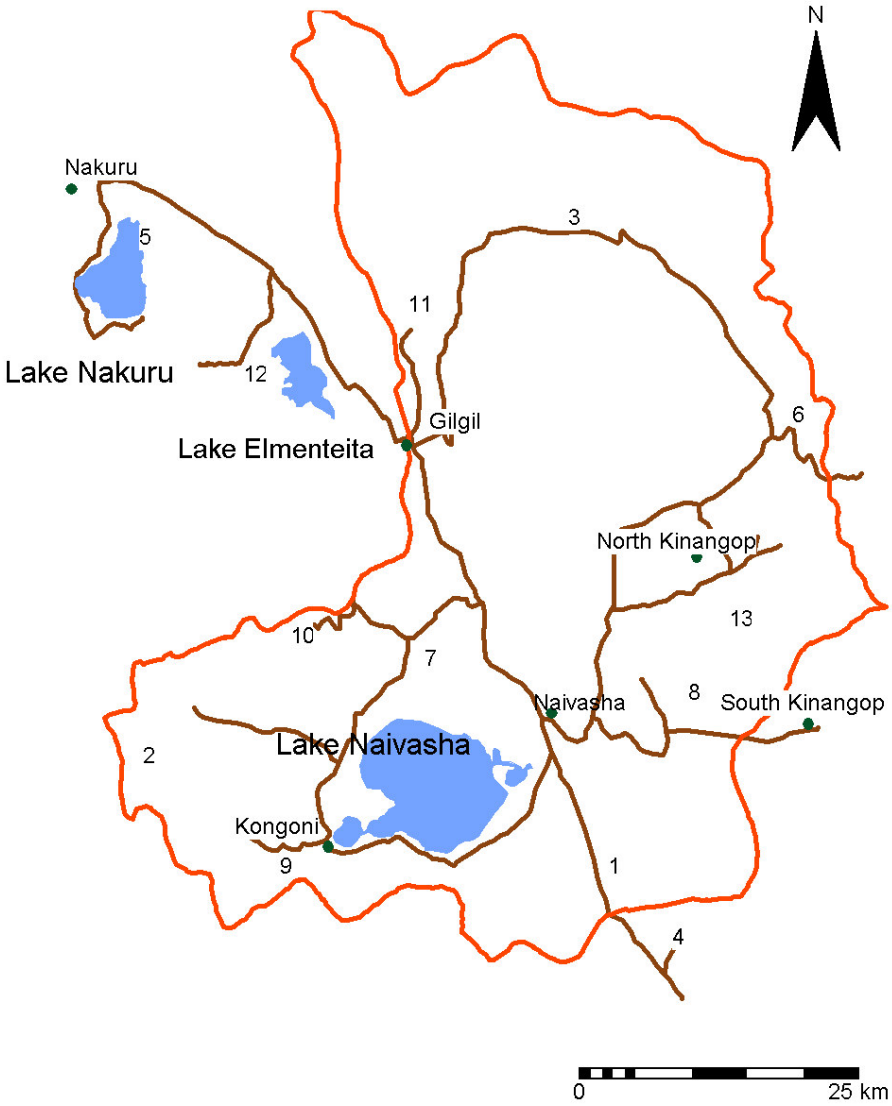
checked and analyzed afterwards as many times as needed. It also allows to concentrate better on the interlocutor and his/her answers during the interview. At the beginning of the interview, in most of the cases it was asked whether was possible to record it in order to facilitate our work, many people agreed, a couple of people did not agreed, other times it was decided that it was convenient not even to ask. In these last cases the researchers had the feeling that asking would force very much the situation, it would prevent spontaneity in the answers, a loss of confidence in the interviewers and a bad disposition of the respondent towards the researchers.
Most of the interviews were programmed in advance, except where the visit to some locations was followed by the immediate availability of the stakeholder to make the interview. In 90% of the interviews three persons were present: two researchers and the interviewed person, in other occasions an intermediary person was also present and also sometimes the interviewed person invited other colleagues to joint, in those cases the personal interview turned into a small meeting breaking the dynamics of question-answer, but facilitating a more dynamic discussion between the colleagues. In these last cases the researcher was participating in a second position but never giving direct opinions. A checklist as it can be seen in Table 3.1 was used as a guideline during all the interviews although, most of the times additional questions following the given answers raised.

Table 3.1. Copy of the checklist form used for the each of the interviews

GENERAL CHECKLIST FOR INTERVIEWS ON WATER ISSUES

Date	Interview number	Location

	Identification of the stakeholder	
	Main activity carried out	
	How long was carrying this activity	
	What they were doing before	
	Timing of the activity (the same for dry and wet season?)	
	Problems with water: Quantity	
	Quality	
	Prices	
	Access	
	If they have problems with water what is their opinion about the possible cause	
	Has it been always like that?	
	Differences with the situation with respect 5, 10, 20 years ago	
	Opinion about a good solution to their problems on water	
	Do you think the situation can go on like that?	
	What would need in your opinion to be improved?	
	Do you have any ideas that how it could be solved?	
	Changes in the environment in relation to the activities	



1. Longonot area
2. Ndabibi area
3. Upper catchment, North Kinangop
4. Kijabe area
5. Nakuru lake
6. Kinangop plateau-Aberdares
7. Riparian zone around the lake
8. South Kinangop
9. Kongoni area-Maela village
10. Eburru settlement-Eburru forest
11. Upper Gilgil area0
12. Elmenteita-Delamere states
13. Tulaga area, Kinangop

Figure 3.2. Field visits within the catchment and surroundings

3.3. Data analysis

The content of the interviews was extracted and analyzed using sociological techniques. Some GIS treatment of the data as well as some visualization techniques were used in order to obtain a better representation of them.

3.3.1. Analysis of secondary data

The *content analysis* method was used to analyze the content of the interviews. First the interviews were transcribed and from the transcription a content analysis was done. This technique can be used for making inferences by systematically and objectively identifying specified characteristics of messages. Content analysis has been used in many different contexts but it is most frequently applied in describing the attributes of a message or statement, it is also used in making inferences about the sender of the message and about its causes and antecedents and finally can be used to make inferences about the effects of messages on recipients (Frankfort-Nachmias and Nachmias, 1996).
This procedure creates quantitative indicators that assess the degree of attention or concern devoted to conceptual units such as themes, categories or issues. It uses a set of procedures to make valid inferences from text. These inferences are about the senders of the message, the message itself, or the audience of the message. The rules of this inferential process vary with the theoretical and substantive interests of the investigator. A central idea in content analysis is that many words of the text are classified into much fewer content categories. Each category may consist of one, several or many words. Words, phrases or other units of text classified in the same category are presumed to have similar meanings (Weber, 1990).
According to Aries (1973) content analysis may be: applied to substantive problems at the intersection of culture, social structure, and social interaction; used to generate dependent variables in experimental designs and used to study small groups as microcosmos of society.
A content analysis exercise involves the interaction of two processes: specification of the characteristics of the content that researchers are to measure, and application of the rules researchers must use for identifying and recording the characteristics appearing in the texts to be analysed. The categories into which researchers code content vary with the nature of the data and the research purpose. The recording unit is the smallest body of content in which the appearance of a reference is noted (a reference is a single occurrence of the content element; The context unit is the largest body of content that may be examined when characterizing a recording unit). The five major recording units used in content analysis are: words or terms, themes, characters, paragraphs and items. In this case the recording unit used has been the theme, which is recommended to use when studying attitudes and values. Eventually, recording units are classified and coded into categories, among the types of categories employed frequently according to Frankfort-Nachmias and Nachmias (1996) are the following:

- "What is said" categories: subject matter (What is the communication about?), direction (How is the subject matter treated?), standard (what is the basis on which classification is made?), values (What values, goals or desires are revealed?), methods (what methods are used to achieve the goals?), actor (who is presented as undertaking certain acts?), origin (where does the communication originates?), location (where does the action take place?), endings (are the conflicts resolved happily, ambiguously, or tragically?), time (when does the action take place?) etc.

Table 3.2. Interviews carried out

1	Dominik Wabua (Hydrologist, Water Resources Ministery, Naivasha)	13-9-2001	La Belle Inn	Not recorded
2	Dominik Wabua(Hydrologist, Water Resources Ministery, Naivasha)	14-9-2001	La Belle Inn	Recorded
3	P. Kiligari (Water Maintenance Naivasha Municipal Council) J.K. Kiriga (Work officer Council) K.Chessevak (Head of Water Supply)	17-9-2001	Naivasha Municipal Council	Not recorded
4	J. Kahora (Chairman of Indigeneous Biodiversity Environmental Conservation Association, IBECA) F.Ngumo (tresurer IBECA)	18-9-2001	Kahora garage, Naivasha	Recorded
5	Workers of the Sewage Plant at Naivasha town	18-9-2001	Sewage plant, Naivasha town	Not recorded
6	J. Wharaher (Assistant manager of the Lake Naivasha Country Club)	18-9-2001	Lake Naivasha Country Club	Recorded
7	R. Kudu (Head of the Fisheries Department Naivasha)	19-9-2001	Fisheries office	Recorded
8	J.Milambo M. Achola (Naivasha town residents and workers at La Belle Inn)	21-9-2001	La Belle Inn	Recorded
9	S.Ndungu Karanja (small farmer North lake)	21-9-2001	Rozies hotel (Naivasha town) and in his own fertilizers shop	Recorded
10	F. Nata (manager Marula farm)	27-9-2001	Marula farm offices	Not recorded
11	Sarah (worker for a small farmer Mr. Muruoki at North lake)	27-9-2001	Muruoki's farm	Not recorded
12	N.M.Nhuhi (Doctor and owner of a clinic in Naivasha town)	27-9-2001	Private clinic Dr. N.M. Nhuhi	Not recorded
13	Mr. X (Head of the Agricultural office Naivasha)	27-9-2001	La Belle Inn	Not recorded
14	Hans Junger Scholl (Manager of the water supply project and sewage system Naivasha)	28-9-2001	Naivasha Municipal Council	Recorded
15	Sarah Higgings (Secretary Lake Naivasha Riparian Association)	28-9-2001	Sarah Higgings house	Recorded
16	Daniel Koros (WWF Nakuru, project manager of the Upper Malewa project)	1-10-2001	WWF offices Nakuru	Not recorded
17	Obed Mulani Nickson Otino Anthony Karinge(Biologists, Elsamere Research Centre)	2-10-2001	Elsamere Research Centre	Recorded
18	Dorcas Wairimu (Secretary Kenyan Nuts-Marendat farm, North lake)	3-10-2001	Marendat farm	Not recorded
19	Mark Lidonde (Hydrologist Water Resources Ministery Nakuru)	4-10-2001	La Belle Inn	Recorded
20	Andrew McCarthy (volunteer worker WWF Upper Malewa project, geologist)	4-10-2001	La Belle Inn	Not recorded
21	Peter Kimani (School director) Anthony Moangi Ngaruiya (Teacher)	6-10-2001	Maela primary school	Recorded
22	Douglas Gachucha Boniface Kuria JohnGithangi (Friends of Eburru forest)	6-10-2001	Eburru settlement	Recorded
23	Lord Delamere (owner of Manera farm North lake)	8-10-2001	Farm at Elmenteita	Not recorded
24	Father Giovanni Perusa (Mission hospital North Kinangop)	10-10-2001	Mission hospital North Kinangop	Recorded

25	George Morara (Head of the Kenyan Marine and Fisheries Research Institute) John O. Malala (Chief of the research team)	11-10-2001	Kenyan Marine and Fisheries Research Institute	Recorded

- "How is it said" categories: form of type of communication, form of statement and device.

In the analysis of this research the type of communication were oral interviews, some of them were recorded and other not. The themes raised during the interview were used as recording unit, from which the standard, the direction, the values and the time were assessed.

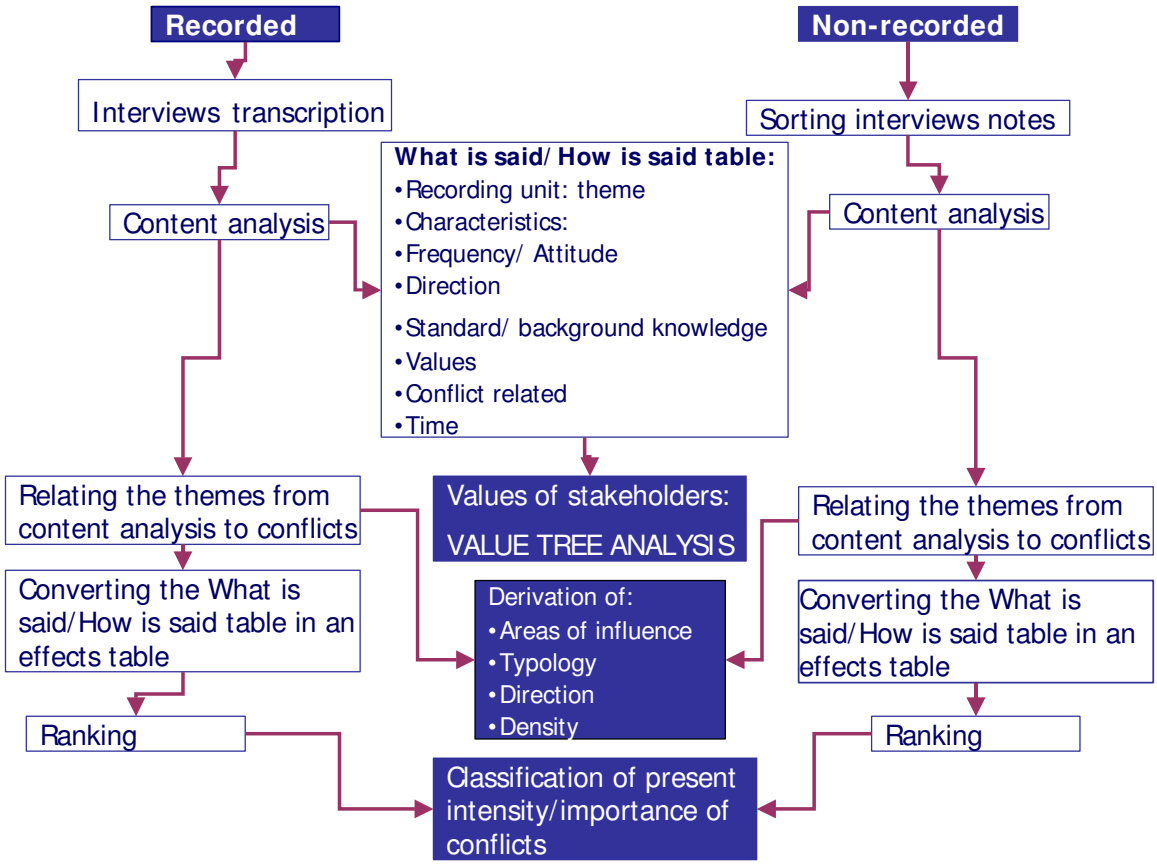


Figure 3.3. Diagram representing the treatment of the interviews to derive data

Furthermore, the ranked results of the content analysis identify which are the main subjects worrying each stakeholder. The themes were related to potential water conflicts, and the quantitative assessment of these themes could indicate the dynamic of the conflicts at the moment of the fieldwork.

The diagram in Figure 3.3 gives a general idea of the sequences in the treatment of the data derived from the interviews.

3.3.2. Stakeholder and conflict analysis model

Figure 3.4. summarizes the modified model for an integrated stakeholder and conflict analysis in this research. In the model three phases can be distinguished: a first phase where the stakeholders and the

conflict are identified and described, a second phase where an individual analysis of stakeholders and the conflicts is performed:

analyzing the intensity of the conflicts in the society nowadays and defining sources and types of conflicts; and a third phase where an analysis of physical factors determining conflicts and relations between conflicts is made (conceptual model of relations).

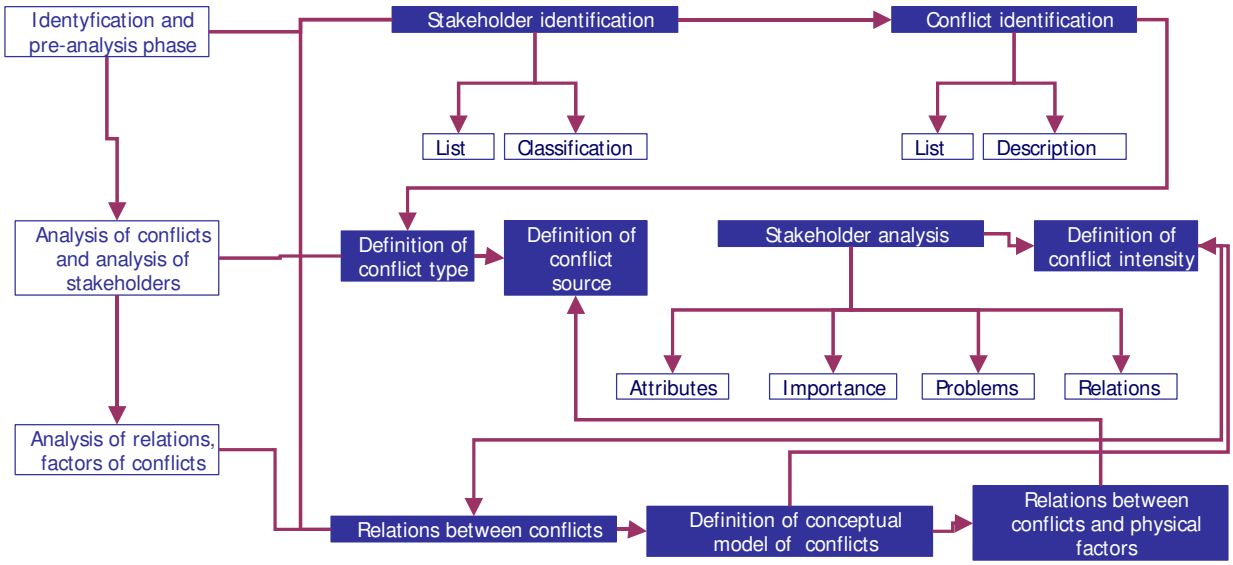


Figure 3.4. Integrated model of stakeholder and conflict analysis

3.3.2.1. Analysis of stakeholders values

The analysis of the stakeholders values is carried out as a part of the stakeholder analysis. To investigate deeper the values of the set of stakeholders was thought to be an interesting tool to get to know them better and to identify common and uncommon values that can help to analyze the conflicts and in a later stage (not in this research) for conflict management.

The value tree technique was originally designed to aid an individual decision-maker in making a choice among alternatives that vary on several value-relevant dimensions (attributes). Nowadays they are used for the initial stage of structuring a conflict among multiple stakeholders (von Winterfeldt, 1987).

Discovering and analyzing the set of values that guide the actions and decisions of the stakeholders help to know them and understand them better. This can enormously help in later stages of conflict resolution when it is useful to prevent situations, predict actions or positions of stakeholders. A general knowledge of the different ethics and concerns of them will help in the search of common solutions and negotiations.

The value tree analysis in this research has two objectives: first, to structure and analyze the conflicts among the stakeholders, and, second, as an exercise to prepare conflict management in the future.

In a first place, an individual value tree is constructed for each stakeholder the information is later synthesized in a common value tree. Potentially this common value tree can be shown to the stakeholders and can be used as a basis for the discussion. It can also be used as a basis for the search

of alternatives and to evaluate them deriving indicators according to those values as described by von Winterfeldt (1987).
According to the technique of von Winterfeldt (1987) the common value tree can be just an addition of the individual trees, however the author uses this procedure for deriving indicators from the values to evaluate different alternatives. In this case the value tree technique will be used to explore the potential disagreements, the conflicts, between stakeholders, then the common value tree has not been just a simple addition. The values from the individual value trees are reordered and joint into new categories where common and uncommon values for all the stakeholders can be identified.

3.3.2.2. Analysis of intensity of conflicts

To quantify the results of the content analysis derived from the interviews and to try to get an idea of the present day intensity of conflicts in the society were considered an interesting step in the analysis of the conflicts. The objective was to investigate from the available information which conflicts had more attention or degree of concern from the society nowadays
Two indexes, which express the degree of concern of society (Equation 1), and the index of concern of the Lake Naivasha Management Plan (Equation 2), are developed from the Content analysis of the interviews and the common value tree.
From the Tables of content analysis (Tables 1 and 2 in the Annex), the subjects which rose during the interviews were assigned as components[1] of the list of identified conflicts, as shown in Table 3 of the Appendix. The frequency of each subject during the interviews and the direction in which it was mentioned are quantified, and the summation of the values of the different components in a conflict gives as result the index of concern of the group of stakeholders as stated in Equation 1.

$$IC_{SH's} = \sum_{n}^{i=1} (Frequency * Direction) \qquad \textit{Equation 1}$$

where $IC_{SH's}$ is the index of concern about a conflict between pairs of stakeholders; i makes a reference to each component of a conflict and n varies between 1 and 3, depending on the assigned number of components of each conflict.
The incorporation of the values of the stakeholders participating in a conflict weighted from the point of view of the Lake Naivasha Management Plan gave as a result the index expressed in Equation 2.

$$IC_{LNMP} = \left(\sum_{n}^{i=1} Frequency * Direction \right) * (Weight\_value_{SH1} + Weight\_value_{SH2}) \qquad \textit{Equation 2}$$

where IC_{LNMP} is the index of concern about a conflict of the Lake Naivasha Management Plan; $Weight\_value_{SH1}$ is the weight assigned to the main value of stakeholder 1 participating in a conflict; $Weight\_value_{SH2}$ is the weight assigned to the main value of stakeholder 2 participating in the same conflict, as these values, obtained from the common value tree of the Stakeholders, were weighted from the perspective of the LNMP using the Pairwise comparison method[2].

[1] The components are defined as issues (some can be "subconflicts", other ones can be factors) that participate in the conflict situation or that contribute to a different degree to create a particular conflict situation. However a conflict is not just the addition of several components, a conflict by definition implies much more aspects that are not represented by those components (physical, social, psychological, emotional and historical aspects).
[2] The values expressed in the common value tree of the stakeholders (Chapter 4) were compared using Pairwise comparison taking as perspective the Lake Naivasha Management Plan and its priorities (Table 5.2). Since these values were related to specific stakeholders during the stakeholder analysis performed (Figure 1 in the Appendix), the weights assigned to these

3.3.3. GIS and visualization tools

The visualization of the conflicts is carried out in Chapter 6. Several attempts of visualization are developed. For the first and second attempts of visualization, more qualitative than quantitative, ILWIS and several drawing programs (Freehand, Fireworks, Paintshopro) in combination with GIS software (ArcView) have been used. The third attempt which focused more only in quantifying spaces of conflicts was based entirely in work done in ILWIS. This third attempt combined a False Color Composite (TM 96) in the background with some data obtained from the ITC Naivasha data base and other data obtained from other researches at Naivasha. The idea was to approach the conflict mapping from spatial indicators synthesizing in a map existing information from different sources as explained in Table 6.2 (Chapter 6). More details about the visualization methods are given in Chapter 6.
Some GIS analysis and GIS modeling was carried out in order to determine the influence of physical factors on the water-related conflicts. The analysis done was very preliminary, as an example of how the relation between both issues could be investigated. The software used for the modeling was ILWIS. More details about the maps developed are given in Chapter 7 when trying to explain with more detail the purpose of the analysis.

values and therefore to the stakeholders were used in Equation 2 to assess the degree of concern of the LNMP over the conflicts.

Chapter 4. Analysis of the stakeholders

A stakeholder analysis is carried out to identify the actors involved in the use and management of the water resources within the Naivasha catchment, their values, their interests and their problems. This type of analysis is justified when one of the actors is in a position to damage or weaken the decision makers or the managers of the resources, or on the contrary if the actor supports or enhances the decision-makers authority, and in the last place, if one of the actors can influence in an important way the direction of an organization activity.
There are reasons to think that the stakeholder analysis in this research is justified by all of the reasons mentioned above, it could be supposed that some organizations operating within the catchment could influence the Naivasha Management Plan.
A stakeholder analysis is an instrument for understanding a system, and changes in the system, by identifying stakeholders and assessing their relationships and their respective interest in that system. It seeks to differentiate and study stakeholders on the basis of their attributes and criteria appropriate to the specific situation. These may include the interest of each stakeholder, their importance and influence, and the networks and coalitions to which they belong (Verplanke, 2001).
The purpose of stakeholder analysis is to indicate whose interest should be taken into account when making a decision. At the same time, the analysis ought to indicate why those interests should be taken into account (Verplanke, 2001). The stakeholder analysis undertaken in this chapter has focused more specifically in the classification of the stakeholders in bigger groups taking into account their interest and common general value (subchapter 4.1 and 4.2), in the analysis of their relations (subchapter 4.3) and in the analysis of their values (subchapter 4.4).

4.1. Identification of stakeholders

The identification of the stakeholders involved in the use and management of water resources within the Naivasha catchment was carried out in two phases, first a preliminary list of them was constructed in the pre-fieldwork period and later this list was further developed during the fieldwork. The list and a very preliminary classification are shown in Table 4.1. In the list, distinctions at two levels are done. The first differentiation is between *Primary* and *Secondary* stakeholders. It is understood as Primary stakeholders those ones who are directly affected by a project (in this case the Lake Naivasha Management Plan and the policy of water supply of the authorities) and as Secondary stakeholders, those ones who are somehow directly or indirectly related with the projects but are not so directly affected by them.
Active stakeholders are those who affect or determine a decision or action in relation with the two references taken: the Lake Naivasha Management Plan and the Policy of Water Supply of the authorities. Passive stakeholders are those affected by a decision or action, in a positive or a negative way, in the Naivasha Management Plan and water policy.
Figure 4.1 shows a map indicating the approximated location of the stakeholders, it does not pretend to be a point map because most of the stakeholders are just groups of individuals located at many

points spread all over the catchment, however the map pretends to give a general idea of their physical location or area of action or influence.

Table 4.1. Stakeholder list

Level		**Stakeholders**	**Type**
Primary	1.	Big farms around lake Naivasha (Lake Naivasha Riparian Association, Lake Naivasha Growers Group): 1.1. Mixed cattle/agricultural farms (North of the lake mostly) 1.2. Large commercial farms (Mostly at the South part of the lake with some exceptions)	Active
	2.	Small Malewa farmers (approximately close to the middle catchment)	Active
	3.	Small farms North Kinangop	Active
	4.	Small farms South Kinangop	Active
	5.	Farmers Eburru area	Active
	6.	Farmers Kongoni-Ndabibi	Pasive
	7.	Fisheries Department	Active
	8.	Local Administration (Naivasha town Council)	Active
	9.	Nakuru town Council	Active
	10.	Fishermen	Active
	11.	Poachers	Active
	12.	Tourist sector	Pasive
Secondary	13.	Water Resources Ministery: 12.1. Nakuru division 12.2. Naivasha Division	Active
	14.	Pastoralists	Active
	15.	Indigenous Biodiversity Environmental Conservation Association	Pasive
	16.	WWF	Pasive
	17.	Kenya Power Company	Active
	18.	Friends of Eburru forest	Pasive

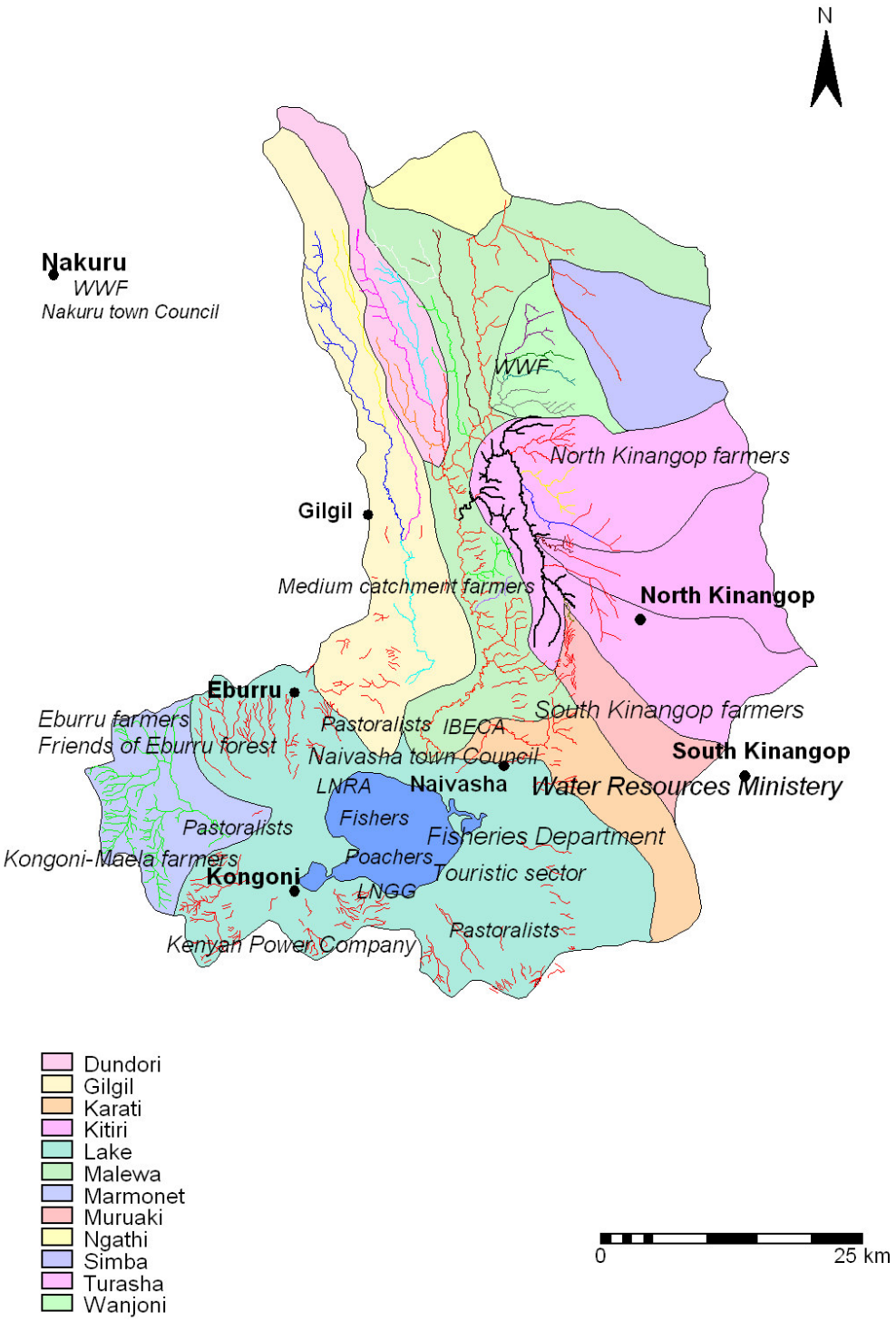


Figure 4.1. Map indicating the approximate location of the activities or areas of action of the stakeholders; it is superimposed on a map of the subcatchments (LNRA: Lake Naivasha Riparian Association, LNGG: Lake Naivasha Growers Group).

4.2. Classification of stakeholders

Due to the large number of stakeholders identified, a classification of them in functional groups is undertaken, further from the one expressed in Table 4.1.
The classification attempted here is based in the identification of common interests and concerns among the different stakeholders and the values behind their actions. This can shed some light and give some evidences on where (in between which stakeholders) the conflict can arise.
At this stage complete value trees for each stakeholder have not been yet developed, they are used later (subchapter 4.4) in a deeper value analysis, however a list of values and a grouping of the stakeholders according these values is carried out to support the stakeholder classification.
The stakeholders classification proposed is summarized in Figure 4.2.
Six stakeholder groups that joint a total of 18 individual stakeholders have been identified:

1. *Intensive users*

This is a heterogeneous group that joints the owners or users of the big farms and the different economic resorts around the lake. It is quite heterogeneous because there are different types of farmers around the lake and they do not have much in common in their activities with the tourist resorts. However both are interested in very high revenues due to the high investments done in their activities. All the owners of land around the lake belong to the Lake Naivasha Riparian Association, this is a voluntary non-profit-making organization established in 1926. The members develop different type of activities: crop farming, flower growing, animal husbandry, dairy farming and tourist activities. The LNRA developed, promoted and implemented the Management Plan since they were aware of the environmental threats in the region, their biggest concern was the quality and the quantity of the lake water. At the beginning of the development of the Management Plan, a group of growers did not agree with the interest and opinions of LNRA and formed their own group, Lake Naivasha Growers Group. Within this group of "Intensive users" several groups can be made:

- *The tourist resorts*, they do claim the importance of environment for their activities however they do not really have the knowledge of understanding which environmental issues are important and how all are related. In this sense they do claim the availability of water and the good quality of them to carry out their "boat rides", the importance of preserving wildlife (especially birds), however they do not have any problem in clearing all the vegetation in the riparian area (Papyrus) to obtain good and clear views on the lake, and when they were asked about the importance of *Papyrus* for the lake ecosystem sustainability they did not know, when it was explained they minimize it.
- *Some owners of flower farms*, which did not really care very much about the lake sustainability because they are very much interested in a very intensive use of water (including free water extraction from the lake).
- *Other owners of flower and other type of farms* which really care about the environmental sustainability of the lake and they are in a position to make compatible their economic interest with the lake sustainability.

When interviewing several farmers individually a fact called our attention, some farmers having properties in the Northern lake complained about the way that the farmers in the Southern lake carry

out their activities. Some of the Northern farms are still more focused on dairy production although introducing progressively intensive vegetable and flower growing. They do defend a more rational and sustainable land use (that they say they practice) in opposition to the overexploitation of resources carried out in most farms of the Southern lake. For example they say they do not extract water from the rivers or the lake, but only from boreholes while extracting water from the lake is a regular practice of some farms in the Southern lake.

2. *Medium-small farmers*

This is a wide group formed by small and medium farmers who do not develop their activities in the riparian area but most of them in the upper parts of the medium and the upper catchment. They have in common the fact that they do not have any economic power and they are just interested in covering their basic needs of food, housing, schooling etc. However the subgroups within this group are different among them, especially due to the different physical constraints existing where they live:

- *North Kinangop farmers.* When the former "White Highlands" were opened to the African landownership under the Swynnerton Plan (see chapter 1). The properties distributed were in majority 4 or 5 acres-sized and they were later subdivided according to the traditions of the Kikuyu. Nowadays the communities in this area carry out a subsistence agriculture based mainly in the cultivation of vegetables and pyrethrum. However they have problems to reach the market in Naivasha town or in Nairobi because of the very bad road infrastructure connecting them to Naivasha town. The terrible condition of this road isolates them not from only from the economic point of view but also from the social point of view because of the difficulties to access the hospitals (Mission Hospital of North Kinangop) and service centers and increases the prices of their products that cannot compete with the vegetables grown downstream. The agriculture that they practice is rainfed but in the last years they have developed alternative sources of economy based in the resources of the forest areas close by, such as timber production and charcoal burning. The timber is highly appreciated to construct fences and building structures and the charcoal as energy source.
- *South Kinangop farmers*: their situation is very similar to the one of the North Kinangop however they have the slight advantage of being closer to the market areas and more easily accessible.
- *Small Malewa farmers*: this is a group containing a variety of users, mainly it refers to the small farmers who exploit property close to the rivers, most of them rent the land (between 3 and 7 acres normally) and cultivate vegetables for the local market, they employ 4 or 5 people and double that in harvest periods. They use water from the rivers and practice furrow irrigation, using as much water as they want after obtaining a license. They do not complain about the price of the water but about the maintenance cost of the pump.
- *Eburru farmers*: this area was also one of the resettlement areas of the 1960s, however due to the scarcity of water resources there, the settlement established was small. They also practice now subsistence agriculture although in the last years they are also exploiting forest resources such as timber and charcoal burning. They do

have problems with the water supply and they have organized some community places for water production from geothermal sources, abundant in the area.

- *Kongoni farmers*: Maela village is a Kikuyu settlement since 1996 coming from Narok district, they were settled there as a solution to the tribal conflicts with the Maasai in their own district. They have a subsistence agricultural economy, cultivating mainly maize and getting their water from a borehole located in the village. Many farmers complete their livelihood by going to work as labor on farms in the Narok district, receiving only food as a payment.

3. Fishermen

Under this group the two communities of fishermen have been included (the legal and the illegal). They behave in a very different ways as a result of their legal or illegal situation, however the main interest of both is economic. The value attributed to them is abundant fish stock because it is the resource that they need for their economic activities. It is supposed also that an abundant fish stock would reduce the illegal situation of the poachers because more legal licenses would be granted.

- *Legal fishermen.* In 2000 there were 311 licenses for fishing, some of the fishermen also contract some other people to help them. Since the ban on fishery in February 2001 the fishermen have been allocated mainly to work in farms, although the farms preferred to contract the women of the fishermen. They had in September 2001, 150 fishermen or wives of fishermen working on flower farms. They normally have quite good relations with the Fisheries Department and they show concern about sustainable practices of fishing. The decision to close the lake to fishing was taken by consensus between the fishermen and the Government.
- *Poachers.* The poachers increase each year due to the difficult economic situation of the area and the relative facility of making some money by fishing. The Fisheries Department try to deal with them and try to provide alternatives for their activities, they meet in a kind of popular meetings called *baranzas*. They employ very destructive methods, non-sustainable, for fishing: nets of small size that capture small fish which have not bred yet, they fish behind the *Papyrus* (making a corridor behind the first line of *Papyrus*) disturbing the breeding ecosystem of the fish and destroying the eggs.

4. Managers

The management of natural resources, and in particular of water and natural resources related with water is undertaken by Government Departments, with the exception of the Lake Naivasha Riparian Association which has the mandate to manage the resources of the lake and it does it through the implementation of the existing Lake Naivasha Management Plan.

- *Naivasha town Council.* They are in charge of the water supply and sewage system of Naivasha town (200000 inhabitants) and municipality together with the Water Resources Ministry and the Water Cooperation.
- *Fisheries Department.* The Fisheries Office located at Naivasha is in charge of the management of the fisheries of the whole Nakuru district, which includes capital intensive fishery which is most important at lake Naivasha and fish farming in the entire district. They are responsible for the management of the lake and give advice,

training and awareness to the community around. They also do the marketing of the fishery products in the district.

- *Nakuru Town Council.* They are in charge of the water supply and sewage system of Nakuru town, Gilgil town together with the Water Resources Ministery and the Water Cooperation.
- *Water Resources Ministry.* They share the responsibility together with the local councils of managing the water supply and sewage systems. One of their main responsibilities is managing water abstraction. The legal framework for apportioning water is provided by the Water Act. The act is supposed to be enforced by this Ministry and its Water Apportionment Board. Efforts are made to grant licenses based on the water budget. However the lack of human and economic resources mean that the permits are expended almost automatically after payment of the fee. Officially not more than one borehole can be drilled in a radius of 800 metres, however due to the poor or non-existent water supply system, boreholes can be found everywhere not respecting at all the legal distance, with full knowledge of the authorities.
- *Lake Naivasha Riparian Association*. This is a non-profit-making organization formed by the owners having properties in the shoreline of the lake. It was established in 1926, the management process of the lake was initiated by them because they realized the environmental threats in the region. Their interest is to promote sustainable development in the area. Because the association is formed by owners of land that have also a very significant economic interest, sometimes some of its members act in contradiction to the principles of the association to which they belong. For example although the "Foreshore Rights of Riparian Owners" states that the riparian land and the lake are government property and should be kept free for public use, the riparian owners have been following the lake every time that it recedes and they cultivate the riparian land sometimes until the lake.
- *Lake Naivasha Growers Group.* This group broke off from the Lake Naivasha Riparian Association in 1995, mainly because they did not agree on some basic issues concerning the Lake Naivasha Management Plan, especially in reference to the control of water extraction from the lake. The extraction of water from the lake is basic for their economic activities. Although they have incorporated especial environmental friendly techniques in the development of their activities, it is still not clear the amount of water that they extract and the degree of pollution that they cause into the lake.

5. *Environmentalists (Activitists and Scientists)*
    - *WWF.* The World Wildlife Fund office located close to lake Nakuru has been developing some community-based programs in the last years within the Naivasha catchment. One of them was development in the North Kinangop area and it was basically to show the farmers how to farm in an environmental friendly way, to make them aware of the potential problems of erosion and to create awareness about the danger of destroying the forest. A similar type of program is being developed with the communities close to the Crater lake. Despite their motivation and interest in their

work they complain about the lack of resources because a big part of them is based on volunteer work.

- *Kenyan Marine Research Institute.* This institute together with the Fisheries Office belongs to the Ministry of Fisheries and Wildlife, its main objective is to conserve the fishery resources and regulate its exploitation. Their main tasks are research, to designate and protect fish breeding areas in the lake; continuous monitoring the fish catch and riparian shoreline; record and process catch stock data for yield prediction, the task that they share with the Fisheries office about issue new permits and renew permits for fishing, creating awareness and giving training to the local communities. This was the institution in charge of carrying out an investigation of the lake condition which caused the decrease of fish stock last year and forced the closure of the lake to fishing.
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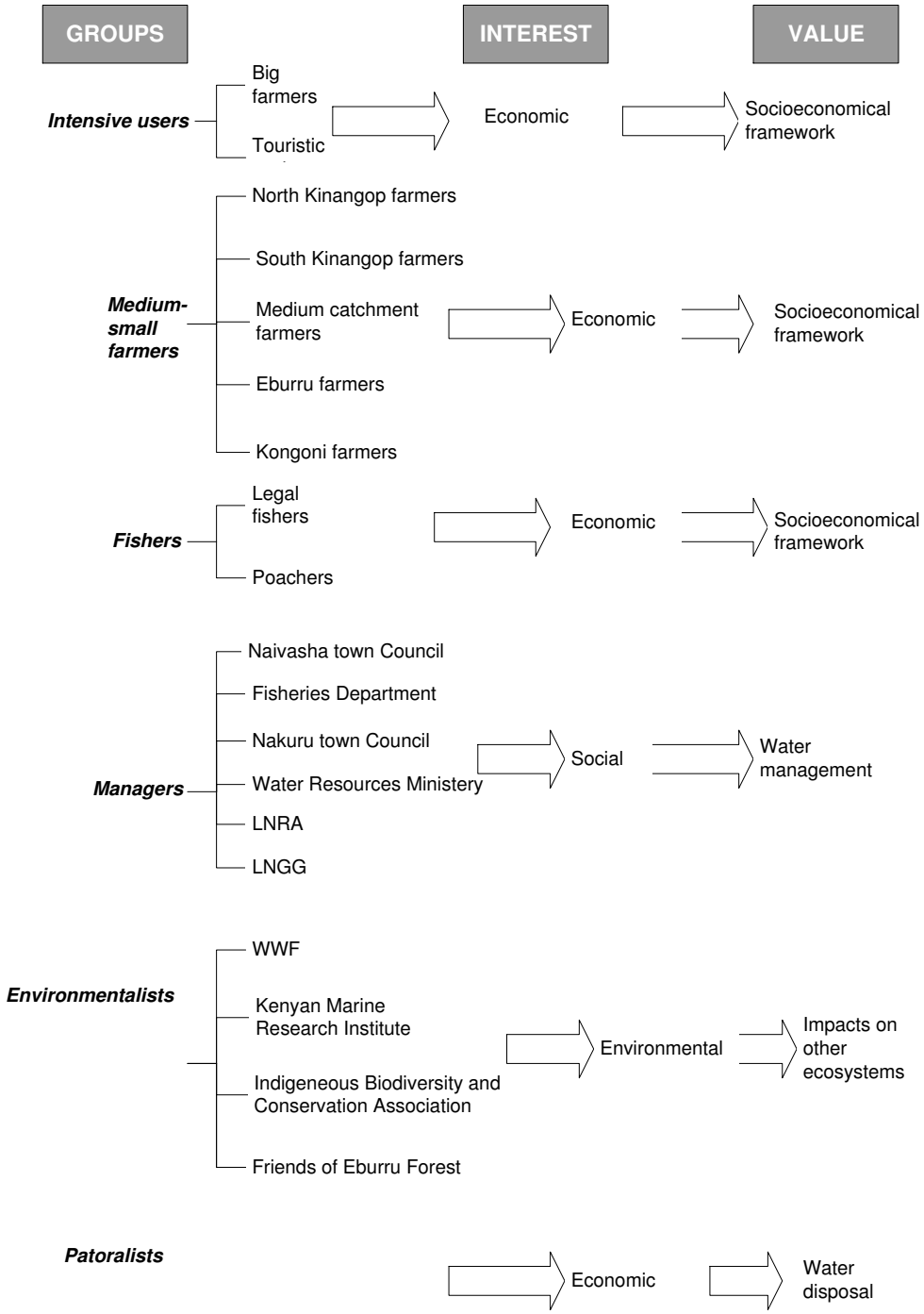


Figure 4.2. Stakeholder types, interest and values (these last ones are the same as those on Figure 4.5, more details on them in figures 4.4a and 4.4b)

- *Indigenous Biodiversity and Conservation Association.* This association was created in may 2001 and their main goal is to ensure that the environmental protection is done for the preservation of what they called "indigenous inheritance around the lake". It is just a small organization from some private and individual initiatives that are still trying to organize themselves. Although they aim at preserving the environment of lake Naivasha and surroundings, they have some other goals that do not seem very environmentally friendly as they claim to open all the riparian land for public access and use. They do feel that the white rich farmers are still taking profit

of their privileged location around the lake and making a lot of money on the basis of overexploiting the natural resources.

- *Friends of Eburru Forest.* This is also a small association created with the purpose of protecting the Eburru forest, some local people are participating as well as some members of tourist business as the Rift-Valley lodge who have some tourist interest in the area.

6. Pastoralists

Before colonial times the totality of the Naivasha catchment was Maasai rangeland, at the beginning of the last century they were persuaded to move away from the Naivasha area and two reserves were established at the North and South of the Naivasha area. Nowadays there are calculated to be 20000 pastoralists in Narok and Nakuru districts (Czuczor, 1997). Most of them are potential users of the lake, all of them are Maasai and they hold a cattle herd of approximately 200000 (Czuczor, 1997). They keep their traditional system of life, moving around following the green pastures. The free access to the lake was stopped in 1970.

4.3. Stakeholders interrelations

From the content analysis of the interviews an idea of the relations between most of the stakeholders could be derived. These impressions of the relations are expressed in Figure 4.2. The relations have been evaluated from a qualitative approach, taking into account the way that the specific stakeholders referred to other stakeholders during the interviews in a spontaneous way. Direct questions about their opinion about other stakeholders where not done. To draw the diagram of Figure 4.2. inspiration was taken from the social technique *Sociogram* building, used to assess the relations within a community of individuals or different groups. Only a directional representation has been made and not the quantitative approach of this technique. It must be said that the relations expressed are not in two directions, not because they do not exist, but because information available for both directions could not be found. The arrows in the diagram express which stakeholder mentioned other ones and in which manner (except for some relations that were documented from other secondary data).
It was quite clear from the fieldwork that the relations established between the LNRA and the other communities around the catchment are dominant, maybe because they are the authority responsible for managing the lake they have quite a clear opinion about the way that the other communities influence their activities. However we will not analyze that in this part but the way that communication works among the different stakeholders. It is important to make clear that in the diagram of Figure 4.3 not all the relations existing between the stakeholders are represented but only the ones that were documented in the content analysis of the interviews.

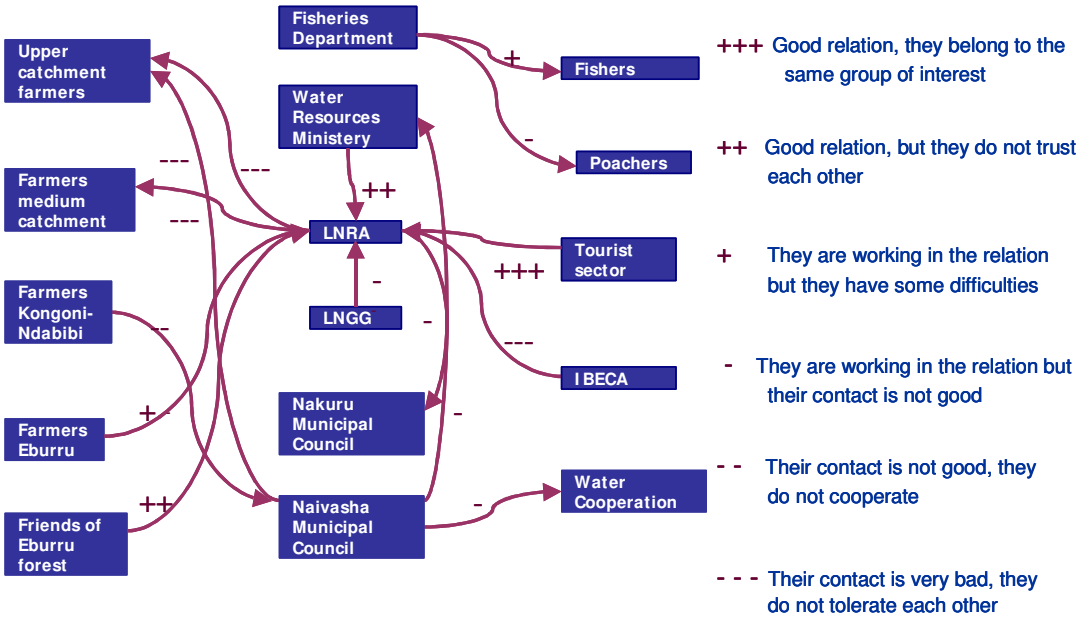


Figure 4.3. Stakeholder sociogram

Basically it can be distinguished:

- The relations established between LNRA and other communities within the catchment:
  - Negative, between LNRA and farmers in the middle and upper catchments, they not have a good contact and they do not work together.
  - Quite positive relations between LNRA and the Eburru community, they have good contact and they work together in the restoration of the forest and looking for alternative economic sources for the farmers.
  - Bad relations between LNRA and LNGG because of their different ideas on environmental sustainability and making money.
  - Bad relations with the Nakuru City Council, they do not trust each other
  - Bad relations with the Indigenous Biodiversity and Environmental Conservation Association, they do not tolerate each other
  - Quite positive relations with the Water Resources Ministry, they work together.
- The relations between Naivasha Town Council, the Water Resources Ministry and the Water Cooperation are not very good, they are forced to work together in the water supply and sewage system but their contact is not good.
- The Fisheries Department have a working relation that it is quite positive with the legal fishermen and slightly negative with the poachers, although both are looking for solutions

4.4. Analysis of stakeholders values

The value tree analysis performed here had two objectives: on the one hand, as a means to structure and analyze the conflicts among the stakeholders, and, on the other hand, as an exercise to prepare future conflict resolution. It is based in the technique of von Winterfeldt (1987) as explained in Chapter 3.

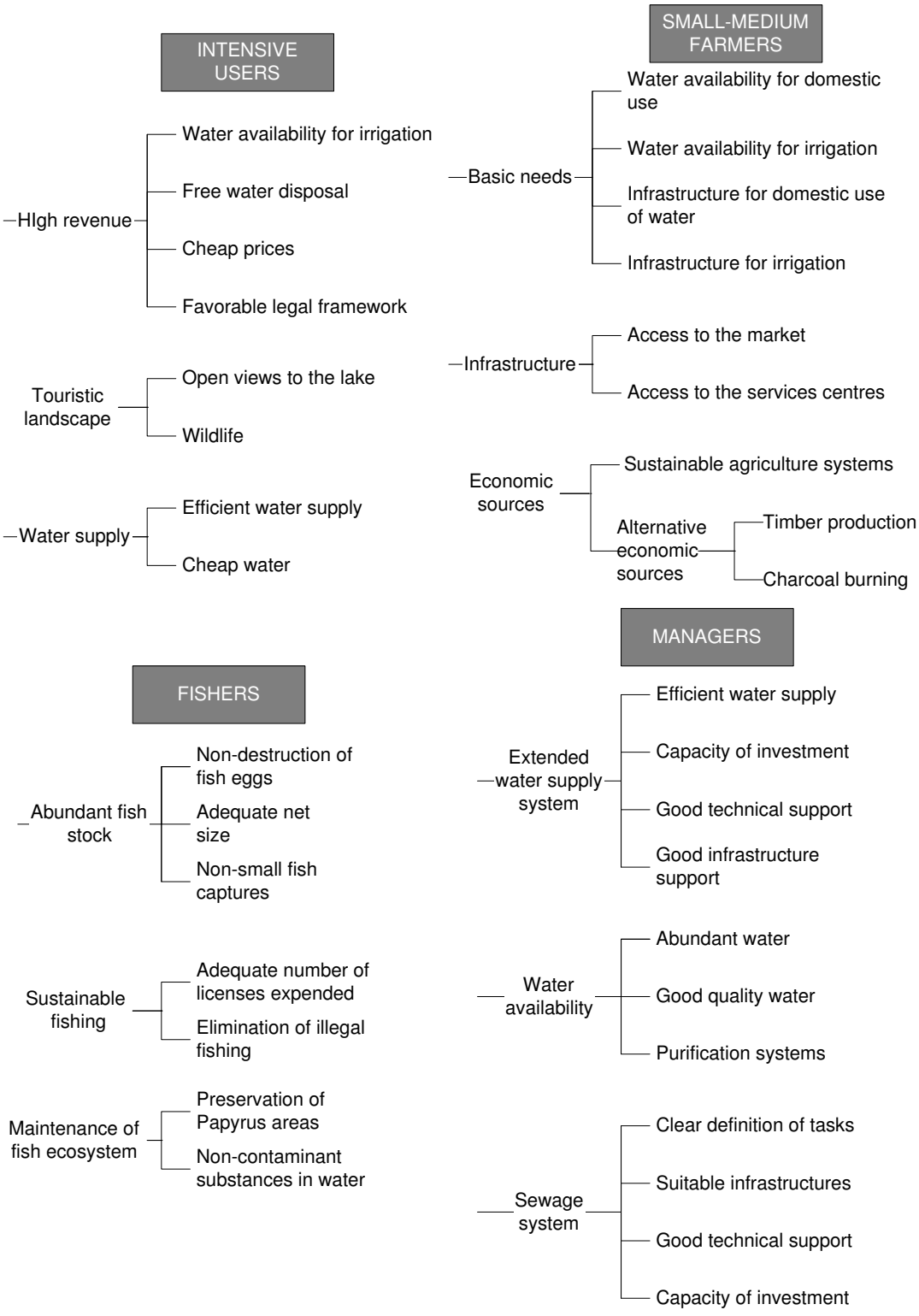


Figure 4.4a. Value trees of the intensive users, small-medium farmers, fishermen and managers

In a first place, an individual value tree was constructed for each stakeholder (Figure 4.4a and 4.4b), the information was later synthesized in a common value tree (Figure 4.5). Potentially this common value tree can be shown to the stakeholders and can be used as a basis for the discussion. It can also

be used as a basis for the search of alternatives and to evaluate them deriving indicators according to those values as described by von Winterfeldt (1987).

The common value tree was constructed based in our own judgment and that tries to synthesize the individual value trees (Figure 4.5). The categories have been redefined and the stakeholders have been related to one of the categories higher in the hierarchy. This common value tree pretends to identify common and uncommon values between different and similar stakeholders.

In general some considerations can be made, the uncommon values that can be distinguished when analyzing the individual value trees could be probably in the basis of some of the conflicts that have raised or will rise in the future. Most of these values support the behavior of the group that has been named *Intensive users,* these are: the *high revenue* that these stakeholders expect from their activities and the *tourist landscape,* important for the development and maintenance of the tourist sector. The first one seems very much linked with the *free water extraction from the lake and boreholes* and a *relaxed and favorable legal framework* in which to operate. These values are not in the basis of the behavior of other stakeholders because they do not favor them (Figure 4.4a and 4.4.b).

Another potential conflictive set of values are the ones related with the *alternative economic sources* of the *Small and medium farmers* located in the upper and middle catchment. They produce *timber* and burn *charcoal* (Figure 4.4a) as alternative economic sources, this implies directly a destruction of the vegetation cover, that, according to other stakeholders is already manifesting effects downstream. In the common value tree an important value is *alternative economic sources*, it is considered that all the stakeholders can be interested in sources which can solve the economic problems of the upstream farmers and are environmentally sustainable, not having off-site effects downstream (Figure 4.5).

From the value tree exercise can be derived:

- A set of values that is *common* for all the stakeholders: the common ones mentioned in the individual trees. Common values could be those in the categories *water disposal*, *water management* and *impact on water bodies*.
- The values that can be *acceptable* for all the stakeholders: the ones that is only mentioned individually by some stakeholders but are not in opposition to the values of other stakeholders. In this case the acceptable values would be in the category *impact on other ecosystems* (they imply an indirect impact on water bodies) and the *socioeconomic framework* (they imply a direct impact on the land use).

Finally there are values that are *unacceptable* to the community of stakeholders: individual values of some stakeholders but in opposition to the majority. Unacceptable values are those related to the *high revenue* acquisition and the *tourist landscape,* if this implies a sacrifice of environmental issues. The use of alternative economic sources that are not environmentally sustainable, like the intensive present day practices of *timber production* and *charcoal burning,* all fall as well within this category.

The common value tree, besides being used to compare ideas derived from it with the analysis of conflicts in the next chapter, could be used to derive alternatives when planning, especially in participatory planning, and as a starting basis for negotiation when looking for alternatives, in general conflict resolution. In this sense it seems that there is more agreement than disagreement between the values which underlay the behavior of the different groups of stakeholders. Alternatives based on "common" and "acceptable" values could be found; and alternative solutions to the present actions or situations based on the "unacceptable" values should be worked out implying compromise and negotiation between the stakeholder groups.

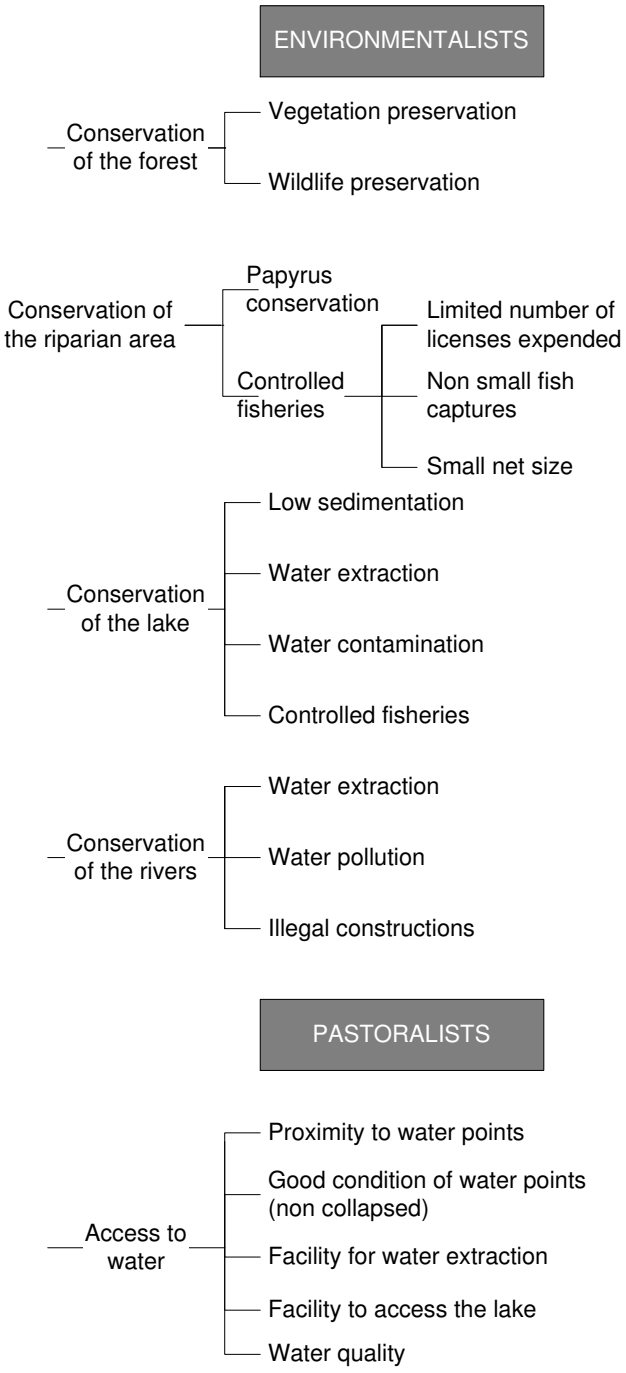


Figure 4.4b. Value trees of the environmentalists and pastoralists

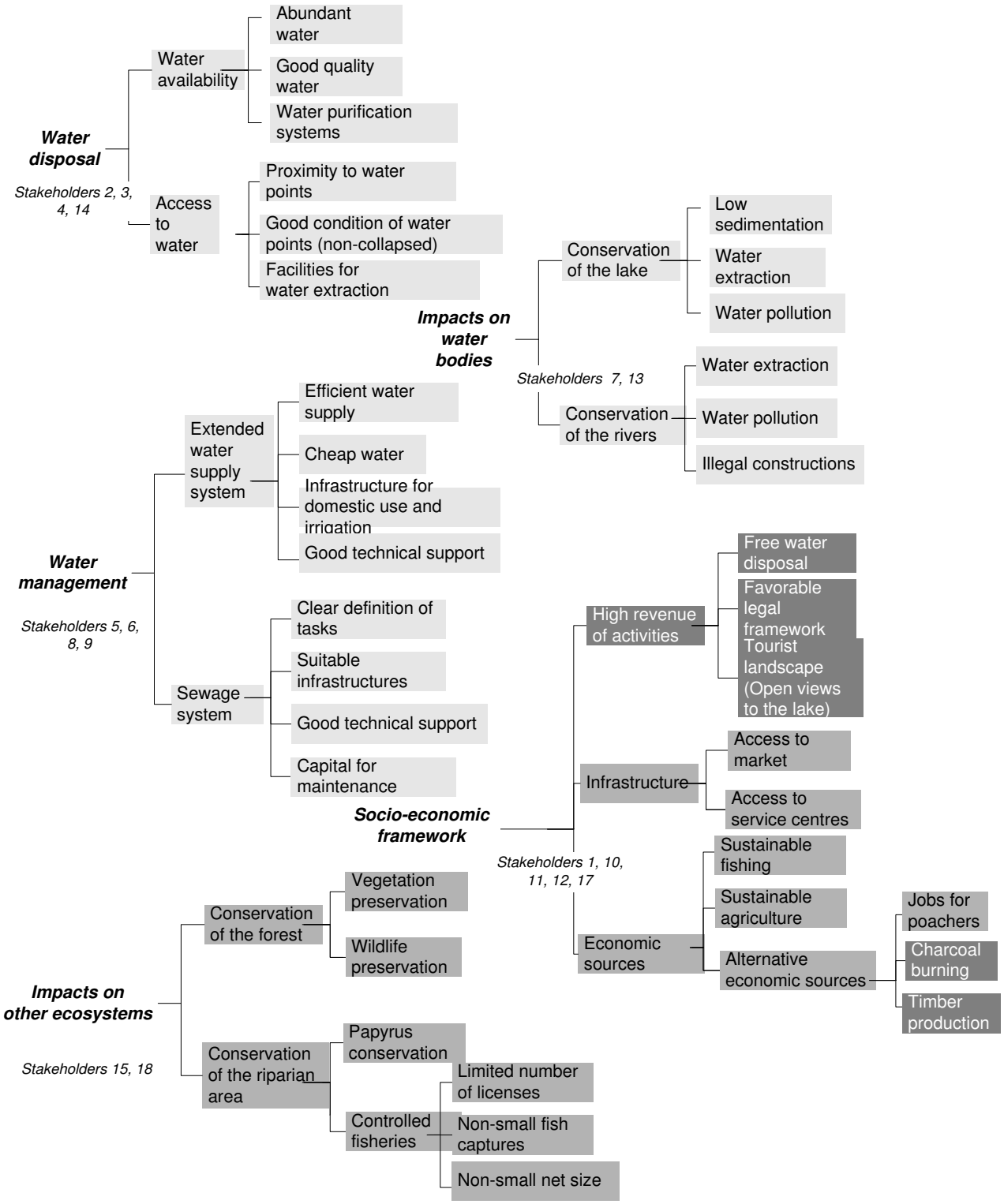


Figure 4.5. Common value tree of all the stakeholder groups, the values are related to the stakeholders according to the numbers in the list of Table 4.1. The *common* values for all stakeholders are in light gray boxes, the *acceptable* values for all the stakeholders are in dark gray boxes, the unacceptable values by the whole community of stakeholders are in dark gray boxes with white letters.

Chapter 5. Analysis of the conflicts

The global conflict analysis, as understood in chapter 1, started in the previous chapter with a closer examination of the stakeholders, in this chapter the attention is given to the identified conflicts between them. The conflicts are described; the degree of concern of the different stakeholders about them is assessed. An attempt of classification of these conflicts is done based on different criteria, and finally, the factors that could influence the rise and development of these conflicts will be discussed in chapter 7.

In general speaking the word 'conflict' has negative connotations, very often is automatically associated with hard disputes with violent characteristics. However this view of conflict is not always helpful and true. According to Warner and Jones (1998) conflict should be seen as a potential force for positive social change because its presence is a visible demonstration of society adapting to new political, economic and physical environment. This is very much the case of the rural areas of developing countries, where multiple causes such as new technologies, commercialisation of common property resources, privatisation of public services, growing consumerism, new government policies, new agricultural patterns etc. exert a high pressure on individuals and community groups towards change. The lake Naivasha area is a place where some of the factors mentioned above together with very particular circumstances converge, where there is an abundance of natural resources of different types and many different stakeholder groups with different degree of access to them, as well as very different political and economic power. Thus, in principle it seems a potential area where conflicts can arise around water, one of the most appreciated resources in the region. Concerning water resources, the scale of investigation, basin or catchment level, was chosen because a basin offers a natural unit of analysis for the study of the relationship between conflict and freshwater resources, as already pointed out by other authors (Yoffe and Ward, 1999).

5.1. Exploration of conflicts

A conflictive situation can be defined as a state of disharmony caused by a disagreement in the actions that are to be taken, the conflicts themselves are indicators of underlying struggles between antithetical forces. The conflict itself is the dispute existing between different stakeholders on a certain issue, in general terms, but in this research to simplify and clarify terms, conflicts have been defined as *disagreements between two stakeholders over a general matter related directly or indirectly to water.*

In this research each conflict has been related to several components (derived from the content analysis of the interviews), some of them can be considered "subconflicts" and other ones are factors that have an important influence in the conflict. These components have been quantified to derive the intensity of the conflict nowadays (Tables 1, 2, 3 in the appendix and subchapter 5.1.2). However each conflict is much more than just the addition of the components done here, there are other aspects and factors of them (physical, social, historical, emotional) that did not came up during the interviews (and therefore have not been quantified) but define and greatly influence the conflicts, some account of them is given in the identification and description of the conflicts (subchapter 5.1.1).

5.1.1. Conflict identification

Although a preliminary list of conflicts was elaborated before going to the field based on the review of secondary data (existing reports and news published in the media), the list changed very much during and after the fieldwork. Many more conflicts were identified and an idea of the different scale and degree of intensity of them was developed. Table 5.1 shows the inventory of identified conflicts at the catchment level and indicates their type of source and scale.

Table 5.1. Conflict inventory on water-related issues

	Conflicts	**Source**	**Scale**
1	Small farmers North Kinangop (upper catchment) versus small Malewa farmers	Conflicting goals	Inter-community
2	Small farmers South Kinangop (upper catchment) versus small Malewa farmers	Conflicting goals	Inter-community
3	Small farmers North Kinangop (upper catchment) versus big farms around Naivasha lake (downstream)	Conflicting goals	Inter-community
4	Small Malewa farmers versus big farms around Naivasha lake	Conflicting goals	Inter-community
5	Mixed cattle/agriculture farms versus large commercial farms	Factual disagreement	Intra-group (intrahousehold)
6	Farmers around lake versus fishermen	Conflicting goals	Inter-community
7	Fisheries Department versus fishermen	Factual disagreement	Inter-community
8	Fisheries Department versus poachers	Factual disagreement	Inter-community
9	Friends of Eburru forest versus Eburru forest users	Conflicting goals	Intra-community
10	Kenya Power Company versus Eburru settlement	Conflicting goals	National-local
11	Indigenous Biodiversity Environmental Conservation Association versus Lake Naivasha Riparian Association	Conflicting goals	Inter-group
12	Naivasha town Council versus North Kinangop farmers	Relational	Inter-community
13	Lake Naivasha Riparian Association versus Nakuru city council	Conflicting goals	Inter-basins
14	Longonot Kijabe area water scarcity	Structural	Local, macro-micro
15	Ndabibi-Kongoni area: lack of minimum infrastructure	Structural	Local, macro-micro
16	Naivasha city Council versus community	Structural	Local, macro-micro

A small description of the conflicts follows, Figure 5.1 shows the land use map of the catchment and the drainage system that can help to understand the spatial distribution of activities while describing the conflicts:

1. Small farmers North Kinangop (upper catchment) versus small Malewa farmers

The farmers in the middle catchment have shown their concern about some of the activities taking place in the upper catchment (North Kinangop) such as charcoal burning and chopping the trees for timber production. They complain about the increase of sediment load in the runoff of the Malewa River as consequence of these activities. They also understand that the people in the upper catchment

carry out these type of activities because they do not have enough means to survive, however they say that they can do nothing to help them.
In principle this change of activities in the upper catchment can be the cause of increasing siltation of the rivers and on the lake. A significant decrease of the land cover exposes the soil to erosion processes. Taking into account the clayey soils and the high rainfall of the area, which can provoke high antecedent soil moisture, high runoff rates with perhaps a considerable sediment concentration can occur. If this runoff reaches the main river streams and reaches the lake it would cause a higher sedimentation rate in the lake.
The upper catchment farmers normally own small farms that were distributed in the 1960s under the Swynnerton plan, the properties distributed had 4-5 acres, but after the partitions due to family distributions they are normally much smaller nowadays. These are mainly subsistence farms because the bad infrastructure does not allow access to the market of their products. They cultivate mainly vegetables (carrots, onions) and pyrethrums however they have terrible difficulties to access the markets due to the impassable roads. This same problem causes a rise in the price of their products that can not compete with the same products produced downstream. The farmers upstream are quite aware that an overexploitation of forest resources is taking place; however they argue that they do not have other options and they need the money so they are going to continue with their activities unless the Government helps them, for example proposing alternative options to make a living. On the other hand they feel that the people downstream and in the middle stream are also using very intensively other type of resources and somehow they do have also the right to do the same.
WWF has been developing a community-based project in the upper Malewa catchment area trying to give some formation to the farmers to develop some kind of alternative economic sources and trying to link upper catchment farmers and small Malewa farmers. However although the middle-catchment farmers understand the problems of the upper catchment farmers they are not ready to cooperate with them. These middle catchment people felt also marginalized from the LNRA and feel as nobody is protecting their interest.

2. Small farmers South Kinangop (upper catchment) versus small Malewa farmers
This conflict has the same characteristics as the former one, however it is considered individually because the physical constraints of the farmers in the South Kinangop area are slightly different from those of the farmers of North Kinangop. Although the South Kinangop area is also the upper catchment of the Turasha River and the activities of the inhabitants here will have influence downstream, in theory they should have less problems to market their agricultural products because of their situation close to the Naivasha and Nairobi markets and the slightly better condition of the road.

3. Small farmers North/South Kinangop (upper catchment) versus big farms around Naivasha lake (downstream)
Basically the farmers downstream complain about the same issues as do the small Malewa farmers on the activities of the North Kinangop farmers. It is the same type of conflict, however it seems that the conflict is more intense here or at least the farmers downstream complain more energetically about this. They are very concerned about heavy increase of the sediment load of the main river discharging in Naivasha lake which have important consequences in the sedimentation/aggradation processes of the lake. They also understand that the people in the upper catchment do not have many options to make a living. However in their Management Plan they do not plan many actions for sustainable

development further from the shoreline of the lake. They mention in their Environmental Conservation Program several activities which include short-term training in various aspects of environmental conservation, in some areas within the lake and the catchment areas, but they do not specify where. They also mention some re-aforestation programs in the catchment (LNRA, 1995). However no activities focussing on alternative economic sources to fight the overexploitation of the forest are mentioned.

4. Small Malewa farmers versus big farms around Naivasha lake

Farmers around the lake complain about the amount of water that people in the middle catchment extract. They accused them of extracting water from the Gilgil and Malewa river without control because they do not practice water-efficient methods of irrigation, but furrow irrigation, that inundates the fields through several channels conducting the water from the river. Although the small Malewa farmers are aware that their methods of irrigation consume a lot of water they do not worry about it because they think the river has plenty of water. They do not care about the complaints of the downstream farmers because the downstream farmers do worse and they do not have much right to complain when poor people are tying to make a living. The small Malewa farmers accuse the downstream farmers of extracting very high amounts of water from the lake and exploiting very large properties inherited from the colonial times, as well as impeding the passage of livestock to communal terrains around the lake.

5. Mixed cattle/agriculture farms versus large commercial farms

Even when all the farmers around the lake, officially all the owners of a piece of land on the shoreline, belong to the LNRA, not all of them have the same opinions. A certain, hidden animosity between Northern and Southern farmers has been detected. In the Southern lake the big vegetable and flowers farms are located and they use large amounts of water from the lake. Northern farmers accused Southern ones of too much water extraction and water pollution. According to Ahmmad (2001), most of the farms are irrigating more land and abstracting more water than declared. Although most of them declared that groundwater abstractions were done to meet domestic use and other minor requirements, his analysis and observations demonstrate that borehole abstractions are also used for irrigation requirement. Other research done on water pollution (Moncada, 2001) concludes that the contaminants derived from the flower industry can cause a loss of biodiversity and even affect the fishery industry (declination of fish harvest).

Northern farmers are more traditional cattle farmers, they claim to practice a more sustainable use of the land, these farms are dedicated mainly to cattle, although they are introducing now progressively vegetable and flower growing in the last years. However they say that they do not use surface water but only groundwater, therefore they think that they are not affecting the lake levels with extraction either from the rivers or from the lake. While they accuse the South farmers of only being interested in making quick money and not caring for a sustainable use of the resources. However the results of Dao Vie Dung (2000) of some sampled farms point out that the irrigation efficiency of the northern part of the lake is very low because the total actual irrigation application for the whole growing season is more than total crop water requirement.

6. Farmers around lake versus fishermen

Fishermen accuse farmers around the lake of extracting too much water from the lake and they argue that the pumps that they use for extraction are taking the eggs of the fishes, which has directly caused a decrease in the fish stock. They also complain about the pollutants that the farms discharge directly into the lake.
However the farmers respond saying that the decrease of the fish stock is a consequence of the small size of the nets that the fishermen use and the overexploitation of the fish resources of the lake due to the high number of fishermen and poachers.

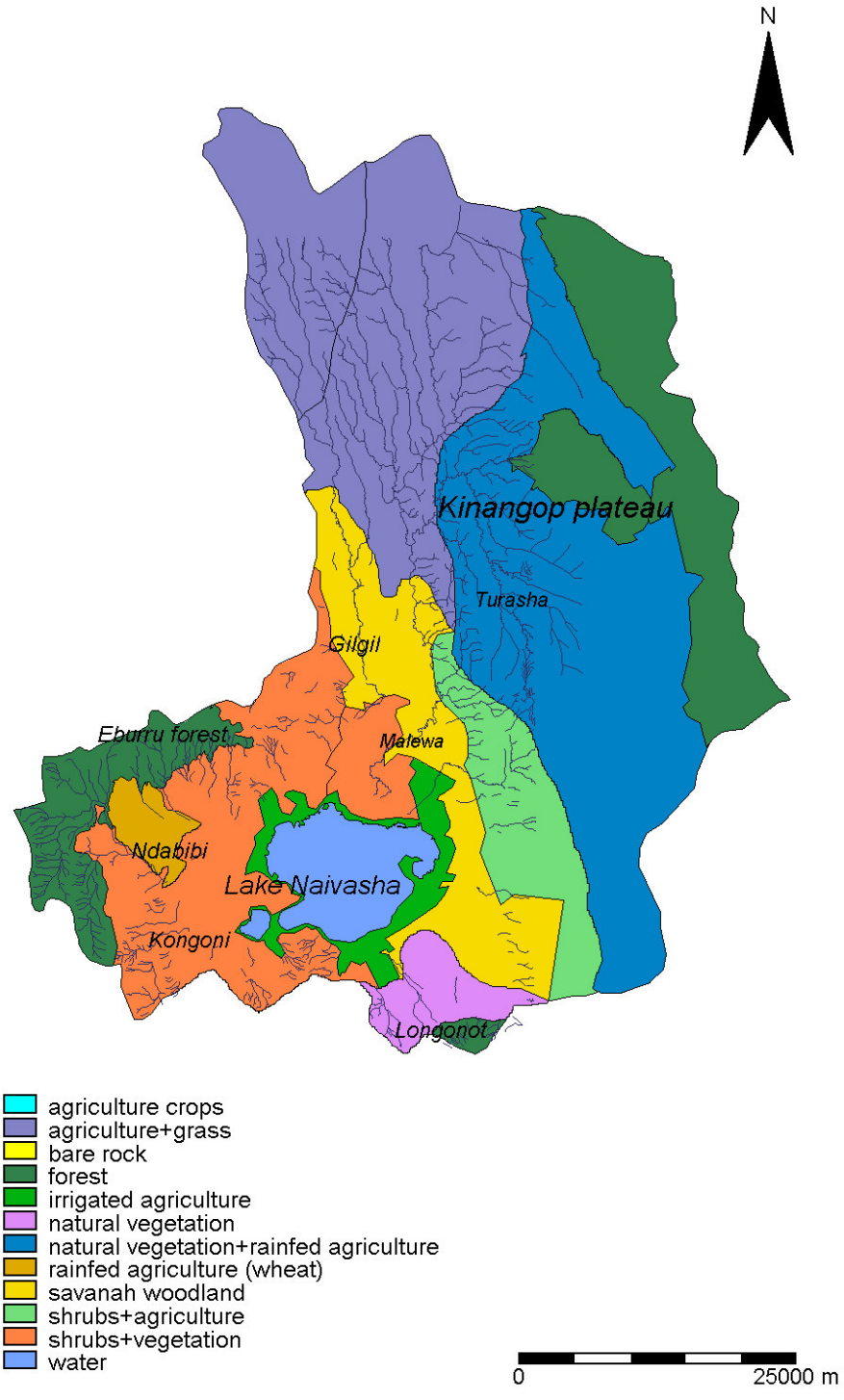


Figure 5.1. Landuse map of the catchment and drainage system

7. Fisheries Department versus fishermen

The Fisheries Department has put a ban on fishing in the lake since February 2001, no fishing activities are allowed since then. Although the decision according with the Fisheries Department, was taken with consensus with the fishermen, some fishermen are in disagreement with the long duration of the ban.

8. Fisheries Department versus poachers

According to the Fisheries Department the number of poachers is increasing every year due to the bad economic situation of the area and attracted by the high revenues that can be got by fishing. The Fisheries Department accuse the poachers of fishing without a license and using non-sustainable fishing methods: constructing canals clearing *Papyrus* two metres behind the shoreline, so they can fish in these canals without being seen, these *Papyrus* areas are also the breeding areas for fish, so if they are caught there they can not grow and breed. They are also accused of using very small net sizes that catch small sized fish that do not have the opportunity to breed.
The poachers accuse the Fisheries Department of not distributing enough licenses for fishing.

9. Friends of Eburru forest versus Eburru forest users

People from the settlement of Eburru are encroaching into the forest to burn charcoal and produce timber as alternative economic sources. Some stakeholders (some private rich farmers) have also accused a civil servant (the main forest officer of Eburru) of being involved in these activities and leading them. The leader of Friends of Eburru Forest works for the tourist resort close to Eburru (the Naivasha Golf Club in the Rift-Valley lodge), which has an interest in the area. Friends of Eburru Forest is completely against these activities and tries to preserve the forest as an environmental value to be included in the tourist attractions of the area.

10. Kenya Power Company versus Eburru settlement

In 1987 the KPC started a project for geothermal exploitation of the Eburru area. They required a lot of water to drill the boreholes and for their own consumption, they installed pipelines and water was pumped from lake Naivasha. Using this infrastructure they were pumping also water for the inhabitants of the Eburru settlement. The project finished in 1999 (according to the data of our informant) and no more water was pumped freely by the KPC. They offered to leave the entire infrastructure there, but the community had to pay the cost of pumping the water from the lake. They could not pay it and they just had to get back to the traditional system of getting water in the area: by condensation of steam in some steam sources. The community without any official support has organized this. Two communal sites are ready where each family is allowed to take 40 l of water per day. Some individual initiatives are also taken and smaller extraction places have been also organised. Some Eburru settlement inhabitants still think that the KPC could contribute to cover the costs of the water pumping from the lake as a kind of compensation measures, or at least the Government could help them in the maintenance of this water supply system.

11. Indigenous Biodiversity Environmental Conservation Association versus Lake Naivasha Riparian Association

The IBECA is an emerging organization, which sees the LNRA as their biggest enemy. They claim the rights of the local people to enjoy and use the riparian land around the lake that nowadays is not accessible and only used by the private owners. They claim back the opening of all the existing corridors to access the lake, of which a part are open to the public and other part are closed. This organization does not like the free water extraction from the lake by the big farms and they consider this as they are stealing their water resources. They support their complaint with the reasoning that the resources should be enjoyed and used for the benefit of the indigenous people of the area and not to the benefit of the rich farmers. The LNRA have a very terrible opinion of this organisation, according to LNRA they do not know what they are saying and they want just to make profit of something that does not belong only to them.

12. Naivasha town Council versus North Kinangop farmers

This is an old conflict that was never solved but alternative solutions to the problems came spontaneously. Twenty years ago it was a supply of surface water from the Aberdares, from the Geta settlement directly to Naivasha town, there the water was treated in a treatment plant and the city had an acceptable water supply provided by the City Council. However the farmers of the North Kinangop, where the water was coming from, felt rejected and not involved in this project. They could not understand why they were not provided with that water coming to their own area but the water had to be given to the people downstream that could use the water from the lake. They built their own connections to the main pipe providing Naivasha and finally almost no water was reaching the town. The problem was never solved and the entire infrastructure built to supply that water and treat it is still there completely ruined by years of non-use. The city is since then enterely dependent on groundwater, people drill their own boreholes and some of them have made a living out of it by selling the water, current prices are now 4 Ksh for 20 l approximately.

The population of the city has grown very much in the last years and the Council now complains that they have a very high water demand and they would need to use the water from the Aberdares not to overexploitate the Naivasha aquifer.

13. Lake Naivasha Riparian Association versus Nakuru city council

The Nakuru water project tries to transfer more water from the Turasha river to the city of Nakuru. The city of Nakuru is not inside the limits of the Naivasha catchment, this is a conflict between two different water basins. LNRA is very strongly in opposition to this project because they are very worried about the water resources of the lake and they do not agree at all with transferring water from Naivasha catchment to another catchment. This project is funded by the Japanese Government and it already implemented Phase I: a barrage and offtake from the Turasha, 10 kms upstream of the confluence with the Malewa. Phase II was designed to take water off the Malewa to raise the total offtake to 100000m^3 day^{-1}. This scheme raised considerable concern around the lake. Also it should be noticed that Naivasha Council had ideas of tapping this source for some of their water if the scheme is ever implemented.

It seems that one of the most important issues is related to the very limited participation in the planning of the scheme by the people who will be more affected by it, they also complain about the lack of a proper feasibility study and environmental impact assessment. The Turasha scheme supplied in 1993 13300 m^3day^{-1} to Nakuru, one third of the town's supply at that moment and a further 4700

m^3day^{-1} to Gilgil and rural areas (LNROA ,1993). The pressure ejected by the LNRA stopped by the time of the second phase.
The city council of Nakuru is supporting this project presenting it just as an enlargement of the transfer of water between these two catchments taking place already and justified by the growth of the Nakuru population. Information from the Water Resources Ministry Nakuru Division says that the aquifer of Nakuru is still large enough to support population and there are no saline intrusions.

14. Longonot-Kijabe area: water scarcity

The Longonot-Kijabe area does not show a clear conflict between different stakeholders on water, it could be called more a kind of structural conflict (Prein, 1988), due to the water scarcity of the region, the lack of any water supply infrastructure, the difficulties of the community to harvest water for domestic and agricultural use and the little support from the authorities to overcome these problems

15. Ndabibi-Kongoni area: lack of minimum infrastructure

Here there is a type of structural conflict, as in the case mentioned above, also due to the lack of minimum infrastructure for water supply and harvesting for the Kikuyu settlement of the area. Furthermore in this area very often there are conflicts during the dry season between the Maasai and the large farms. The Maasai believe that the large farms should have multiple uses of cultivating wheat and be converted to pastureland after harvesting (Ouma, 2001). During dry periods most livestock from neighbouring Narok district are watered at a water point only 6 km away from the big farms at Ndabibi and Maasai have always opted to graze their livestock there after watering. These always have resulted in serious conflicts and the way to solve them have been always by litigation. From the Maasai point of view and from their culture what is in the top of the soil after farmers have harvested belong to the Maasai, however the farmers justify their position saying that if the situation goes on like this serious land degradation and erosion processes can occur. According to this author large scale farms within traditionally pastoralist areas should offer multiple uses for cultivation and grazing land. Administrative policies on conflict over resource control in rangeland areas should be redirected towards mediation and arbitration taking into account the customary laws.

16. Naivasha city Council versus Naivasha community

The Naivasha city Council serves an area of 949 km^2 and between 250000 and 500000 people. In 1993 there were officially three boreholes for the water supply of the municipality, two run by the council and the other one by the Water Conservation and Pipeline Board (LNROA, 1993). There were already many other boreholes run by the Catholic Church. Nowadays the official boreholes remain the same but many any other private boreholes appeared. There are no water pipelines to houses, only the houses or the places where they have their own borehole have been able to built their own pipeline system.
The water is sold at a price of 4Ksh for 20 l. The sewage system of the town is also not working since 1993. Besides the lack of funds and the vandalism (for example all the electrical system of the sewage plant was damaged and stolen some years ago and never repaired), it seems to be a problem also of management of the water supply because the three authorities which have to manage it, the Naivasha city council, the Water Board and the Water Resources Ministry do not agree about the distribution of responsibilities, specially in the responsibility of managing the Sewage system. Nowadays a new project of improvement of the water and sewage system is being planned and will be implemented.

5.1.2. Current degree of concern of the stakeholders on water conflicts (Intensity of conflicts)

The degree of concern of the group of stakeholders over the water conflicts is assessed, as well as the degree of concern of the Lake Naivasha Management Plan about water conflicts.
The intention is to try to develop two indicators of the intensity of conflicts based on the stakeholders perception of the situations and their values. These indicators have been developed and presented as two indexes in Equations 1 and 2 (Chapter 3).
These two positions have been chosen because one of our initial assumptions is that the stakeholders selected and interviewed are representative of the society in the area, or at least of the society which is participating on water issues. Thus, to explore which conflicts society as a whole is currently more concerned about, will give an indication of the intensity of the conflicts.
The second point of view is related to our reference, the Lake Naivasha Management Plan. The values behind the Plan were explored, and the degree of concern of society about water issues was modified by adding the values of the LNMP. From this approach it is seen which conflicts can be more the concern of the LNMP according to its values. The comparison between this result with the one obtained for the group of stakeholders will allow to see if the LNMP has the same worries as society as a whole.
The two indexes developed express the degree of concern of society (Equation 1, Chapter 3), and the index of concern of the LNMP (Equation 2, Chapter 3). They are derived from the Content analysis of the interviews and the common value tree developed in Chapter 4.
Table 5.2 shows the results of the Pairwise comparison performed on the main values of the common value tree of the stakeholders from the perspective of the Lake Naivasha Management Plan. The main objective of the management plan is 'To manage existing human activities in the lake ecosystem through voluntarily adopted sustainable wise use principles to ensure the conservation of the fresh water resource". From these main objectives and from the secondary objectives stated in the plan (LNRA, 1999), it is understood that the emphasis of the plan is on the promotion of the economy around the lake in a compatible way with the maintenance of the fresh water resources. In this way the main priority has been given to the value called *Impact on water bodies*, followed by *Impact on other ecosystems* because it has a very important secondary impact on the water bodies, in a third place to the *Socioeconomic framework,* because the maintenance of the economy is very important for the Management Plan, and in the last places to the *Domestic water management* and the *Agricultural water disposal* because they seem not to be so priority subjects in the Management Plan.
The results of the $IC_{SH's}$[3] indicates that the concerns of the society can be divided in two big groups:

[3] The range of values that can be obtained from the indexes vary for the $IC_{SH's}$ from 0.25 (a conflict with only one component mentioned one time during the interviews in a slightly negative way) to an unknown number (a conflict having an unknown number of components mentioned during the interviews in very negative way). In this case the component which had the highest score was "Cutting *papyrus"* mentioned 25 times in the interviews, in different ways. This component scored 23.75, but it was only one component of the conflict *Fisheries Department vs poachers.* This conflict had the highest $IC_{SH's}$ (32.75) and the lowest $IC_{SH's}$ was 0.25 in this case (Table 3 and 4 in the Appendix)
The values of the IC_{LNMP} are normally lower than the $IC_{SH's}$ because they are corrected with the weights of the stakeholders values participating in the conflict according to the LNMP (Table 5.2). They can vary also from 0.01 to an unknown number (depending on the times that a certain component is mentioned in the interviews). Here they ranged from 0.01 (*Longonot-Kijabe water scarcity*) to 23.42 (*Fisheries Department vs poachers)* (Table 4 in the Appendix).

One group which is formed by 6 conflicts that obtained more than a 15 value in the index and a second group of more 10 conflicts which score less than 10 (Figure 5.2 and 5.3). If we attend to the conflicts of the first group, the worries of the society can be divided into three categories:

- Conflicts between upper and lower catchment
- Conflicts of fishermen with other stakeholders, especially about illegal fishing
- Conflicts of the Administration and the Community about the management of domestic water

Table 5.2. Weights resulted from the pairwise comparison (Inconsistency index 0.08)

	Impacts...ecosystems	Socioeconomic	Impacts water bodies	Water disposal	Water management	Weight
Impacts on other ecosystems		1	0.2	3	7	0.164
Socioeconomic framework	1		0.143	1	7	0.124
Impacts on water bodies	5	7		7	9	0.591
Water disposal	0.33	1	0.143		5	0.093
Water management	0.143	0.143	0.111	0.2		0.029

When the IC_{LNMP} is calculated although the hierarchy of conflicts remain the same, the difference of concern about the different conflicts (the distance between conflicts) change very much, because the LNMP is interested in some particular items of the management of water, giving little importance to the *Water supply for domestic use* for example, because it is not within its objectives. However other smaller conflicts for the society as a whole are more of the interest of the LNMP as *the Nakuru water project* and the conflict between *LNRA versus IBECA*.

This indicates also that the concerns of the LNMP do not overlap completely with the concerns of the whole society about the water needs and conflicts. The LNMP is only managing some aspects of the water issues and not all the water problems and conflicts existing in the area.

If we look at the index of concern by groups of stakeholders, the attention given to the different conflicts according to the stakeholder type can be observed (Figure 5.4). Some interesting questions rise, for example, in the *Intensive users* group the *conflict between Mixed cattle/agriculture farms versus large commercial farms* gets the highest index of concern between all the other conflicts, although in the indexes for the whole group of stakeholders or from the point of view of the Management Plan (Figures 5.1 and 5.2) has low scores. In fact this is an internal conflict between the group called *Intensive users,* and even within the subgroup of *Intensive users* formed by the owners or users of big farms around the lake. This conflict is somehow a bit hidden and people do not talk really very openly about it, it seems politically not correct to accuse your own colleagues of using the resources badly. However all the owners of big farms around the lake mentioned it in a way or another, trying to protect themselves (they use the water in a sustainable way) and accuse the others of a bad use of the resources (the Northern farmers say that they respect the land and the water and they are not interested in such an intensive agriculture as the Southern farms. As said by one farmer of the Northern part of the lake referring to the Southern farmers: “only interested in making much money as quick as possible and leaving the country”. According to them, the Southern farmers use the water from the lake freely, they pollute the lake and they do not respect the riparian zone, building greenhouses within the riparian limit. The Southern farmers say that they make an effort to use the

resources in a sustainable manner but the Northern farms are extracting illegally so much water from the rivers as they want and they are introducing also very intensive agricultural practices).
The *Intensive users* also care about conflicts like *Upstream versus downstream* group of conflicts (*North Kinangop versus middle catchment, South Kinangop versus small Malewa farmers,*

North/South Kinangop versus big farms downstream), about *Fisheries Department versus poachers* and about the water supply system.

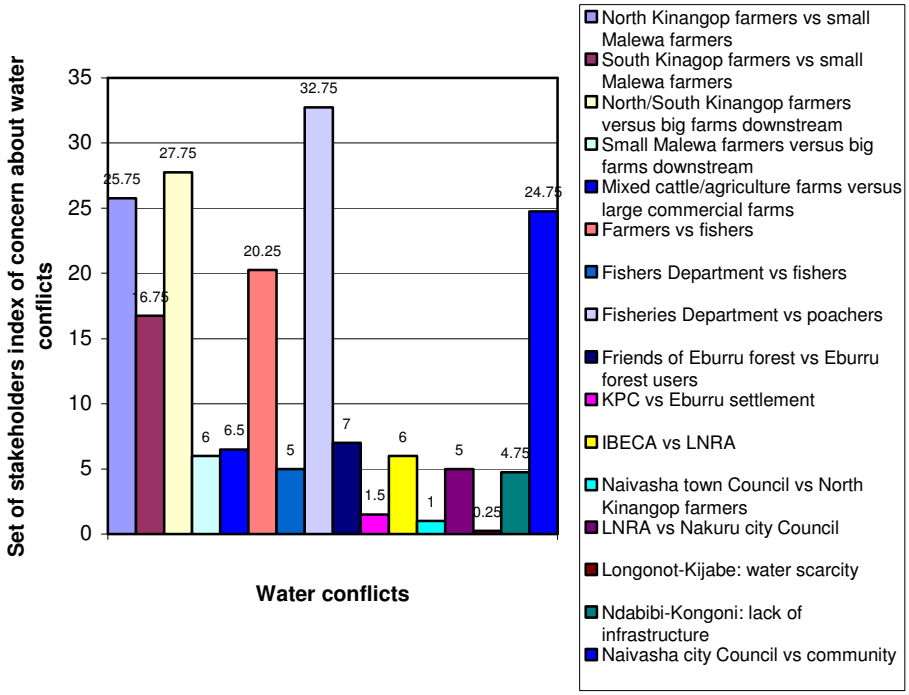


Figure 5.2. Index of concern of the stakeholders on the different water conflicts

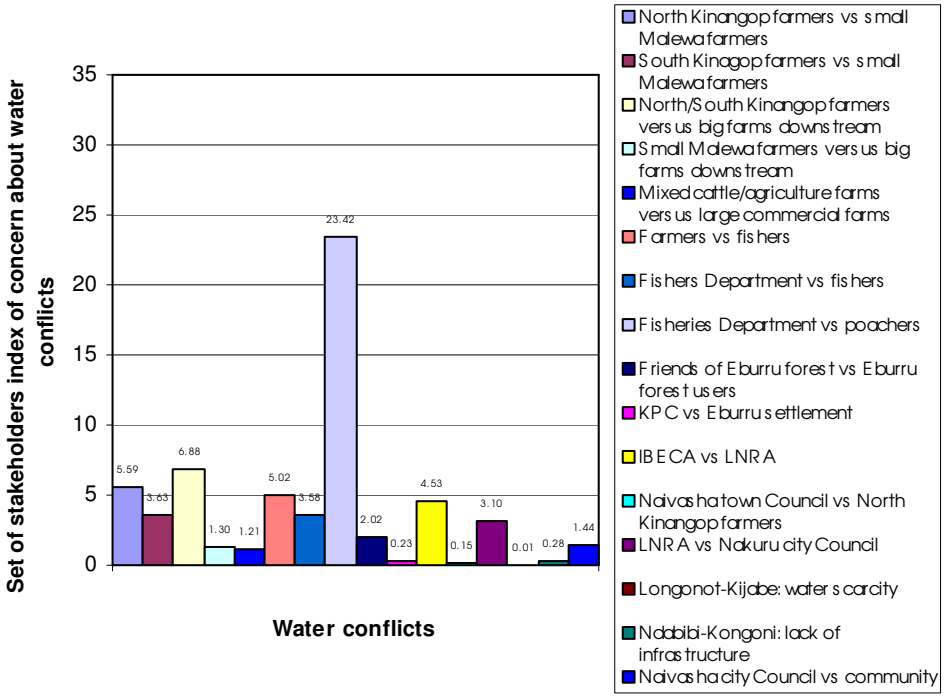


Figure 5.3. Index of concern of the Lake Naivasha Management Plan on the different water conflicts

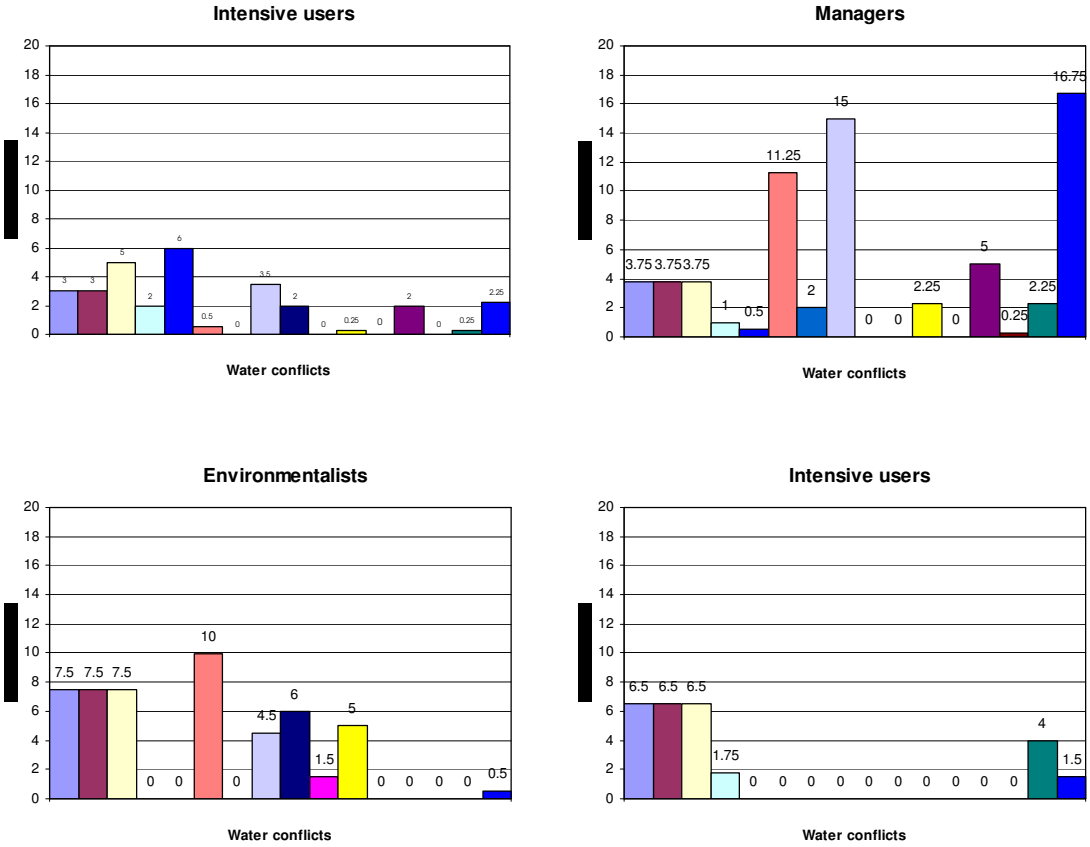


Figure 5.4. Index of concern about conflicts by stakeholders groups (The community group is not represented because only scored a 5.5 of IC in the *Naivasha city Council vs community* conflicts and 0 in the rest of conflicts; from the Pastoralists group no data were available. The legend of the graphs is the same as in Figures 5.1 and 5.2).

The attention of the *Managers* is more concentrated in the conflicts about *Water supply* and the conflicts of the *fishermen*.

The *Environmentalists* care more about all the conflicts in relation with the *Upper catchment* areas (Kinangop, Eburru forest) and the conflict *Fishermen versus the farmers,* especially in relation with the pollution of the lake.

The *Small and medium farmers* are concerned about the conflict were the *Upper catchment* areas are involved as well as the conflicts in relation to their *Water supply*. They are quite conscious that their encroachment of the forest has off-site effects downstream.

The *Community* group is in fact only worried about the immediate problem of water supply that can be translated in a conflict between them and the Naivasha city Council and they are not really aware of other conflicts. From the *Pastoralists* group not data were available to derive de index of concern about conflicts.

5.2. Classification of conflicts

The conflicts normally arise from complex situations where many different factors are involved. As Warner and Jones (1998) said they reflect complex situations with many causal forces.

Although it is very unlikely that a conflict has only one source and every conflict is probably the result of the convergence of different factors, the dominant source of the conflicts identified within the Naivasha catchment has tried to be recognized. It is assumed here that one of the sources of conflicts is dominant over the others. This exercise represents an attempt of conceptualization of the understanding of the sources in order to help in future conflict resolution.
Furthermore a typology of conflicts has been attempted in order to distinguish which are more close to the water resources (directly related) and to which aspects of the water resources they are related, from the ones that are more involved with other natural resources, which have an influence also on water resources.

5.2.1. Classification based on the source

The classification of the conflict sources is based on two classifications, *functional conflicts* (Prein, 1988) and the classification of Mostert (1998). The first one refers to those conflicts that are not concerned with personal or subjective that relate to the persons involved with those conflicts. They merely consider the relationships within an object reality. The second one refers to conflicts resulted from a disagreement about a fact or action between at least two stakeholders.
Verplanke (2001) summarizes five structural sources of conflicts that would be related to the *functional conflicts* mentioned above: interdependence, ambiguity, structural differentiation, scarcity and communication barriers.
Mostert (1998) pointed out three main sources of conflicts:

- Factual Disagreement, it refers to a disagreement on the facts of a case, for example, opinions that differ about the impacts of certain activities, the risks involved, and the relevant laws. Factual disagreements can have several causes, for example one cause can be that facts are hardly ever totally certain, uncertainty in the results and uncertainty in the rules. Another cause the fact that the parties in a conflict often have different information, and third cause is the limited capacity of individuals to process information.
- Conflicting goals between the stakeholders can be a source of conflicts. The goals refer to a desired situation, interests as goals refer to personal gains or losses and values as goals are more fundamental and are culturally determined.
- Relational aspects between the stakeholders can lead to conflictive situations. When the relational aspects are source of conflicts, they are normally related to distrust often caused by communication and to power struggles.

Both classifications have been used jointly here. The distribution of the identified conflicts according to the categories mentioned above is presented in Figure 5.5.
Three conflicts have been classified as having a structural source. The conflict *Longonot-Kijabe* area where there is scarcity of water, the *Ndabibi-Kongoni* area where there is a scarcity of funds and an interdependence with the authorities to solve the problem of water supply for agriculture especially; and the conflict of the *Naivasha town Council versus the Community* where, one of the sources is the ambiguity in the distribution of tasks and responsibilities between the managers combined with a scarcity of funds.

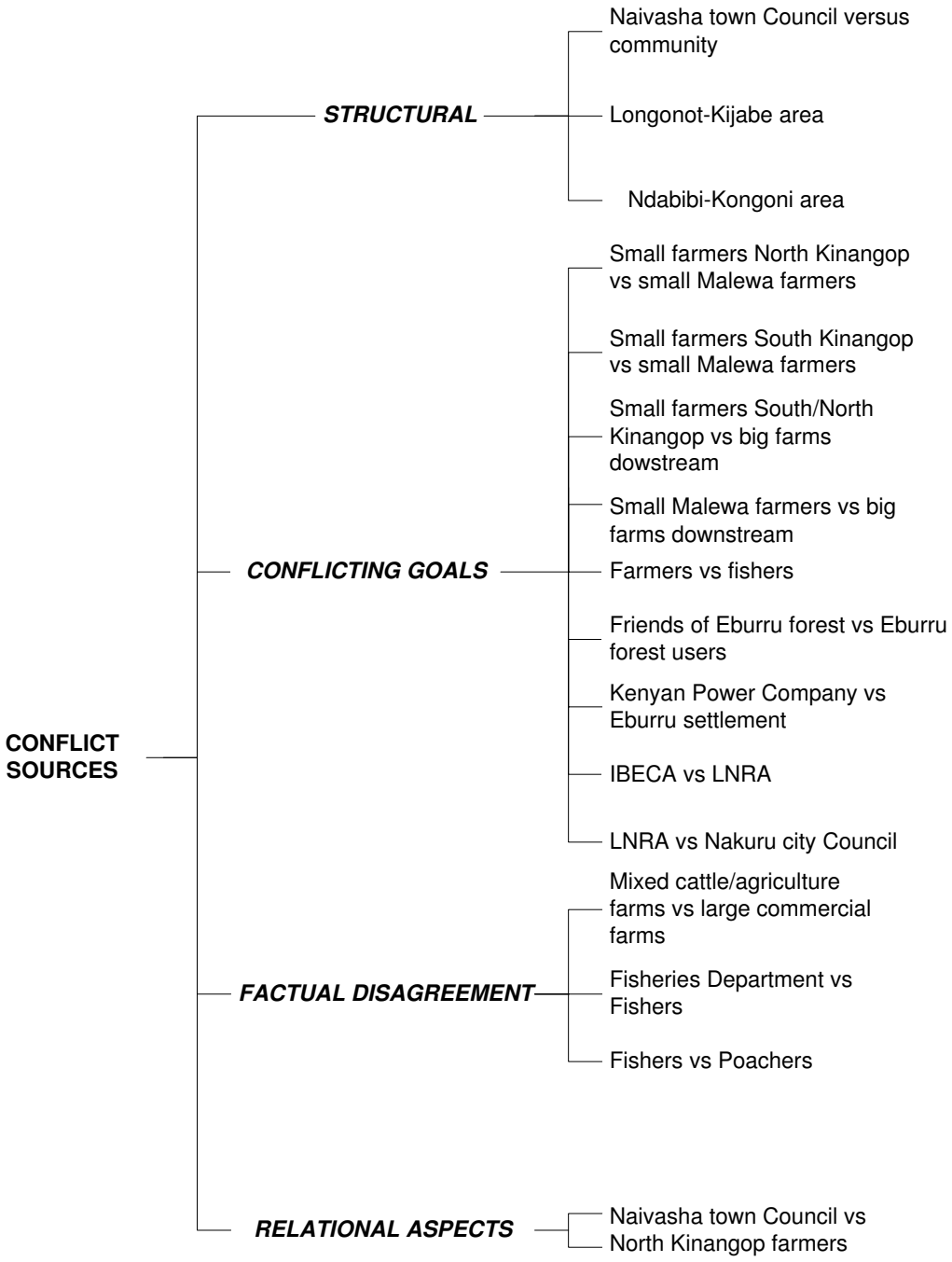


Figure 5.5. Conflicts classified according to their source

The rest of conflicts have been classified according to Mostert (1998), the source of many of them is rooted in the conflicting goals between many of the stakeholders. Stakeholders having different values have confronting interests in the use of the resources. To this category belong conflicts between the different types of farmers within the catchment, between managers and environmentalists (*LNRA versus IBECA*), between the group of managers (*LNRA vs Nakuru city Council*) and between industry and community (*KPC versus Eburru settlement*).

There are some conflicts that are more based in the disagreement on the facts, this means that both stakeholders participating in the conflict have the same goal, for example capturing a lot of fishes or having a sustainable level of water in the lake while using the water for irrigation. But they accuse one each other of certain actions (*Mixed cattle/agriculture versus large commercial farms, Fisheries Department versus fishermen, Fishermen versus poachers*). The conflict between *Naivasha town Council versus North Kinangop farmers* resulted in the disappearance some years ago of one important branch of the water supply system for Naivasha town. It has its source in a lack of communication between the managers and the communities involved, the denial of participatory mechanisms in the project planning and the lack of an impact assessment, not only physical but social of the project.

5.2.2. Defining a typology of water conflicts

The same nature of the water resource, its dynamic character (the water is subjected to a cycle, the hydrological cycle, that conditions the way in which it appears in the environment: in liquid, solid or vapor form) and the high influence that the use of other resources have on water makes difficult to distinguish which conflicts are purely related to water or are related to other resources which influence the water availability. For human consumption and the sustainability of human activities a certain amount of water in liquid stage, non-polluted and located at specific places is needed. In this case the society needs a sustainable level of clean water in the lake and in the aquifers of the catchment, but a part of the society needs also means to make a living which do not have a direct or indirect impact in the water resources.

Thus in order to understand better the conflicts and their nature, a basic typology of conflicts is proposed. From this approach it is not meant that a conflict that belong to a certain category has only that aspect and do not participate of other categories, but it is just a way to simplify the reality in order to understand better the core problem of each conflict.

Two basic categories in the typology are established trying to answer two questions: which conflicts are directly in relation with the water resources? And which conflicts are more in relation with other natural resources that at the same time have an influence in the water availability or water quality? (Figure 5.6).

Within the first category (*Water-directly-related* conflicts) several subcategories have been established in relation to the aspect of the water resources that constitutes the main matter of conflict, in this way *Water use* refers to the *extractions* done from the *lake*, the *rivers* and the *ground*; another category has been established in relation to the stage or condition of the *resources* within the *lake,* this is mainly in connection with the fishing in the lake, a natural resource very fragile and that is being overexploited because it produces a direct revenue in a society with much poverty; other category is considering the S*carcity of water*; and the last one is considering the conflicts in relation with the *Water supply*.

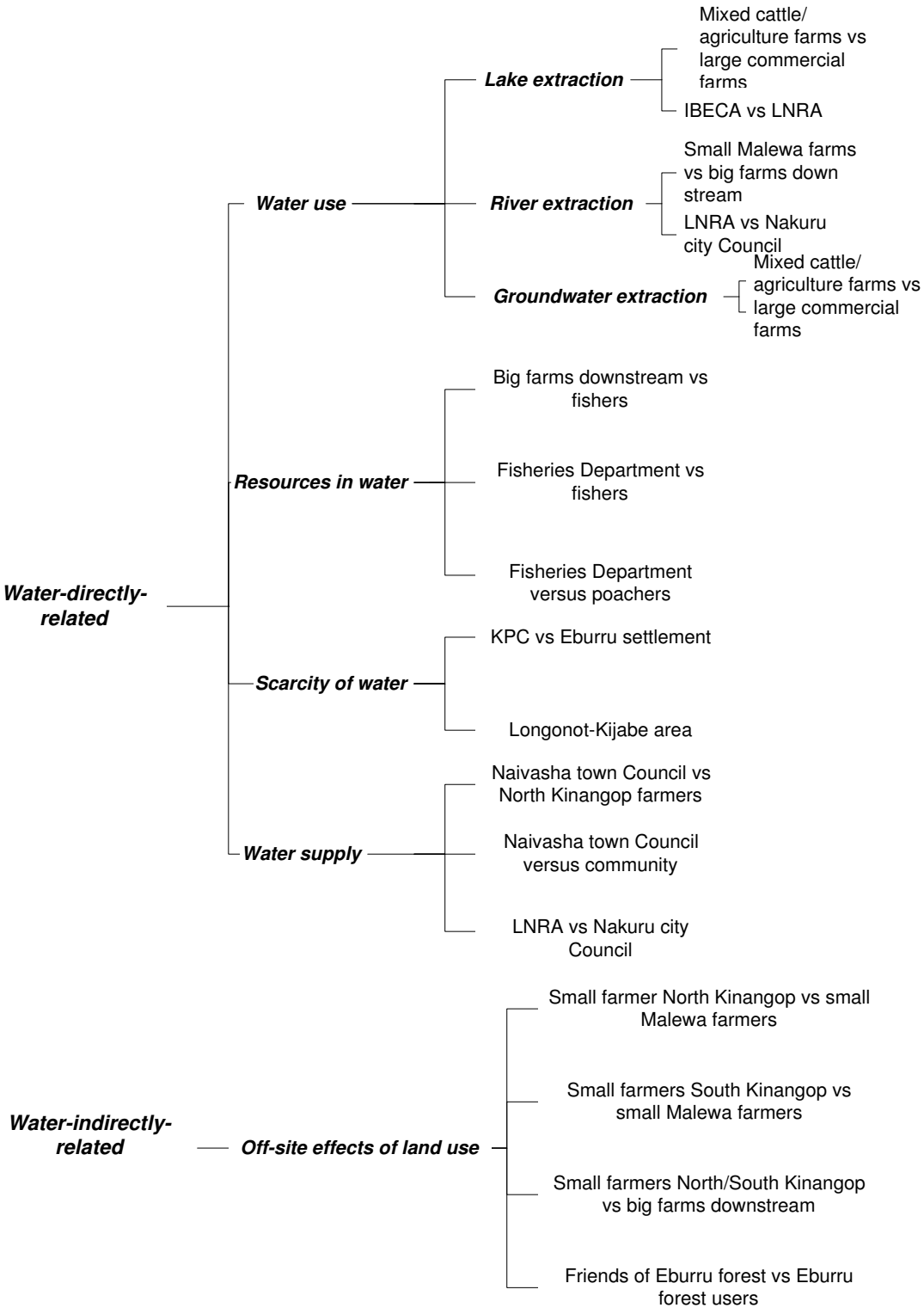


Figure 5.6. Typology of conflicts proposed

Furthermore within the conflicts *indirectly related to water* are all the conflicts that imply the use of other natural resource. Any change in the condition or extension of that resource has a direct influence in the water amount and quality. Most of the conflicts within this category are in relation with the utilization of the forest or the vegetation. The disturbance of the vegetation cover has a direct impact on water availability and quality. The decrease of the vegetation cover is directly related to the runoff

generation processes, different runoff generation mechanisms have been associated with different degree of vegetation coverage, but anyhow it is demonstrated that the reduction of the forest leads to higher runoff rates and expose the soil to erosion. In several areas of the upper catchment of Naivasha: North and South Kinangop and Eburru, the forest is being encroached and used to produce alternative economic sources for the farmers. The users of water resources downstream are complaining of higher sediment yield in the river water that ends up in the lake. This could provoke an acceleration of the process of sedimentation of the lake.

Some conflicts that have not been defined within this category have also a component indirectly related to water, for example the *Fisheries Department versus poachers*. The main problem between them is the illegal fishing in the lake, so it has been classified as a conflict in relation with the misuse of the lake resources, however the poachers in fact cause a very big damage to the riparian ecosystem, fishing within the *Papyrus* band surrounding the lake, clearing a vegetation that is crucial for the birds, for the breeding of the fishes and as a filter for sediments and contaminants. Another conflict, *IBECA versus LNRA* has been classified as being in relation with the water extraction of the lake; the IBECA is against the use of water of the lake by the big farms surrounding the lake. They support their claims in environmental theories however they also claim the right of enjoyment and use of an area that they feel was taken from them already in the colonial times. From their point of view the lake and surroundings represent an important economic resource that the original people from the area has not had the opportunity to use, however is making richer to the ones that they consider already as rich. They claim the opening to the public access of the riparian land, in this case this conflict between these two associations have some kind of historical-emotional components that are very much related with land conflicts in relation with the confused situation of ownership of the riparian land.

It is hazardous to sort the conflicts as belonging to one type or other because normally they have several interrelated factors and could be sorted out in different types at the same time. However this exercise is taken as a conceptualization attempt trying to distinguish which is the main item in each conflict, being aware that each conflict can have components of several types.

Chapter 6. Visualization of conflicts

To understand the complexity of the real world, man reacts trying, first, to isolate parts of reality and, second, to investigate how the parts operate under simplified conditions, as Chorley (1971) said when trying to explain systems theory in Physical Geography. If we understand a map as a simplified model of the reality, a map should then help to understand this reality. The isolation of parts of the conflicts and the visual representation of those parts could help to comprehend the spatial dimension of the conflicts. This could be used by the planners to understand the areas of conflict and the spatial relations of those areas (are they close to each other?, are they close to some natural resources or to human activities? etc.) and to keep in mind a spatial reference of the identified conflicts.

The idea of visualization of conflicts will be a step further in the process of conflict mapping. It is, on one hand, the result of the conflict analysis and, on the other hand, it could be used to analyze further the relations conflicts have with other physical or socioeconomic variables that could be represented in the same space.

The concept of visualization means "to make visible", presentation maps make aspects of the world visible and the maps facilitate thinking, problem solving and decision making (Maceachren and Kraak, 1997). The visualization of conflicts might be used as a tool by the planner, giving them a further understanding of the conflicts and a clear idea of the spatial dimensions.

Maps are important tools for decision support, especially in relation with the earth's resources. In this process maps help to visualize spatial data, to reveal and understand spatial distributions and relations (Kraak, 1996).

Moreover the visualization applied to the synthesis of information, according to Maceachren and Kraak (1997) moves the emphasis away from single investigators towards groups (perhaps of specialists) and from revealing unknowns toward presenting knowns. Visualization applied to presentation emphasizes public use and the "presentation" of information that is largely known to the information designer, but not to the client of the presentation, who can derive considerable benefit from use of interactivity.

In this sense, for instance some creative use of visualization for public use has been proposed with initiatives like the one of McKinnon (2001) who used several graphics and computer tools to approach smallholder rural communities in Laos by means of a Participatory Learning and Action system with satisfactory results. It allowed for open consultation, transparency and articulation of challenges and problems shared with all the stakeholders. The system was called MIGIS (Mobile Interactive GIS) and gave very good results in engaging farmers interest (McKinnon, 2001).

The idea behind this chapter is to approach the problem of visualization of conflicts on water issues, structuring the problem, thinking about the objective of the visualization, and exploring some ways in which it could be done. All this has a very preliminary character because when going deeper in this exercise, the visualization issue comes into the field of the cartography and it needs more attention and time that could be dedicated here.

6.1. Framework for the visualization of water conflicts: is it really possible to map them (cartographically)?

Conflict visualization is proposed here as a further step in the conflict mapping exercise, understood as the systematic collection of information about the dynamics of a conflict, and in the conflict analysis process. It was considered that the construction of a physical map would facilitate the visualization and communication processes. Both processes defined by Maceachren and Kraak (1997) as the prompting of visual thinking and knowledge construction (visualization); and the transfer of information (communication).

The conflict mapping and analysis is thought to give some feedback to the existing Lake Naivasha Management Plan, and the creation of an analog conflict map could be part of that feedback to be used potentially by the managers.

The idea has been worked out and a basis is established formulating some conflict dimensions to be represented in a map and attempting some visualizations.

A conflict map makes sense in principle in the same way as any other map: to help to understand the complexity of the reality by decomposing some aspects of that reality in spatial references. More specifically it is proposed that a conflict map in the sense of visualization would help the planners in the following ways:

- Synthesizing results obtained in different research fields
- Helping to structure the problems
- Helping to concretize and materialize the problems
- Facilitating discussion between stakeholders
- Stimulating participation of all the stakeholders in the planning process
- Integrating views and problems and understanding relations at a catchment scale.

To approach the problem of visualization first it is important to determine what it is we want to show and how it can be said. Mapping other type of realities that do not imply emotional, psychological and social factors or subjective perceptions is more direct. But mapping conflicts that reflect complex situations with all these ingredients (emotional, psychological, social and historical factors) results in a more controversial type of exercise. Even more in this case, because the conflicts analyzed here are about water, and this natural resource is more difficult to trace in space. Land conflicts are probably more direct to map because we can always georeference the pieces of land that are the object of the conflicts.

The first idea was to determine what we want to show. It was to established that the conflict map should not pretend to represent the whole complexity of each conflict, formed by many different factors and dimensions, but only to extract their spatial dimensions.

This led to ideas about which dimensions could be represented in space and how these dimensions could be represented. A proposal of the dimensions and ways of representation is in Table 6.1.

Table 6.1. Potential dimensions of water conflicts to be represented in a map

Dimension of the conflicts	Levels	Questions to answer	Possible way of visualization
Space	Area of influence	- Are the conflicts dispersed around an area, or very localized?	As areas with fuzzy boundaries, not fixed borders with soft colours and in the contacts could overlap
	Focus of conflicts		With a symbol when they are located in a city or village or a specific location
Direction	Directional	- Are the conflicts "flowing" in some direction between two areas? - Or are they within the same area?	An arrow indicating between which two areas the conflict is happening, and also which stake holder is aware of the conflict
	Non-directional		A looped arrow indicating that the conflict is happening within one area
Intensity/Scale	Important	- How much are these conflicts affecting the living of the people's lives?	By the thickness of the arrow
	Medium		
	Minor		
Density of the conflicts	High	- How many conflicts are in an area or in a focus?	By the colour intensity of the area of influence, or by a pattern of density
	Medium		
	Low		
Type of conflict	According to the final classification based on the issue (as for example shown above)	- What is the main conflict component or arena? - What aspect of the water issue is the cause of conflict? - Is there a direct or an indirect relation with the availability of water?	By the colour of the arrow

6.2. Attempts at visualization: (mis)understanding the message

The visualization here represents only a first attempt on the subject and gives only some ideas of the potential maps to be. Given the complexity of the matter and the experience in cartography needed, this would in itself need a deeper research.

Nevertheless, the ideas worked out so far are exposed here with the intention to use them as a basis for further thinking.

A first approximation, a very simple one, is shown in Figure 6.1, this map would just represent zones of conflict that were approximately identified in the field, and some conflicts related to each of these zones. The main problem with this visualization is that the areas shown appear as discrete units with clear boundaries, this is not really the case because they are not georeferenced, they only respond to the subjective impression of the researcher and no clear boundaries can be given to them. The map would only represent the space of conflicts and the density of conflicts (according to Table 6.1), but in a very subjective way. There could be misunderstandings about the dimensions and boundaries of the areas which are purely arbitrary and do not have a physical meaning. Also large areas give the impression of large conflicts (high intensity).In Chapter 4 an approximation for the visualization of the stakeholder locations supported the description and analysis of the stakeholders (Figure 4.1).

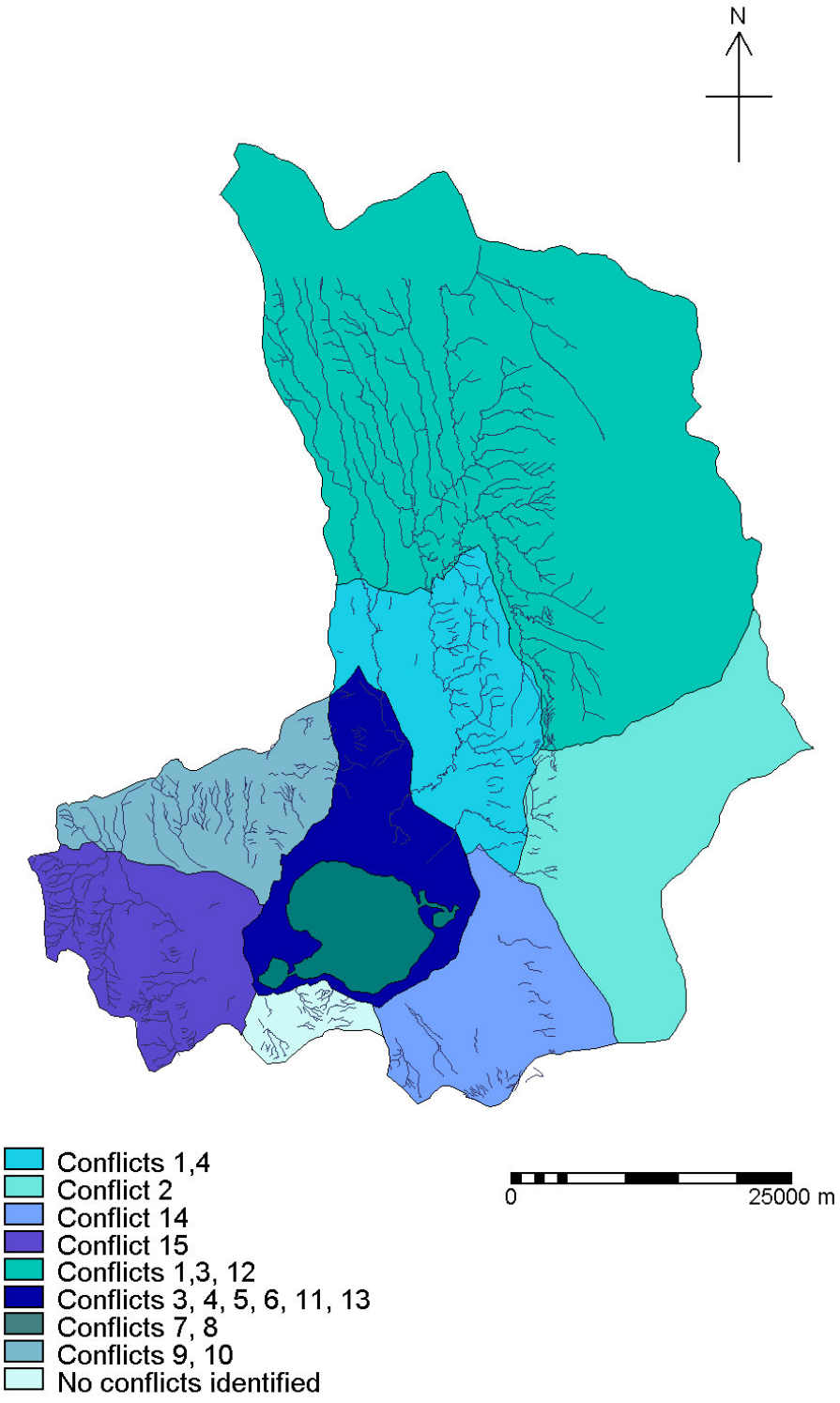


Figure 6.1. First approximation of visualization of areas of water conflicts

A second attempt is represented in Figure 6.2. The map represented in this figure is already more sophisticated and further elaborated than the one in Figure 6.1. The boundaries of the areas have been transformed in fuzzy limits to give the impression of an approximate area but without a clear knowledge of where it starts and where it ends. This still represents the spatial dimension. Attempts were also made to represent other dimensions of the conflicts (according to Table 6.1): the direction (the arrows), the intensity (the thickness of the arrows), the density (number of arrows coming from an area) and the type of conflicts (colors, this dimension is related with the typology of conflicts developed in Chapter 5). The main problem is probably that the map is too visually crowded and it is not very clear if it communicates all the dimensions of the conflicts that are intended. It is not clear if the reader would understand the map. In Chapter 5 other aspects of the conflicts as sources (structural, factual disagreement, conflicting goals, relational aspects) were explored, these could not be represented here because they do not have a spatial dimension.

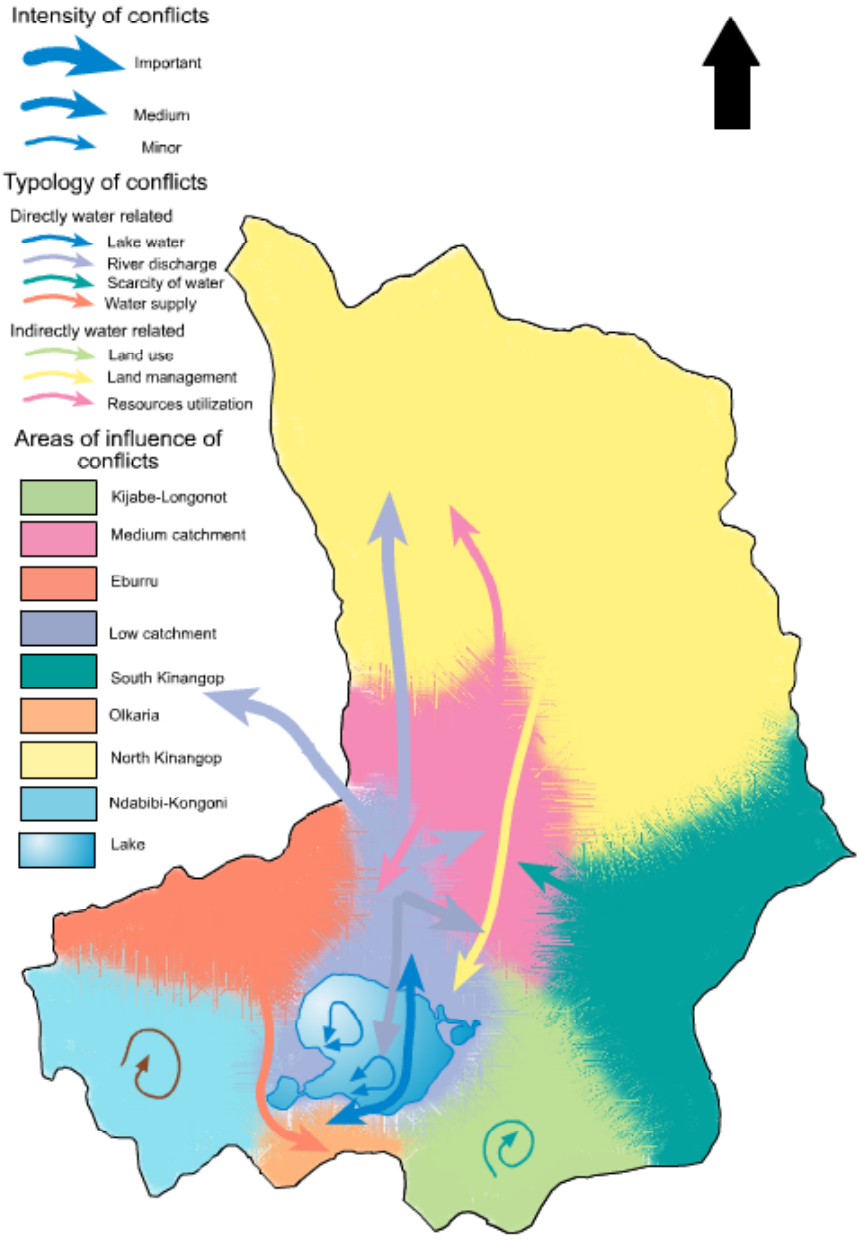


Figure 6.2. Second approximation of visualization of water conflicts

The third approximation of visualization is presented in Figures 6.3a and 6.3b and the emphasis was put on trying to find spatial indicators with a known physical dimension (points, lines or areas) which could represent some aspects of the identified conflicts.
In this approach the intention is only to represent the spatial dimension of the conflict (if the data were available or could be modeled) that is, the physical spaces which participate in a conflict. This visualization exercise is more in relation with the dimension space of Table 6.1. The main problems are the difficulty to find reality-based indicators, which express this spatial dimension (a good data base on the area is needed) and the not representation of other dimensions of the conflicts expressed in Table 6.1. The main advantage is that it is a synthesizing exercise of several types of information.
To approach this exercise the information analyzed in chapter 5 (Analysis of the conflicts) was recovered. The conflicts were decomposed on components that were important subjects mentioned during the interviews with the stakeholders. *The components are defined as issues that participate in the conflict situation or that contribute to a different degree to create a particular conflict situation.*
However a conflict is not just the addition of several components, a conflict by definition implies many more aspects that are not represented by those components and could not be represented in a map (social, psychological, emotional and historical aspects). The components were a way to measure the degree of concern of the stakeholders about the conflicts based on secondary data analysis. Some of these components have a spatial dimension or could be associated to indicators with a spatial dimension. Gather information from existing secondary data and the ongoing research in the area was to collect the spatial indicators of the components (Table 6.2).
In this way it is possible to visualize the conflict areas or the areas contributing to a certain conflict. The representation of the information was split in two maps, one representing more the conflicts indirectly related to water (mainly land or other resource conflicts that have an impact on water, "indirectly-related to water conflicts" (Chapter 5)) (Figure 6.3a), and the other map representing the more directly water-related conflicts (more directly related to water consumption, "conflicts directly related to water" (Chapter 5)) (Figure 6.3b).
However this division is not very secure because the maps are not accurately adjusted to that division. As explained in Chapter 5, conflicts are not so easy to classify and some of them reflect both proposed categories.
Not all the components identified during the interviews and that form part of the conflicts could be represented in the space, in fact for two components in the list: *Economic alternatives for fishermen* and *Water quality* no spatial indicators could be found yet. So the maps presented here translate in the space the areas or focus that form part of several conflicts.
For the elaboration of the spatial indicators the expertise of researchers involved in specific issues within the catchment was very important. The spatial indicators were individually discussed with them and they also contributed with information and data as it can be seen in Table 6.2.
From Figure 6.3a the areas of forest within the catchment, and especially the areas where forest has disappeared in the last 40 years, are possibly involved with the increase of the sediment load of the rivers due to an increase of erosion of deforested areas (Conflicts 1, 2, 3, 9 in the list). The issue of whether or not deforestation is related to increased sediment load is discussed in Chapter 7.
The riparian area, represented here by *Cyperus papyrus* cover is a very important area in relation to the dominant conflict nowadays between *Poachers and Fisheries Department* (Conflict 8).

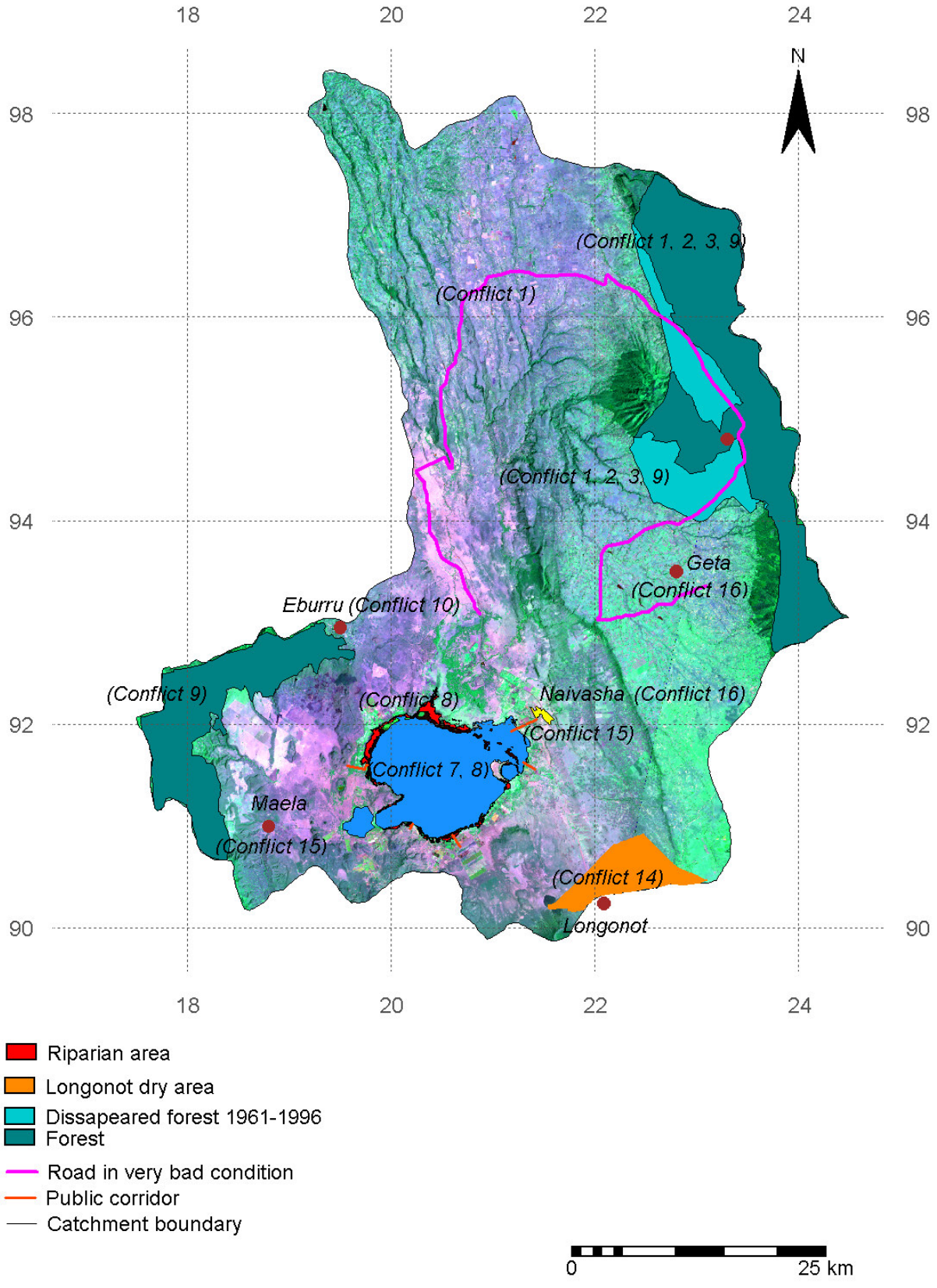


Figure 6.3a. Spaces of conflicts more indirectly related to water (In the back a False Color Composite TM 96 Bands 3, 4, 5, green areas correspond to vegetation)

The area called "Longonot dry area" is in relation to the structural conflict of water scarcity at the Southeast of the catchment (Conflict 15).
The "road in very bad condition" is very much related to the conflict especially of the North Kinangop farmers and downstream farmers. This impassable road provokes the isolation of this upper catchment area, especially in social and economic terms, leading to an overexploitation of forest resources which in long term can influence the quality of the surface water (increased sediment load) and alter the recharges of the aquifers.

Table 6.2. Decomposition of conflicts into components and indicators used to spatially represent the components

Conflict number	***Conflicts***	***Components of the conflicts according to the interviews***	***Spatial indicator of the component and source***
1	North Kinangop farmers vs farmers middle catchment	Upper catchment destruction (Kinangop)	Forest and forest disappeared after 1961 (own elaboration from Land cover map of the Naivasha data base ITC and forest cover according to Carey Jones, 1965)
		Bad infrastructure	Road in bad condition (own elaboration)
2	South Kinangop farmers vs small Malewa farmers	Upper catchment destruction (Kinangop)	Forest and forest disappeared after 1961 (own elaboration from Land cover map of the Naivasha data base ITC and forest cover according to Carey Jones, 1965)
3	North/South Kinangop farmers versus big farms downstream	Upper catchment destruction (Kinangop)	Forest and forest disappeared after 1961 (own elaboration from Land cover map of the ITC Naivasha data base and forest cover according to Carey Jones, 1965)
		Water pollution of the rivers	Malewa and Gilgil rivers and main subsidiaries (own elaboration from the drainage map of the ITC Naivasha data base) and sampling points for river pollution from Muñoz Villers (2002)
		Bad infrastructure	Road in bad condition (own elaboration)
4	Small Malewa farmers versus big farms downstream	Water extraction from the rivers	Malewa and Gilgil rivers and main subsidiaries (own elaboration from the drainage map of the ITC Naivasha data base)
		Water pollution rivers	Sampling points for river pollution from Muñoz Villers (2002)
5	Mixed cattle/agriculture versus large commercial farms	Land utilization	Water consumption by farms (Pereira, 2002)
6	Farmers vs fishermen	Water pollution lake	Point-pollution sources from Muñoz Villers (2002) and area of non-point source pollution (own elaboration from information of Muñoz Villers, 2002)
		Water extraction lake	Water consumption for farms (Pereira, 2002)
7	Fishermen Department vs fishermen	Fishing methods	Lake map (own elaboration from Water bodies map from ITC Naivasha data base)
		Economic alternatives for fishermen	-
8	Fisheries Department vs poachers	Illegal fisheries	Lake map (own elaboration from Water bodies map from ITC Naivasha data base)
		Cutting papyrus	Area of *Cyperus papyrus* 2001 from Mena (2002)
		Fishing methods	Lake map (own elaboration from Water bodies map from ITC Naivasha data base)
9	Friends of Eburru Forest vs Eburru Forest users	Destruction of Eburru forest	Forest and forest disappeared after 1961 (own elaboration from Land cover map of the Naivasha data base ITC and forest cover according to Carey Jones, 1965)
10	KPC vs Eburru settlement	Water supply Eburru	Eburru settlement (own elaboration)
11	IBECA vs LNRA	Water pollution lake	Point-pollution sources from Muñoz Villers (2002) and area of non-point source pollution (own elaboration from information of Muñoz Villers, 2002)
12	Water supply Geta project	Water supply Geta project	Geta settlement (own elaboration)
13	Nakuru water project	Nakuru water project	Nakuru settlement (own elaboration)
14	Longonot dry area	Longonot dry area	Longonot dry area (own elaboration from Rainfall map and Land cover map of ITC Naivasha data base)
15	Water supply Kongoni-Maela	Water supply Kongoni-Maela	Maela settlement (own elaboration)
	Water quality	Water quality	-
	Maasai water access	Maasai water access	Public corridors map (Mena, 2002)
16	Water supply Naivasha	Water supply Naivasha	Naivasha city (Mena 2002)
	Sewage system	Sewage system	Point –pollution sources (Muñoz Villers, 2002)
	Geta project	Geta project	Geta settlement (own elaboration)

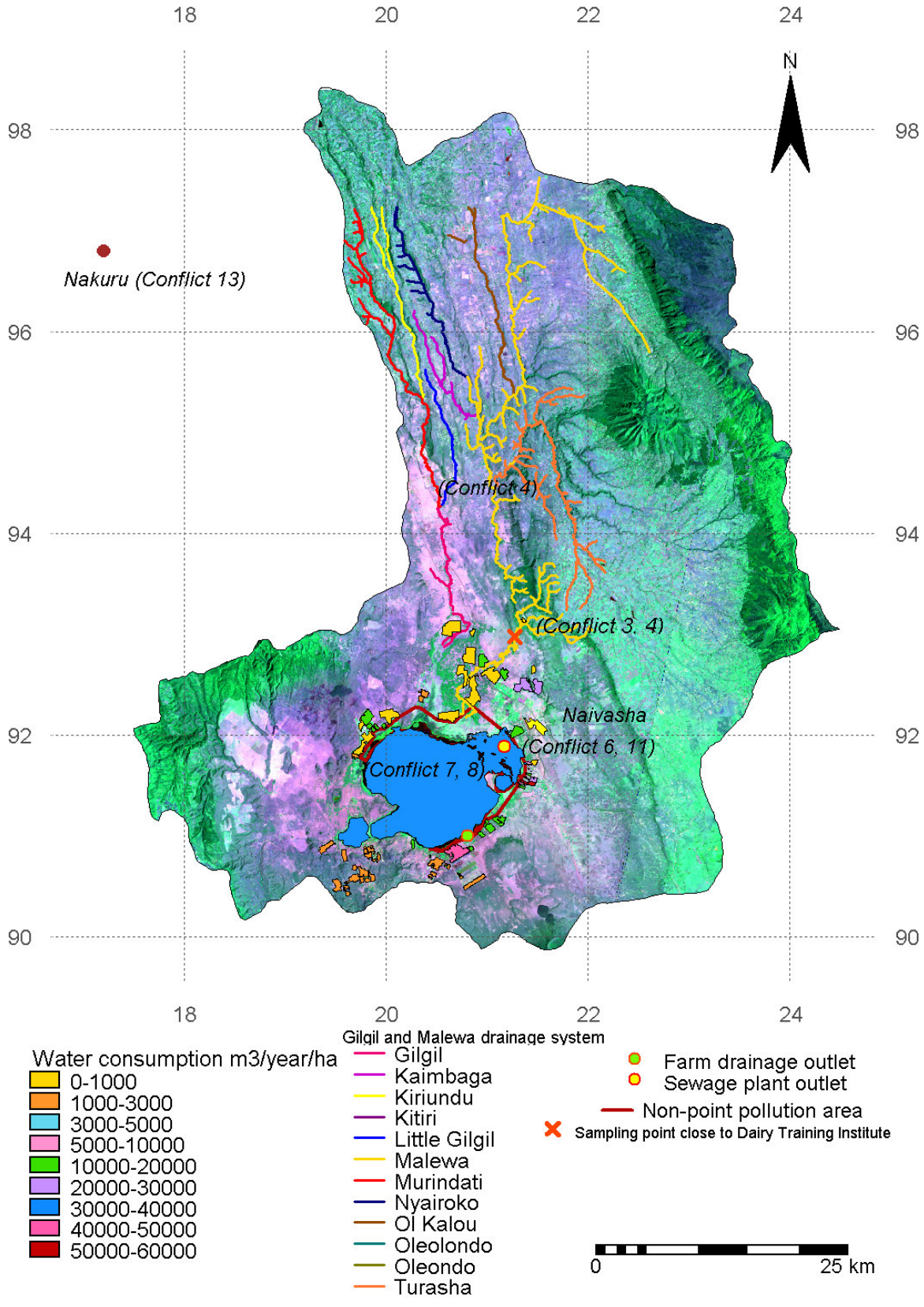


Figure 6.3b. Spaces of conflicts more directly related to water (In the back a False Color Composite TM 96 Bands 3, 4, 5, green areas correspond to vegetation)

Eburru and Maela settlements have problems of water supply in relation to Conflict 15 and Conflict 10.
Geta settlement is related to one subconflict in the past (the failure of the Geta project, see description of the conflicts in chapter 5) but nowadays is having some influence (according to the stakeholders) on the conflict of water supply for Naivasha city council (Conflict 16).
From Figure 6.3b the spaces more directly related with conflicts involving water use and consumption can be seen. In this way most of these spaces are focused around the lake and rivers. The level of water extraction of the lake has been represented by the indicator: Water consumption by farms (Pereira, 2002) although the water consumption represents both the extraction of surface water and groundwater, and both directly or indirectly can affect the lake level. This is related to Conflict 5 (the way in which the different farmers around the lake use the resources creates a confrontation between them) and 6 (the fishermen accuse the farmers of extracting too much water and the way that this is done is disturbing the fish breeding).
Around the lake, two clear point sources of pollution were located as indicated in the map (Figure 6.3b) however the shoreline from the North till the Southeast of the lake (as indicated in the map) can be considered a continuous non-point source of pollution after examining carefully different indicators of water pollution all over the lake by Muñoz Villers (2002).
A direct indicator of water extraction in the rivers is not available, but at least from Gilgil River it is known that is a significant amount, since almost no water of Gilgil is contributing nowadays to the lake. The extraction of the Malewa River is done mainly by small farmers, although no records could be represented. The pollution of the lake is related to the conflicts between farmers and fishermen (Conflict 6) and to conflicts between farmers and environmentalists associations (Conflict 11).
The pollution of the rivers is difficult to estimate, point-pollution sources have not been yet localized, but available information from Muñoz Villers (2002) points out that from the Dairy Training School and downstream in the Malewa river (Figure 6.3b), the pollution is quite serious. All the areas close to the settlement of the Dairy Training School and the farms around release contaminant fertilizers and organic waste (high values of Chemical Oxygen Demand and Ammonia (NH_4^+)). However it is suspected that although no data of water pollution are available, much higher in the upper catchments of Malewa and Gilgil, all the areas close to settlements and rivers could be potentially a non-point source of pollution due mainly to the lack of proper sewage systems. The water pollution of rivers is a component of Conflicts 3 and 4 where the interest of upper and small Malewa farmers, on one side, and downstream farmers, on the other, confront each other.
The symbols for maps in Figures 6.3a and 6.3b were chosen according to the type of data represented which determined the type of map for each indicator (point map, segment map and polygon map): data in relation with conflicts of supply systems of some settlements or towns are represented as points, as well as the point pollution sources which represent the components *Water pollution of river* and *Water pollution of lake*. However the representation of a non-point pollution source around the lake required the establishment of an area where pollution comes from, this was also meant to represent the component *Water pollution of the lake*.
Lines were used to represent the road in bad condition and the drainage system.
The component Longonot dry area is represented as an area in Figure 6.3a. The spaces of present-day forest and disappeared forest are also represented as areas in Figure 6.3a. These two last ones are in

relation with the component *Upper catchment destruction (Kinangop)* and *destruction of the Eburru forest.*
The indicator in relation with the component *Water extraction from lake* that is Water consumption by farms is also represented as areas because the data show the consumption per year and per surface unit (ha) of the different farms around the lake (a polygon map).

The visualization exercise has resulted in an interesting subject but much more complicated and deeper that could be foreseen at the beginning of the research. The "final" conflict maps were not produced due to time constraints and because the subject deserves more attention that could be given here. However the attempts seem very promising and also indicate possible different ways of solving the problem, through a more quantitative or qualitative direction. Some cooperation with the Cartography Department at ITC has suggested that probably the use of the concept of "Dynamic maps" could be very interesting to visualize the conflicts, especially when introducing temporal elements.
A combination of both approaches qualitative and quantitative could give also interesting results. The conflicts show complex situations and only some spatial dimensions of them can be visually represented. It is important to clarify what means the representation and how it can be useful to the managers.
In the case of representing conflicts related to water the situation is especially difficult because, as it has been shown in former chapters, there is a wide variety of conflicts related to water (in relation to river water, to lake water, to the resources of the lake, to the vegetation, to the water supply etc.) The conflict map seems specially an interesting tool because it synthesizes different information on environmental aspects, location of resources and infrastructures (depending on the spatial components of the conflicts), gives an idea of the spatial distribution of some conflict areas and brings together all this information at a catchment scale, which can help to the reader to keep in mind a whole spatial pattern of the situation.

Chapter 7. Anatomy of conflicts: a synthesis of results

The concept *anatomy of conflicts* is introduced by Mostert (1998), from his work about creating a framework for conflict resolution. He refers to the anatomy as "putting all possible sources of conflicts together and indicating all the interrelations". Although the stress here is not given to the sources, because enough about them was explained in Chapter 5, the term anatomy seems still very appropriated since the perspective was in analyzing the structure or the morphology of the conflicts. The emphasis of the chapter is in separating the set of conflicts in parts to ascertain their position, relations, structure, and function, on one hand; and, on the other hand to indicate or preliminary evaluate how the current Management Plan is covering all the needs, problems and shortages expressed by the conflicts. This has been attempted in three parts, first a conceptual model of interrelations, that pretends also to summarise and simplify the numerous conflicts detected, is presented; second, an example or a very preliminary attempt of how an spatial analysis of the relations between some physical, social and historical factors and the conflicts is given; and third, a discussion on the needs of water management of the catchment and the role of the actual Lake Naivasha Plan is presented. The idea is to bring together all the main results of former chapters (except the visualization matter) to synthesize them and to discuss further some spatial relations of the conflicts with physical factors.

7.1. A conceptual model of relations between conflicts

A very simple and conceptual model of relations between conflicts is proposed in Figure 7.1. The model is partially based in the results of the index of concern for the stakeholders group ($IC_{SH's}$, *Chapter* 5) and from the analysis of the conflicts in general. The results of the $IC_{SH's}$ give an idea of a certain hierarchy in the distribution of concern about the conflicts related to water (this hierarchy is represented by the numbers within the boxes). On top of it a general division has been made to understand better the picture of conflicts. Some conflicts are more in relation with the livelihood of people at different levels, in the sense that water is used as an economic resource; and other conflicts are more in relation with the life conditions of people, water for domestic use and the sewage systems. Furthermore the big arrows represent a general recommendation of where the general focus on the conflict management and resolution could be placed according to the analysis done.
At the top of the hierarchy, the *conflicts related directly with the resources in the lake*, the fish, mainly, have been placed (*Fisheries Department versus poachers, Fishermen versus farmers*). These conflicts took most of the attention of the stakeholders in the last year, since a ban on fishing was put on the lake to try to recover the fish stock and to investigate the causes of the decrease of fish. Under these conflicts there are other two groups of conflicts almost at the same level: *Upper catchment related conflicts* (*North Kinangop farmers versus small Malewa farmers, South Kinangop farmers versus small Malewa farmers, North/South Kinangop farmers versus big farms downstream)* and *Water supply conflicts* (*Naivasha city Council versus community*). In a fourth and fifth level, but with

a much lower $IC_{SH's}$ other conflicts have been included. In the group called *Conflicts related with resources in other parts of the catchment* conflicts as *Small Malewa farmers versus big farms downstream, Mixed cattle/agriculture farms versus large commercial farms, Friends of Eburru forest versus Eburru forest users* are included. All these conflicts are in relation with a use of the resources (directly or indirectly related to water) that can have consequences in the quality and amount of water available in the lake.

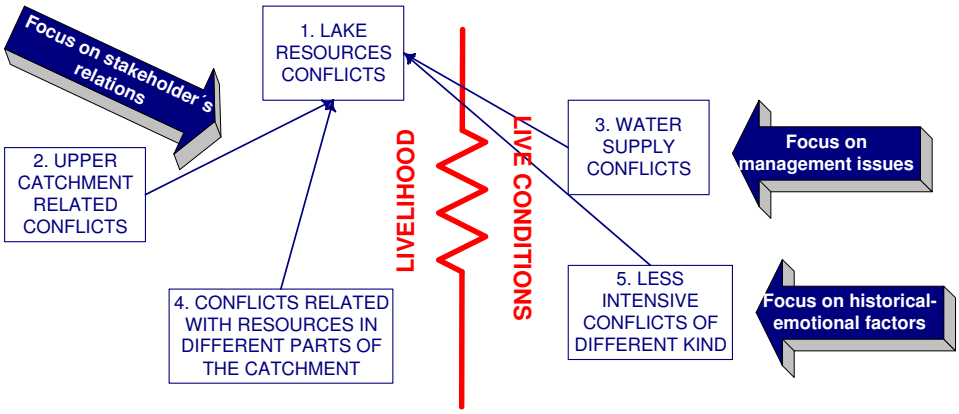


Figure 7.1. Conceptual model of relations between conflicts

The fifth group that is called *Less intensive conflicts of different kind*, because is an heterogeneous group that compiles many different conflicts: *Ndabibi-Kongoni: lack of infrastructure, Longonot-Kijabe: water scarcity, LNRA versus Nakuru city council, Naivasha town council versus North Kinangop farmers, IBECA versus LNRA, Fisheries Department versus fishermen.* These are conflicts spread all over the catchment and reflect different type of problems: management problems, bad relations between the stakeholders, scarcity of resources in some areas etc.

External relations between these conflicts and other type of land, emotional, work and power conflicts probably exist, however here the focus is only to analyse the relations within the water-related conflicts.

All these conflicts can have some connections between them, but the most important relation points out in a very clear direction, all have an impact on the resources downstream and therefore on the conflicts on water resources at the lake. That is due to the character of the water resource: always flowing downstream, here downstream is the lake, and any activity affecting the water resources in any part of the catchment finally will reach downstream and in a short or long term will affect the resources there.

Even the water supply group of conflicts, that apparently seems to be disconnected from the lake resources, it affects the lake resources in a long term. Research going on is demonstrating that the non functioning of the sewage system of Naivasha city, the farms and the other domestic discharges are responsible of high rates of COD (Chemical Oxygen Demand) of the lake which are an indicator of the chemical and bacteriological concentration, and, in the lake they are above the standards of the World Health Organisation 1993 (Muñoz Villers, 2002). All the measurements of water pollution of the lake done in 2001 have shown high values of Ammonium derived from the farms or from the sewage system also above the standards of the WHO 1993 (Muñoz Villers, 2002). However although a high degree of concern about the activities upstream is taking place, the estimation of the siltation of the lake and the sediment concentration of the Malewa River are not so high as expected. The lake has

lost only 5% of its capacity in the last 44 years and that does not seem a very worrying figure (Rupasingha, 2002).

Groups 1, 2 and 4 (Figure 7.1) are all conflicts directly or indirectly related to water but that affect to the **livelihood** of different groups in the society. Groups 3 and 5 (Figure 7.1) are water conflicts but more in relation with the domestic use of water, **water for human needs**: drinking water and hygienic measures. In this sense two big dimensions of the use of the natural resource water for human beings are reflected in the model of conflicts: water as an economic resource, and water for human needs.

Furthermore after analysing the conflicts a thought has been given to the direction in which the emphasis must be given when a conflict management is attempted. For the conflicts that affect very much the livelihood of people, it is thought that the attention must be given to the communication between stakeholders, designing common objectives if possible and if not, thinking in alternative programs of livelihood for development and conservation (see subchapter 7.3). Conflicts will not be solved if stakeholders do not work together changing attitudes and compromising.

The attention in relation with the conflicts of water supply must be put in the management problems within and between the Administration institutions, in a framework of money scarcity, as here, the management programs must be even more efficient. A big part of the attention of the heterogeneous group of conflicts (5, Figure 7.1) should be given to the emotional-historical factors in relation with the occupation of the land and the utilization of the resources along recent historical times. Some groups have the impression that historically other groups of the society have had, and have nowadays, some privileges from which they were excluded and that is not fair. Land conflicts should be reviewed in relation to this.

7.2. Exploring the possibilities of relating conflicts to physical factors from a spatial analysis perspective

The possibilities of finding relations between physical factors and conflicts have been explored and an example is given. It means a very preliminary attempt to understand better the conflicts from the spatial point of view is carried out. The idea is to relate the spatial distribution of conflicts with the distribution of some physical variables in the space to explore the relations between physical and social factors in conflict analysis and management. This exercise would require a large number of analysis that go beyond the objective of this thesis but just a simple approach is tried here.

Some maps showing the distribution of some variables have been constructed based on observed data, others have been recovered from the existing data base on the area and some other have been modeled with the available information. In this way a selection of spatial variables have been analyzed at the catchment level, covering the following topics:

1. Climatic pattern: *Precipitation map* (modeled from Naivasha data base) (Figure 7.2 A)
2. Hydrological pattern: *Drainage system and subcatchments map* (recovered from Naivasha data base) (Figure 7.2, B).
3. Human influence and land cover: *Land use map* (recover from data base) (Figure 7.2 C).
4. Political decisions on land distribution: *Map of settlements after 1961 under Swynnerton plan* (redrawn and adapted from secondary data) (Figure 7.2 D).
5. Geomorphologic characteristics: *Terrain Map Units map* (recovered from data base) (Figure 7.3 A)

6. Geomorphologic processes: *Erosion map* (recovered from data base) (Figure 7.3 B) Indicator of use of water resources: *Map of pressure on water bodies* (modeled, based on buffer areas around water bodies and land use) (Figure 7.4 A)
7. Indicator of use of vegetation resources: *Map of pressure on vegetation* (modeled, based on land use and settlements after 1961) (Figure 7.4 B).
8. Indicator of use of vegetation resources: Map of pressure on vegetation (modeled, based on land use and settlements after 1961) (Figure 7.4B).

To elaborate maps 7 and 8 in the list above, two maps in each case were crossed (as it is indicated) and decision tables were elaborated. A category to each of the crossed units was assigned based on the idea of what pressure could each unit have on the water bodies or on the vegetation.

The idea of making a map of pressure on water bodies and of pressure on vegetation is related to the basic categorization of the typology established for water conflicts on chapter 5: *Conflicts related directly to water, Conflicts indirectly related to water.* A map indicating the risk areas in relation to these two concepts or at least the distribution pattern of those areas could help to the managers at a basin management level. The proposed solution in the decision tables is an open and transparent procedure where experts of different kind could participate in indicating the range of risk for the different units according to the combination of the two variables shown.

First it is interesting to point out that in some of the maps shown (Figures 7.2, 7.3 and 7.4) some strange borders, too rectilinear, seem not very natural. This is the case of the separation between the scheduled area and other type of settlements in the *Settlements map* (Figure 7.2 D). Having a look to the other maps, this is probably a good example of how the physical conditions of the natural environment can affect the spatial distribution of some human decisions, in this case the establishment of a settlement scheme. In fact the separation of these units in the *Settlement map* is following approximately the separation line (that is almost a straight diagonal with direction SE NW) between the volcanic plain and other units, as the volcanic complex, the escarpment and the volcanic plateau in the *Terrain Map Units map* (Figure 7.3 A). This diagonal can be also nearly observed in the modeled *Map of Pressure on water bodies* and *Map of pressure on vegetation* (Figure 7.4 B). The pattern of pressure on water and vegetation, showed respectively by the mentioned maps, follows in a way this diagonal. In the first map (Figure 7.4 A) the area of medium pressure on water bodies it is located at the western part of this diagonal and overlaps part of the drainage system (Figure 7.2 B). In the map of pressure on vegetation (Figure 7.4 B), the diagonal marks the difference between West and East, the first with low and very low pressure on vegetation and the second with medium, high and very high pressure on vegetation.

The rationale behind the construction of the maps is twofold:

- In a first place is an exercise to explore and summarize the combination of some physical variables on the resources
- In a second place, the resources selected have been water and vegetation, because the anthropic pressure on both is directly and indirectly, respectively, related with the water conflicts.

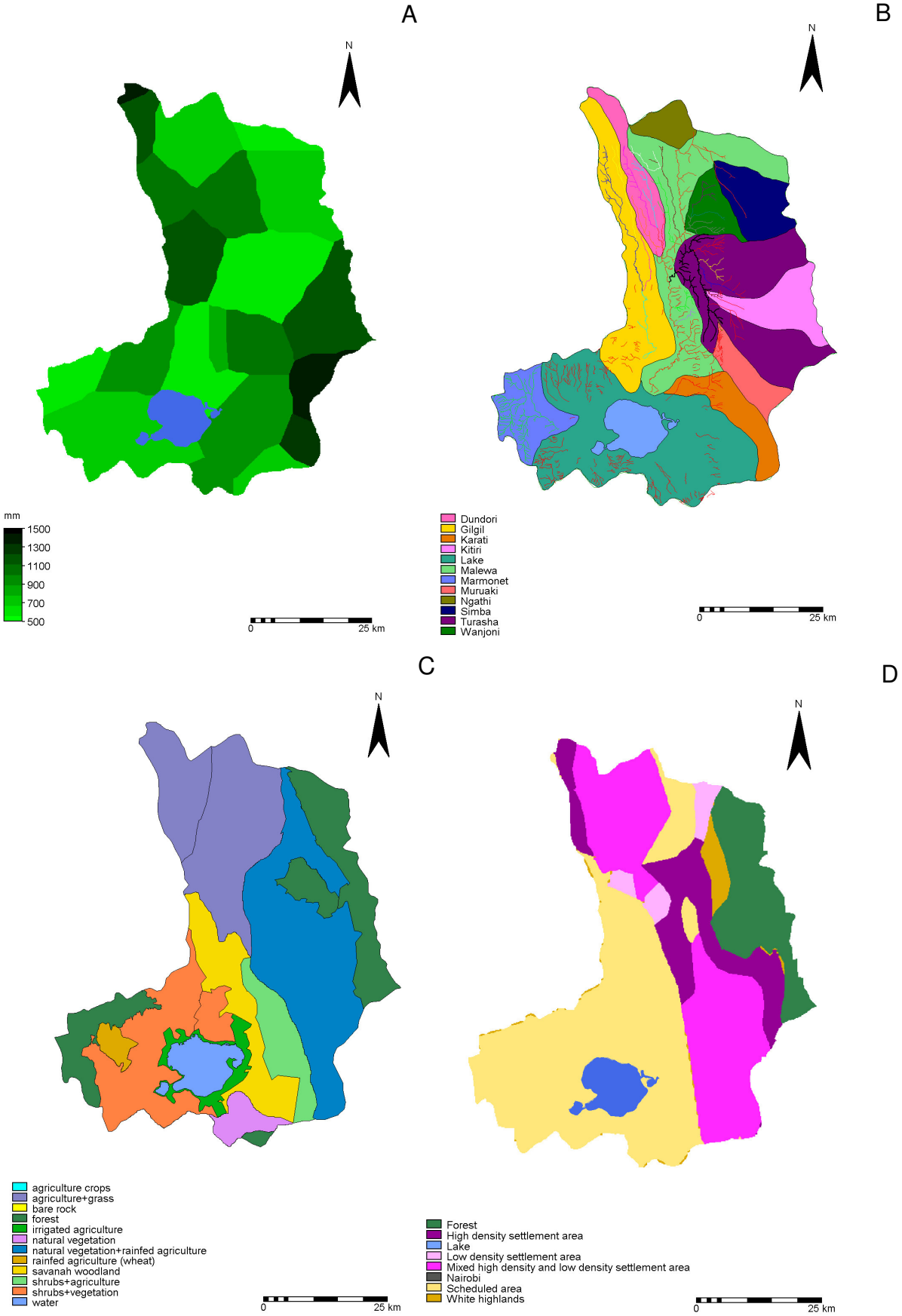
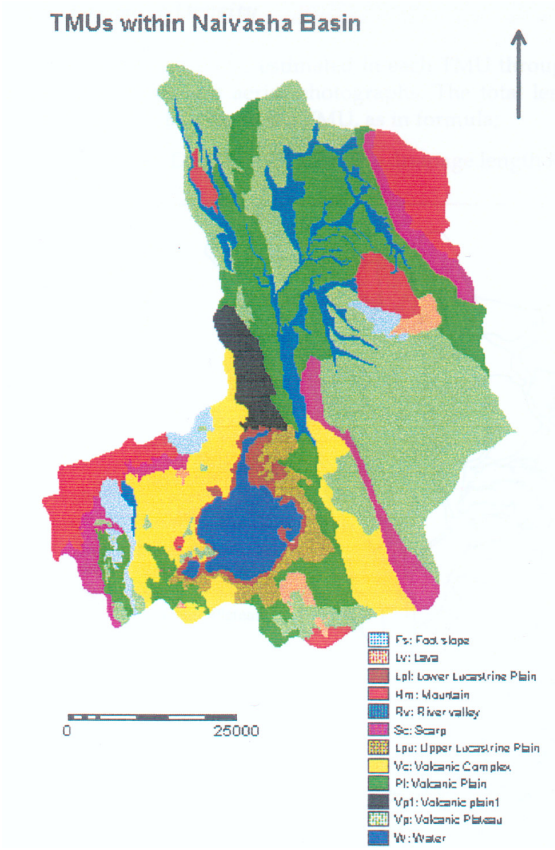


Figure 7.2. Precipitation map (A), Drainage system and subcatchments (B), Land cover map (C), Settlement areas after 1961 (adapted from Carey Jones, 1965) (D).

A



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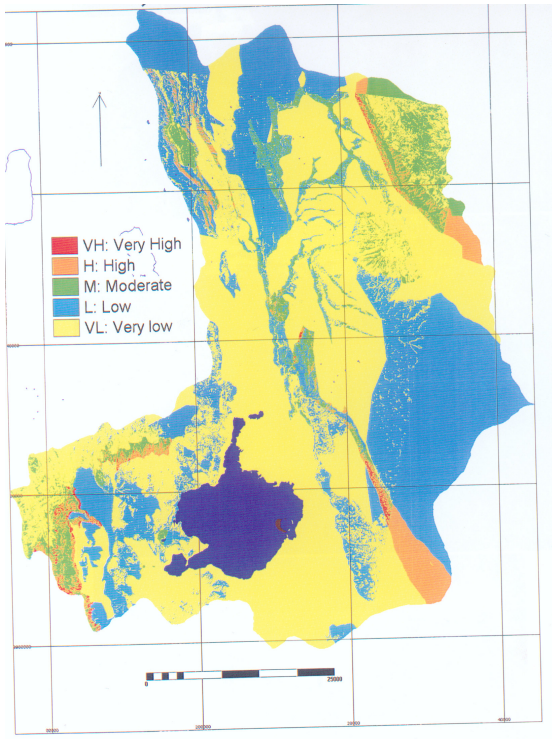

Figure 7.3. Terrain Map Units Map (A) and Erosion map based on Terrain Map Units, rainfall and cover (Hamududu, 1998).

If both the *Map of Pressure on water bodies* (Figure 7.4 A) and the *Map of pressure on vegetation* (Figure 7.4 B) are observed, it can be noticed that both are almost complementary. This means, in general terms, that high-medium pressure on water bodies correspond with low-medium pressure on vegetation and the other way around, of course with some exceptions. However this general pattern is logical in the case of the Naivasha catchment because closeness to forest and to watercourses does not coincide always here.

Analyzing the *Map of pressure on water bodies* (Figure7.4 A) it is observed that the high and medium pressure areas appear distributed mainly in two zones:

1. Around the rivers Malewa and Gilgil (Figure 7.2 B)
2. Around the lake

Area 1 overlap very well with the densest areas of drainage (Figure 7.2 B) where at the same time agriculture practices that are not completely rainfed (Figure 7.2 C) need water from rivers. The rainfall distribution (Figure 7.2. A) shows also an area of less rain along the middle catchment of Malewa where it is logical that more water for irrigation is needed. However the rain map should be again modeled with other method, as a function of the altitude maybe, and not using only the Thiessen polygons that sometimes lead to not very accurate results. This area is in relation with the conflict *Small Malewa farmers-big farms downstream,* where downstream farmers complain about the water abstraction from the middle catchment.

The area 2, around the lake is where the highest pressure on water is exerted due to the fact that the abundance and accessibility to fresh water resources, as well as the property distribution in big parcels of land, inherited from the scheduled areas of colonial times, have facilitated the development of intensive agricultural practices that need much irrigation. This area is related to the high amount of conflicts where the downstream farmers are involved, with the medium stream and upper catchment farmers, with the fishermen, with the IBECA etc.

The rest of the catchment with forest areas, rainfed agriculture and at a major distance of the main watercourses does exert a low pressure on water bodies.

The pattern of spatial distribution of pressure on vegetation seems very different to the pattern of spatial distribution of pressure on water bodies, almost the opposite. The map looks very empty because the crossed classes classified as very high pressure on vegetation are the areas were forest existed in 1961 and it does not exist now (rainfed agricultural areas), high pressure for the intensive agriculture around the lake and medium pressure for the forest areas. The rest is undetermined because not enough information about the population pattern is available to make inferences.

Therefore the higher pressure on vegetation is distributed mainly in three areas:

The areas surrounding the forest and the forest in the East of the catchment (Figure 7.4 B and Figure 7.2 C) cause a very high and a high pressure on vegetation. The areas marked as high pressure are areas where the forest has disappeared in the last 40 years. These areas were established as high density settlements and the bad access to the area reduces the competitiveness in the market of their agricultural products, giving place to use the forest as an alternative economic source. Their closeness to the forest areas induces and facilitates these practices. So these areas can be potentially the areas where the activities that can produce an increase of the siltation in rivers and lake take place. This is directly connected to the *Upper catchment related conflicts* mentioned in the conceptual model of Figure 7.1. The activities there affect directly to the Turasha and Kitiri catchment subsidiaries of the Malewa (Figure 7.2 B). However although the upper catchment-lower catchment conflicts are over the

danger of siltation and the lower catchment people are very worried about this arguing an increase of sediment load in the rivers, the problem does not seem nowadays really serious. An indication of the sediment concentration is given by a couple of samples taken in Turasha and Karati rivers in October 2001 that showed a sediment concentration of 0.11 and 0.077 $kgm^{-3,}$ respectively. A survey on sediment sampling was carried out by Rupasingha (2002) who found an average sediment concentration of 0.213 and 0.99 kgm^{-3} (based on nine measurements along the river) in October of 2001 for the Malewa and the Gilgil riverrespectively. She compared also those data to the time series of available sediment data for Malewa, between 1932 and 1990 the sediment concentration was 0.23 kgm^{-3} and between 1957 and 1990 0.26 kgm^{-3}. It seems that after the settlements started in 1961 an increase in the sediment load of the river (suspended sediment) took place, the average sediment for the two subsidiaries of Malewa and the Malewa last year do not indicate a worrying increase of the sediment load compared with the figures of the existing time series. The sediment concentration measured last year is under the average recorded for last century. However the areas should be under control and monitoring because it is still a potential source of sediments, especially if the encroaching of the forest continues.

1. The forest in the West of the catchment, some areas of this forest are being overexploited, for example the Eburru area what is in relation with the conflict Friends of Eburru forest versus Eburru forest.
2. Another area where a high pressure on vegetation occurs is around the lake. Here the pressure is exerted on the riparian vegetation, in particular on the *Cyperus papyrus.* The *Papyrus* is cleared due to different reasons, but mainly to create agricultural land and to fish within the space that it occupies. The *Papyrus* is cleared inside de big farms surrounding the lake (although the owners say they do not do it). It is also cleared close to the corridors by people to cultivate small plots, and it is cleared by the poachers to fish in those areas, as well as many different users cleared it to obtain material for construction. The disappearance of this type of vegetation is of great importance for the sustainability of the lake because as it has been said before, this vegetation filters sediments and chemicals from the runoff water. This pressure area is in relation especially with water conflicts such as: *Fishermen versus farmer and Poachers versus Fisheries Department.*

7.3. Experience of Naivasha catchment: need of water management at a catchment level

From the analysis of the index of concern of the society or the group of stakeholders ($IC_{SH'S}$) and the index of concern of the Lake Naivasha Management Plan (IC_{LNMP}) in Chapter 5, it could be seen that the concerns or interests of the whole set of stakeholders involved in the use and management of water issues do not overlap completely the concerns of the current management plan being implemented for the lake resources.

The management plan, although it prevents and mentions shyly some activities to be done outside the riparian limits, it is not a plan done to manage the water resources at a catchment level; this was not its objective. One aspect seems quite neglected in the implementation of the plan, the prevention activities in the upper catchment areas and, other aspect is completely ignored in the plan: the water supply system of the living areas.

The plan was prepared with the intention to manage the water resources of the lake, somehow they prevented that the activities in the upper catchment were important for the lake, but not much was done about it. Furthermore is not a plan designed to manage the whole set of water issues within the catchment because this is beyond the objectives that they established. However in the analysis done until now it can be seen that the management of the water resources in the catchment and the management of the lake can not be separated, in a long term some of the activities taking place in the catchment will affect the lake resources; and nowadays problems with the water supply (especially the high pollution due to the sewage system) is already affecting the lake resources.

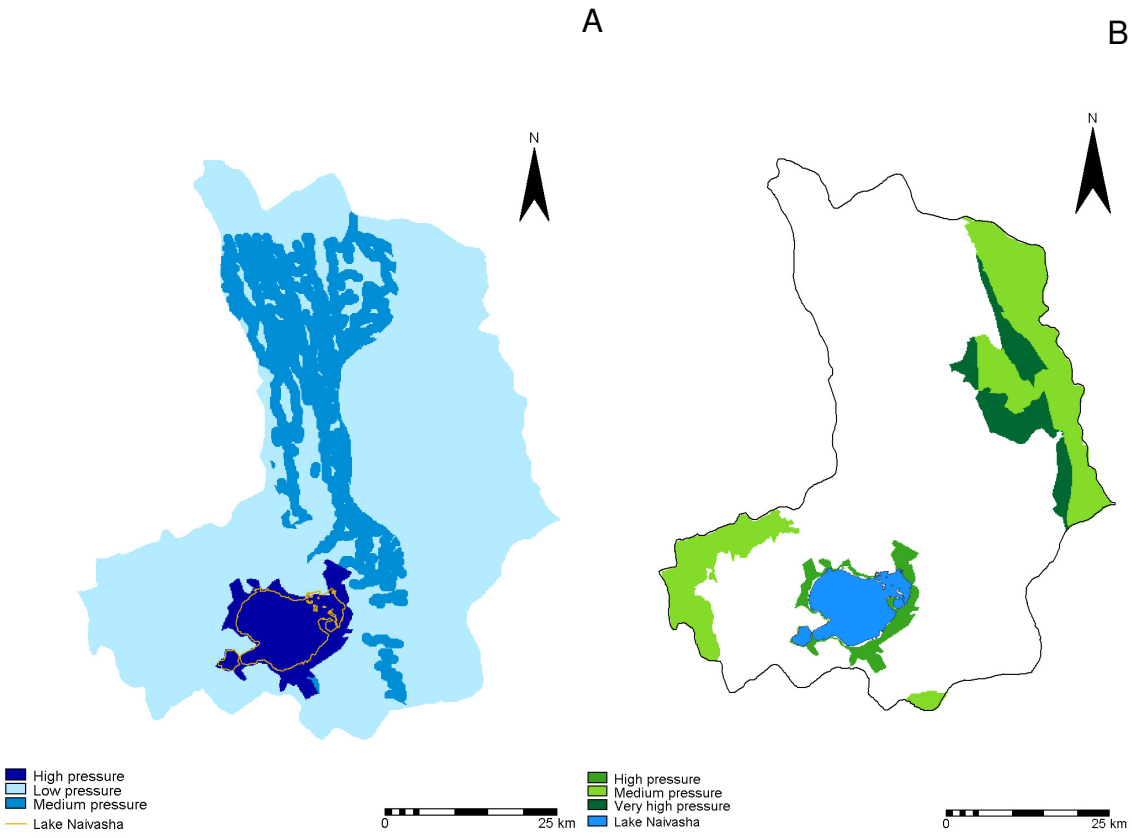

Figure 7.4. Map of pressure on water bodies (A) and map of pressure on vegetation cover

The second and third level in the hierarchy of conflicts (2. Upper catchment related conflicts and 3. Water supply) established in the conceptual model (Figure 7.1) in relation with the analysis of concern about conflicts (see chapter 5) are the result of non-proper p
lanning and management.

The Lake Naivasha Management Plan is started, designed, supported and implemented by the Lake Naivasha Riparian Association. This organization has nowadays the mandate to manage the lake but it is inevitably formed by owners or users of riparian land that have an important economic power and a very clear economic interest on the lake. Although the plan reflects an important effort to expand the views to the catchment level, the reality seems to reflect that the Plan still serves to the interest of some stakeholders and to some aspects of the water issues.

A management plan at the catchment level seems to be needed. Specially in the management of water issues is important to look at the catchment as a basic unit, because the water resource is physically

constrained by many factors and processes acting at the basin level and the water available in the lake will depend entirely on what is happening in the whole catchment and not only in one of their parts.

As recommended in one of the reports of the 2nd World Water Forum (2001) the prevention of conflicts on water goes through a management established in a basin-level framework where the following elements have to be present: treating the system as a unit, involvement of both state and non-state actors, recognition of the social and cultural context, clear appropriation rules and creation of an information sharing network.

The current management plan in Naivasha is paying special attention to the activities taking place around and in the lake and not to the catchment. In this sense problems as deforestation lead to conflicts (even when the scientific results do not point out at a worrying increase of the sedimentation in the lake nowadays (Rupasingha, 2002)), as it is happening now, between upper and lower catchment. However it is clear that deforestation is not a sustainable practice for the environment in medium and long term.

To approach this problem of deforestation in the upper catchment is not an easy task and many factors have to be taken into account. Maybe the introduction of a Plan of Development and Conservation (Integrated Conservation and Development Projects, ICDP) could be a possible alternative. This type of projects attempt to link the conservation of natural resources with the development needs of local people. According to Abbot and Thomas (2001) the changing attitudes and behaviors toward resource utilization are important outcomes of this type of plans, because development opportunities on their own are unlikely to stop non-sustainable exploitation of natural ecosystems if people continue to regard it as rational from their individual standpoint.

In the Naivasha case 15-20 years ago a quick development of agricultural industries around the lake started without a planning, polarizing even more the differences in income and in use of the land between different parts of the society: some owners very powerful controlling a big part of the water resources downstream and using the land very intensively, completely integrated in a international market economy, creating jobs for a big part of the population; and a big part of the population just trying to make a livelihood from the land in other areas of the catchment (small and medium farmers) or in the same lake (fishermen and poachers). This development continues nowadays but it is starting to show its direct and indirect effects on the environment. The starting of that development was not accompanied by conservation measures neither close to the lake nor in other areas of the catchment. Conservation measures for development projects at any scale (at catchment level, landscape units or subcatchment level) are an interesting tool to be taken into account when planning because they care and prevent the other side of the development.

From that point of view Abbot and Thomas (2001) classify these measures in: *compensation* measures; *alternatives,* which consist in increasing the value of livelihoods derived from land outside the site valued for biodiversity*; enhancement* measures where development can focus on increasing the value of resources from the natural area itself (developing tourism, developing markets for previously unexploited product). The goal is to provide an economic incentive for local people to manage and protect the resource base on which the enterprise depends.

To manage the conflicts where the activities taking place in the upper catchment areas are involved is necessary to look deeply at the problems that are causing the conflicts. Here it seems that a big part of the problem is an increase of deforestation caused by the use of the forest in a non-sustainable manner as an alternative economic source for the people. Two basic measures seem to be crucial in a possible plan of management of the conflict: a livelihood program of activities that help people not to go back to the forest or to use it in a sustainable way that would point out at a change of behavior and attitude for the resources (an ICDP project for instance); and an improved road infrastructure that is crucial

for the flow of economic activities and social services. The accessibility and mobility are embedded in the development nexus in far-reaching ways (Porter, 2002). The poor road access of many areas of Africa keeps them in a continuous state of marginality, as it is specially the case of the North Kinangop plateau in the Naivasha catchment.
The other group of conflicts which are very much from the concern of the group of stakeholders are the conflicts of Water supply, in special the conflict of *Water supply versus community.* The Lake Naivasha Management Plan has as main objective the manage of economic activities in the lake ecosystem to ensure the conservation of the fresh water resources. The management of other water issues that have been detected to play an important role in water conflicts within the catchment, as the water supply of the living areas, are beyond the objectives of the Management Plan.
A wider plan at a catchment level including the covering of the human water needs and their management is lacking in the area. The spontaneous and partial solutions to the problems of water supply that include the drilling of boreholes without much control all over the catchment and especially around the Naivasha city can in a long term have an important influence in the aquifer. The problem of the sewage system is included in the conflict of *Naivasha city council versus community* and this really has a direct effect on the lake contamination and affect directly the lake resources. So this conflict in relation of Water supply is not included in the plan but has a medium and long term effect on the lake resources as well.
Experience from other areas has concluded that an integrated water supply policy designed to improve the degraded environment while at the same time improving efficiency and reducing inequity is needed. This water supply should also be integrated with related environmental infrastructure needs such as sanitation and waste disposal (Basu and Main, 2001). This is the case of Calcutta, where the development of the last 20 years in agriculture and in population has caused a great pressure on the aquifers with collateral effects as contamination by arsenic, salinization, threaten of subsidence etc. This lead to the conclusion that the management of the main water supply problems in the city: improved distribution of existing supply through effective pipeline rehabilitation and extension, and the net recharge of aquifers, call for greater community involvement in management.
Water pricing has been suggested (Becht, personal communication) as a measure to explore which could potentially help to solve conflicts between upper and lower catchment. A system of selling water from where the water is produced (water production (water infiltrated/runoff water) per unit of land) could be organized as a system to inject some flows of money from downstream to upstream based on environmental protection and also as a way to control water extraction from the lake. According to Wegelin-Schuringa, 2000, water pricing is one of several mutually reinforcing elements in demand-side man-agreement of water needs that are already proving effective in Third World cities.

The availability of water resources is determined by the behaviour of the hydrological cycle at the catchment level, the alteration of any mechanism or process within the cycle (for instance change of infiltration and percolation rates, increase of runoff and sediment load etc.) directly or by affecting any of the factors which condition those processes will have effects in the quantity and quality of the water resources within the catchment. This cyclic nature of the water resource (with links and feedbacks between their processes) provokes that at a management level the separation of the different water issues for their management do not give good results in a long term. At a certain point the different management issues converge and need to be treated in an integrated way at a catchment level. The water resources of lake Naivasha are being managed but other very important aspects of water within the catchment are being

ignored or poorly managed, those last ones are having negative effects on the lake resources and all water issues need an integrated management at the catchment scale.

Chapter 8. Conclusions

From this research involving the analysis and mapping of conflicts related to water in the catchment area of Lake Naivasha, two types of conclusions can be drawn. Conclusions on the methodological approach adopted to map and analyze the conflicts; and conclusions on the content of the research into the conflicts per se.

Attention is given to the methodological approach because no established **methods** exist on how a whole conflict analysis and mapping should be done and, at the beginning of the investigation, this was a quite substantial problem. This short review summarizes how it was handled and what was the result:

- The methods used structure and separate parts of a wide variety of complex situations (conflicts at a big catchment scale, about 3000 km^2), later integrate them and make a synthesizing exercise to understand the relations between them. To perform that, methods like interviews and content analysis of field interviews are quite effective to extract the information important for the study and to quantify the qualitative aspects of the information (Chapters 4 and 5).

- The analysis of the values of the stakeholders resulted in an effective exercise to understand them and to identify common values between apparently very different stakeholders. They were also useful to visualize the uncommon or differentiating values (Chapter 4). Weights were given to the values based on the priorities of the Lake Naivasha Management Plan and this was used to assess the degree of concern of the LNMP over the identified conflicts (Chapter 5). The degree of concern of the society (the group of stakeholders represented in this research) over the water-related conflicts was also assessed and compared with the perspective of the LNMP. From this, an indication of the intensity of the conflicts at the present moment was obtained. This was later contrasted with the existing information and the ongoing research on certain water issues in the catchment, to check whether the perception of the conflicts from the stakeholder's point of view could be founded with a scientific base or, whether it was only a subjective (and maybe erroneous) perception of the stakeholders.

- The visualization of the spatial aspects of the conflicts, could not be developed very far, but the attempts carried out forced a reflection on the subject. Visualization of conflicts can be an interesting tool to be used by the planners and to facilitate the discussion between stakeholders in conflict management.

- The sequence of methods used can probably be applicable to other areas and situations, especially when looking at a wide variety of stakeholders and conflicts, because it gives an understanding of the situation at a catchment scale. The hydrological cycle works at catchment (and subcatchment) scale, any alteration of the processes and factors of the cycle will have consequences in the water resources within the catchment. A global overview of the pattern of conflicts within the catchment helps to understand relations between conflicts, their causes and effects. The

disadvantage is that the level of analysis of each conflict is not very deep because much time, especially in the field, is necessary for that.

With respect to the **contents** of the research, several conclusions can be obtained from the pattern of conflicts within the catchment:

- A conceptual model of relations between conflicts is presented in Figure 7.1 (Chapter 7). The model summarizes also the hierarchy of current water-related conflicts identified in the watershed. The conflicts can be regrouped in two major classes: conflicts related to the living conditions of people and conflicts related to the livelihood. However all affect the resources of the lake in a medium or long term.

- The conflicts are disagreements that reflect very complex situations between pairs of stakeholders (in this research only two main stakeholders were identified with each conflict to simplify the situation, however in practice much more stakeholders can be involved). The problems related with water are, most of the time, mixed with other land, ethnic, social and economic conflicts. And, especially in this area, very often some emotional-historical factors in relation with the inheritance of past colonial times and the present economic situation have an influence on the conflicts. In this sense it is quite difficult to separate what are called “water-related conflicts” from other types of conflicts. And all the “water-related conflicts” have components from all these factors and other types of conflicts.

- Since this research has been a first approach to map the water-related conflicts in the catchment area of Lake Naivasha, it has tried to keep a holistic point of view. This was done with the purpose to understand at least at a general level the organization of characteristics, factors, and relations between conflicts and stakeholders as a global picture of the situation in the area.
  Some relations between physical and socio-economic constraints and conflicts exist. For example the proximity to water bodies and forest conditions the development of conflicts of different type. A spatial analysis of them could be continued in further research at a catchment and a subcatchment level. Some preliminary ideas on how it could be done were given in Chapter 7, but the subject needs fuller data and more attention.
  The visualization idea of the conflicts should also be further explored; and the land ownership conflict could also be investigated since the unclear land tenure of some areas (especially the riparian land) is present in many identified conflicts.

- Some conflicts that exist and worry the stakeholders are formed by problems not founded on scientific data, for example in the case of the potential problem of siltation of rivers and lakes. Some stakeholders, mainly downstream, are alarmed about what they believe to be a high increase of sediment load coming from the rivers into the lake. This conflict raises a high degree of concern in the society nowadays, but exploring the existing data and the analyzed information of some other researchers, it is concluded that the alarm around this conflict is exaggerated and that threaten of siltation does not seem so high nowadays (see Chapter 7). However control of activities in the upper catchment is crucial to maintain the availability of water and to control erosion.

- The conflicts that are more intense at the present moment and that raise a high degree of concern from the whole society as well as from the Lake Naivasha Management Plan, are those related to fisheries of the lake. It seems clear that the pressure on fishing that took place at least two years ago, has contributed to this situation. However the increasing and worrying contamination of some parts of the lake could, if not already now, also influence also the fish stock in a medium term. The conflicts here are being partially managed but really very much attention must be given to the alternative economy sources for fishermen and poachers. Perhaps Integrated Development and Conservation Plans could be adopted (see Chapter 7)

- Any isolated action in relation to water management in any part of the catchment has consequences on other places because water and the ecosystems try always to find naturally a balance. The results of the conflict analysis point in a very clear direction: it is not possible in the medium and long term to separate the management of the lake and its ecosystem from the management of other water issues and activities within the catchment. Later or sooner both subjects (especially the management of the lake ecosystem and the management of the water supply) converge at a certain point (see Chapter 7). Several examples: the problem of the non-working sewage plant is affecting the level of pollution of the lake quite seriously, even reaching Crescent Island according to ongoing research. The activities in the upper catchment are a constant matter of concern of the downstream stakeholders, creating conflicts. Decisions taken by some stakeholders in some parts of the catchment (like the KPC) affect the living conditions of other stakeholders (Eburru settlement) (see conflicts description in chapter 5). Bad management decisions in the past (failure of Geta project) has had consequences until now in the water supply system of the city. The problem of water supply of Nakuru town can affect Lake Naivasha, etc.

- All the issues identified must be taken into account and the relations between them. The visualization of the spatial dimensions of conflicts would help the manager to keep in mind the pattern of distribution of conflicts in the catchment. It is understood that the Lake Naivasha Management Plan has as its main objective to manage the activities in the Lake ecosystem to ensure its conservation. The plan did not pretend to manage all water issues within the catchment. The LNMP is taken in this study only as a reference point to identify conflicts and stakeholders because they are the main authority to manage the lake. However in the exercise of identifying conflicts and analyzing them, it was clear that although the separation of management of different water issues can be done at certain levels, at a higher level in the hierarchy they converge and an integrated management at that level (catchment scale) is required.

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Appendix

Table 1. Content analysis table for the recorded interviews

Stakeholder	Matter[a]	Frequency[b]	Direction[c]	Standard[d]	Interest	Values	Conflict related[f]
Indigeneous Biodiversity Environmental Conservation Association	Upper catchment destruction (North Kinangop)	3	1	Field experience	Environment	Impacts on other ecosystems	Upper catchment/ Medium and lower catchment
	Water extraction lake	3	1	Field experience			Big farms/IBECA
	Water pollution lake	3	1	Popular knowledge			Big farms/IBECA
	Papyrus cutting	1	0.5	Field experience			Big farms/IBECA
	Water supply Naivasha	1	0.5	Field experience			Upper catchment/Naivasha Council
Naivasha Country Club	Water supply Naivasha	2	0.25	Field experience	Economic	Socioeconomical framework (Touristic landscape) Impacts on other ecosystems (Wildlife preservation)	-
	Water pollution lake	1	0.25	Popular knowledge			Big farms/IBECA
	Water extraction lake	1	0.25	Popular knowledge			Big farms/IBECA
	Fishing	1	0.25	Popular knowledge			-
	Papyrus cutting	1	0.25	Popular knowledge			Touristic resorts/Fisheries Department (?)
Fisheries Department	Illegal fisheries	5	1	Field experience	Economic	Impacts on other ecosystems (Conservation of the riparian area)	Poachers vs Fisheries Department
	Cutting papyrus	7	1	Field experience			Poachers vs Fisheries Department

	Upper catchment destruction (North Kinangop)	1	0.25	Popular knowledge		Impacts on water bodies (Conservation of the lake)	North/South Kinangop farmers vs Big farms downstream
	Water pollution lake	1	0.25	Popular knowledge			Fishers vs farms
	Maasai access to water	1	0.25	Popular knowledge			Ndabibi-Kongoni area
	Fishing methods	1	1	Scientific knowledge			Fishers vs Fisheries Department
	Economic alternatives for fishers	1	1	Field experience			Fishers vs Fisheries Department

Table 1. Content analysis table for the recorded interviews (Continued)

Stakeholder	Matter[a]	Frequency[b]	Direction[c]	Standard[d]	Interest	Values[e]	Conflict related[f]
Water Resources Ministery Naivasha	Water extraction lake	6	1	Scientific knowledge /field experience	Environmental	Impacts on water bodies	North vs South lake farmers IBECA/LNRA
	Cutting papyrus	3	1				Poachers vs Fisheries Department
	Water supply Naivasha	4	1				Community vs Naiva city Council
	Upper catchment destruction (Kinangop)	2	1				North/South Kinango farmers vs Big farms downstrea
	Nakuru water project	3	1				Nakuru city council LNRA
	Water extraction rivers	1	1				Medium catchment farmers vs big farms downstream
	Maasai water access	2	1				-
Lake Naivasha Riparian Association (Worker)	Water pollution lake	2	1	Scientific knowledge /field experience	Environmental	Water disposal (water availability) Impacts on water bodies Impacts on other ecosystems	Fishers vs Farmers
	Water extraction lake	3	1				North vs South lake farmers
	Upper catchment destruction (Kinangop)	2	0.5				North/South Kinango farmers vs Big farms downstrea
	Land utilization	1	0.5				North vs South lake farmers

Table 1. Content analysis table for the recorded interviews (Continued)

Stakeholder	Matter[a]	Frequency[b]	Direction[c]	Standard[d]	Interest	Values	Conflict related[f]	Time[g]
Lake Naivasha Riparian Association (Secretary and owner of a big farm)	Illegal fishing	3	1	Field experience	Environmental	Water disposal (Water availability) Impacts on water bodies Impacts on other ecosystems	Poachers vs Fisheries Department	Actual
	Water supply Naivasha	2	1	Field experience			Naivasha city Council vs community	Actual
	Cutting papyrus	4	1	Field experience			Poachers vs Fisheries Department	Actual
	Upper catchment destruction (Kinangop)	3	1	Field experience			North/South Kinangop farmers vs Big farms downstream	Actual
	Eburru forest destruction	2	1	Field experience			Friends of Eburru fores vs Eburru forest users	Actual
	Water extraction rivers	2	1	Field experience			Medium catchment farmers vs big farms downstream	Actual
	Water pollution rivers	2	1	Field experience			Medium catchment farmers vs big farms downstream	Actual
	Maasai water access	1	0.25	Field experience			-	-

Table 1. Content analysis table for the recorded interviews (Continued)

Stakeholder	Matter[a]	Frequency[b]	Direction[c]	Standard[d]	Interest	Values	Conflict related[f]
North Kinangop (Catholic Mission Hospital)	Upper catchment destruction (Kinangop)	3	0.5	Field experience	Social	Water disposal	North/South Kinangop versus bi farms downstream
	Water supply	3	0.5				
	Bad infraestructure	2	1				
Friends of Eburru Forest	Upper catchment destruction (Kinangop)	5	1	Field experience	Environmenta l	Impacts on other ecosystems	Friends of Eburru forest versus Eburru settlement
	Water supply	3	0.5				Eburru settlement v KPC
Kongoni-Ndabibi (Maela school)	Water supply Kongoni	3	1	Field experience	Social	Water disposal Water management	Kongoni-Ndabibi: lack of infrastructur
	Water quality Kongoni	1	0.5				Kongoni-Ndabibi: lack of infrastructur
	Maasai water access	1	0.5				Kongoni-Ndabibi: lack of infrastructur
Naivasha residents	Water supply Naivasha	5	0.5	Field experience	Social	Water management	Community vs Naivasha city Council
Medium catchment farmers	Water extraction rivers	3	0.5	Field experience	Economic	Socioeconomic framework	Medium catchment farmers vs Big farm downstream
Manage of water supply project and sewage system Naivasha	Water supply Naivasha	4	0.5	Scientific knowledge	Social	Water magement	Naivasha city Council vs community
	Sewage system Naivasha	3	0.5			Naivasha city Council vs community	Actual

	Nakuru water project	2	0.25			Nakuru city Council vs LNRA	Actual	

Table 1. Content analysis table for the recorded interviews (Continued)

Stakeholder	Matter[a]	Frequency[b]	Direction[c]	Standard[d]	Interest	Values	Conflict related[f]	Tim
Elsamere Research Centre	Papyrus cutting	3	1	Scientific knowledge	Environmental	Impact on water bodies Impact on other ecosystems	Poachers versus Fisheries Department	Act
	Illegal fishing	3	1				Fishers versus Fisheries Department Fishers versus Poachers	
	Water Pollution lake	2	1				Farmers around lake versus fishers	
	Water extraction lake	2	1				Farmers around lake versus fishers	
	Eburru forest destruction	1	1				Friends of Eburru forest versus Eburru settlement	
	Upper catchment destruction (Kinangop)	1	0.5				North/South Kinangop farmers vs Big farms downstream	
Water Resources Ministery Nakuru	Nakuru water project	3	0.5	Scientific knowledge	Environmental /social	Water management Impact on water bodies	Nakuru city council vs LNRA	Act
	Water supply Naivasha	1	0.25				Community vs Naivasha city Council	
	Upper catchment destruction (Kinangop)	1	0.5				North/South Kinangop farmers vs Big farms downstream	
	Longonot dry area	1	0.25				Longonot-Kiajbe: water scarcity	

Kenyan Marine and Fisheries Research Institute	Papyrus cutting	6	1	Scientific knowledge	Environmental	Impacts on water bodies	Community versus authorities	Act
	Illegal fishing	1	1			Impacts on other ecosystems	Community versus authorities	

[a] Recording unit selected: main subjects in relation with water problems in the conversation

[b] Number of times that each matter came into the conversation

[c] How the subject was treated: 0.25 Slightly negatively; 0.5 Negatively; 1 Very negatively

[d] Background knowledge on the subject showed by the interviewed person: Popular knowledge or believe; field experience, scientific knowledge

[e] Values on which they support (from the common value tree of the stakeholders, Chapter 4) their point of view on the mentioned issue

[f] To which conflict (of the ones identified or new ones) this issue belongs

[g] When is this issue more active or worrying

[h] Other observations, especially referred to other conflicts less related to water

Table 2. Content analysis table for the non-recorded interviews

Stakeholder	Matter[a]	Importance[b]	Direction[c]	Standard[d]	Interest	Values	Conflict related[f]	Ti
Naivasha Municipal Council	Geta project	1	1	Field experience	Social	Impact on water bodies Impact on other ecosystems	Naivasha town Council versus North Kinangop farmers	Ol
	Water supply Naivasha	3	1				Naivasha town Council versus community	Ac
	Sewage system	3	1					
Workers sewage plant (Community)	Sewage system	3	1	Field experience	Social	Water management Impact on water bodies	Naivasha city Council versus community	Ac
Owner of big farm in Northern lake	Land utilization	3	1	Field experience/scientific knowledge	Economic	Impacts on water bodies Impacts on other ecosystems	North farmers versus South farmers	Ac
Community Naivasha (Doctor of a clinic)	-	-	-	Field experience	Social	-		
Head of Agricultural Office Naivasha	-	-	-	Field experience	Social	-	-	-

WWF	Upper catchment destruction (Kinangop)	4	1	Scientific knowledge	Environmental	Impacts on other ecosystems	North/South Kinangop farmers vs Big farms downstream	
Secretary of a big farm in Northern lake	Water extraction rivers	1	0.25	Field experience	Economic	Socioeconomic framework Agricultural water disposal	North farmers versus South farmers	
WWF (representing interest of farmers in the North Kinangop)	Upper catchment destruction (Kinangop)	3	1	Scientific knowledge/Field experience	Environmental	Impacts on other ecosystems	North/South Kinangop farmers vs Big farms downstream	
Owner of big farm Northern lake	Land utilization	3	1	Field experience	Economic	Impacts on other ecosystems	North farmers versus South farmers	

[a] Recording unit selected: main subjects in relation with water problems in the conversation

[b] Importance of the subject treated during the interview in relation with water conflicts, the time employed in each subject is evaluated: 1 Mentioned; 2 Me
centered in that subject; 4 90% of the time was centered in that subject

[c] How the subject was treated: 0.25 Slightly negatively; 0.5 Negatively; 1 Very negatively

[d] Background knowledge on the subject showed by the interviewed person: Popular knowledge or believe; field experience, scientific knowledge

[e] Values on which they support (from the common value tree of the stakeholders, Chapter 4) their point of view on the mentioned issue

[f] To which conflict (of the ones identified or new ones) this issue belongs

[g] When is this issue more active or worrying

[h] Other observations, especially referred to other conflicts less related to water

Table 3. Calculation of index for the group of stakeholders ($IC_{SH's}$) of concern about water conflicts

Conflict number	CONFLICTS	Components (recorded interviews)	Σ(frequency* direction)	St
1	North Kinangop farmers vs farmers medium catchment	Upper catchment destruction (Kinangop)	16.75	
		Bad infrastructure	2	
2	South Kinagop farmers vs medium catchment farmers	Upper catchment destruction (Kinangop)	16.75	
3	North/South Kinangop farmers versus big farms downstream	Upper catchment destruction (Kinangop)	16.75	
		Water pollution of the rivers	2	
		Bad infrastructure	2	
4	Medium catchment farmers versus big farms downstream	Water extraction from the rivers	3.5	
		Water pollution rivers	2	
5	North versus South lake farmers	Land utilization	0.5	
6	Farmers vs fishers	Water pollution lake	6	
		Water extraction lake	14.25	
7	Fishers Department vs fishers	Fishing methods	4	
		Economic alternatives for fishers	1	
8	Fisheries Department vs poachers	Illegal fisheries	5	
		Cutting papyrus	23.75	
		Fishing methods	4	
9	Friends of Eburru forest vs Eburru forest users	Destruction of Eburru forest	7	
10	KPC vs Eburru settlement	Water supply Eburru	1.5	
11	IBECA vs LNRA	Water pollution lake	6	
12	Naivasha town Council vs North Kinangop farmers	Water supply Geta project	1	
13	LNRA vs Nakuru city Council	Nakuru water project	5	
14	Longonot-Kijabe: water scarcity	Longonot dry area	0.25	
15	Ndabibi-Kongoni: lack of infrastructure	Water supply Kongoni-Maela	3	
		Water quality	0.5	
		Maasai water access	1.25	
16	Naivasha city Council	Water supply Naivasha	13.25	
		Sewage system	1.5	
		Geta project		

Table 4. Calculation of the LNMP index of concern about water conflicts (IC_{LNMP})

Water Conflicts	Stakeholders index ($IC_{SH'S}$)	Stakeholders val Stakeholder 1
North Kinangop farmers vs farmers medium catchment	25.75	0.124
South Kinagop farmers vs medium catchment farmers	16.75	0.124
North/South Kinangop farmers versus big farms downstream	27.75	0.124
Medium catchment farmers versus big farms downstream	6	0.093
Mixed cattle/agriculture farms versus large commercial farms	6.5	0.093
Farmers vs fishers	20.25	0.124
Fishers Department vs fishers	5	0.591
Fisheries Department vs poachers	32.75	0.591
Friends of Eburru forest vs Eburru forest users	7	0.164
KPC vs Eburru settlement	1.5	0.124
IBECA vs LNRA	6	0.164
Naivasha town Council vs North Kinangop farmers	1	0.029
LNRA vs Nakuru city Council	5	0.591
Longonot-Kijabe: water scarcity	0.25	0.029
Ndabibi-Kongoni: lack of infrastructure	4.75	0.029
Naivasha city Council vs community	26.25	0.029

Table 5. Partial IC for each stakeholder group about the conflicts (the final IC for each stakeholder group will be the sum of th
stakeholder group)

	Recorded+Non-recorded interviews	(Frequency*Direction) for each stakeholder of the group	Total component value for the whole stakeholder group	
Stakeholders groups	**Components**			**Conflicts related to thecompor**
Intensive users	Upper catchment destruction (Kinangop)	3	3	North/South Kinangop farmers vs
				North Kinangop farmers vs smal
				South Kinangop farmers vs sma
	Water supply Naivasha	0.25+2	2.25	Naivasha city Council vs commu
	Water pollution lake	0.25	0.25	Farmers vs fishers
				IBECA vs LNRA
	Water extraction lake	0.25	0.25	Farmers vs fishers,
	Fishing methods	0.25	0.25	Fisheries Department vs poache
	Cutting papyrus	0.25	0.25	Fisheries Department vs poache
	Illegal fishing	3	3	Fisheries Department vs poache
	Eburru forest destruction	2	2	FEF vs Eburru forest users
	Water extraction rivers	2	2	Medium catchment farmers vs bi
	Water pollution rivers	2	2	North/South Kinangop farmers vs
	Maasai water access	0.25	0.25	Ndabibi-Kongoni: lack of infrastru
	Nakuru water project	2	2	LNRA VS Nakuru city Council
	Land utilization	3+3	6	North vs South lake farmers
Managers	Geta project	1	1	Naivasha city Council vs commu
	Water supply Naivasha	3+4+4+0.25	11.25	Naivasha city Council vs commu
	Sewage system	3+1.5	4.5	Naivasha city Council vs commu
	Illegal fishing	5	5	Fisheries Department vs poache
	Cutting papyrus	7+3	10	Fisheries Department vs poache
	Upper catchment destruction (Kinangop)	0.25+2+1+0.5	3.75	North/South Kinangop farmers vs
				North Kinangop farmers vs smal
				South Kinangop farmers vs sma
	Water pollution lake	0.25	0.25	Farmers vs fishers
				IBECA vs LNRA

Table 5. Partial IC for each stakeholder group about the conflicts (the final IC for each stakeholder group will be the sum of th
stakeholder group) (Continued)

	Maasai water access	0.25+2	2.25	Ndabibi-Kongoni: lack of infrastructure
	Fishing methods	1	1	Fisheries Department vs fishers
	Economic alternatives for fishers	1	1	Fisheries Department vs fishers
	Water extraction lake	6+3	9	Farmers vs fishers
	Nakuru water project	3+0.5+1.5	5	LNRA VS Nakuru city Council
	Water extraction rivers	1	1	Medium catchment farmers vs big farms downs
	Water pollution lake	2	2	Farmers vs fishers
				IBECA vs LNRA
	Land utilization	0.5	0.5	Mixed cattle/agriculture farms versus large com
	Longonot dry area	0.25	0.25	Longonot-Kijabe: water scarcity
Environmentalists	Upper catchment destruction (Kinangop)	3+0.5+4	7.5	North/South Kinangop farmers vs big farms dov
				North Kinangop farmers vs small Malewa farm
				South Kinangop farmers vs small Malewa farm
	Water extraction lake	3+2	5	Farmers vs fishers
	Water pollution lake	3+2	5	Farmers vs fishers
				IBECA vs LNRA
	Cutting papyrus	0.5+3+6+1	1.5	Fisheries Department vs poachers
	Water supply Naivasha	0.5	0.5	Naivasha city Council vs community
	Destruction of Eburru forest	1+5	6	Friends of Eburru forest vs Eburru forest users
	Water supply Eburru	1.5	1.5	KPC vs Eburru settlement
	Illegal fishing	3	3	Fisheries Department vs poachers
Small-medium farmers	Upper catchment destruction (Kinangop)	1.5+3	4.5	North/South Kinangop farmers vs big farms dov
				North Kinangop farmers vs small Malewa farm
				South Kinangop farmers vs small Malewa farm
	Water supply Naivasha	1.5	1.5	Naivasha city Council vs community
	Bad infrastructure	2	2	North/South Kinangop farmers vs big farms dov
				North Kinangop farmers vs small Malewa farm
				South Kinangop farmers vs small Malewa farm
	Water supply Kongoni-Maela	3	3	Ndabibi-Kongoni: lack of infrastructure
	Water quality	0.5	0.5	Ndabibi-Kongoni: lack of infrastructure

Table 5. Partial IC for each stakeholder group about the conflicts (the final IC for each stakeholder group will be the sum of th stakeholder group) (Continued)

	Maasai water access	0.5	0.5	Ndabibi-Kongoni: lack of infrastructure
	Water extraction from the rivers	1.5+0.25	1.75	Medium catchment farmers vs big farms downstream
Community	Water supply Naivasha	2.5	2.5	Naivasha city Council vs community
	Sewage system	3	3	Naivasha city Council vs community

Table 6. IC (Index of concern) for each stakeholder group about the conflicts

	IC_{LNMP}	$IC_{SH'}$	$IC_{INTENSIVE\ USERS}$	$IC_{MANAGERS}$	$IC_{ENVIRONMENTALISTS}$	$IC_{SMALL-MEDIUM\ FARMERS}$	IC_C
North Kinangop farmers vs small Malewa farmers	5.59	25.75	3	3.75	7.5	6.5	
South Kinagop farmers vs small Malewa farmers	3.63	16.75	3	3.75	7.5	6.5	
North/South Kinangop farmers versus big farms downstream	6.88	27.75	5	3.75	7.5	6.5	
Small Malewa farmers versus big farms downstream	1.30	6	2	1	0	1.75	
Mixed cattle/agriculture farms versus large commercial farms	1.21	6.5	6	0.5	0	0	
Farmers vs fishers	5.02	20.25	0.5	11.25	10	0	
Fishers Department vs fishers	3.58	5	0	2	0	0	
Fisheries Department vs poachers	23.42	32.75	3.5	15	4.5	0	
Friends of Eburru forest vs Eburru forest users	2.02	7	2	0	6	0	
KPC vs Eburru settlement	0.23	1.5	0	0	1.5	0	
IBECA vs LNRA	4.53	6	0.25	2.25	5	0	
Naivasha town Council vs North Kinangop farmers	0.15	1	0	0	0	0	
LNRA vs Nakuru city Council	3.10	5	2	5	0	0	
Longonot-Kijabe: water scarcity	0.01	0.25	0	0.25	0	0	
Ndabibi-Kongoni: lack of infrastructure	0.28	4.75	0.25	2.25	0	4	
Naivasha city Council vs community	1.44	24.75	2.25	16.75	0.5	1.5	

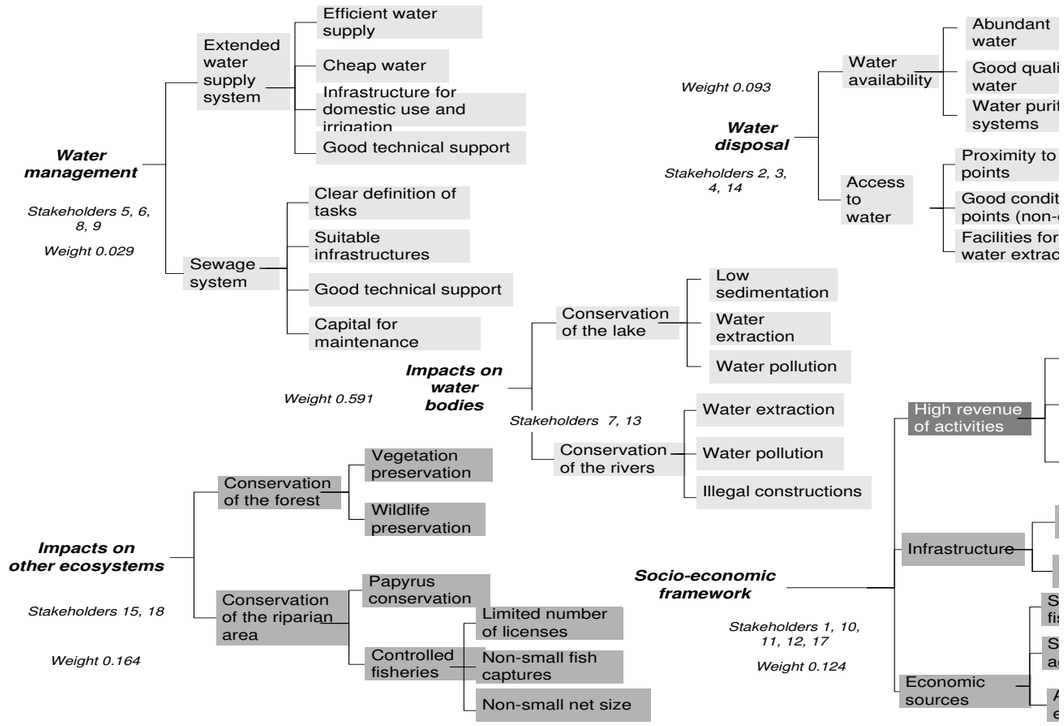

Figure 1. Common value tree of all the stakeholder groups, the values are related to the stakeholders according to the num *common* values for all stakeholders are in light gray boxes, the *acceptable* values for all the stakeholders are in dark gray box whole community of stakeholders are in dark gray boxes with white letters. The weight given to the values and to the stakeho given from the Lake Naivasha Management Plan perspective. The weights have been calculated with the Pairwise Compariso (Chapter 5).