Mara Dryland Becomes Wetland

A social-ecological and multi-scale perspective on the adaptability of the livelihood system around the Tanzanian Mara wetlands

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Photo on cover: view from the hills on the Mara wetlands in Buswahili

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Preface and acknowledgements

While I complete this thesis, my academic study comes to an end. It is an impossible quest to name everybody who made the completion of this study possible. However, with an eye on this Master thesis, there are a few people that I would like to thank in particular.

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In this research recent theories and models that contain a cyclic perspective on reality are being used. These kinds of perspectives were not new for me. On the contrary, from my childhood onwards, I have come across many ancient religious movements that depict the changing world as a cycle. With an eye on these ancient religions and the process of writing this thesis, I would like to quote a contemporary Indian Saint who has transformed my live for the better: *"The intellect is like scissors. It cuts and rejects everything and does not accept anything. The heart, on the other hand, is like a needle – a needle joins everything and makes diverse things one. Love and faith help us to accept and embrace everything. Through love and faith the mind becomes expansive and embraces all diversity"* (Amma).

This thesis is a scientific work and therefore the scissors (intellect) are extensively used. I have cut and rejected a lot, but looking back to the project as a whole, this intellectual approach was to say at least very well embedded in love and faith. Just as happens in the wider scientific world: every time I received an answer to a question, more questions were created. My love for the whole and for truth provided me with the courage to search for further answers on these questions. This 'without blinkers' approach made me to abandon some scientific principles, like strictly defining research topics and questions. Consequently, this thesis sometimes appeared to be impossible at an intellectual level and it was pure faith, that goes beyond any intellectual understanding, which kept me going in joining all the divided parts together again: thanks!

Guide to read this thesis

This study has a wide set-up. It contains data about ecological adaptations, livelihoods, institutions and interventions. Moreover, this data is extensively embedded in contemporary theoretical insights. These features make this thesis highly interesting for readers with an interest in the debates regarding natural resource management, but may also put-off readers that are only interested in the social-ecological system of the Mara basin. For this reason, I have outlined this thesis in a way that one only needs to understand a minor part of the theory to comprehend this study. This minor part is explained in section 2.4 in which I elaborate upon the so-called adaptive cycles. Besides this section, the introduction and conclusion of the theoretical chapter can be very important to understand this study because the main definitions of concepts can be found here. Moreover, section 2.6 of the theoretical chapter can be useful in understanding the importance of bonding and bridging social capital in the perspective of institutional change.

Abstract

This research combines various scientific concepts to describe how local livelihoods have adapted to the changes in the social-ecological system around the Tanzanian Mara wetlands. Conceptually, this study shows that the adaptive cycles from the 'resilience perspective' have a great potential to unite and clarify the nature of the different views in the so-called Malthus versus Boserup debate. The results of this research contribute to insights about what features in the social-ecological system enable sustainable adaptations or unsustainable rigidities in livelihood systems. It is argued that the nature, timing and pace of changes deriving from larger scales can have a large impact on the pathways of livelihood systems. Moreover, it is stressed that local factors as low institutional bias for innovation, multiple functions of livelihood activities and a low degree in homogeneity in dependency to natural resources, contribute to unsustainable rigidities. Features that appear helpful to accomplish sustainable adaptations include interactions between scales, determined enterprising attitudes of locals, bonding and bridging social capital, intensive external involvement and redundancies in policies and interventions.

ABBREVIATIONS AND CURRENCY RATE

GIS	Geographical Information Systems
GLOWS	Global Water for Sustainability Program
IFAD	International Fund for Agricultural Development
SLA	Sustainable Livelihood Approach
TSH	Tanzanian Shilling
VIFAFI	Victoria Farming and Fishing Group
WWF	World Wildlife Fund

Exchange rate of the Tanzanian Shilling (TSH): € 1,- = 627 TSH (during the fieldwork: 28-03-2007)

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INTRODUCTION

Theoretical introduction

There exist various overlapping debates concerning the interactions between ecology, livelihoods and institutions. The theoretical chapter of this thesis reveals that a synthesis between the insights from these debates has an enormous underexposed potential to give direction to research and new understandings of reality.

Regarding these debates, some observers refer to Malthus' ways of thinking and stress that rapid population growth makes that people become trapped in poverty and eventually will lead to catastrophes. Others refer to insights from Boserup and point out that the combination of population growth and scarcity trigger human beings to invent new ways of making a living. However, many observers acknowledge that these visions are partly complementary in reality and that both predictions can hold up to a certain extent.

This thesis aims to gain more understanding about features that enable or disable systems to follow the more positive Boserupian pathways and to avoid the Malthusian catastrophes. In this regard, lessons can be learned from the observation from Tiffen et al. (1994) that the agricultural livelihood system in the Kenyan Machakos district has undergone a large-scale transition from a system with Malthusian characteristics into one with Boserupian features. Both local inhabitants (ibid: 273) and developments on larger scales (Zaal and Oostendorp 2002) are said to have played important roles in this 'regime shift'. These insights indicate that the conditions for such a successful transition may be connected to interactions between scales, in which locals adapt successfully to larger scale changes.

To observe interactions between scales and livelihood adaptations I combine a few research approaches, among which the sustainable livelihood approach. This actor-centred and micro-scale approach is used to gain insights in the way people make a living. Generally speaking, it is praised for its focus on the strengths rather than the weaknesses of the 'poor' (Kirby et al. 2001: 201) and blamed for a lack of attention for larger scales (De Haan and Zoomers 2003). In order to gain insights in the mentioned transitions in livelihoods I have combined the livelihood approach with research that focuses on larger scales.

On top of this combination, this thesis links the sustainable livelihood approach to the heuristic adaptive cycles that derive from the so-called 'resilience perspective' (e.g. Folke 2006). In these cycles, Malthusian features like destruction and crises are seen as periods of release and reorganization, in which there exist a great potential for Boserupian periods of renewal and sustainable exploitation. This link between destruction and renewal in changing systems is often depicted as *"creative destruction"*, a term derived from the economist Schumpeter (1950). Creative destruction points at a prevailing ambiguity in change and transitions, in which both opportunities and threats coexist. In order to focus on the opportunities, it is important to adapt creatively to changing conditions and not to get stuck in unsustainable rigidities that (continue to) cause destruction. In this sense, it seems to be essential to distinguish aspects in social-ecological systems that contribute to either sustainable adaptations or unsustainable rigidities in the livelihood system.

However, while using the adaptive cycles for this purpose, the most commonly used definitions for resilience fall short as measurements of positive transitions. These definitions often stress that "*resilience determines the amount of change a system can undergo without shifting into a new regime"* (e.g. Walker and Salt 2006: 164). In this definition, resilient systems do not easily change into different regimes, while we have seen that there are arguments to appreciate the ability of systems to shift into different regimes. Therefore, I argue that we have to do away with the dominant attention on regime shifts as only undesirable catastrophes (e.g. fire, irreversible environmental damage, famine etc.) and start to focus on positive regime shifts. The above-mentioned positive regime shift in the Kenyan

Machakos district has taken place without (major) catastrophes and is described as a positive 'miracle'. Moreover, this transition shows us that certain types of regime shifts even contain the potential to prevent (further) catastrophes instead of representing them.

The central aim of this study is to unravel the features that contribute to sustainable adaptations and unsustainable rigidities in the livelihood system around the Tanzanian Mara wetlands. To understand the changes of this livelihood system in the context of a larger social-ecological system, a focus on both interactions between social and ecological components and between different scales is inevitable. Observers argue that social-institutional dynamics, which influence livelihood activities, can push ecological dynamics into new pathways. In return, these changing ecologies provide their feedback and influence livelihood activities and institutions (Berkes and Folke 1998; Leach et al. 1999: 240). In addition, the outcomes of local social-ecological dynamics are both influenced and experienced on different scales (Walker and Salt 2006). As we will see below, the social-ecological system surrounding the livelihood system around the Mara wetlands has been clearly under influences from larger scale social-ecological processes.

The case of the Mara wetlands

Attention for the mentioned criss-cross interactions is a real necessity to understand the dynamics around the Mara wetlands[1]. These wetlands are mainly fed by the Mara River, which has its sources in the Kenyan Mau Escarpment. After flowing through two world-famous wildlife parks (Serengeti and Maasai Mara), it continues in the downstream Tanzanian Mara wetlands and finally flows out in Lake Victoria. The fluctuations in the Mara wetlands are interlinked with what is happening in upstream Kenya and with what is happening in downstream Lake Victoria.

In the last decades land cover changes in the Mara basin, mostly caused by population growth and institutional dynamics, have contributed to a rapid expansion of the downstream wetlands. The general decreases in land cover affect the river flows and consequently cause larger and prolonged floods on the downstream floodplains (Mati et al. 2005; Mutie et al. 2006). Moreover, the wetlands also interact with downstream Lake Victoria. The highly fluctuating water levels in this lake correlate significantly with the water depths of the wetlands (Mturi 2007) and wetlands around this lake are highly valued for their role in retaining sediments from the rivers before they flow out into the lake (Kassenga 1997; Bucceri and Fink 2003).

Another important point to consider is that around the same period in which these hydro-ecological dynamics took place also the national institutional system in Tanzania has been subject to large changes, which undoubtedly had major effects on local systems. Firstly, the national government changed from a colonial into an African one, and secondly, this government both adopted and abandoned an Afro-socialist ideology, referred to as Ujamaa.

Although the larger scale dynamics in both the Mara basin and the Tanzanian nation are quite well reported in the scientific literature, there exist large gaps in the literature concerning the local dynamics in the Tanzanian Mara region. First of all, there exist no literature about the interactions between the observed larger and prolonged floods and the local ecological system (e.g. vegetation). Additionally, there are no scientific insights available about how the local livelihoods and institutions interact with these larger and prolonged floods and possible ecological changes. Moreover, the scientific literature provides hardly any information about the influences from various larger scale institutional changes on the local components in the Mara region. This thesis aims to fill these gaps in the literature.

[1] In other publications the Mara wetlands are also referred to as Masirori or Kirumi wetlands.

Research questions and build-up

Next to a contribution to the above-mentioned theoretical queries, this study sketches a multi-scale and social-ecological adaptability perspective on the livelihood system around the Mara wetlands. This perspective sheds light on the effects of various dynamics and interventions on local people and thus provides valuable insights for policy makers. The central research question is: *What features in the social-ecological system have contributed to either sustainable adaptations or unsustainable rigidities in the livelihood system around the Mara wetlands?* The quest to find an answer on this question will mainly focus on the last 5 decades, but to understand the institutional context I had to dig further back into time. On top of the focus on this question, this thesis elaborates on the role of the Mara wetlands in the upstream-downstream interconnectedness in the Mara basin.

In order to sketch a comprehensive answer to the research questions, this thesis is divided into eight chapters in which sub-questions will be answered. The first chapter comprises the theoretical background of this thesis. Subsequently, the second chapter will explain the methodology of this study.

The chapters three and four comprise of two literature studies that clarify how larger scale dynamics have influenced the local system. Chapter three elaborates on the social-ecological interconnectedness in the Mara River basin and the position of the Mara wetlands in these interconnections. Chapter four focuses on the historical interactions between larger scale institutional dynamics and smaller scale institutions in the Tanzanian Mara region.

In the following three chapters, I present the fieldwork data and describe how local components have adapted to the dynamics derived from larger scale influences. For this purpose, these chapters are all accompanied by sub-questions. The adaptive cycles from the resilience perspective function like a connecting thread in these chapters and help to formulate the descriptive answers to some sub-questions.

Chapter five provides an answer to the following questions: *how have local ecological components adapted to the larger and prolonged floods?* And: *what does local knowledge reveals about possible contributors to the wetland expansion?* The conclusive section elaborates on the following question: *how do different scales around the wetland interact with each other and what are the consequences of these interactions for the livelihood sustainability in the basin?* An answer to these questions is obtained from narratives of the local Wakenye people that have been questioned about how local ecological components (e.g. vegetation) have changed under influence from the larger and prolonged floods.

The following chapter shifts its attention to the social components around the wetland and already sheds light on the main research question as stated above. For this purpose, the ecological narratives are merged with historical social narratives about livelihoods and institutions. Subsequently, I sketch the adaptive cycles for the main livelihood activities. Moreover, two sections in this chapter elaborate on the impact of the wetland expansion on the local livelihood system and thereby finalize my contribution in the discussion about the role of the Mara wetlands in the upstream-downstream interconnectedness in the basin.

In order to create a broader view on the sustainable adaptations and unsustainable rigidities in the social-ecological system, (non) governmental interventions are included in the scope of this study. Chapter seven examines the potential of contemporary interventions and collective local initiatives to contribute to the livelihood sustainability. The question answered in this chapter is: *What lessons can we learn from the contemporary efforts from external agents and local people in reshaping the institutions and improving the livelihood sustainability?* The last chapter of this thesis contains a conclusive chapter. In this chapter I present a summary, conclusion and the implications for theory. The last section presents some do's and don'ts concerning interventions and sketches some suggestions to reorganize livelihoods. However, the main implications for policies are integrated in chapter seven.

CHAPTER 1: MERGING DEBATES ON LIVELIHOODS AND NATURAL RESOURCE USE

1.1 Introduction and definitions

This chapter elaborates on the essences of five debates or perspectives concerning natural resources and livelihoods. The aim of this summery is to both clarify the main concepts used in this thesis and to merge some overlapping debates.

For the readers that are not familiar with these theories, the rapid shifting of subjects may be quite an exercise. On the other hand, readers that are familiar with these subjects may think: there is much more to say about each subject individually and some related subjects are left aside. For the first type of reader it is important to remember that this thesis should be also understandable without a detailed understanding of each debate and that it is only essential to understand the adaptive cycles that are explained in section 1.4 and advisable to have a look into section 1.6. To the second type of readers I can say: you are right, there is much more to say about each subject individually and even more subjects are left aside. Fore example, literature concerning Community Based Conservation[2] would have fitted well in this chapter. However, there is a limit to everything and the concepts dealt with in this chapter bring forward the necessary insights to both describe the dynamics concerning the Mara wetlands and to understand most theoretical implications of this thesis.

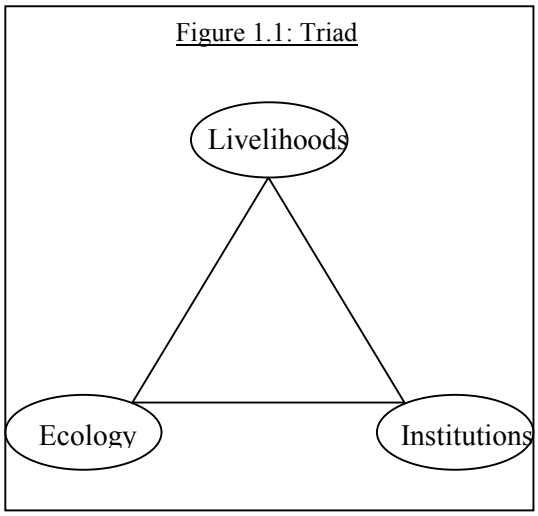


Figure 1.1: Triad

The theoretical framework consists of three main components that function as a triad: the ecology, the livelihoods, and the institutions (figure 1.1). The word ecology is used to refer to the integrated functioning of all biotic and a-biotic components in the environment (e.g. soil, flora, fauna, climate etc.). Livelihoods in general refer to all human efforts to make a living. With the term livelihood system I will refer to the dominant features in the sum of livelihoods in the fieldwork area.

The institutions encompass a more subtle part of the social system and are defined differently by many scientists. For example: *"the humanly devised constraints that structure human interaction"* (North 1993) or "*ways of organizing activities"* (Dietz et al. 2003). I will use a simple, but wide definition: *all knowledge, discourses, regulations, norms, values and ideas that influence human behaviour.* In the conclusions of this thesis I will distinguish between institutions that regulate access to certain resources and institutions that determine the ways of performing livelihood activities. Institutions are closely related to social capital. Scientists also use different definitions for social capital, but in general many scholars acknowledge that the term refers to *"the norms and networks that facilitate collective actions"* (Woolcock and Narayan 2000). As we will see in this chapter, social capital can be perceived as a linking element to make the interactions in the triad more collectively desirable as it can function in an intermediary role between different people that act on different geographical scales. With the term 'social-ecological system' I basically refer to the integrated functioning of the components on multiple scales.

[2] Community Based Conservation is an approach to involve local communities in nature conservation and to combine this with development. This approach has gained in popularity in the 1990s and is seen as an alternative of previous failed attempts to conserve natural habitats by excluding locals resident from these areas, but it is also facing difficulties in implementation (e.g. Agrawal and Gibson 1999; Virtanen 2002; Goldman 2003).

In the triad, the livelihoods influence the ecology by collecting and using natural resources. In return, ecological fluctuations affect the availability of resources and thus the livelihoods. The way in which the livelihoods are performed is strongly influenced by institutions. These institutions are often partly shaped to maintain or enhance food security. There are also direct linkages between the ecology and institutions. Images of nature influence the way people perceive their place in nature (Van den Born et al. 2001). Moreover, many 'traditional' institutions have been shaped and influenced by ecological processes (Berkes and Folke 2003). Furthermore, many people in higher income countries feel a certain bond with the ecology that is expressed in for example nature recreation.

The reason to depict these interactive components as a triad and not as three components that influence each other is that these three components always come together in the actions of people. For example, a fisherman makes a living (livelihood) to go fishing with certain strategies (that are determined by institutions) on spots where he finds himself entitled to fish (regulating institution) and he obviously interacts with the ecology.

The first section of this chapter focuses on the Malthus versus Boserup debate. This is followed by an elaboration on the earlier mentioned case of the transition of an agricultural system from a Malthusian into a Boseperian system. In section 1.4 the resilience perspective and the adaptive cycles are explained and linked to the Mathus-Boserup debate. Afterwards, there is a focus on the discussion on sustainable management of the so-called 'common property resources'. Section 1.6 zooms in on the role of social capital in the interplay between the components of the triad. Subsequently, some insights from these mentioned debates are used to reflect critically on the current use the sustainable livelihood approach. In addition, as mentioned in the introduction, interlinkages between scales are of immense important in these debates. For this reason the second-last section focuses on the quest to find suitable metaphors to define different scales. The last section of this chapter consists of a conclusive section, which gives direction to the build-up and methodology used for this thesis.

1.2 Malthusian versus Boserupian views

Originally, the scholars Malthus and Boserup emphasized different and influential visions on the issues of population growth, food-supply and agriculture. In the last decades their views became prominently visible in debates concerning environmental issues and thus also influenced the discussions beyond population growth and food-supply (Van Bavel 2004). This section introduces the ideas of the two scholars and the implications of these ideas for contemporary science.

Malthus (1766-1834) was an English demographer and political economist. In 1798 he published an essay named: *"An Essay on the Principle of Population"*. His main assumptions in this essay are that the population (if unchecked) grows exponentially and increases at a geometric rate (2,4,8,16,32,64 etc.) and that food-supply grows at an arithmetic rate (1,2,3,4,5,6 etc.). Due to these assumptions, Malthus concluded that the population inevitably will outrun food supply. This would lead to a decrease in the amount of food per person and consequently to famine and a catastrophe (Malthus 1798). Malthus believed that only natural causes (accidents, old age), misery (war, epidemic disease and above all famine), moral restrains and vice (for him: murder, contraception and homosexuality) could check the population growth. Therefore his favoured solution for the problem was in moral restrains (late marriage and sexual abstinence) (ibid).

The main critiques on Malthusian theories are that his method of statistic analysing fails for complex systems in the real world. Malthus took observed trends and calculated them directly into the future. This method often fails for more complex systems. Another critique is that Mathus did not realize the human capacity to increase food-supply through innovations in

the production methods. This critique was underscored by empirical research of Ester Boserup (1910-1999) on the topic of agricultural intensification. Views on this Danish economist and writer are often labelled as anti-Malthusian, because Boserup argues that it are not the agricultural methods that set the limits on the population growth through food supply, but rather that this process works the other way around. Her empirical data shows that populations can determine the agricultural methods and thus increase food production (Boserup 1965).

Boserup observed longer-term rural developments and distinguished five different types of agricultural systems according to the length of fallow (from slash and burn to multi-cropping without fallow). She describes how population growth makes a community to use the land more intensely (less fallow). When agricultural land is insufficiently fallowed, more human effort is needed to maintain the same harvest quantities (like fertilizing etc.) For this reasons an increasing population causes the actors to raise production at the cost of lower efficiency (i.e. agricultural intensification). In this process, a household has to work harder in order to keep the same income and therefore inventions are being made (digging stick, the hoe and the plough) and eventually investments like irrigation schemes might appear (ibid). Because of this insight her work is often associated with the one-liner: *necessity is the mother of invention*.

Another conclusion of Boserup is that the institutions around property rights change in the process of agricultural intensification. Private property rights appear to replace common property institutions when the cultivation cycles are shorter and every piece of land begins to matter (ibid). In addition, Boserup also emphasizes that population growth causes both a decrease of the expenses for transportation per head (e.g. through better roads or fuller buses) and the emergence of market towns. The latter create larger markets and higher demands for farming products. The combination of higher demands and lower transaction costs causes incentives for higher prices and more profitable and innovate agriculture systems (Boserup 1990).

Although the views of Malthus and Boserup are mostly presented as two opposites, they are also seen as complementary. In Neo-Malthusian (and often environmental) thinking, the insights of technological revolutions are included. Neo-Malthusians admit that advanced technologies will increase the use of natural resources and thus avoid famine and catastrophe. However, they stress that the problem is thereby not solved, but only postponed. It is argued that technological innovations do not disqualify the Malthusian theory. They claim that the newly introduced technology do prevent the human population only temporary from a positive check (famine and starvation). At the end of the day, they argue, the growing population and advancing technology will undermine the carrying capacity of the global ecosystem and therefore cause a global catastrophe. Many scientists agree with this, but the discussion is more about the time-scale of this evolving problem (Van Bavel 2004).

Several environmentalists claim that we are living close to these limits of the carrying capacity. Others expect that there will be only short-time and small-scale crises and that these small crises will work as triggers to create solutions by using the ultimate human recourse: creativity. They are convinced that creativity together with technology can tackle all environmental problems. Moreover, they emphasize that empirical research shows that there has never been a global catastrophe like the Neo-Malthusians predict and that such a catastrophe will therefore not happen in the future either (ibid). The main questions in this debate seem to be: will the carrying capacity of the earth put a hold to the creative innovative behaviour of the human race? And if yes, when? Clear-cut answers to these questions are difficult to obtain, but even small progresses in the quest for answers can provide valuable insights to design policies on natural resource use in a context of growing demands.

1.3 Transition from a Malthusian into a Boserupian system

This section focuses on an example of successful or Boserupian recovery after a period of Malthusian crises to clarify how and under which circumstances periods of crises can be relieved by periods of progress. Fifty-five years ago the Kenyan Machakos district was known as a typical example of how Malthusian degradation takes place: it was characterized by overpopulation, soil erosion and poverty. Many descriptions of the area pointed at a typical Malthusian poverty trap, but even while the population has tripled in the same period, the area has changed for the better in the last five decades. The positive changes are visible in a tripled food output per capita and a sharp decline in soils erosion, caused by reforestation and terracing. The critical situation in the period before these positive changes is explained by a combination of droughts, colonial intrusions in the local system, economic regression and wrongly planned governmental interventions, which mainly took place in the colonial period (till 1963) (Tiffen et al. 1994: 18-25).

The link between population growth and this environmental and economic recovery appears obviously present and therefore this case is often associated with Boserup's thesis. Higher population densities are said to increase the accessibility of markets, because this accessibility depends on infrastructure (social and physical) and knowledge, which can be improved by for example roads and schools. Per capita, the costs or efforts for these services decrease as the population densities increase (ibid: 267). The combination of increasing scarcity of land and better accessibility of market, make some activities that might have been a misuse of labor in the case with low population densities, appropriate with high population densities. The local inhabitants are said to have played an important role in this process, because they are the ones that had best sight on the changing costs of land, labour and market opportunities, while these dynamics might appear imperceptible for outsiders (ibid: 273).

Contrary to the data that led to the conclusions as mentioned above, Zaal and Oostendorp (2002) use retrospective data and examine particularly the rate of terracing to explain the above-mentioned 'miracle'. First of all, their study teaches us that the rate of terracing follows the population growth, but that this happened up to different extents per geographical location, depending on the distance of the markets. Secondly, this study shows that terracing took place in peaks during which many plots were terraced around the same time (ibid: 1275-1278). Eventually, these authors conclude their multivariate analysis by stating that the direct impact of the decreasing transaction costs (travel time to arrive at major market) was the "*driving force*" behind the terracing.

These decreasing transaction costs were mainly the result of infrastructural improvements. Furthermore, it was found that the increase in population density and the sharp rise in coffee prices during the 1970s have played (less prominent) roles in accomplishing this miracle. This conclusion raises questions on the direction of the causality between infrastructure and population density. It can be argued that the population density influences the state of the infrastructure, but this argument also holds the other way around: a better infrastructure might cause higher population densities (ibid: 1283-1285).

In spite of the difficulties in interpretation, the arguments in this debate on the 'miracle' of environmental and economic recovery learn us a great deal about the potential of areas in crises. Features of both Malthusian and Boserupian views on reality seem to be visible in one geographical area and the transition from a disastrous Malthusian agricultural system into an innovative Boserupian system appears to take place in certain phases (e.g. of terracing), and under certain circumstances on which the local residents have uplifted their livelihood system. Therefore, it is tempting to see the Malthusian and Boserupian features as cyclic periods of crises and progress, of which the latter also takes place in certain phases (the peaks in terracing). In the next section we will see that these kind phases are more often observed in changing social-ecological systems.

1.4 Resilience perspective and the adaptive cycles

Stability versus change

For a long time dominant perspectives in natural resource management have perceived nature as a stable environment, where resource flows could be controlled and nature would recover itself when human influence was removed or changed (Folke 2006: 253). This view was based on the understanding that ecological systems are always striving and moving towards one stable equilibrium state, endogenously.

Holling (1973) challenged this dominant understanding in ecology. He argued that the stability view of nature could not explain the transient behaviour of systems that are not functioning around a constant equilibrium state. With a focus on anthropocentric influences in fresh water lakes (like increased nutrient enrichments and fishing), he showed that natural systems are resilient towards changes, only up to a certain degree. After a threshold is crossed, the functioning of the entire system changes into a new regime. Holling (1973: 17) made a clear distinction between resilience versus stability: "*Resilience determines the persistence of relationships and is a measure of the ability of this system to absorb changes of state variables, driving variables, and parameters, and still persist…Stability on the other hand is the ability of the system to return to an equilibrium state after temporary disturbances"*.

In the last decades a resilience approach on social-ecological systems has emerged that describes these systems as ever changing, adapting and complex systems, with different 'steady states' (Folke 2006: 262). This insight on the character of social-ecological systems did change the aim of academic views on natural resource management significantly. Instead of the focus on controlling changes in systems, the resilience perspective aims at management to increase the capacity of social-ecological systems to cope with, adapt to, and shape changes (Berkes et al. 2003; Smit and Wandel 2006).

Another aspect of the resilience perspective is that it sees systems as social-ecological systems instead of applying a dichotomy between human versus nature. This view on the union of social and ecological systems is helped by the observation that many of the components of these systems go through similar patterns of change. Because of these shared features in social and ecological components, a group of scientists has developed certain concepts and frameworks that make these changes understandable.

Adaptive cycles and panarchies

One of the central features in the resilience perspective is that all social-ecological systems are affected by many variables of which a few are the so-called 'key controlling variables' (Walker and Salt 2006: 53-61). These are often slow moving variables, because usually people are not very aware of the changes that occur in these controlling variables in their daily life. However, as a key variable moves beyond a certain threshold, the system starts to change in an often-unforeseen way. Variables like climate change or population growth are good examples; although many scientists show with long-term statistics that the climate is changing and the population is growing explosively, most of us don't notice this in our daily life. But when eventually for example crops fail, desertification takes place or resources become scarce, we do notice that the system is crossing a certain threshold. When a system is crossing such a threshold it is called a 'regime shift' (ibid).

These regime shifts are described as one of the phases in the adaptive cycles (see figure 1.2). These cycles appear to be applicable for many social-ecological systems on different scales in both time and space. In this metaphor of change the system passes through different phases, namely: release (regime shift), reorganization, exploitation, and the conservation phase (Holling and Gunderson 2002: 32-49).

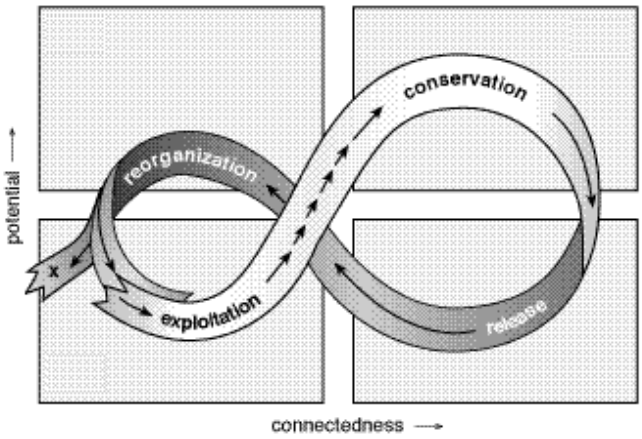


Figure 1.2: The Adaptive Cycle (Holling 1986)

Every phase has its own characteristics. Moreover, different components of one system can be in different phases. In the release phase destruction takes place. In ecological systems this destruction can arrive in for example fire, drought or intense pulses of grazing. In economic systems this phase may be visible in companies that go bankrupt, certain commodities or technologies that lose their value or in livelihood activities that become non-profitable. In social-institutional systems certain norms or laws lose their power or domination in a society.

As the system moves into the reorganization phase a window of opportunity is opened for species (in ecology) or ideas (in social systems) that were suppressed in the previous conservation phase. In this phase, the pioneer species or new ideas of entrepreneurs can capture their niches. Various discourses can influence the institutional setting. This phase is essential for innovation and restructuring, but also full of uncertainty because periods of crises and unexpected renewal can alternate with each other. In this phase policy makers or entrepreneurs have to deal with high uncertainties and have to experiment to find out which components of the system are connected (in a situation of low connectedness).

In the following exploitation phase, the successful components that turned to be successful in the newly emerged setting can start exploiting the resources. In ecological systems this means that there is rapid colonization of species. In economic systems, a few successful companies are conquering the markets or people found the right inputs (e.g. new techniques, fertilizers) to increase agricultural harvests. And in institutional systems one discourse may starts to influence the social norms of the people in a dominant way. This all means that capital in the form of nutrients or social resources (human skills, trust or networks) are accumulating and sequestering, which marks the beginning of the conservation phase.

The system eventually moves into the conservation phase when the resources are getting more locked in certain patterns and become less available for newcomers. Large companies may be using their advantages of scope to discourage others to enter the same market. Eventually it will be harder for them to keep their position and they might have to cut wages or apply for subsidies to survive. Because the components of the system become more tightly-bound, the connectedness increases and eventually makes that the system becomes more rigid in its control and thus less resilient towards changes. In ecosystems, most nutrients become more and more tightly-bound within existing vegetation and thereby this vegetation is reducing the chances for newcomers. And in economic and institutional systems bureaucracy might emerge or people start to depend that much on one resource or technique that shifting to an alternative becomes impossible.

Major disturbances can trigger the next release phase. In ecosystems these disturbances can arrive as for example fire and diseases. In social systems they can become visible in war, political change or over-exploitation of resources (ibid: 33-49).

These adaptive cycles can be observed on different spatial and time scales and can thus manifest themselves distinctively for different components of the system. Reflecting on the interlinkages between different scales and components of systems is essential in the resilience perspective. The way these different scales influence each other is described by the term 'panarchy'. This term derives from the Greek god Pan, who symbolises the universal nature and has not only the ability to sustain, but also to create unpredictable change (Walker and salt: 89). In general, larger scale events affect smaller scales stronger in their functioning than the other way around. For example, by focussing on the social aspects in these panarchies, recovery path from individuals that are affected by shocks are often highly influenced by a collective memory at the scale of the community. This can be seen as social capital derived from a larger scale. Although the panarchy often functions as hierarchical system, linkages between scales can work both ways. If, for example, many individuals of a community unite their ideas, they can have the power to influence governance structures and outcomes at larger scales. (ibid: 116).

Holling et al. (2002: 15) stress that both social and ecological components of many system have proved to be very flexible and able to adapt to major changes and disturbances because they move through adaptive circles and thus have the ability to renew themselves (and their resources or ways to obtain these). Therefore, they argue that the adaptive cycles explain the ability of social-ecological systems to adapt to changing conditions in their functioning. In this sense, we can say that they provide an answer to the questions posed at the end of the introduction about the Malthus-Boserup debate. The observed social-ecological adaptability could be the reason why the global carrying capacity of the ecosystem is not crossed yet and that major or global catastrophes have not happened yet (according to conventional history). The observation that social and ecological adaptability may determine the carrying capacity certainly counts for systems that have many direct interlinkages between social and ecological components (like systems around wetland ecologies, see: box 1.1)

Embracing changes

In the resilience perspective it is argued that the current approaches to create a sustainable world have failed (Walker and Salt 2006: 5). These attempts are found to give too much attention to average conditions and ignore major disturbances. Furthermore, there is too much of a narrow emphasis on increasing efficiency and optimising certain parts of the social-ecological systems and therefore other parts are ignored. Moreover, the overload of attention on certain parts of the system is responsible for eliminating redundancies what will lead to losses in resilience, especially for future generations. The enduring focus on optimising certain parts of a system diminishes the resilience of the system through increasing dependency of one isolated part of a system that is often already overexploited (ibid: 1-10).

The resilience perspective claims to offer an alternative towards these failed attempts to create a sustainable world. With a focus on the adaptive cycles, the heart of the resilience perspective is described as: "*to embrace change*" (ibid: 9). Social-ecological systems always change; to ignore or to resist change will increase vulnerability and forego opportunities. In contrary to many other views on sustainability, the resilience perspective doesn't necessarily tries to preserve systems as they are. Due to focus on 'embracing' and adapting to changes instead of sustaining certain situations, the regime shifts and other changes can be perceived as windows of opportunities and not merely as destructing events. This view is often clarified with Schumpeter's (1950) insight on economic changes and innovations, which he described through the concept of *"creative destruction"*.

Box 1.1: The state and importance of wetland ecologies

A widely used definition for wetlands is *"Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, blackish, or salt, including area of marine water with depth of which at low tide does not exceed six meters"* (The Ramsar Convention 1971: see Ramsar 2007b). These habitats vary a lot and due to these different features people further divide wetlands with names such as: floodplains, tree or papyrus swamps, permanent wetland and seasonal wetland.

Fluctuating water levels, which are common in wetlands, make the ecology in these habitats highly dynamic, because the hydrology determines the flora and fauna. Deeper water bodies support other flora and fauna than shallow water bodies and hence the vegetation types vary according the water levels that fluctuate over space and time (Cwikiel 2003). This variation contributes to high levels of biodiversity. The richness in species in these habitats is also supported by the typical mixture between terrestrial and aquatic features in wetland ecologies. In this sense 'wetlands in drylands' (like the Mara wetlands) are even more valuable, because many species survive due to the available water, which is scarce in dryland ecologies. To emphasize the importance of wetland ecologies scientists use terms like *"cradles of biodiversity"* (Lambert 2003), *"biological supermarkets"* and *"kidneys of the landscape"* (Mitsch and Gosselink 2000).

Next to their ecological importance, wetlands also produce vital functions and services to the society. The services include resources that are directly obtained by livelihood activities such as: fibre collection, fish and water for domestic. The functions usually have a wider geographical reach and can include factors like: groundwater discharge, flood control, trapping of sediments and water purification (Gren et al. 1994: 56).

The first two mentioned functions are related to the swampy soil structure that can absorb large water quantities and hence functions as a sponge. This sponge retains water in the system, which otherwise may cause floods elsewhere. Consequently, this water becomes available for many purposes locally. For example, the large quantities of water do recharge the groundwater on the wetland shores that subsequently can become more suitable for agriculture (e.g. Acharya 2000).

The functions of trapping sediments and water purification are related to: (a) the vegetation that traps, retains and 'recycles' sediments and nutrients, (b) the shallow water bodies that also cause a rapid sediment-water exchange, and (c) to the decomposing organisms in wetlands that lead to processes such as denitrification, which removes chemicals from the water (Gren et al. 1994: 57).

In spite of the importance of wetlands, they continue to be degraded in a rapid pace. In the past century about 50 percent from the world's wetlands have been lost (IUCN 2007). International organizations that work on global scale (e.g. Wetland International and WWF) stress the importance of sustainable management of wetlands. Around the world, 156 national governments have underscored their concerns about the state of wetland ecologies by signing the Ramsar convention. This intergovernmental treaty provides frameworks for national actions and international cooperation for the conservation and 'wise use' of wetlands (Ramsar 2007a).

As mentioned above, it is important to make this kind of framework in tune with the ecological dynamics, but also local social dynamics should be included. In many African wetlands in drylands the latter comprise processes like commodification of natural resources, changing property rights and population growth. Unlike is often assumed in conventional wisdom about rural livelihoods in Africa, these processes don't seem to lead to large-scale wetland degradation inevitably. In four case studies across the continent it are rather the larger scale changes on the basin scales that cause ecological fluctuations. On the local scale, policy frameworks will have to deal with factors such as local social differentiations and need to incorporate questions like: whose resources and livelihoods are affected by social-ecological changes? (Bernstein and Woodhouse 2000: 195- 213).

Because of this different view on change it must be noted that the important focus on the persistence of the system in the original definition of resilience from Holling (as quoted above) doesn't make a resilient system also a desirable system per se. For example, the area of the Everglades wetlands in Florida used to be a dry savannah ten thousand years ago. If we had lived there in the period of transition we might had tried to prevent this area to shift into different regimes, while the wetland is nowadays highly appreciated by many people (Holling and Gunderson 2002: 31). Because of this insight, Holling et al. (2002: 14) have created another name for this perspective on nature: *"nature evolving"*. They argue that this name is more complete than "*nature resilient"*, because it also includes the active learning of social institutions and adaptable management.

This discussion on terminology reveals that the capacity of a system to stay in the same regime might point at a high degree of resilience, but that this is not necessarily desirable. Thus, some phases in the adaptive cycle are more desirable than others. This is of course very much linked to the scale of the system, but especially for smaller components of the systems a very high degree of resilience doesn't appear very desirable. For example, if a livelihood activity is found to be far into a conservation phase, a regime shift may be more desirable than persistence, because the livelihood activity probably has already lost its appreciated profitability. In this late conservation phase, economic activities are often characterized by more sunk costs; this means that we have to put more efforts to reach the same output (Walker and Salt 2006: 85-87). This feature has a great similarity with agricultural intensification, which according to Boserup works as a trigger for inventions.

Thus, during late conservation phases inventions can cause a release out this less desirable phase and can thus be seen as a reorganization to re-harmonize the differently changed components of the system. If this reorganization doesn't take place, the resilience of the specific livelihood activity decreases and the chances that a release phase turns into a Malthusian catastrophe instead of a Boserupian trigger for invention rise. However, as long as the livelihoods of the people are secured by other activities, such a small-scale catastrophe may be more desirable than a long enduring conservation phase, because it forces renewal upon the system. The desirableness of a release phase does depend, next to the sustainability of the wider livelihoods, also a great deal on time that the system needs to reorganize quickly and to find the new opportunities in the newly emerged context.

From this theoretical elaboration, a system as a whole appears to be healthy when its smaller components go smoothly through the adaptive cycle according to their external dynamics. This flexibility to successfully shift towards different states is not always observed in reality because maladaptive features often trap systems around the globe. These maladaptive systems (in a social sense) are constrained by traps that are sustained by for example poverty or institutional rigidity. In these cases, systems can be highly resilient towards changes or, but are also trapped in one (undesirable) phase, while external or internal variables may put pressure on the system to make a shift into another regime (Holling et al. 2002: 5). This also shed light on the implications of the adaptive cycles for policies and interventions. For example, subsidies can both save a system from a Malthusian catastrophe and keep a system trapped in conservation phase. Hence, the timing and durations of the subsidies seems to be of great importance.

1.5 Governance of common property

The emphasis on (institutional) flexibility also exists on another debate on the governance of natural resources. This debate emerged out of a distinction between different property rights. Resources that are kept under 'common property' instead of more clearly defined property rights (e.g. privately or governmentally owned), are often seen as more vulnerable to larger scale institutional changes, especially if the concerning institutions are

unable to cope with a changing context. These types of resources are hard to define, because the shared features have more to do with the way they are governed than their ecological characteristics. In general it can be said that they share the feature that it is hard to exclude other users (Dietz et al. 2002). Examples of common property regimes are often found in forests, lakes, oceans and clear air.

Hardin's (1968) publications "*The Tragedy of the Commons"*" is often seen as the take-off for the academic focus on the governance of common pool resources. In this publication, Hardin set out the argument that human beings are only overexploiting common pool resources and that therefore this type of resource will be depleted in the future. In his understanding every individual aims at maximum individual profit and thus acts according to selfish rational principles. He has argued that only coercive social power (mutually agreed) and a shift from common to private or government property could make people use 'their' resources sustainable.

Other scholars have raised arguments against Hardin's catastrophic thesis. Cox (1985) agues that Hardin's metaphor of the British herders that overexploited the common pasture resources is not correct historically. She shows how the commons in England used to be governed by institutions that granted the different individual users-rights to the people (through both formal and informal bylaws). For this reason, she argues, that the commons were not free, as Hardin had described them. She emphasizes that there is evidence for other ways to govern property than private or government property only. Furthermore, she states that the enclosure of the commons has not been a result of any tragedy as Hardin described, but more of *"social change and the perennial exploitation of the poor"* (ibid: 58). It appeared that some powerful, opportunistic individuals exploited a new emerged situation and thereby pushed the poor from 'their' common property to intensify their own agricultural practice. The governing institutions of the poorer users of the commons did not manage to adapt successfully to the combination of this exploitive behaviour and the major changes between the 14th and 19th century (e.g. "*the industrial revolution, agrarian reform, and transfigured farming practices"*) (ibid: 61). In this context, property rights changed and some people exploited newly emerged opportunities, while other lost their entitlements over resources. This publication reveals that there exist more types of property rights and that common property is something else than open-access. The table below gives an overview of these different types of human property arrangements.

Type of property regime	Description
Open-access	Absence of any well-defined property rights; completely open access to resources that are free to everyone.
Common Property	Recourse held by community of users who may apportion or regulate access by members and may exclude non-members.
State Property	The resource is held by the government, which may regulate or exploit the resource or grant public access: government can enforce, sanction, or subsidize the use by some people.
Private property	An individual owns property and has the right to exclude others from use as well as sell or rent the property rights.

Table 1.1: Property regimes (source: Burger and Gochfeld 1998)

These property rights are not discrete as one geographical area might consist of both open access and government characteristics. In some cases national governments have laid down regulations on, for example, certain types or sizes of fish, but besides this regulation the resource property may be open-access or held by a community (common property).

Ostrom (1990) examines long-enduring common property institutions on their robustness towards changes and their successes in general. She emphasizes that institutions around common resources are most resilient towards change if they are designed by the users themselves through an accessible collective choice arrangement and if they are embedded in various larger administrative scales. Additionally, also the following characteristics were found important for long-enduring property successful regimes: clearly defined boundaries, monitoring possibilities, graduated sanctions towards perpetrators, and the existence of conflict resolution mechanisms (ibid: 91-102).

More then a decade after Ostrom's publication the body of empirical research on this subject had grown and generated even more profound insights into the features of long enduring institutions on CPR's. Dietz et al. (2003: 1908-1910) do not only repeat Ostrom's findings, but also reveal that: monitoring is only useful if information is shared and trusted, modest violation of rules should be answered with modest sanctions only, and that the institutions should be prepared for change.

This brings us to the importance of successful adaptable management, for which they found that the following features are helpful: a well-structured dialogue between scientist and resource users, institutional variety (e.g. market, community self-governance, hierarchy etc.) and 'complex, redundant institutions' that are nested in multiple layers of administrations and (ibid). Institutions should be linked across scales both horizontally (across space) and vertically (across hierarchical administrations) (Berkes 2003: 293). This linking helps to reduce mismatches between changing institutions, livelihoods and ecosystems.

Efforts of centralized governments to lay down rules on local communities (often referred to as top-down efforts) have proven to be inadequately in governance of natural resources. Empirical studies show that the local people and their institutions are often more capable of responding to changes than the centralized ones (Ostrom 1990; Berkes 2003; Dietz et al. 2003). For this reason there seems to be a re-appreciation of local knowledge and traditional governance of natural resources. These traditional institutions build on local knowledge that differs from the knowledge of conventional resource managers. Local knowledge often includes features of social-ecological systems such as non-linear relationships and threshold effects (Berkes and Folke 2003: 122-124). Conventional resource managers usually obtain quantitative data, which mostly focus on exploitation and conservation phases, while the local knowledge puts more emphasis on qualitative data and on the release and reorganization phases (ibid: 145).

However, too much decentralization in resource management may delay feedbacks between users groups and adjacent areas. Due to the interaction between different social-ecological scales the institutions have to function and evolve on these different scales also in order to counteract mismatches (Berkes 2003: 316).

Many people can understand most of the features of the observed successful institutions, but are rather put off by the 'complex, redundant and nested institutions' because these are often associated with bureaucracy and unnecessarily complexity. However, it is important to note that (a) not all institutions are formal arrangements, and (b) that well functioning institutions are usually the result of a long evolution, in which different discursive agents eventually create sets of institutions that influence human behaviour for the better (Richerson et al. 2003: 404-411). This evolutionary process in which institutions evolve takes place on multiple scales as for example: individual, kin and larger groups (tribe, nation etc.). Moreover, it is emphasized that most institutions evolve slowly and in unpredictable ways: both regress and progress are possible. These conclusions raise the question whether and how it is possible to speed up the evolutionary processes in cases that new commons have emerged and/or that older institutions have vanished. This brings us to concept of the role of social capital in the forming of institutions for natural resource management.

1.6 Social capital in an intermediary role

The functioning of the institutions is next to the governance of natural resources also found to be very important in general development and poverty issues. Moreover, both social and ecological drivers of change cause, next to the mentioned windows of opportunities also many undesired outcomes (e.g. Adger 2000; Wily 2000). Ever since the concept of entitlements was introduced in the discussion around poverty and development, the role of the institutions in distributing the undesired and desired outcomes of certain situations is widely accepted. Amartya Sen (1981) introduced the concept of entitlements to explain how people in Bangladesh could starve, while there was enough food available on larger scales. He showed that for a large segment of the population, social and political institutions resulted in a lack of entitlements to food.

For a long period scientist have described institutions as quite rigid and therefore as a certain 'structure' in which individuals could express their limited 'agency'. Giddens (1984) did away with the sharp dichotomy in this agency and structure debate. He emphasized that individuals have been influencing and changing the institutions (or structure) constantly and summarized these findings in his 'structuration' theory. The main insights derived from this work, is that the institutions are formed and reshaped by the society and that people can thus influence the institutions to make them more desirable for their livelihoods.

Regarding the way people can influence institutions, it is often argued that vulnerable or poor livelihoods lack 'bridging' social capital with other groups than their own community and with people that define certain institutions for larger scales. Bridging social capital contains thus a potential to influence the large-scale institutions. A lack of this capital is often seen as a reason why these people do not 'get ahead' in an economic sense.

On the other hand, poor or vulnerable livelihoods often have a large stock of 'bonding' social capital within their community that functions as a safety net and permits them to 'get by' in times of crises. The synthesis of bonding and bridging capital appears to be most ideal for improving livelihoods (Woolcock and Narayan 2000: 225-228). Thus, social capital seems to provide an infrastructure for interactions between people (and livelihoods) and the formal and informal institutions, which can make institutions flexible to the desires of individuals.

Next to the interactions between institutions and livelihoods, Leach et al. (1999: 240) argue that humans also form the natural environment and in a comparison with Giddins (1984) call this the 'structuration' of the (natural) environment. Moreover, they stress that certain institutional settings can influence human activities and push ecological dynamics into new pathways. This changing ecology provides its feedback and influences livelihood activities and institutions again (ibid).

Other observers emphasize that this feedback from the ecology on the society rarely only reaches the ones responsible for the ecological change. "*The transfer of disadvantages"* is described as the essence of environmental problems (Tellegen and Wolsink 1998: 83-88). These disadvantages are transferred in time, space or from the individual to the collective. They are in fact equal to the external costs of production and consumption, and it is mostly not clear when and by whom these externalities will be paid (ibid). However, many observers do stress that poorer people in the sense of income, education or in the sense of the ability to influence institutions (again!) suffer a disproportional part of these feedbacks from ecological change or transfers of disadvantages. The branch of science that studies this type of transfers of disadvantages is called 'environmental (in) justice'. (e.g. Bickerstaff 2003; Kurz 2003; Gray and Moseley 2005).

Linking people that receive or transfer these disadvantages may be an efficient way to deal with environmental problems. As argued before groups of individuals can form a power that can influences institutions on larger scales (Walker and Salt 2006: 116). In this sense, establishing and formalizing cooperative groups can be helpful.

This also underscored by empirical research. Pretty (2003) argues that the cooperative groups can be a good device to speed up the evolutionary processes around institutions. These groups reform or increase social capital among and between groups and their members. Empirical studies have shown that cooperative groups can encourage changes in human behaviour, help rule compliance, reduce monitoring costs and thus improve natural resource management. With other words: cooperative groups have the potential to increase trust and reciprocity among the members of these groups.

This potential especially comes forward if there is frequent communication within the group and with other groups and if the local groups receive support from higher-level authorities. Other positive features that help these groups to be successful are: relative small group sizes, clear reciprocal arrangements and lack of easy exit options for members (ibid).

The latter lays a finger on the sore spot on the promising story of social capital: it can be a liability and asset at the same time (Portes 2000; Woolcock and Narayan 2000; Pretty 2003). Social capital might also turn into a repressive social structure. For example, societies with large differences in power relations (e.g. feudal society) can have very strong institutions, but these are more based on fear and power instead of on more egalitarian values (Woolcock and Narayan 2000). Moreover, individuals can also use their social ties to abuse collective facilities (Portes 2000).

In spite of these negative potentials of social capital, this section has mostly stressed the importance of this capital for linking the dynamics in the ecology, livelihoods and institutions in order to create a harmonious functioning within this triad. The insights of when social capital and institutions are successful, are all pointing to the importance of bonding and bridging social capital and the interlinkages between scales. This conclusion resembles a lot with the features for successful institutions for common property as outlined in the previous section.

1.7 Livelihood sustainability in larger scales

A few of the noted insights in the previous sections have clear implications for the sustainable livelihood approach (SLA). Since the 1980s the popularity of this approach has increased rapidly in development-studies. The decades before the rise of the livelihood approach were dominated by 'Grand Theories', like dependencia or peripheral capitalism.

In contrary to those Grand Theories, the livelihood approach gives room for empirical analyses at micro-scale (Reitsma et al. 1992: 37). Instead of focussing on barriers to sustainable development, the SLA is concentrating on the agency of the actors and their potential, capacities and strengths, rather than their weaknesses (Kirby et al. 2001: 201). The livelihood concept is an approach to study what people do for a living, how they do these activities and what they eventually gain by doing activities.

An often-used definition is: *"a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household"* (Ellis 2000: 10). At the centre of this approach is an actor who is drawing from assets to make a living. This happens within a certain context (e.g. history, politics, climate etc.). The chosen livelihood strategies and the returning benefits from these strategies are influenced by this context and by institutional arrangements (Scoones 1998).

The current micro-scale use of the SLA is at odds with the broadly agreed importance of the interactions between the ecology, livelihoods and institutions on different scales in time and space. Research in practice does appears not to integrate this ambiguity because the micro-scale SLA is replacing a macro-scale focus on sustainable development as some academics feel that this term has reached a conceptual dead-end (Sneddon 2000: 521). Of course, the controversy and the meaning of the term sustainable has become a debate on its

own (e.g. Hueting and Reijnders 1998; Sneddon 2000). However, contrary to the SLA (actor - and human-centred), the rapport that is often described as the 'inventor' of the term sustainable development, "*Our Common Future"*, focussed on a collective and both human - and eco-centred sustainable world (World Commission on Environment and Development, 1987). To replace this idea with a micro-based, human-centred concept looks like an escape from a complex, collective ideal towards a clearly set out unit of analyse on micro-level. As is stressed below, larger scales are embedded in the definitions of the SLA, but loose their value when the SLA is not combined with research about large scales.

By combining the livelihood concept with sustainability, the focus of this livelihood approach is placed within a wider scale in both time and space. One of the most commonly used definitions of the SLA is: "*A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base"* (Carney 1998: 4).

The first part of the definition is very much concerned with the sustainability of the livelihood on a wider time-scale and focuses on the social sustainability of the unit. This is undoubtedly the legacy from Chambers (1990), who distinguished between poverty and vulnerability. Poverty is generally a static concept, which measures are often 'absolute' and fixed in time. Vulnerability, on the other hand, is more dynamic and includes changing processes in the time-scale, as people move in and out of poverty (Lipton and Maxwell 1992: 10). Being vulnerable means being defenceless against certain adversities and thereby being exposed to risk, stresses and shocks. Therefore, a social sustainable household "*can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and into the future"*. The shocks imply short-term events with sudden large consequences, while the stresses include usually longer-term trends with that affect the livelihood gradually. Another distinction from Chambers (1990), the difference between the external side of vulnerability (stresses and shocks) and the internal side (the ability to cope with these), is clearly visible in this definition.

The second part of the definition is emphasizing a wider geographical space in "*not undermining the natural resource base"* and is thus about the ecological sustainability. There exists an interaction between the social and ecological sustainability: if a livelihood is undermining its natural resource base it can create its own stresses or shocks. Anyhow, the focus on the micro-scale is problematic in order to make an assessment for sustainability for natural resource management.

The concept of an ecological footprint shows us the difficulty to combine social and ecological sustainability in one definition without the focus on trade-offs. After all, the livelihoods in the higher-income countries are producing the majority of the environmental external costs (larger footprint on the global ecosystem). And if we apply the SLA to higher income countries we will probably find out that most livelihoods in these countries are socially sustainable from their actor-centred perspective on micro-level (to cope with or recover from stresses and shocks), but following the ecological footprint outcomes, they are not ecologically sustainable from a more collective view on sustainability in the use of the natural resource base. On the contrary, the livelihoods in the lower-income countries are often less socially sustainable from an actor-centred and micro-scale perspective, while they are in general more ecologically sustainable from a more collective perspective (in terms of use of natural resources) (see also Gray & Moseley 2004: 13).

Therefore, I argue that, even though the definition from Carney (1998: 4) is concerned with "*the natural resource base"* in general and not with the livelihood's natural resource base, it cannot reveal this large picture of the natural resource base. In this context there must be attention for the 'essence of environmental problems' which social scientist often describe as "*the transfer of disadvantage"* or environmental external costs (e.g. Tellegen and Wolsink

1998: 83-88). This reveals that a focus on sustainability of resources kept under common property institutions should always be a collective one. If the focus stays on the micro-scale (e.g. a household) and the disadvantages are transferred, then how can we assess whether a livelihood is undermining the natural resource base? In theory, we can study many micro-scale livelihoods, and analyse whether some are receiving the disadvantages from other. However, in practice this approach seems to be too labour-intensive.

These above examples illustrate the difficulty of using social and ecological sustainability in one definition, which is applied on the micro-scale only. In this perspective it is impossible to assess whether a livelihood is 'sustainable' or not, or which livelihoods are more 'sustainable' than other livelihoods. Departure from the micro-based analyses is necessary for this to happen. If we want to focus on a somehow more collective sort of sustainability we have to focus on what a livelihood is transferring to others, the so-called trade-offs.

These trade-offs are actually already included in the SLA (Scoones 1998: 8), but apparently not very much emphasized in research on SL. This argument of the weakness of the micro-scale analysis is in line with another definition of SL, which resembles to the one I will use in this thesis: "*A sustainable livelihood is one which can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term* (adopted from Chambers and Conway 1992: 7-8).

In particular for issues that are embedded in interactions between scales, like interconnectedness between upstream and downstream areas in a catchment area (e.g. in the Mara basin), the concept of trade-offs can be a good device to understand sustainability issues at both the scale of the livelihood units (e.g. households) and at the basin scale.

The argument about the weaknesses of the micro-scale analysis is in line with other critics of the SLA. De Haan and Zoomers (2003: 359) state that there is too much focus on the micro-level, while processes like globalization make livelihoods more multi-local. Furthermore, there is a lack of attention on access to resources and the power relation that determine the entitlements (ibid: 2005). Brons et al. (forthcoming: 12) argue that more attention should be given to the interfaces between the internal and external sides of vulnerability and between individual and collective responses. These authors further state that research on SL should focus more on the contributions of livelihoods to the collective instead of only focussing on the exploitive nature of livelihoods. They stress that not only the collective action and thus the institutions and power relations involved are "*glossed over*", but as well the activities people undertake that do not generate direct income.

All this critique is problematic for a study that focuses on the interactions between the ecology, livelihoods and institutions on different scales with social capital as an intermediary. It appears that the focus on the micro-scale and agency of the livelihood units is accompanied with avoidance of the larger scales. In this thesis there is a focus on the interaction between larger scales and livelihoods. For this purpose, there is more attention for the changes in livelihood activities on the scale of the community, while there is less focus on the specific performances of the smaller livelihood units (e.g. households).

1.8 Metaphors to define scales

It is not my aim to elaborate on the larger discussion concerning scale-issues, but rather to clarify and justify the way I use the concept of scale in this thesis. In ecological and in social studies there exist no common definitions for scale and in the latter the general understanding of the importance of scale appears to be underdeveloped (Gibson et al. 1999).

However, many ecological and social scientists use the metaphors of 'higher' and 'lower' to distinguish different scales in their research (ibid). These metaphors are developed to describe the functioning of hierarchies and interlinkages between scales. In this view, different levels of scale can influence each other 'top-down' or 'bottom-up'. In development-studies, the term top-down is often used to define attempts from higher (non) governmental organizations to create development without including the local knowledge and perspectives in their policies. The term bottom-up refers to attempts from or with local people to create development (which may be facilitated by the top-level organizations) (Potter et al. 2004). There exist multiple reasons why I will try to avoid the metaphors of higher and lower or top-down and bottom-up in this research.

Firstly, part of this study concerns the ecological components of the system and as emphasized in the resilience perspective: natural processes are normally complex non-linear and discontinuous systems, which cannot be caught with these metaphors only (Gibson et al. 1999). The metaphor of the panarchy appears promising to describe the interactions between larger and smaller scale processes, because it emphasizes that social-ecological systems function in a more subtle way than top-down or bottom-up only.

Secondly, in social science these metaphors are easily associated with rigid top-down policies, which most often have failed for governance of natural resources (Holling et al. 2003: 72-77). The interventions from these 'higher' levels of scale (e.g. national governments) do often fail in their desired outcomes, and might thus have a lot influence, but also lack the actual power to fulfil the ideal picture that the agents had in mind when initiating these interventions. Therefore, the power from the so-called higher scale institutions is at least disputable and it is unfortunate to continue to rely on these metaphors, while there is an urge to shift towards new ways of governance, which should be neither bottom-up nor top-down. As we have in the sections above, the conditions under which this new way of governance can take place, appear to comprise a large degree of institutional autonomy on local scales and the embeddedness of these local institutions in larger (geographical and administrative) scales. Thus, also in the social sense, one cannot speak about a solely bottom-up or top-down situation, but rather about a context in which various interlinkages between institutional actors on different geographical and administrative scales determine the outcomes of certain processes.

Thirdly, in the sense of the interactions between different social-institutional scales in, for example, governmental bodies higher and lower are often used to define a hierarchy of power relations, whereby the more powerful are higher than the less powerful. The same metaphors are also used to define successful against less successful people or people with more status against people with less status. This is most clearly depicted by the presentation of winners on stage after sport events. The winners are usually standing on the higher stage while the number two and three of the events stand on lower stages (Wilterdink and Heerikhuizen 2003: 175-176).

These ways of using the terms higher and lower are very unfortunate when we pay attention to recent arguments in development debates about the role of language in sustaining certain discourses and power relations. Scholars (e.g. Foucault 1972; Escobar 1995) have increasingly stressed the common vocabularies of scientists, professionals and politicians not only describe reality but also sustain certain discourses or 'constructs of the reality' on reality. For example, in the previous five decades the terms 'developing world' and 'developed

world' have created a construct of development in which the transitions that have occurred in the (mostly western) developed word are seen as the 'way forward'. Consequently, these constructs became a model to restructure the developing world in a western-centric way. It is argued that these dominant discourses created a lack of space for individual freedom in defining development (Escobar 1995).

In this discursive sense, there is a serious chance that the multiple (negative) meanings of the word lower (e.g. distance, level, not important, not honest, behave badly, sad[3]) also create multiple associations. To classify any unit (group of people, geographical area etc.) as lower from the start, may influence the images that the readers obtain from a text and in this way create an image, or a 'construct of the reality' that sustains certain discourses on the reality, in which higher defined scales (often administrative bodies) are more powerful (or more suitable) in creating the ideal context for 'development'. In this case, the discourse of a powerless local level which is inadequate (or too low) to organize its own resources might be fed by the use of the word low and its various negative images. In particular for development issues these disputable metaphors to define power relations are problematic because solutions for poverty lie in the transfer of power from the powerful towards the powerless people (Chambers 1995).

For these reasons I have decided to use the concept of scale in the geographical sense only. This also means that I don't use the word 'level' to define the position of a certain scale and that I will refer to, for example, larger or smaller scale events or dynamics. In practice this means that I will refer to: the global scale, national scales, Mara basin scale, Lake Victoria scale, wetland scale, and the local scale (fieldwork area). The terms 'top-down' and 'bottom-up' are replaced with 'externally designed' or 'internally designed' approaches, referring to whether the approaches or interventions have been designed in or outside the local fieldwork area.

1.9 Conclusion, definitions and direction of research

From this chapter we can clearly learn that the various debates around the interactions between the ecology, livelihoods, development and institutions have large implications for each other. In the research design and conclusions of this thesis five of these implications, which are summarized below, are taken into consideration.

Firstly, the adaptive cycles in the resilience perspective have shed new light on the Malthus versus Boserup debate. We have seen that external or internal variables can push ecologies, livelihood activities and institutions into conservation phases, which eventually need to give place for release phases to both avoid rigid or non-profitable systems, and to enhance the opportunities for renewal. In this sense, it appears that the different phases cannot function properly without each other and are thus part of the same processes, which create the necessary renewal in dynamic social-ecological systems. Livelihood activities that are far into conservation phases resemble with Malthusian viewpoints, while Boserup argues that these conservation phases trigger invention, reorganization and eventually exploitation. In this perspective, conservation phases can be seen as signals, which show us that a livelihood activity is drifting apart from its context.

Thus, Malthusian and Boserupian views on reality can be seen as two sides of the same coin that provide the necessary ingredients for development as long as the adaptive cycles move smoothly and are not hindered by poverty or rigidity traps. Moreover, if these smooth adaptations in the smaller livelihood components are taking place, it is quite likely that the chances of catastrophes to take place will be reduced. This research therefore focuses on the adaptability in the cycles of the ecology, institutions and livelihood activities to see

[3] http://dictionary.cambridge.org/results.asp?searchword=lower&x=0&y=0 (Accessed on 22 Oct. 2007).

how the system is dealing with factors as rapidly growing population densities, increasing demands for natural resources, and both institutional and ecological changes deriving from larger scales.

Secondly, regarding livelihood activities, this thesis examines both the desirableness and potential of the existing phases in the adaptive cycles. Some livelihood activities may show high potential because they are in reorganization, release or exploitation phases, while other might show low potential in conservation phases. It seems that activities in exploitation phases are most desirable. The activities in this phase should be sustainable in the sense that they shouldn't produce more negative than positive trade-offs in both time and space. Such a sustainable exploitation phase I will call a 'sustainable adaptation'. Unsustainable rigidities will be equaled with components that remain stuck in an undesirable phase in the adaptive cycle and/or that produce trade-offs towards other units. The definition of sustainable adaptations (see box 1.2) is in line with common definitions of 'sustainable development' that mostly resemble with the one from the Brundland report "*Our common future*"[4] (WCED 1987).

Thirdly, because of the arguments set forward, the sustainable livelihood is used in this thesis as one component in a larger framework instead of a main central element. There will be attention for transfers of (dis)advantages (trade-offs) between the livelihoods and other units on different scales. These trade-offs will be especially examined in the perspective of the upstream-downstream interconnectedness in the Mara basin.

Furthermore, the renewal and innovations of livelihood activities will be placed in the larger institutional and ecological context. Therefore, the livelihood approach is used as a mixture between an elaboration on the phases of the livelihood activities in the adaptive cycles and the performance of livelihood units (family homesteads). Because most livelihood units (households) in the fieldwork area perform more than one livelihood activity, this division helps to distinguish between regime shifts in livelihood activities that are desirable (as mentioned above) and release phases that cause problems for the livelihoods of people (e.g. food shortages on the scale of the homestead).

Fourthly, we have seen that both the governance of natural resources and the distribution of the positive and negative trade-offs of certain dynamics are influenced by the state of the institutions. These institutions in their turn can be influenced by (groups of) individuals, especially if these (groups of) individuals are well embedded with bonding and bridging social capital. Moreover, the establishment of cooperative groups appears to improve the potentially existing social capital and thus seem to be a good device to speed up the evolutionary and reorganizing processes around the institutions that regulate the usage around resources and or improve the situation of poor people. Regarding these interactions between people and their institutions, this thesis elaborates (a) on the influences from the larger scale institutions on the local system, and (b) on the general successes and constraints faced by the locally based cooperative groups. In addition, the features that have appeared to be helpful in reorganizing or sustaining suitable institutions (e.g. redundancies and multi-scale embeddedness) will be examined on how they affect the courses of the adaptive cycles in livelihood activities and institutions.

Fifthly, the arguments around the importance of adaptive cycles, trade-offs and evolutionary processes around institutions all stress the importance of multiple scales in the research approach. This importance is underscores with the features that helped or made 'the miracle of Mackakos' to take place. Moreover, wetland ecologies are highly influenced by changes from other social and ecological scales (see box 1.1). With an eye on the wetland

[4] In this report sustainable development is defined as: *"a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with the future as well as present needs"* (WCED 1987: 9).

ecology, it should be noted that we are facing a unique case with the Mara wetland. As explained in box 1.1, wetlands around the world are being degraded, but the Mara wetlands are expanding because of developments at larger scales[5]. For these reasons, the build-up of this thesis comprises different scales and in the conclusion I will also elaborate on the nature of the interactions between these scales. Although there is a firm holistic approach in the description of the interactions between scales and components, the final aim of this research is to examine the outcomes of these interactions for the livelihoods of the people living in the Mara basin.

Box 1.2: Defining the concepts

A livelihood is sustainable if it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide net benefits to (other) livelihoods on the local and larger scales on both the short and the long run.

Trade-off: The effect that an actor or activity has on the social-ecological environment that affects other livelihoods in either time or space. Depending on the way the receiving party adapts to the changing ecology, trade-offs can be received as positive or negative.

Sustainable adaptation: A livelihood activity that is in an exploitation phase (as portrayed in the adaptive cycles) and produces net benefits to (other) livelihoods in space and time.

Unsustainable rigidity: The trappedness of a component in the adaptive cycle that decreases the profitability or sustainability of livelihoods and/or causes (negatively received) trade-offs to the other livelihoods.

[5] I only managed to find two other cases in which wetlands have been expanding rapidly in the time-span of decades. The first is the Hara swamp in Ethiopia. (Also) in this case, fluctuations in the river flow and sedimentation seem to be causes of the expansion (see: McHugh et al. 2007). The second case has been found in the Sudd Swamps in Southern Sudan. This expansion is associated with an almost doubling outflow of Lake Victoria after the early 1960s (Sutcliffe and Parks 1987, In: Conway et al. 2005).

CHAPTER 2: METHODOLOGY, BUILD-UP AND GENDER

2.1 Selection of research units

In chapter three and four two literature studies enable us to create an overview of larger scale factors that have influenced the fieldwork area, but they certainly fall short in describing the interactions between these larger scale dynamics and the local dynamics around the Mara wetlands. To fill these gaps in the literature, I have conducted a ground study around the Mara wetlands between February and June 2007. The set-up of this fieldwork comprises a multiple case study, in which different components of the local system are examined.

The multiple cases consist out of three neighbouring villages, which are selected in communication with representatives of the Musoma district government and the World Wildlife Fund (WWF). There were various criteria involved in this selection-procedure. Firstly, it was a necessity to find accommodation for me to conduct the daily fieldwork activities. Secondly, it was, of course, important to choose a village where the wetland has expanded significantly during the last decades. Thirdly, it was agreed with the WWF representatives that the presence of fishing-activities was an important criterion. Because a very dense papyrus vegetation, which reduces the open water bodies, fishing-activities are impossible in many parts of the Mara wetlands. Therefore, this decision made many villages to dropout. Fourthly, we aimed at large differences between the cases (e.g. different ethnicity, different interventions or a different ecological situation) in order to make an interesting comparison.

A quick inventory of the possibilities regarding the fieldwork locations revealed that Buswahili-village was a good starting point, because: (a) there was suitable accommodation for me, (b) fishermen were active, (c) the wetland had expanded significantly (observed on satellite pictures), and (d) both the WWF and Mara-FIP[6] had been involved in interventions in this village. Although the initial plan was to search for another village elsewhere for an interesting comparison, the two villages directly upstream from Buswahili, named Kongoto and Wegero, turned out to be an ideal selection. The ecological context between the three villages differed significantly because the wetland expansion was in different stages during the period of fieldwork. This means that the three villages had different types of wetlands ranging from densely vegetated papyrus wetlands to seasonally inundated forests. The difference in ecological context gave the opportunity to generate insights into the differences of livelihood interaction with these three stages of the wetland expansion. The selected villages are three of the four villages of the Buswahili ward, which is located in the Musoma district in the Tanzanian Mara region. This ward is inhabited by the Kikurya speaking Wakenye people.

To examine the different components of the system various subunits in the villages were selected according to the different research topics. The distinctive research methods used for the specific components are explained in the following section.

2.2 Fieldwork research-methods per chapter

<u>Local ecological dynamics (chapter five)</u>

For the purpose of creating an overview of the interactions between the ecological scales, I have conducted oral histories from the village elders. These elders were selected through a combination of advices from local residents and convenient homestead visits in the villages. The oral histories have been conducted in open interviews, in which the elders were

[6] This is a rural development program, which was carried out by the Tanzanian government and funded by IFAD (see chapter seven for details).

asked to sketch an overview of the changes in the wetland area (e.g. hydrology, flora and fauna) during their lifetimes. In addition to these descriptive records, the elders were also asked to elaborate on the by them perceived causes for these ecological changes. Almost all the interviews have been conducted in meetings in which one elder, an interpreter and I participated.

For the completion of the chapter on ecological changes in the wetland I have summarized the outcomes of these interviews into local narratives, and interpreted them with a 'resilience perspective' framework comprising out of adaptive cycles and different scales. In the conclusion of this chapter the data from the literature study about the dynamics in the Mara basin supports the described interactions between ecological scales. This synthesis is ideal to retrieve the whole picture of ecological change because in this way the available conventional scientific knowledge is merged with the newly obtained local knowledge. As noted in section 1.5 these types of knowledge generally cover different aspects of ecological change.

Livelihoods between ecological and institutional dynamics (chapter six)

Chapter six focuses on how the local livelihoods and institutions have changed within the context of both the changing wetland ecology, and the larger scale institutional influences. For the purpose of this chapter, the same elders as mentioned above were asked to describe the changes in the livelihood activities (e.g. fishing techniques) and the institutions around the livelihoods and natural resources. In particular, there has been attention for innovations in livelihood activities, institutional dynamics and the influence from the changing ecology on the livelihoods. These interviews are combined and summarized in a similar way as in the previous chapter. In order to create a more comprehensive overview of the dynamics and the importance of the various livelihood activities 20 additional open interviews were conducted with people who performed specific livelihood activities in and around the wetland.

Moreover, two local research assistants have conducted 72 semi-structured livelihood questionnaires with homestead leaders in the three villages (for the analyses of these questionnaires the statistical computer programs SPSS and Excel have been used). The sample for these questionnaires has not been taken in a random way because of a few reasons. The first aim was to include a few of the different users of the wetland resources (e.g. large cattle keepers, fishermen and mat-makers) in this sample. Only after the inclusion of these different perspectives in the samples of each village, the research assistants were asked to continue with convenient homestead visits.

I have tried to apply these selection-criteria in a systematic way, but this turned out to be too complicated. The composition in the users of the wetland resources turned out to be different per village. At the beginning of the fieldwork I was unable to obtain the necessary data for a framework that would have guided such a systematic approach. Therefore the sample of about half of the 72 questionnaires have been taken in a convenient way and the other half has been taken by consulting local people in order to find people that performed certain livelihood activities. One implication of this selection method is that the inventory of the livelihood assets of the homesteads (e.g. number of cattle and size of cropland) may not be totally representative for the fieldwork area as a whole. On the other hand and more importantly for this research, the questionnaires do sketch a comprehensive overview of the multiple perspectives on the fluctuations regarding the wetland resources.

Before the interviews about the social dynamics started, I always mentioned the confidentiality of these interviews and that the names of the respondents would not be mentioned anywhere. In this way I hoped to obtain also more controversial data about the institutional and livelihood dynamics. It happened quite often that other people joined the interview sessions out of curiosity. In some cases I did accept this because I am convinced

that a strict partition of respondents and other villagers may create an image of strict secrecy around the data collection, which could lead to wrong images of research in this area where hardly anybody is aware of the purposes of scientific research. This point is important because in this region many unknown aspects of life are said to be approached with a high degree of suspicion[7]. However, in other cases, especially when more sensitive subjects were concerned, I tried to re-establish a setting in which only the respondent was present.

The combination of oral histories, open interviews with people working in the wetland, and the questionnaires provided the data which is used to sketch the adaptive cycles for the main livelihood activities and their accompanying institutions. After this elaboration on each of the main livelihood activities, the conclusion of this chapter sketches an overview of the observed interactions between the ecology, livelihoods and institutions.

Contemporary institutions and interventions (chapter seven)

In this chapter, the efforts from the formal institutions (e.g. national, district and ward governments), NGOs and self-initiatives in improving the livelihood sustainability are examined. For this purpose, I have conducted various open interviews with officers from the district, ward and village administrations and NGO representatives. In addition, there have been open interviews with representatives from all cooperative groups in the three villages.

Furthermore, local residents, officers and members of the cooperative groups have been questioned about the results of the development-aimed efforts, the experienced obstacles in these attempts and their personal suggestions for 'the way forward'. To sketch an overview of the accomplishments of these interventions and institutions the adaptive cycles are again used to describe and explain the observed changes. In the conclusion of this part there will be attention for observed difficulties of certain interventions and the successes of others.

Functions and positions	**Interview technique**	**Number of people**
Male elders from fieldwork area	Individual and group-wise open interviews	17
Representatives of local cooperative groups	Individual open interviews	10
Homestead leaders (often male in some cases female)	Semi-structured questionnaires	72
Village chairmen (from fieldwork villages)	Individual open interviews	3
Buswahili and Kongoto water committee chairmen	Individual open interviews	2
Locals with regular livelihood activities in and around wetland (e.g. mat-makers, fishermen etc.)	Individual and group-wise open interviews	22
Women-groups	Group interviews	6
Officers from the Musoma district departments of Fisheries, Natural Resources, Livestock and Agriculture, Cooperative Groups, Mara-FIP and LVEMP afforestation. From Buswahili ward: Executive Officer, Ward Agricultural officer, Health Officer and Village Executive Officers	Individual open interviews	16
NGO representatives (from VIFAFI, WWF and VI-Agro forestry)	Individual open interviews	5
Total people spoken to		**153**

Table 2.1: Overview of people consulted for this research

[7] I was frequently told by researchers, NGO representatives and locals hat suspicion towards strangers is common in this area and that reducing suspicion is of immense importance for successful research in this area.

2.3 Gender and research methodology

Only about 10 percent of the respondents spoken to in this research are female. This under-representation of women has both reasons and implications that are connected with gender issues. There have been various obstacles for me to conduct more interviews with women. First, in the traditions of this area women are not always speaking freely when men are present. For this reason, I have tried to find female interpreters to assist with these interviews. This turned out to be a harsh task as the women that spoke English and Kikurya[8] in and around the villages were either not fluent or confident enough in their English to assist with these interviews. Another time, the lady in question had to discuss the proposal to work as an interpreter with her husband. After this 'discussion' she only said that she was too busy. Later my interpreter told me that she was not allowed to make this decision on her own according the traditions and that her husband may had refused to cooperate. This situation points at unequal power relations between man and women, which are found quite common among Kikurya speaking groups in the region (e.g. Rwezaura 1985; Tobisson 1986).

The unequal power relations came to my attention again when I approached a lady who I wanted to speak to because she performed a specific livelihood activity. Her husband (the leader of the homestead) was clearly not happy with the fact that I paid so much attention to his wife instead of to him because it was often seen as an honour when I, the guest from abroad, visited a homestead. In his reaction, he took the seat next to his wife and closely observed every action she performed and listened to every word she uttered (with an annoyed gaze) while I conducted the interview.

Because I was unable to find a female interpreter I decided to approach the village leaders in order to assist me in forming women groups for group interviews. I assumed that in it would be easier to explain their husbands that they were not welcome to participate in this setting. This approach worked in Wegero village, but failed in Kongoto and Buswahili. In the latter I was sick on the first appointment and on the second appointment only two of the eight invited women showed up. In Kongoto, the situation was similar and I was told that the low attendance was probably connected with the female responsibilities in the household and livelihood activities, which often get priority over other aspects of life.

In spite that there are a few sign of a transitions in institutions and power relations (as explained in chapter six), the fact that I encountered difficulties in approaching women in a local collectively appreciated way, reveals that there are large gender differences. As argued below, this has some implications for the way we have to understand the outcomes of the research.

In the wider Mara region man and woman have separated 'spaces' of knowledge, because there also exist strong divisions of daily routines between the sexes (Shetler 2003c: 284-285). These spaces of knowledge became visible in differences of the interviews between the sexes. The male respondents mostly first spoke out predominantly negative about the wetland expansion, and only admitted the positive influences on their livelihoods later in the interviews. On the other hand, women often expressed themselves first positive and later in the interviews indifferent about the influences of the wetland expansion on their livelihoods. This situation may be connected to the different spaces of knowledge and labour, but also to the situation that men often use their speech to claim power over certain resources or services (Rwezaura 1985; Tobisson 1986: 93; Shetler 2003b). In this sense, I often suspected that men played the role of a victim from ecological and institutional change in order to claim their right for my assistance in their livelihood (as a white male I was often automatically assumed to have access to wealth). This 'victim role' often became less prominent during the continuations of the interviews. On the other hand, I also suspected that the indifferent

[8] Although all people in the area speak at least some Kiswahili, many women don't master and use this language as much as Kikurya. Therefore, a Kikurya speaking interpreter was found to be a necessity.

attitude of many women was caused by their cultural constraints in expressing strong opinions towards men (my interpreter and me).

These observations, doubts and under-representation concerning the distinctive gender perspectives in this research are carefully weighted in the formulations of the conclusions. However, it must be noted that this under-representation might also imply that I did not obtain enough data to gain a very comprehensive image of these female perspectives. Hence, further research with a focus on the female perspectives on the local dynamics around the Mara wetland is part of the recommendations.

CHAPTER 3: DYNAMICS ON BASIN SCALE

3.1 Chapter build-up and introducing the Mara basin

Below, this chapter starts with an introduction about the main geographical features of the basin. The following sections continue with an overview of land cover changes from the last 35 years as observed on satellite pictures. This is followed by a literature study about the causes behind these land cover changes. The literature study continues with an elaboration on trade-offs between land users that occur through the river. Subsequently, there is attention for the (dis)integrative functioning of the Mara basin policies and administrations. The concluding remarks sketch the implications of the larger scale drivers of change for the Mara wetlands.

The main geographical features of the basin

The Mara River basin covers a surface of 13.504 km2, of which approximately 65 % is located in Kenya and 35% in Tanzania. From its sources in the Kenyan highlands, the river flows for about 395 km into the south-west direction. For the purpose of this thesis the basin is divided in three land use and/or administrative units (see also map 3.1):

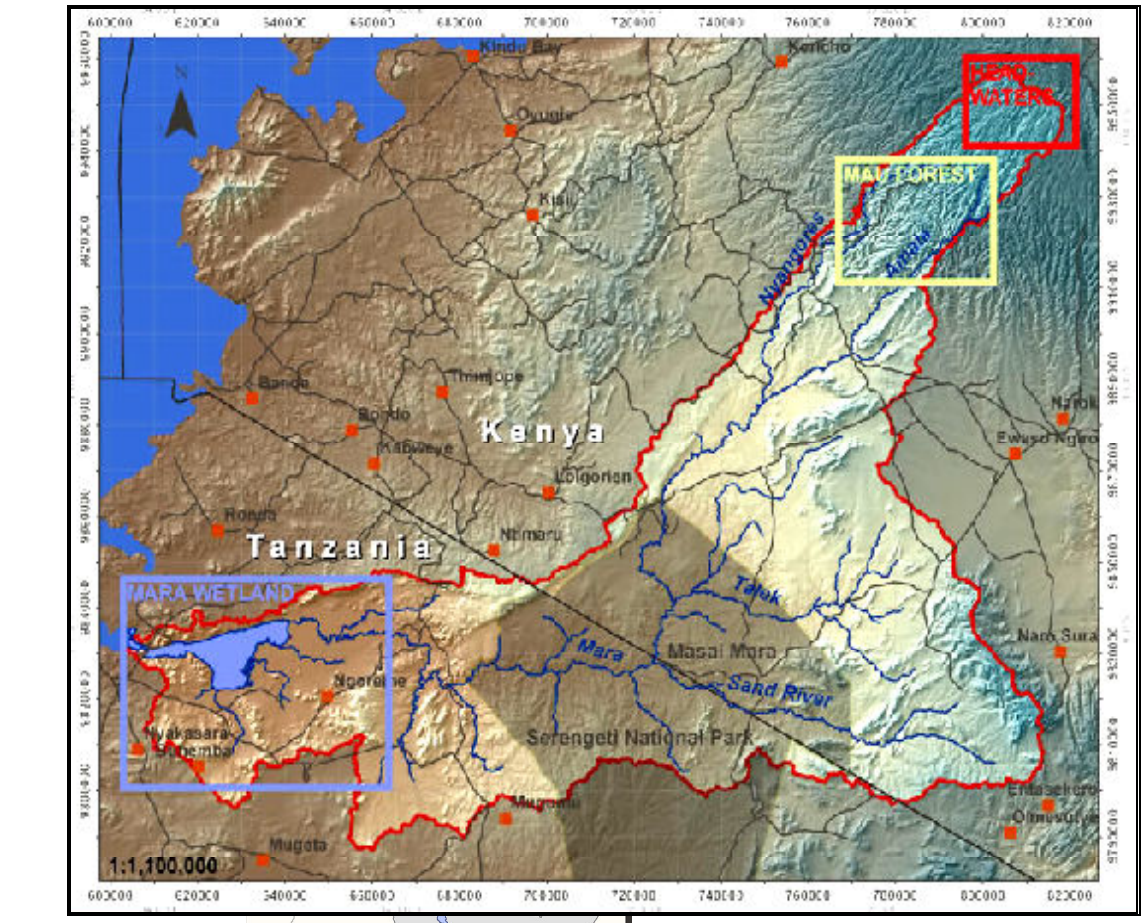
The Mau Escarpment: The main sources of the Mara River, the Amala and Nyangores Rivers, drain from this escarpment. This part of the basin supports besides forests, both small-scale agriculture (less than 10 acres) and medium-size farms (often tea farms up to 40 acres).

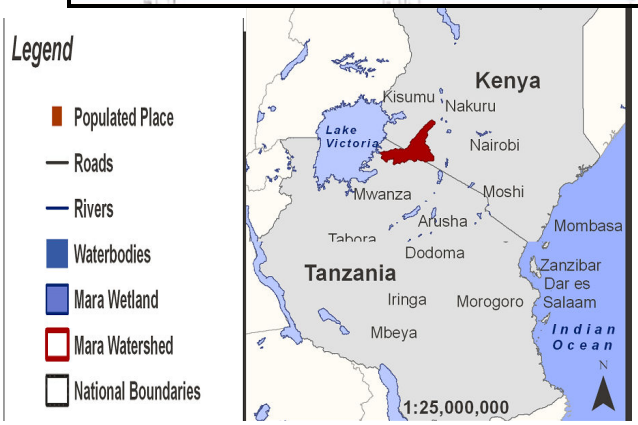
The Kenyan Rangelands: In this area, the Amala and Nyangores rivers flow out of the Mau Escarpment and converge to form the Mara River. The River then meanders further through open savannah grasslands that is mostly governed by Maasai group ranches and used as pasture for livestock and for both small - and large-scale agriculture (more than 40 acres). The basins of four important tributaries to the Mara (the Talek, Engare, Sand and Engito rivers) are also located in this area, together with some upland areas like the Loita Hills.

The Protected areas: Eventually the river flows into the world-famous Maasai Mara National Reserve, where it merges with three of the four mentioned tributaries. On the Kenyan-Tanzanian border, the river flows into the Serengeti National Park and is joined by the fourth major tributary: the Sand (or Longaianiet) River. In these wildlife parks human activity is restricted to wildlife viewing.

Downstream Tanzania: Just after the Mara River flows out of Ikorongo Game reserve (which borders Serengeti National Park) it meanders sharply northwards. At the location where the river meanders into the southwestern direction again the main channel is lost in different streams, which feed the downstream Mara wetlands. These streams and wetlands continue for about 70 kilometers downstream. In this part of the basin human and livestock densities are high and small-scale subsistence agriculture is the main land use (WWF forthcoming).

The altitudes in the basin range from 2,932 meter around the sources in the Mau Escarpment to 1,134 meter around Lake Victoria. The amount of precipitation varies according to these altitudes. The Mau Escarpment receives most rainfall with a mean annual rainfall between 1,000 and 1,750 millimeter. The transboundery middle savannah grasslands receive an average between 900 and 1,000 millimeter, and the Kenyan lower Loita hills and the area around Lake Victoria only about 700 and 850 millimeter rain per year. On top of this rainfall variability in space, the region is also know for its rainfall variability in time, which means that the different areas all receive variable amounts of rainfall over the year. The rainfall seasons are bi-modal, with the long rains starting in mid-March to June with a peak in April, while the short rains occur between September and December (ibid).

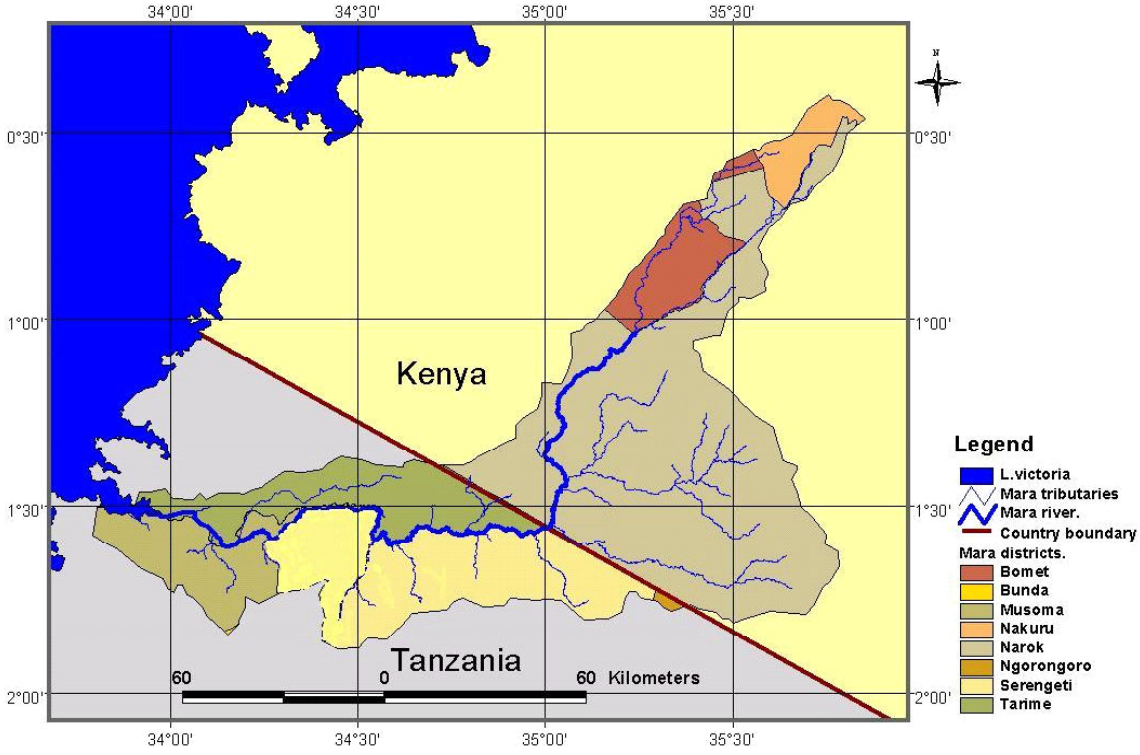




	Kenya	Tanzania	Total
Mara basin in km^2	8,192.76	5,311.10	13,503.86
Mara River length in km	119.02	223.51	342.53
Protected area in km^2	1,718.06	1,741.26	3,459.32
Wetland area in km^2	-	204.46	204.46
Wetland width in km	-	12.90	12.90
Wetland length in km	-	36.80	36.80

Map 3.1: Mara basin (source: GLOWS 2007)

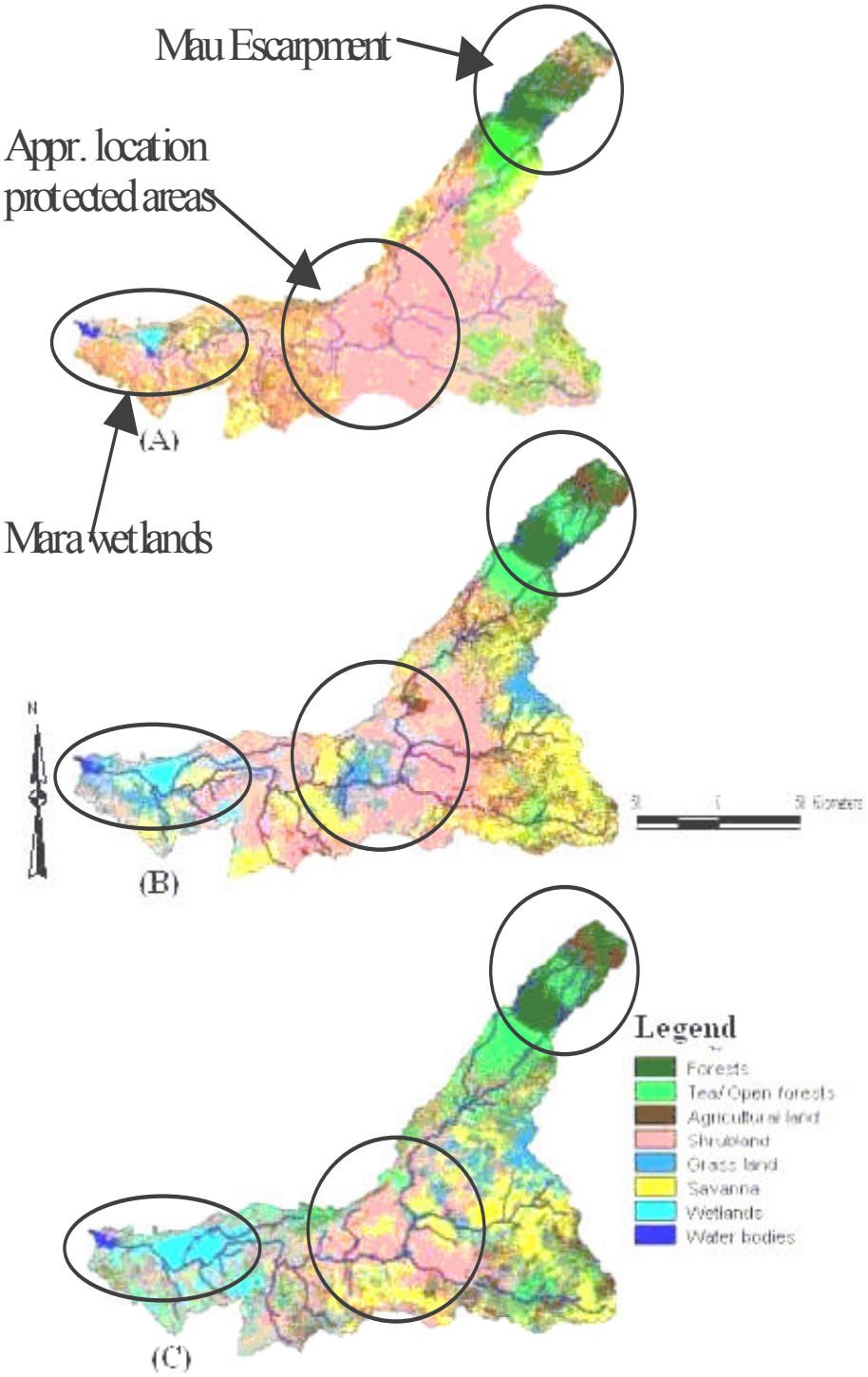
The basin administration is divided between two countries and nine different districts as shown on map 3.2. The ninth district, Transmara, is recently carved from the Narok district, and not displayed on the map. This district covers part of the surface on the eastside of the Mara River in Kenya. Furthermore, the surfaces covered by the Bunda and Ngorongoro districts in Tanzania are negligible on basin scale.



Map 3.2: The Mara basin in administrative units (source: WWF forthcoming)

3.2 Changes from above: a GIS map analysis

Two recently published studies on the Mara basin reveal a fast changing social-ecological environment. Both Mati et al. (2005) and Mutie et al. (2006) show with maps derived from a combination of satellite pictures and GIS[9] application that the Basin's land cover and land use have changed rapidly. Below, the GIS maps are displayed and represent the years 1973 (A), 1986 (B) and 2000 (C).



Map 3.3: Mara basin land cover changes: (A) 1973, (B) 1986, (C) 2000 (Mutie et al. 2006)

[9] The abbreviation GIS refers to Geographical Information Systems, which is a common name for types of software used for the analyses of cartographic images.

For the Kenyan Mau Escarpment, map A shows that the land was covered by forests and some gaps filled with a mixture of shrublands and agricultural land in 1973. On the map of 1986, parts of these gaps are covered by forests, while other parts changed into primarily agricultural lands. Furthermore, a large area of the Mau Forests seems to have changed into tea/open forest in the period between 1973 and 1986. For the same period the maps display a large replacement of tea/open forest and savannah for agricultural in the area where the Amala and the Nyangores Rivers flow out of the forested area and converge as the Mara River. However, between 1986 and 2000, a large part of the land cover in this area seems to have changed into tea/open forest again. The land covers around the Sand and Talek Rivers are also subject to change. In this part, savannah and agricultural land appear to have replaced shrubland and tea/open forest between 1973 and 1986. And between 1986 and 2000 some parts seem to be covered with tea/open forest again, while the agricultural lands have expanded more.

Furthermore, also the land covers of the protected areas of Maasai Mara and Serengeti seem to have changed significantly. In the period between 1973 and 1986, a large part of the shrublands cover is replaced by grasslands and savannahs. By the year 2000 many grasslands seem to have changed into savannah and shrubland (again). In addition, some parts of savannah have changed into shrubland in this period, while on other locations shrubland changed into savannah. Moreover, some areas with agricultural lands in the Tanzanian part of the protected areas are replaced by grassland and savannah on the 1986 map compared with 1973.

In Tanzania, the most visible change is the expansion of the Mara wetlands. From a small bleu dot on the map of 1973, these wetlands have changed into a large pattern of riparian and non-riparian wetlands on the maps representing 1986 and 2000. On top of that, near the river mouth and around the wetland, the predominant shrublands from 1973 are replaced by grasslands in 1986, and changed into a mixture of different land covers by the year 2000. Furthermore, between 1973 and 1986 a large amount of scattered agricultural land between the wetlands and national parks is replaced by savannah and shrubland, while in 2000 some of these areas seem be covered with tea/open forests, wetlands and savannahs. The table below gives a statistical overview of the land cover changes between the different maps (years).

Year/period Land cover type	1973 (km^2)	1986 (km^2)	2000 (km^2)	Change 1973-2000 (km^2)	Change in %
Forest	1008	893	689	-319	-32
Tea / Open forest	621	1073	1948	+1327	+214
Agricultural land	826	1617	2504	+1678	+203
Shrubland	5361	5105	3546	-1815	-34
Grassland	2465	1621	1345	-1120	-45
Savannah	3163	2867	2354	-809	-26
Wetlands	286	604	1394	+1108	+387
Water bodies	104	54	55	-49	-47

Table 3.1: Land cover change statistics (source: Mutie et al. 2006)

In the basin as a whole, the amounts of both agricultural land and tea/open forests have tripled, while forests, shrublands, grasslands and savannahs have decreased between 26 percent and 45 percent. The expansion of the downstream wetlands with 387 percent is the most striking number in the table.

3.3 Literature findings on upstream land cover change and trade-offs

The Mau Escarpment

The land cover dynamics in the Mau Escarpment can be explained by a process that started in the 1930s. In this period parts of the indigenous Mau forests were cleared and replaced by exotic species used for timber plantations. In the late 1940s the British colonial government aimed to reduce the plantation costs and as well as to increase the amount of arable land for the African residents. For these reasons they introduced the so-called 'Shamba system'. This system allowed the local people to clear parts of the forest for cultivation as long as they also grew seedlings to fulfill the demand for timber. The opened plots were mostly smaller than one acre and only cultivated with crops until the tree-seedlings matured, which took a period between three and five years time (Obare and Wangwe 1998). The forests started to be used more intensively in the post-colonial period from the early 1960s onwards. The Mau uplands and mountains became known as 'high potential lands' because of the porous and highly fertile volcanic soils (Singida 1986: 33-34). The large gaps in the forest vegetation with shrublands (visible on the 1973 map) might be explainable by this intensification of the Shamba system, which was still in use after independence.

In the 1980s the population grew rapidly and so also the demand for (crop) land. Consequently, the demands for land exceeded the arable lands as set in the Shamba system. Therefore this system was abandoned and people that lived around the forest moved in and settled in the areas that were cleared for the Shamba system (Obare and Wangwe 1998). This rapid in-migration led to large-scale conversion of forests into agricultural lands (The Weekly Review (29-10) 1993 in: Dietz 1996: 8) and explains the change from the land covers in the gaps of the Mau forest (from a mixture of shrublands and agriculture in 1973 to solely agricultural in 1986 and 2000). According to some studies, deforestation of the Mau forests has increased from the 1990s onwards, but because often only small parts of land are cleared, the developments are difficult to detect from the satellite pictures (Geteta et al. 2003: 11). This deforestation is caused by three main actors: large logging companies, fuel wood (charcoal and firewood) collectors, and people that are expanding their agricultural activities (WWF forthcoming).

Kenyan Rangelands

The establishment of the Maasai Mara National Reserve in 1961 marked an important change in land use on the Kenyan rangelands. The rangelands bordering this protected area were reserved to function as a buffer between the high potential lands in the Mau uplands and the national reserve. In 1968 these rangelands were demarcated into Maasai[10] group ranches, which were managed by an elected committee that owned the ranges on private title per group. These rangelands can be divided in outer and inner ring ranches around the Maasai Mara Reserve. In particular the inner ring rangelands are used for grazing by both wildlife and cattle (Serneels and Lambin 2001: 68).

A rapid population growth in the 1970s from about three percent per annum (Singida 1984: 24), was followed by a more alarming rate of 6.4 percent per annum in the 1980s (Homewood et al. 2001: 12547). These high rates were caused by in-migration (ibid). This large in-migration also becomes clear in 1989 census in which about 25% of the population reported lifetime in-migration, and about 50 percent was non-Maasai (Thomson and Homewood 2001: 112). In the 1970s some immigrants started large-scale wheat farming in the region. This change in land use accelerated in the 1980s when the land committees leased away large parts of 'their' ranches to entrepreneurs from outside the area (Serneels and

[10] The Maasai are the 'original' inhabitants in this area.

Lambin 2001: 79). This development explains the large expansion of agriculture lands on the outer group ranches between 1973 and 1986 as observed on the GIS maps.

The land cover changes between 1986 and 2000 in the area nearer to the Maasai Mara Reserve (from shrubland into grassland and savannah) may be explainable by two factors. Firstly, in 1993, the system of group committees was abandoned in some rangelands and the land was divided between the members. In most cases this process was accompanied by controversies over land ownership. Consequently, people not only cleared tree covers and expanded small-scale agriculture as livelihood activities, but also to legitimize land ownership (Kiyiapi 1999: 4). Secondly, since the mid-1990s the Maasai themselves started to get more involve in both small-scale (10-50 acres) and large-scale (2000-4000 acres) wheat farming (Thomson and Homewood 2001: 123). This shift from the (elite) Maasai from a pastoral into a cash orientated lifestyle is seen as another cause of expansion of agriculture. Instead of reserving the land for pasture, this 'idle' land is now seen as a potential resource for agricultural activities. These activities point towards a conversion of shrublands into agricultural lands and not in grasslands and savannah (as we saw on the maps). However, it must be noted that the distinction between grasslands and wheat agriculture can be somehow difficult to detect on satellite images (Seerneel et al. 2001: 3414). Another possible cause of these land cover changes is explained in the next section: land covers also change without human influence.

Land cover changes in the protected areas

The changing land covers in and around the Kenyan Maasai Mara Reserve are explainable through a combination of social and natural causes. The changes from shrubland into grassland and savannah are mostly directly caused by disturbances as fire, heavy browsing by elephants and natural succession. However, social factors also play a role in this changing environment. The expansion of large and small-scale agriculture in both the inner and outer rings around the reserve have increased the competition for biomass and access to water between wildlife and livestock in and around the Maasai Mara Reserve. Consequently this contributed to general decreases in vegetation (Homewood et al. 2001; Seernal and Lambin 2001).

These social developments are not observed in the Tanzanian part of the Mara-Serengeti ecosystem, while the maps show a similar land cover change in this part of the basin. Dublin et al. (1990: 1157-1158) argue that these land cover changes are the result of different 'stable' states in the vegetation. In the period between 1960 and 1980, the combinations of a low density of wildebeest population, high rainfall and fires have resulted into a decrease of shrubland. The fires destroyed the trees, while the grass productivity was high due to low wildebeest grazing and high rainfall. Consequently, the amounts of grasses were sufficient to cause regular large fires on the plains again. These factors prevented the tree seedlings to mature and retained the land covers in grassland and savannah vegetations. In the 1980s the wildebeests increased and thus the grasses and fires decreased. However, in this period the elephant population increased rapidly and extensive browsing and trampling prevented the tree cover to recover.

The appearance of the agricultural lands in the Serengeti National Park in 1973 can be explained by the weak financial position of the National Park, which reduced the effectiveness of the park authorities until the 1980s (Serengeti Park website 2000). For the same area there is an increase of both shrubland and open forest visible between the maps of 1986 and 2000. This might be connected with the establishment of Ikorongo Game Reserve in 1994. Ikorongo borders Serengeti and its status as game reserve restricts human activity.

Trade-offs through the river in upstream Kenya and protected areas

The deforestation in the Mau Escarpment produces trade-offs through the river flows due to a faster run-off of rainwater and an increase in soil erosion. The Mau Escarpment is of vital importance for the supply of the Mara river flow. This especially accounts for the dry season when most other tributaries dry up. The faster run-off is accelerating the fluctuations in the river flow and therefore higher peaks and lows are observed in the Mara River (Geteta et al. 2003; Mati et al. 2005; Mutie et al. 2006). Moreover, local residents also blame deforestation for changing rainfall patterns, which also influence the river flows and water availability (Awer et al. 2004).

The trade-offs from deforestation in this region have contributed to an ethnic conflict that took place in the 1990s. This conflict occurred between the Kikuyu[11] and the Maasai and started when the Narok Country Counsel declared part of the Mau forest a protected catchment area. After this declaration, many immigrants were suddenly ordered to leave. Even before the Kikuyu settlers could took notice of this, the forced evictions started and eventually led to ethnic clashes. The sudden change in protective status of the forest was connected to low water levels in a dam that drains from these catchments. These lows were caused by a combination of drought and catchments deforestation. The trade-offs from the deforestation were puffed-up by political tribalism and eventually made the sudden shift in protective status possible. The benefits from the agriculturalists affected the long-term interests of the pastoralists (Dietz 1994: 7-10).

Concerning these contrasting interests, a similar situation continues up to today. On top of deforestation, many of the large-scale farmers on the (former) Maasai rangelands contribute to the more extreme lows in the river flow, because they use water from the Mara and tributaries for irrigation. The official water permits in 2003 allow an amount of water to be extracted from the Mara River that could rise up to 25 percent in the dry season water flows in the Mara River. However, the official authorities lack the capacity to enforce these permits and the total amount of water used for irrigation is thus probably much higher (Gereta et al. 2003: 11). The lower dry season water levels in the Mara River are a concern for the livestock keepers near the national parks, but also for people depending on these wildlife parks for tourism related incomes. In the dry periods, the Mara River and some water pools are the only water sources in the region for domestic use, livestock and wildlife. Accessional droughts are common in the region, but the more extreme lows in the river flows increase the social-ecological vulnerability for droughts. At the end of the droughts of 1993 and 2005-2006, the Mara River was reduced to a series of small pools connected by only a sluggish flow, which was probably sustained by an underground seepage from the Mau Escarpment. These droughts had severe impacts on human beings, livestock and wildlife. (Gereta et al. 2003; McClain et al. 2006).

These impacts could enlarge in the future and affect the world-famous protected areas. The most famous and one of the most important phenomenons of the Mara-Serengeti ecosystem is the herbivore migration. This migration brings large groups of herbivores in search of water and pasture to the Mara River during the dry season. It is listed as an UNESCO-heritage and one of the major tourist draws to the region. During the drought of 1993, about 20 percent of the wildebeest population died and this rate could increase during future droughts if the river flows are further reduced in de dry season (Gereta et al. 2003: 16). The wildebeests already changed their migration pattern in 1993 and moved to villages where they were sometimes slaughtered by people who also suffered the consequences of this drought. If the dry season flows in the Mara River decrease even more, the migration pattern of the wildebeests might change and consequently the entire ecosystem might start to behave

[11] This is the largest ethic group in Kenya.

differently. The importance of the herbivore migration is underscored by the fact that many predators also follow the migration and that the wildebeest calve during their stay around the Mara River. Eventually, the ecological changes could have an impact on the tourist arrivals and thus employment and foreign revenues in Kenya and Tanzania (ibid: 17-35).

Furthermore, other trade-offs are caused by large-scale farmers that use pesticides and other chemicals to increase yields and protect crops against pests. Small-scale agriculture is not always accompanied with erosion-protective measures and cattle dips are sometimes located near the riverbanks. Consequently, agro-chemicals and nutrients end up in the rivers and pollute downstream areas (Gereta et al. 2003; Awer et al. 2004). In a water quality assessment, Singler and McClain (2006) found that concentrations of this kind of polluters[12] were below the existing standards, but also stressed that even small amounts of these compounds have the potential to create deleterious effects if they accumulate in food chains or contribute to eutrophication[13] (ibid: 34).

3.4 Literature findings on land cover change and trade-offs around the Mara wetlands

Tanzanian land cover changes

On the Tanzanian side of the basin the single most eye-catching phenomenon on the maps is the expansion of the wetlands. However, next to the wetland expansion also the shift from shrublands into grasslands between the maps of 1973 and 1986 is noteworthy. The literature reconfirms this development. The upper hills in this region are mostly deforested and shrublands are under pressure because of a high demand for fuel wood (URT 2003: 82; Matie et al. 2005: 3). This demand of fuel wood grows exponentially together with the population, which has been growing with about 2,6 percent per annum since the 1960s (URT 2003; Kideghesho et al. 2006). Furthermore, because the Mara River is the only permanent water source, human settlements tend to concentration near the water sources. This concentration of human activity such as cultivating on slopes near the water bodies, (over)grazing and trampling caused by cattle, fuel wood collection, and charcoal burning, is causing visible soil erosion (Mbuya 2004; Yanda and Majule 2004).

Other causes for the reduction in shrublands are found in clearance of the vegetation that takes place for tsetse fly eradication and expanding agricultural practices (URT 2003: 82). Especially in Serengeti district many people shift frequently to new lands because there exist a large quantity of accessible land. Consequently the farmers clear more trees. Some information points at an interaction between the expanding croplands and unsustainable pastoral land use. The land requirement for the amount of livestock in Serengeti district exceeds the available land by 30% (Kideghesho et al. 2006: 940). And gully erosion is frequently observed in the Mara Region in general (Yanda and Majule 2004).

Especially during the 1980s population growth was accompanied by large-scale social insecurity and unrest in the region. This situation was most clearly visible in large-scale cattle raiding and intra- and inter-tribal conflicts. As a result the pressure on natural resources near population places, where there was still a certain degree of security, increased.

Mutie et al. (2006) and Mati et al. (2005) interpret the rapid wetland expansion by two processes that are caused by the land cover changes in the entire Mara basin: a faster run-off of rainwater and erosion of the top soil. The effect of decreasing vegetation on the run-off of rainwater in areas with a lot of relief (like the Mara basin) is shown in figure 3.1.

[12] In this conclusion the authors refer to nutrients, mercury, pesticides and PCBs (Polychlorinated Biphenyl)

[13] This is: "*a process whereby a body of water becomes rich in dissolved nutrients through natural or man-made processes. This often results in a deficiency of dissolved oxygen, producing an environment that favours plant over animal life"* (eobglossary.gsfc.nasa.gov/Library/glossary.php3) Accessed on 22 Nov. 2007).

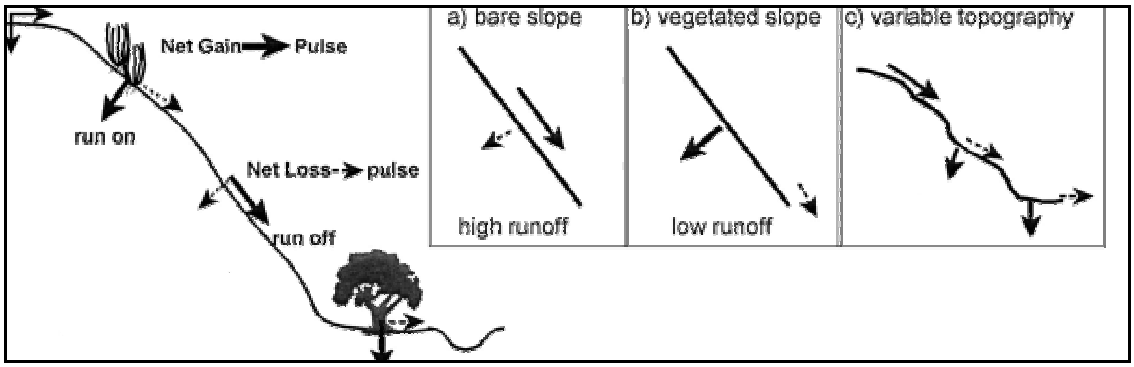


Figure 3.1: Effect of decreasing vegetation on the run-off (source: Belnap et al. 2005)

Computer simulations for the run-off and available river flow data reveal that the general decreases in land cover have fastened the run-off of rainwater. As mentioned above, this results in larger fluctuations in the river flows between the dry and wet seasons. The larger peaks in the wet season have caused more extreme inundation of the downstream floodplains. On top of this, the increase in soil erosion has accelerated the accumulation of sediments in downstream Tanzania that subsequently has blocked the water to flow into Lake Victoria (Mati et al. 2005; Mutie et al. 2006). Taken together, these processes have created a situation, in which the river has become incapable to handle the discharge of its water flows. Consequently, a 'back water flow' from the lake started to affects the floodplains up to 40 kilometres inland. These processes have contributed to more extreme and prolonged inundation of the downstream floodplains in Tanzania and subsequently to a rapid expansion of these wetlands (Mati et al 2005; Mutie et al. 2006).

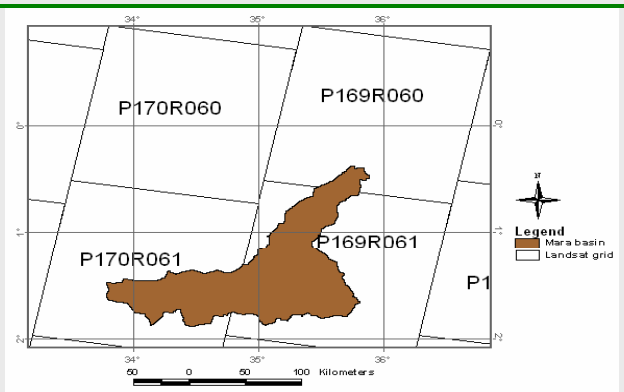
Mturi (2007: 50-55) stresses that next to these land cover changes, also the dynamics in downstream Lake Victoria have contributed to the wetland expansion. For the years between 1969 and 1977 there exist a stronger correlation between the highly fluctuating water levels of Lake Victoria and the water depth of the wetland near Musoma Bay than between the changes in the water quantity in the river flow and the water depth. This turned out to be true for both the rainy seasons when the river discharge is high and for the dry seasons when the discharge is low. For this reason, Mturi (2007) concludes that the water levels in Lake Victoria seem to be the most dominant factor in determining the depth of the wetland. In the same study, no correlation was found between rainfall in Musoma town and the water depth of the wetland, but it should be noted that the rainfall patterns in the Mara region show a high degree of variability in both space and time (which indicates the uncertainties of this analysis).

Uncertainties in these concludions are also admitted by and underscored by further parts of Mturi's research (2007: 58). In a satellite analysis he classified the wetland expansion into three phases: a constant size between 1973 and 1984, a rapid expansion between 1984 and 1988, in which the wetland expanded with 140% (from 250 km^2 to 600 km^2) and a constant phase again between 1988 and 2006. Mturi admits that his statement about the lake levels as the most dominating factors in the wetland hydrology falls short in explaining this rapid expansion, because the lake levels did not rise significantly in this period. Moreover, it should be noted that satellite picture analyses are accompanied with other uncertainties (see box 3.1). Mturi's clasification appears in contrast with the GIS maps in section 3.2, because he describes the largest expansion between 1986 and 1988 (by 129%). This can explain the large differences in wetland size between 1986 and 2000 as observed by this other study. Basically, the contribution of Mturi's study reveals that the largest expansion may have occurred between 1984 and 1988, while the GIS maps (Mutie et al. 2006) used the year in between these years (1986) for their interpretation.

Box 3.1: Factors of uncertainty with GIS map analyses

Impressions of land cover changes derived from satellite pictures contain some relevant uncertainties. The problem is that the maps used for this study are only based on one snapshot for each year. Therefore, these maps may include seasonal changes in the analyses that are portrayed as long-term dynamics. This is in particular true for areas with strong contrasts between dry and wet seasons like the Mara basin. Moreover, this area is known for a high degree of rainfall variability over the years. This can, of course, influence snapshots that are used for describing the land cover changes. These uncertainties are in particularly relevant in the case of measuring floodplain wetlands. The Mara floodplains only inundate regularly during the wet seasons and snapshots can thus easily display seasonal changes instead of trends that occur during decades. For the analysis of the GIS maps, Mutie et al. (2006) have used the snapshots as displayed in the table below.

Map for the year:	*Landset used from the (date):*
1973: P181R60	1-1 1973
1973: P181R61	29-7 1975
1973: P182R61	31-8 1973
1986: P169R60	28-1 1986
1986: P169R61	28-1 1986
1986: P170R61	18-10 1986
2000: P169R60	27-1 2000
2000: P169R61	27-1 2000
2000: P170R61	12-7 2000



From this figure we can conclude that the data obtained for the Tanzanian (and wetland) part of the basin derives from the 31st of July 1973 (dry season), 18th of October 1986 (rainy season), and the 12th July 2000 (dry season). These three dates differ quite a lot in seasons and can thus easily misrepresent seasonal changes for longer-term dynamics. In addition, also after reviewing the dates of the snapshots, we are still in mystery about both the amount and timing of the rainfall in the different years. Moreover, it is important to stress that also Mturi (2007) did not use multiple snap- shots per year for his analysis. From the table below, it becomes clear that satellite images from different seasons are compared with each other.

Lansats used for wetland expansion analysis by Mturi (2007)
Landsat MSS: 31st of July 1973
Landsat TM: 28th of May 1984
Landsat TM: 15th of August 1986
Landsat TM: 18th of February 1988
Landsat TM: 3rd of September 1990
Landsat TM: 5th of September 1995
Landsat TM: 14th of August 1999
Landsat TM: 7th of September 2002
Google Earth Image: 15th of March 2007

The dates from the snapshots are no direct reason to reject the conclusion about the rapid wetland expansion between 1984 and 1988. The measure of the 1984 wetland size derives from a snapshot taken shortly after the long rainy season, while the 1988 snapshot was taken one and a half month after the ending of the short rainy season. Therefore, this analysis might even underestimate the expansion. In addition, the timing of the snapshots in the second constant phase between 1988 and 2002 can affect the conclusion because they are all taken at the end of the long dry season. However, as we are still in mystery about the possible differences in both the amount and timing of rainfall between the years, it is impossible to give any judgments about the influence from the timing of the snapshots on the conclusions.

From these elaborations we can sate that we are facing many uncertainties concerning the causes and nature of the wetland expansion. This emphasizes the importance of generating understanding in differences between the seasonal changes (inundated flood plains) and permanent wetlands. On the satellite pictures as shown below, we can receive a glimpse of the differences between the longer during expansion of the wetlands and the seasonal dynamics.

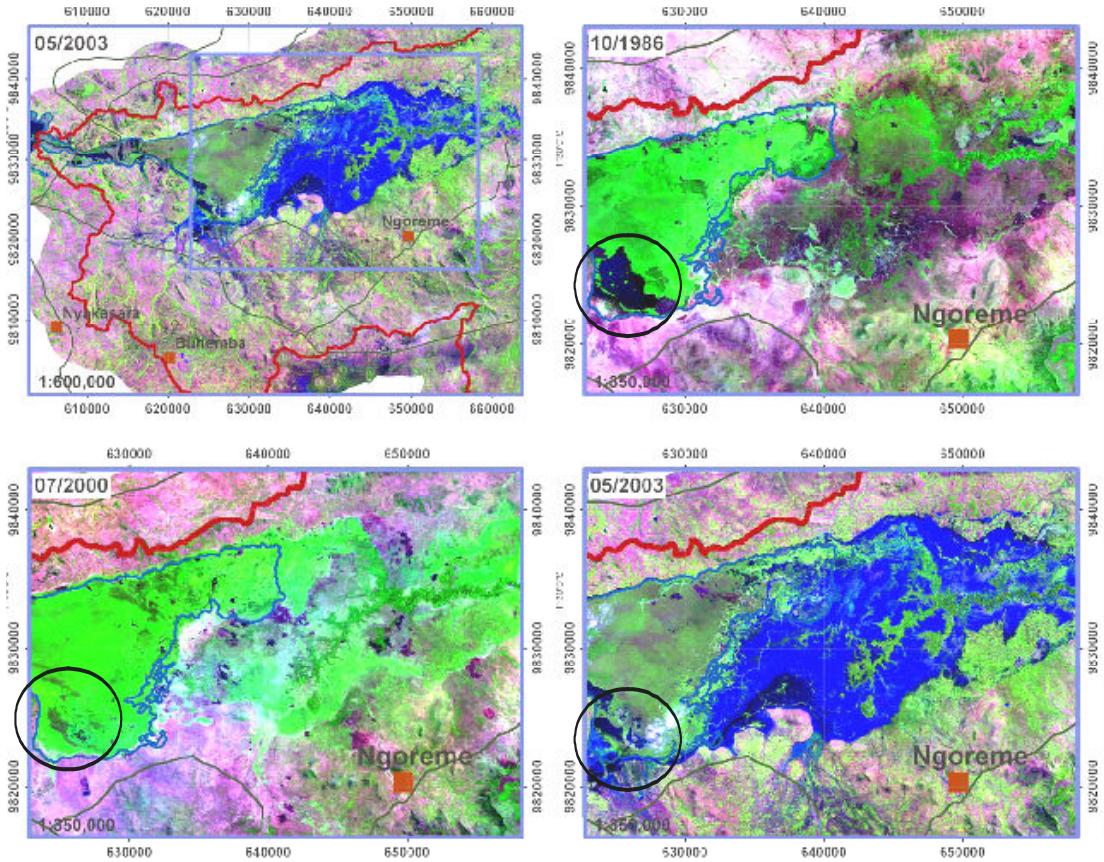


Figure 3.2: Satellite pictures from Mara wetlands (source: McClain / GLOWS 2007)[14]

These satellite pictures reveal interesting insights concerning the different aspects of the wetland expansion. First of all, the seasonal dynamics are clearly visible. The wetland appears as a large green area (thus covered by vegetation) on the pictures made in the dry season and beginning of the short rainy season (in October 1986: right-top and July 2000: left-bottom). On the snapshot made at the end of the long rainy season (May 2003: right-bottom), all the floodplains and also a large part of the wetland vegetations, are covered with water.

Furthermore, the changes between the different years are also eye-catching since these reveal more aspects than just a linear expansion. A process of silting or drying-up of water bodies is visible within the circles drawn in the left-down corner of the pictures. At the end of the dry season (October) in 1986, there exists a large inland lake, but on the picture made in the beginning of the dry season in 2000, only a few dark spots (shallow water) appear on the picture. Moreover, on the picture made at the end of the long rainy season in 2003, this lake only partly regained its size while the valley upstream was entirely inundated. Furthermore, a large part of the land cover of the wetland seems to have changed from a dark color with green spots in 1986, to a more 'wetland vegetation color' in 2000. It remains hard to judge whether this change has its origin in seasonal or in longer-term processes.

[14] The pictures are taken in the same periods as the ones used for designing the GIS maps presented in section 3.2. The picture at the left-top is taken at the same date as the one at the left-bottom, but represents a larger area.

Trade-offs through the river in downstream Tanzania

The visible changes (wetland expansion) caused by trade-offs from the basin and Lake Victoria scale have been already explained in the previous section. Observers have noted some implications of the wetland expansion for the local inhabitants. People used to be able to cross the Mara River and wetlands in the dry periods, but nowadays the valley is waterlogged to the extent that this crossing is impossible. In addition, the expanding wetlands have swallowed former pasture and arable land, but also provide fertile sediments for agriculture that have drifted on the shores (Mati et al. 2005).

Next to the water quantity, also the water quality in the Mara River and wetlands is a point of concern. In the earlier mentioned water quality assessment, it has been found that the organic matters are most abundant in the wetlands near the river mouth in Tanzania. In this area, the nutrient concentrations are above the natural levels and appear to cause eutrophication. The actual source of this eutrophication is difficult to find out, but agriculture in the basin seems to be the main contributor to this problem, because nutrient concentrations in the river reach their highest peaks in the areas where agriculture is most intensive (Singler and McClain 2006: 34). Because general mineral contents in the river also increase from upstream to downstream areas this means that there appears to be a large influence from these upstream areas towards the downstream areas. The general increase of minerals is probably also linked to the influences from mining and evaporation of water from the river surface (ibid). Moreover, the impact of soil erosion is also observed in the silting of water bodies. The decreasing open water bodies have caused a decrease in the availability of some fish species from 1990 onwards (Mutie et al. 2006; Mturi 2007).

Another point regarding the water quality is the expansion of small- and large-scale-gold mining in the Mara region. Especially the small-scale gold miners use mercury in a risky manner. Small quantity of mercury in the water can have disastrous effects on the social-ecological system (Yanda and Majule 2004; Singler and McClain 2006).

Trade-offs between the Mara wetlands and Lake Victoria

Besides the mentioned interconnection between the fluctuating water levels in downstream Lake Victoria, the basin interacts in more ways with this lake. Especially since the 1990s, increasing amounts of sediments flowing into this lake from river basins in general have contributed to both eutrophication and an invasion of the water hyacinth. This is a large problem for the inhabitants around the lake that depend on its water for domestic use and fisheries. Many observers blame population growth and land use changes for the problems.

The increasing population pressure is not only causing more soil erosion, it also contributes to wetland degradation. Consequently, the so-called buffer function of these habitats between the basins and the lake declines. Wetlands around Lake Victoria in general, and papyrus wetlands (like the Mara wetlands) in particular, are known to trap and retain sediments in the river flow before the water reaches the lake. This function of the wetlands is said to have an important potential for improving the ecological situation in the lake (Balirwa 1995; Kassenga 1997; Bucceri and Fink 2001; Machiwa 2003; Gichuki 2003).

On top of this, wetlands are known as important refugia for endangered fish species, which are common in Lake Victoria due to the tragic introduction of the Nile perch[15]. In spite of the importance of the wetland functions, many of the wetland habitats are being degraded. Scholars blame, next to the population pressure, the following processes for this degradation: declining water levels in Lake Victoria, extensive water extraction for agriculture, pollution from agriculture and urban centres, and vegetation destruction for grazing and agriculture (ibid).

[15] The introduction of the Nike perch in the lake's ecosystem has led to a disastrous decrease in diversity in fish species in the lake.

3.5 Transboundery problems and management in the Mara basin

In the year 1983 the first dispute between Kenya and Tanzania about the Mara River took place. In the late 1970s, the Tanzanian government had initiated a development program for hydropower, flood control and irrigation. There were plans to reclaim the Ikongo valley for sugar plantations and smallholders farming. In 1983, these activities came to a halt because there was no bilateral agreement between Kenya and Tanzania on shared water use. Kenya did not have any plans on water management, but by that time, the officials were not prepared to make promises about future water use (Matondo 2000: 2; NELSAP 2002: 3).

Another dispute took place in the 1990s when the Kenyan government proposed two projects that could influence the water flows downstream significantly (Gereta et al. 2003). The first project was a hydropower project referred to as the Amala project. This project included three dams in the Ewaso River and a diversion from water from the Amala River (a tributary of Mara).

The second project aimed at providing more agricultural land for the Kenyan citizens. For this purpose the degazettment of the Mau Forest was proposed. This forest is of great importance for the Mara hydrology because it is the basin of the main tributaries of the Mara River. Further deforestation of these forests would accelerate the already rising fluctuation in the river flow.

On top of these two projects, the already mentioned introduction of large-scale farming in Kenya also contributes to the lower lows in the river flow. Gereta et al. (2003) calculate with computer simulations that the combination of these three developments could be devastating for the ecology and people that rely on the Mara River around the protected areas and in downstream Tanzania.

Gereta et al. (2003) further state that most of the benefits from these projects and developments will go to Kenya while the disadvantages will be carried by Tanzania. Therefore, they stress the importance of the composition of a transboundery authority in the Mara watershed.

Presently, there are some signs that the first steps for a transboundery institutional framework are being taken. The Nile Equatorial Lakes Subsidiary Action Program (NELSAP 2002) has proposed a three years project to develop such framework. With an approximate budget of US$ three million, this project aims to bring together various stakeholders, make risk assessments and to harmonize national water policies. The executing agencies are the Ministry of Water Resources in Kenya and the Department of Water Resources in Tanzania, and the implementing actors will vary between international consultants, local resource user groups and the sub-basin water offices (ibid).

Furthermore, the World Wildlife Fund (WWF 2007) have expanded their project in the Kenyan Mara basin towards Tanzania and since 2006 started a five-year international transboundery initiative. This initiative includes (not exclusively): active support of the mentioned transboundery management efforts, organizing multi-stakeholder meetings, environmental education, securing biodiversity and establishing a knowledge management system. The WWF-program is carried out within cooperation with both the NELSAP initiative and the American institute ‘Global Water for Sustainability’ (GLOWS).

The multi-stakeholder meetings are reported to cause heavily loaded discussions between large-scale agriculturalists (that irrigate their crops) and pastoralist. The latter complain about the lower water levels in the dry season, while the first argue that they create a lot of employment and food-supply and thus benefit the livelihood system collectively (Awer et al. 2004).

3.6 Drivers of change and implications for the Mara wetland

This literature study reveals a high degree of interconnectedness within the Mara Basin and Lake Victoria. The wetlands are interconnected with local, upstream and downstream developments. Regarding the uncertainties around the validity of the GIS maps analysis it is important to stress that this type of analysis is not incorrect, bur rather incomplete. The observed changes can only be truly understood in combination with ground studies, which I will present in chapter five and beyond.

From the literature study we have learned that the main influences from the upstream and local areas are more extreme highs and lows in the river flow and soil erosion, which both contribute to the wetland expansion. These processes are caused by changes in land use that differ in scale and nature per each part of the basin.

In the Kenyan part both deforestation for fuel wood collection and expanding small- and large-scale agriculture are causing trade-offs to the wetland area. The main drivers behind these land use changes lie in a combination of a 'population explosion' caused by in-migration, institutional reorganization (e.g. shift from communal to private tenure) and economic opportunities (Homewood et al. 2001; Matie et al. 2005: 147). These developments have also accelerated land covers changes in the protected areas, even though the main drivers of these changes seem to lie in fluctuating wildlife populations and rainfall patterns. We have seen that the land use changes and accompanying trade-offs create tensions between different land users in the basin (e.g. tourism, animal keeping and crop cultivation).

In the Tanzanian part of the basin, the land use changes seem to be less severe as in Kenya and the decrease in shrublands appears to be the most prominent land use change. The literature gives population growth and unsustainable use of resources as the developments behind the clearance of shrublands. This major contrast between Kenya and Tanzania is explained by Homewood et al. (2001): in Tanzania, the communal land tenure systems, different market opportunities and agricultural policies reduce land use options and thus sustain the natural land covers[16]. However, the observation that human activity concentrates near the water sources in Tanzania points at possible anthropocentric influences on the wetland hydrology that are nor directly visible on satellite pictures.

The history of the governance of the basin shows mainly disintegration, but recent developments point into the direction of efforts in transboundery integration and an increasing attention from (non) governmental organizations for the dynamics in the basin. The proposed projects on the Kenyan site that were likely to affect the downstream areas are already abandoned or postponed. Furthermore, the possible effects from the trade-offs from upstream Kenya to the transboundery protected areas might bring the basin scale dynamics to the attention of more (inter)national organizations because of the fame of these protected areas.

The interaction between the Mara wetlands and Lake Victoria is threefold. Firstly, the rising water levels as portrayed in figure 3.3 are likely to have contributed to the observed wetland expansion. During the past century the main driver behind the fluctuating water levels in Lake Victoria has been rainfall variability, which is (partly) linked to global climatic events like El Niño[17]. The torrential and prolonged rains in the early 1960s and 1997 have pushed the lake levels upwards (Mistry and Conway 2003).

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[16] It must be noted that Homewood et al. (2001) focus on the changes in the Tanzanian territory east from Serengeti National Park, while the Tanzanian Mara Region is located on the west side of this National Park. There exist large differences in the context between these two parts (in e.g. climate, vegetation, population spread etc.) (ibid: 12545).

[17] This is: "*a periodic but anomalous warming of the surface waters of eastern equatorial Pacific ocean (off South American coast), which occurs irregularly every 2 to 7 years and disrupts weather patterns around the world"* (http://www.businessdictionary.com/definition/El-Ni-o.html) (Accessed: 25 Oct. 2007).

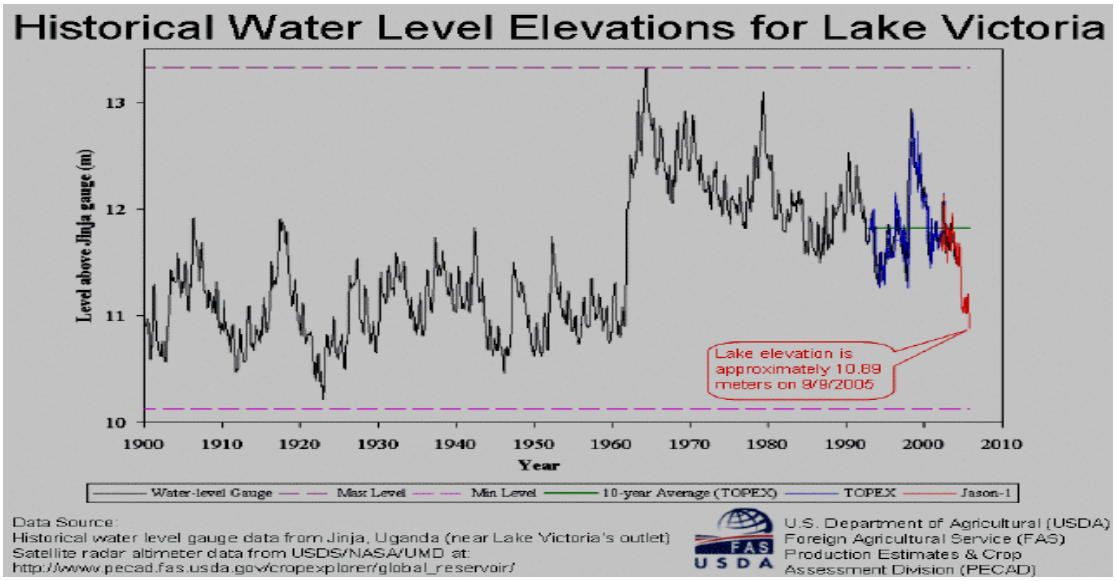


Figure 3.3: Fluctuating water levels of Lake Victoria in Jinja, Uganda (source USAID)

The receding water levels since 2000 are said to be caused by a combination of droughts and the installment of a new hydro-electric dam in Uganda. The Ugandan government is blamed for ignoring agreements about the lake that are made in the colonial era and seems to be in a dilemma because the country is in urgent need of electricity (Evans 2007). The second interconnectedness between the lake and wetland lies with the functions of wetland vegetation in trapping and retaining sediments, which are reducing negative trade-offs from the basin towards the lake. For this reason, the conservation of wetland habitats is an important point on the agenda of the organizations that are concerned about the lake's ecosystem (Machiwa 2003). The third interconnectedness has been found in endangered fish species that to find refugia in wetlands around this lake.

CHAPTER 4: INSTITUTIONAL DYNAMICS IN THE TANZANIAN MARA REGION

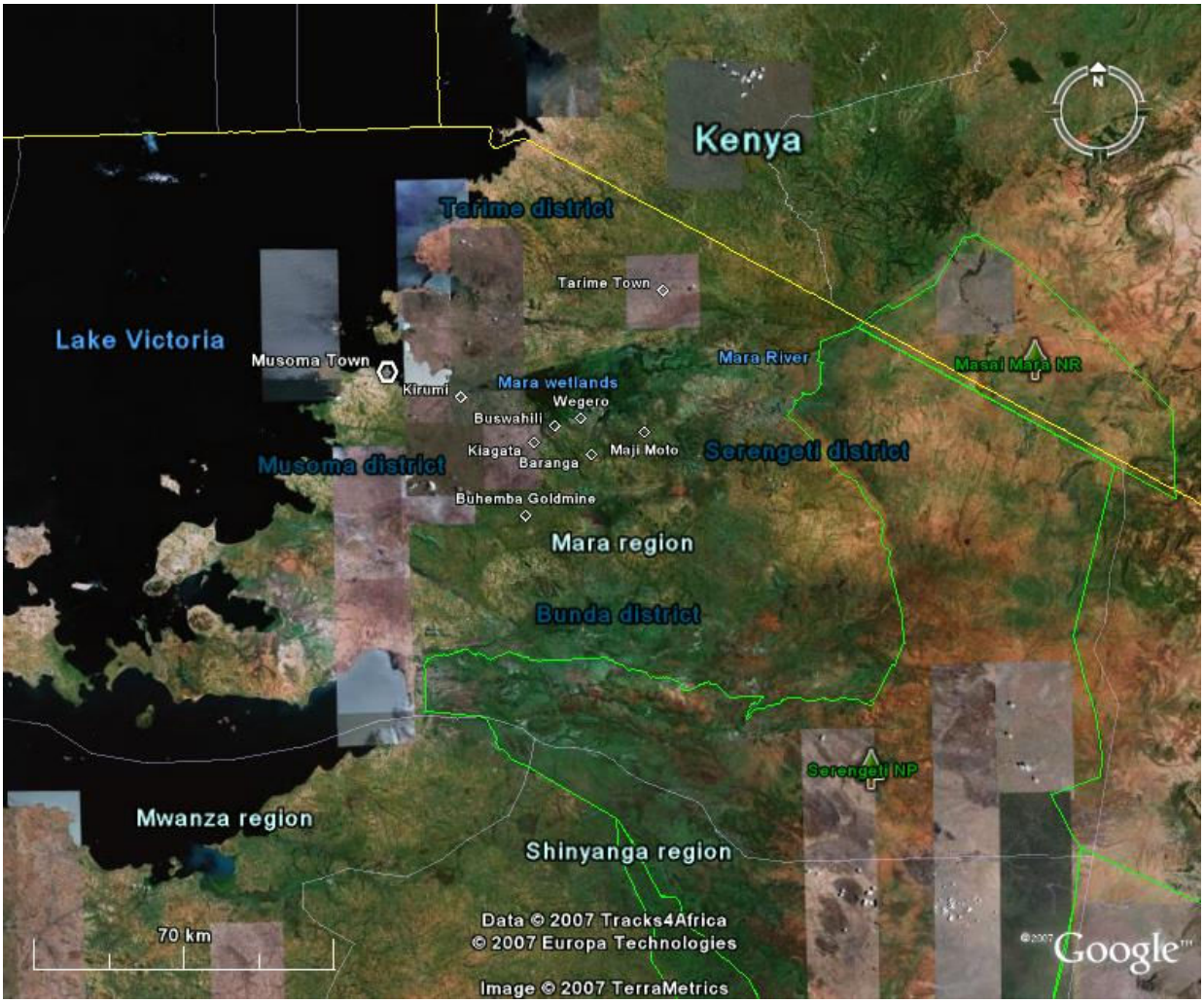
4.1 Chapter build-up and introducing the Mara region

This chapter concentrates on dynamics in the Tanzanian Mara region. The main focus is on how institutional dynamics from larger scales have influenced the local institutional setting since the pre-colonial period. Additionally, there is attention for population growth and the current state of the livelihoods in this region. This chapter finishes with a sketch of the institutional adaptive cycle for the Mara regions and an overview of some larger scale social processes that (probably) have influenced the fieldwork area.

Administrative divisions

The Tanzanian part of the Mara River basin falls under the Mara regional administrative unit. The Mara region is bordering Kenya to the north and flanked by Lake Victoria in the west. In the Serengeti National Park, which is covering both the southern and eastern borders of the Mara region, human activity is restricted.

In the Mara region the Mara River basin (and wetland) is located in three different districts: Musoma, Tarime and Serengeti district (Bunda is the fourth district in the Mara region, but only covers a very small part the Mara River basin). The district border between Tarime and Musoma/Serengeti districts follows approximately the Mara River and the northern shores of the wetlands (see map below). The border between Serengeti and Musoma district is located between Wegero and Maji Moto.



Map 4.1: Google Earth Map of the Tanzanian Mara region

Climate, vegetation, soil types and land use

The Mara River and its riparian wetlands are the only permanent water sources in the Tanzanian Mara region and thus of immense importance for the inhabitants of this region. In this region the wetlands and streams merge with many seasonal streams and rivers, of which the Tigitai, Suguti and Kyarana are the most important tributaries (URT 2003: 23).

The Mara region can be roughly divided into three climatic zones, which all cover parts of the Mara basin: the Northern zone, Central zone and the Lowlands. The wetlands are mostly concentrated in the Central zone. In all three zones the rain falls in two rainy seasons: the long rainy season between February and June and the short rainy season between September and January. The short rainy seasons are relatively unreliable in the lower areas of the Lowland and Central zones. The soil types in the region are formed by a combination of weathering of granite rocks and volcanic influences. There exist a large variety of soils in the region as for example: red sandy soils, light sandy loams, grey and black clays, and black cotton soils (ibid).

The Northern zone of the region comprises the Tarime and Southern Serengeti highlands. This zone receives an average rainfall of 1250-2000 mm per year. Because the high amount of rainfall is combined with well-drained fertile red or brown soils this zone has the greatest agricultural potential. About 12 percent of the total population of the Mara region lives in this part, resulting in a population density of about 295 per km^2. The most commonly grown crops are maize, cassava and sorghum. Important cash crops are coffee, groundnuts and tobacco. The indigenous cattle population is decreasing and slowly replaced with smallholders diary cattle (ibid).

The Central zone covers most of Musoma district and the eastern parts of Serengeti district (URT 2002: 2). This Central zone is typical of the central African plateau and includes the Serengeti National Park. It has a surface of 10.702 km^2 and a population density[18] of 53 people per km^2 (URT 2002: 2). This zone receives less rainfall: between 900 and 1300 mm per year. The rainfall is variable in this zone and the areas with higher altitudes receive generally more than the lower areas. Most of this zone is covered by black cotton soils, which are know both for its fertility and its hardness. They are very hard when dry and very heavy when absorbed with rainwater. Therefore the use of ox ploughing is a necessity for successful agriculture. Sorghum and maize are the most important crops in this area and a large part of the savannah and shrublands are used for indigenous cattle grazing. Paddy, which is grown as a cash crop, is becoming increasingly more common in the well-watered areas (ibid).

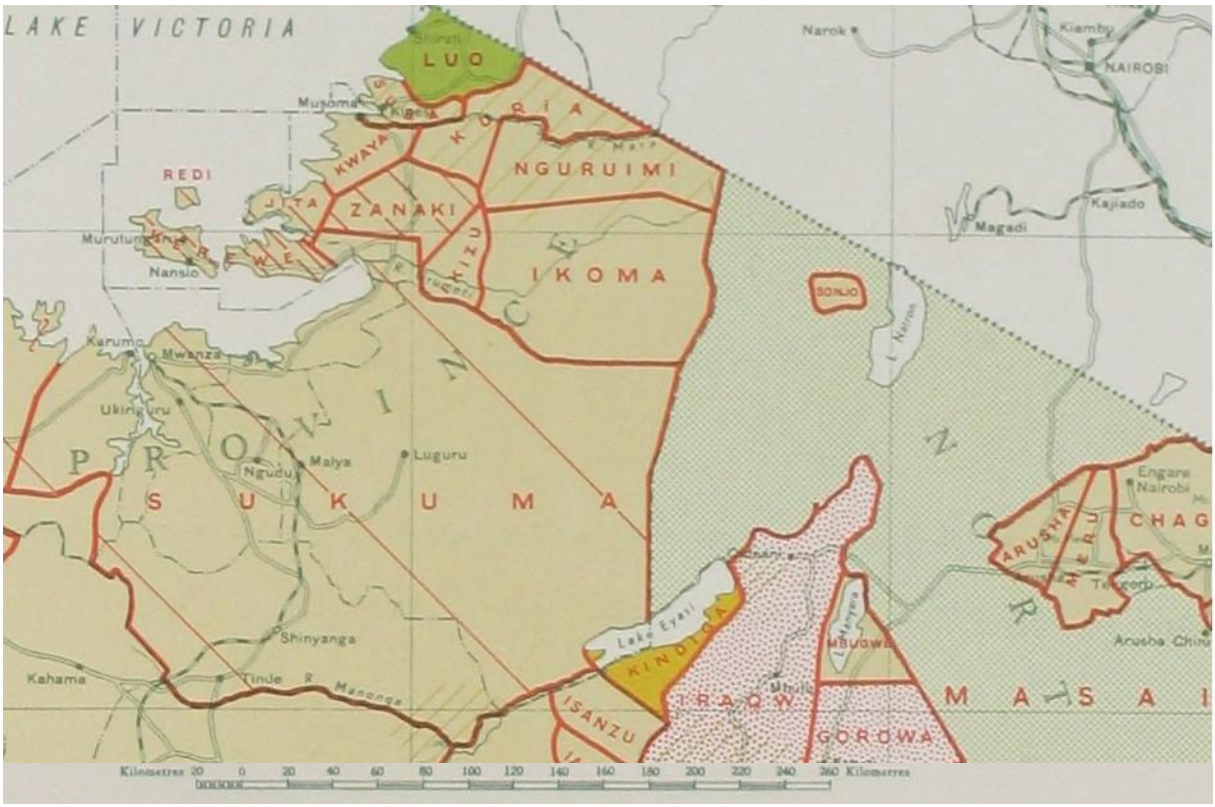
The third zone is called the Lowland zone and includes most of Bunda district and the lakeshores (ibid). The zone occupies an area of 3.500 km^2 and has an average population density of 131 persons per km^2. This zone receives only between 700-900 mm rainfall annually. Although some of the soils are light and sandy, others in river valleys and seasonal wetland are rather black and heavy. The combination of soil infertility and low rainfall forces people to focus on cassava for their main food crops. Cotton is the most important cash crop and paddy cultivation is increasing near the rivers and streams. Fishing in Lake Victoria provides, next to agriculture, an important livelihood occupation (ibid).

Ethnic groups

The Mara region is a mosaic of different ethnic groups (see map below). On this map the ethnic groups in and around the Mara region are shown. There are roughly 12 major different ethnic groups, which consist again out of about 43 smaller units, referred to as clans or smaller tribes (Shetler 2003a: 2). This fieldwork in this thesis focuses on one of the

[18] It doesn't become clear from this publication whether the surface of Serengeti National Park (in which human activity is restricted) is included in this figure. This means that the population may live more concentrated and that the population densities may be much higher in practice.

Kikurya speaking groups. These groups are neighboured by the Nguruimi, the Luo, Zanaki and the Suba. The Sukumu and Maasai surround the Mara region. All ethnic groups can be classified in different language groups. For example, the Luo speak a Western Nilotic language and the Kurya and Nguruimi languages are classified in the Bantu language group. This points at different origin of these groups, but there are also many linguistic similarities in the region. For example, most of the groups in the Mara region use similar words for supernatural beings (ancestors) and calendar months. Moreover, most groups practice a similar generation-class organization. This suggests a high degree of historical interaction between the ethnic groups.



Map 4.2: Ethnic map of Mara and surroundings (source: Tribal and Ethnographic Map Department of Lands and Surveys, Tanganyika 1956, third edition)

Though the Kurya are portrayed as one ethnic group on map 4.2, they can be also be separated in 11 smaller groups in Tanzania and even more across the border in Kenya. Seen from a Kurya perspective, these groups can be better described as individual tribes. The unifying features between these groups are the language and similar cultural repertoires concerning age-sets, rituals, livelihoods and social hierarchies. These features make it very tempting to simplify the social complexity and diversity in this region. As we will see in the next section, this oversimplification is a result from the Europeans who drew the borders between the ethnic groups, even though they didn't understand the social-ethnic complexity.

This complexity becomes clear in the general answers of Kikurya speaking people after being asked for their cultural identity: they will always answer with the name of their 'clan' or 'smaller tribe'. The importance of the differences in Kikurya speaking groups is also stated by anthropologists who stress that there exist no uniform group as the Kurya (Tobisson 1986: 95). Moreover, the Kikurya speaking groups do often hardly have any relations or practice only hostile interactions with each other. This complexity is even more visible in the fact that the neighbouring 'ethnic group', the Nguruimi speak a similar language, but clearly claim not to be Kurya. The Kurya, however, claim that the Nguruimi were once a Kikurya

speaking group and that they have alienated over the years. These elaborations point at a high degree on non-clarity in the ethnic origins and social relations. The complexity made me to decide not to threat the Kurya as one uniform ethnic group. Hence, I will refer to the people living in the fieldwork area as the Kikurya speaking Wakenye people[19].

Most records of oral histories state that these Kikurya speaking groups arrived from the region northwest of Mount Elgon, which is located on the border between Kenya and Uganda. A few observers claim that some of these groups have ancestral connections with the Maasai (Rwezaura 1985: 23). However, because the Kikurya language belongs to the Bantu and not to the Eastern Nilotic language group (like the Maasai language does) there must have been at least large-scale influences from other tribes. The great importance of cattle for the Kurya livelihood system and culture made many scholars argue that the Kurya were originally livestock herders that have later turned into a dual subsistence (including crop cultivation). If this transition indeed has taken place somewhere in history, it has happened before the arrival of the Kikurya speaking groups in the Mara region, because ever since they have lived in this region, there are records of crop cultivation (Rwezaura 1985: 23).

4.2 Social institutional history

Early history: A forgotten but prosperous region

Shetler (1995: 77) argues that the Mara region has been almost entirely forgotten or ignored for scholarly, colonial and national concerns. This low attention for the Mara region might be connected to the relative late large-scale immigration to this region. In the 18th and 19th century the region was a frontier in which settlers (including the Kurya groups) and refugees from the Rift Valley and 'Sukuma-land' formed new communities. Before this period other small groups had lived in the region for centuries, but the area was largely uninhabited (ibid).

The newly arriving ethnic groups brought their institutions and cultures with them. Many of these groups maintained kin ties with their home areas, while they also integrated with their new social environment. These characteristics created a social reality that was constantly in flux. This flux was visible in, for example, intra-marriages between different tribes. Due to these dynamics, a large trading network based on reciprocity connected the Lake Victoria area with the neighbouring areas. This network contributed to the relative prosperity of the region (ibid: 80-81). Another reason for this prosperity may have been the productiveness of the region. The first European visitors noted: *"whithersoever I turned my footsteps, I came upon stacks of corn, etc. and upon full granaries"* and described well-fed and healthy local people (ibid: 82).

On top of this productivity, the diversity of livelihood activities decreased the dependency on each of them and thus the livelihood sustainability. Animal keeping, hunting, fishing and crop cultivation were all practiced in an area where land was plentiful and people were scarce. In addition, the Mara region has a great variety of microenvironments that assures diversity in livelihood activities and stimulated exchanges between the different groups. These exchanges were necessary for survival in times of drought and accompanying crop failure, which are common in the region. The combination of the diversity in social ties, microenvironments and livelihood activities made it rare for the entire Mara region to experience famine at once. In times of food shortages, ties with the original home areas and other communities in other ecological zones came into use. These relations were based on reciprocity and trade (ibid: 82-83).

[19] The Wakenye are sometimes also defined as Bukenye and further divided between Bukenye 1 and Bukenye 2 depending on whether the people in question live on the northern or southern border of the Mara River (Shetler 2003a: 2).

The position of the Kikurya speaking groups in these trading networks was often good, because they mostly occupied both high and low land areas and thus could solve food shortages within their own clans in a reciprocally manner. And when outsiders faced food shortages, the Kikurya speaking groups were happy to exchange their staple foods for cattle, because the cattle receiving parties were often in a better position in these deals (Rwezaura 1985: 25).

Hostilities and external influences

Besides these peaceful social ties, the Mara region was also a place for conflicts as groups searched for domination of others. Villages were often fortified with stones or other materials. It is not sure how long these hostile relations date back (Shetler 1995: 84), but they surely were present in the 19th century and their origin could well have a connection with the major disasters that occurred in the second part of this century. The appearance of these disasters is linked with the incorporation of this region into the global Indian Ocean trading system, which had various influences on the local system (Shetler 2003b: 387).

First of all, although the main 19th century coastal caravan trade routes bypassed the Mara region, they did contribute indirectly to the insecurity by increasing the demand for slaves. Some local people reacted to this demand by hunting and raiding of people (Shetler 1995: 84).

In addition, these caravan routes brought small pox, sexually transmitted diseases and cattle diseases to the region. Especially rinderpest was disastrous for the region. Historical reports reveal that some Kikurya speaking groups lost almost all their cattle (Rwezaura 1985: 71). After the diseases reduced again, the people did not receive time to restore their stocks. The declining stocks of cattle had caused an internal conflict between different Maasai clans, which made some clans to expand their territory at the expense of other ethnic groups in and around the contemporary Serengeti National Park. At the end of the 19th century, these conflicts and (cattle) diseases caused food shortages and a declining power of the Maasai. These crises made the Maasai cattle to raid more cattle from their neighbouring ethnic groups.

Together, these events resulted in the 'Famine of the Feet' in 1890, when many people in the Mara region walked to Sukuma-land to find food. According to oral histories, these disasters marked the disruption from a period of welfare to one of famine. Moreover, the Maasai raiding resulted in large displacements of people, a decrease in cattle and the clustering of people. And these factors are seen again as the main drivers for a sudden increase in vegetation, which caused a rapid rise in the population of the sleeping sickness transmitting tsetse flies.

As a result of these disruptions, some ethnics groups fell apart, new once were formed and the institutional organization (concerning age groups) within the groups was changed significantly (Shetler 2003b: 387-388). The unity of some contemporary ethnic groups (e.g. the Nguruimi) in the region dates back from this period in which they united and combined force to defend themselves against the Maasai. These hostile interactions forced the people in the Eastern Mara[20] to forge their own identities and form new groups that were able to battle the Maasai. For the same purpose a new age set organization was established[21]. Eventually the united groups were strong enough to defeat the Maasai and to secure their resources (ibid: 406). This newly formed institutional organization paved the way for relative prosperity in the years following the disasters. Subsequently, this prosperity made it possible for the Eastern Mara people to avoid large-scale involvements in the migrant labour system, which took place in the beginning of the colonial period. Shetler argues that this example illustrates that *"a*

[20] Specifically this are the Ikizu, Sizaki, Ikoma, Ngoreme, Nata and Tatoga.

[21] Although not documented in detail for the Kurya in Tanzania, it is noteworthy that this age set reorganization also happened among the Kikurya speaking groups in Kenya (Fedders and Salvadori 1980).

long standing cultural repertoire for dealing with radical change already exist and could be trapped to address current problems. 'Tradition' is at least as adaptable as it is resilient" (ibid: 411-412).

Colonial influences

As noted already, European contact with the Mara Region came relatively late. The first Europeans that arrived in the region during the 19th century described the area as a wilderness that was filled a large number of wild animals. The Lake region was one of the last to be explored by European travellers. In general, the first contacts were characterized by misunderstanding and violence. The people on the easterly shores of Lake Victoria had a reputation of being 'warlike' and are reported to have massacred entire caravans that were only crossing the area to purchase ivory elsewhere.

Missionaries were reticent to start their work in the Mara region, because of the great variety of languages and cultures present in the region. One missionary remarked in the 1950s that the area had "*all the confusion of the Tower of Babel and that one should hope for a repetition of the miracle of the first Pentecost"* (Shetler 1995: 84-85). Other regions with more centralized powers, like in Sukuma-land, seemed to be more promising for their missions. Therefore, the Mara region was one of the least 'missionized' areas in the region (ibid).

Also the colonial authorities had difficulties to install their power in the region. After an Anglo-German agreement in 1890, the contemporary Tanzanian territory became known on European maps as German East Africa (Fleisher 2000: 753-754). The Germans tried to levy taxes, recruit African labourers and introduce their law and order with fines and punishments. For these purposes they installed collaborators as chiefs over the local people. This intervention was at odds with most traditional institutions in the region, in which councils of elders were often leading the ethnic groups. The German rulers forced a totally new system of rule over the people. They imposed (livestock) taxes and seized livestock in cases that these taxes were not paid. In other cases livestock was taken arbitrarily and without compensation (ibid).

These actions made some Kikurya speaking groups to justify the 'taking of' cattle from others. This changed the character of cattle raiding, which used to be institutionalised (on a small-scale at least) before. In the pre-colonial period Kikurya speaking groups made a distinction between raiders and thieves. Raiding was seen as a way that young man could prove their maturity. Moreover, the elders were (firmly) in control and received the profits of this raiding. During the First World War, the Germans were forced to withdraw from Africa. This situation created a power vacuum in the area north of the Mara River (ibid).

At the moment the British took over control from the Germans, popular movements had already overthrown all German-appointed chiefs (Shetler 1995: 86). Just as the Germans, the British also had difficulties in exercising power. They reinstalled local chiefs, but often blamed them for their incapacity in leadership. It was in this context that cattle raiding became the number one problem of the region and changed in character (Fleisher 2000: 754).

The British administration failed to draw lines between the tribes: the district officer had to adjust them constantly. Local resistance towards the British took forms from armed resurrections to sabotage of cash crops. A British commissioner described the people in this region as less obedient and progressive as the Sukuma and noted that some were even chasing government officials with spears (ibid).

One of the principle goals of the British colonial officials was to transform the Kurya from pastoralist into peasant cultivators. They hoped that people would start to create a surplus of cash crops in order to support the industrialisation in Europe. For this purpose, the colonial officers started to bother the Kurya pastoral components of the economy with taxes,

destocking, forced cattle sales, and also introduced drought resistance crops such as maize (Fleisher 2000: 755). In the highland areas these efforts were partly successful because of the fertile soils, but in the other areas the people tended to stick to their pastoralist traditions.

In these areas the money obtained from the newly introduced livelihood activities (e.g. mining and cash crops), was often used to purchase new cattle. In addition, the market for crops was not easily accessible for the inhabitants in the Mara region. Although the British rule had unified Kenya and Tanzania, these areas stayed two separated administrations, which made trade untenable.

However, eventually the determination of the tribes to stick to the importance of the cattle in their traditions was slowly eroded through the growing dependency for manufactured goods from Europe. In Tanganyika[22], the sales of cattle by Africans rose to its highest level in 1928 and Mara was no exception (ibid). This was, however, mainly caused by the colonial government that made selling a certain number of cattle complimentarily. Most Kurya people conducted many successful efforts to avoid these forced sales of cattle and taxations (Rwezaura 1985: 41-46).

Because an increase in the bridewealth rates, the importance of cattle raiding rose among the Kikurya speaking groups. The increase in bridewealth was connected to several factors. Firstly, in spite of all colonial efforts in destocking the number of cattle rose rapidly during the 1920s and 1930s. This was connected to a better control of cattle diseases and the newly emerged job possibilities like mining and employment in the British army. The livestock herder bought new cattle from their salaries (ibid: 71-72).

Secondly, although polygamy families had served larger community interests in the pre-colonial period, this form of family organization changed in character because resources became scarcer during the colonial period. This change came together with a decrease in the power of the elders in the communities, which was caused by the mentioned colonial interferences in the institutions. Moreover, the newly introduced livelihood activities (e.g. mining) gave younger people (also) opportunities to accumulate capital and made them more independent from the power of the elders. Some elders coped with the decreasing power and lower availability of resources by marrying more women. With more wives, they were able to claim more land and increase the productivity because women do most agricultural labour. This larger demand for brides pushed the bridewealth rates upwards.

Consequently, cattle raiding became an important option for youths that could not afford these high rates and for elders that used their control on raiding to compensate their economic losses (ibid: 79-83). Partly because the elders saw these high rates as a way to comply with the changing economic and institutional changes, attempt of the colonial government to control the bridewealth rates failed. Generally speaking, a high bridewealth meant a large income for the elders (Tobisson 1986: 27).

For these reasons, the North Mara cattle markets had completely shut down again for the lack of sellers after the colonial power had decreased in the Second World War. Cattle raiding, on the other hand, had in the mean time become *"an entrepreneurial capitalist enterprise"* (Fleisher 2000: 759). Especially the returning Kikurya speaking soldiers who had fought in the Second World War contributed to this increase in raiding, which now also happened beyond the control of the elders and was clearly connected to the high bridewealth rate (ibid).

[22] This used to be the name for the contemporary mainland of Tanzania. In 1964 Tanganyika joined with the islands of Zanzibar and later in that year the name was changed into Tanzania.

Independence, socialism and disorder

After National Independence of Tanzania in 1961 president Nyerere promoted national pride and introduced Kiswahili as the national language. There was minor attention for local ethnicities in his vision of African socialism. This has led to a much lower degree of tribalism compared with neighbouring Kenya (Shetler 1995). Nyerere's political party, the TANU (Tanzania African National Union), worked according a vision of African socialism called Ujamaa[23]. This vision started as a vision for 'an attitude of mind' but gradually changed into the enforcement of externally designed ('top-down') policies (Tobisson 1986: 36).

The most prominent part of these policies was the Ujamaa Villagization Program. In this program all residents were asked and often forced to live in the village centres, which were surrounded by small plots of land where the people grew their small individual crops. However, large-scale communal cropland became more important in this Afro-socialist program. Many residents agreed with the resettlement because of the promise of immense governmental support in agricultural production such as tractors and fertilizers. However, there are also reports that TANU militiamen used extensive force in the Mara region in order to organize this mass-movement of people (ibid). The Villagization program arrived relatively late in this region, but from 1973 onwards it affected the region in a similar ways as it affected the other parts of Tanzania.

The program had a serious effect on customary laws, because many different (ethnic) groups were forced to live together. The larger communal croplands were chosen by the authorities and located further away from the village centres (Shao 1986). This was combined with a shortage of government staff and consequently did lead to a lack of clarity in land-allocations, which were previously organized by customary law. Furthermore, due to haste of the implementation of the program, many village centres were not prepared to cope with the arrival of large groups of people. As a result, the hygienic situation in the village centres decreased and diseases spread more prominently than before. This also counted for cattle diseases. Moreover, large-scale cattle keeping in the village centres became a threat to the cropland, because cattle frequently destroyed crops in the new centralized setting (Tobisson 1986: 40-42).

The (forced) mass movement of people towards the village centres caused food shortages, because the people were forced to move during the harvest period. The government had tried to organize the movements in the dry periods, but overlooked the rainfall variability, which is common in Tanzania (Shao 1986). On top of this short-term problem, the land allocations conducted by the authorities disregarded the knowledge of the local people, who knew exactly which land was most suitable for crop cultivation. These allocations were based on observed patterns of successful crop cultivation in the wetter regions in Tanzania. Moreover, the larger distance to the communal croplands reduced the available time for working. For these reasons, the governmental aid, which aimed to increase agricultural production, did not succeed. In general the agricultural production declined (ibid).

The most prominent advantages of the Villagization Program were found in the improvement of education, medical and commercial facilities in the villages (Tobisson 1986: 43). These advantages did not compensate the earlier mentioned disadvantages and many people in Mara did abandon the Ujamaa principles soon after they saw the program didn't worked as expected. The village centres were left to be ruled by *"petty-bourgeois"* elements (Bugengo 1973). Moreover, the general settlement patterns continued to be more centralized after the temporary clustering compared with the pre-Ujamaa period.

[23] Ujamaa is the Kiswahili name for extended family or familyhood. This term was used by Nyerere to define his vision of African socialism in which co-operation and collective advancement were seen as the rationale of appropriate individual behaviour.

In the 1980s the Tanzanian government abandoned the Ujamaa philosophy and started to restructure its economy. President Nyerere first initiated these changes. After Nyerere left office, Tanzania's restructuring was highly influenced by the Structural Adjustment Programs from the World Bank (Tietenberg 1997). This led to higher financial budgets, but not only to better outcomes of policies (in Tanzania as a whole). The institutional changes aimed at more suitable pricing of crops (before, these were highly influenced by socialist planning), better product marketing and more utilization of industrial capacity. These policies are said to have increased agricultural-output prices but these benefits were reduced again by inflation (ibid).

The rising agricultural output and exports, and industrial imports caused a higher income per capita. However, most farmers did not benefit from this because the prices for their crops did not improve and the costs for inputs such as fertilizer rose. At the same time, employment declined and the minimum wages decreased. In general, many Tanzanian farmers reacted to these economic problems by clearing more land for agriculture. Moreover, the declining access to agricultural inputs had an adverse effect on soils conservation (ibid).

Especially in the 1980s there was a lack of socio-political regulation in the Mara region. This led to an unstable situation in which intra - and intertribal conflict terrorized the region. These conflicts were most visible in cattle raiding and vital clashes between groups. Moreover, the social insecurity led to large-scale migration to uninhabited areas in the Serengeti district. This made some ecological areas to be under-utilized, while others were over-utilized (Christiansson and Tobisson 1989: 64). Despite about ten 'crackdowns' of the military wing of the national police and the deportation of 200 cattle raiders to other part of Tanzania in the 1980s, the order in the region could not be restored (Fleisher 2000: 214; Heald 2005: 266). One of the consequences of cattle raiding was a large decrease in cattle in the raided areas[24] between 1978 and 1995.

In the early 1990s, government officials initiated an alternative way to restore order in the region and sponsored a form of village vigilantism referred to as Sungusungu. In Tarime district, there exist multiple layers in the hierarchical system that leads the Sungusungu groups. There are commanders on district, division and village levels. The idea behind these layers is that in case of law violations, the village leader informs the higher levels, and then after consultation he will have the right to 'arrest' perpetrators (with the help of the village based Sungusungu group) (Fleisher 2000).

The autonomy of the groups goes quite far: they are allowed to codify their own laws and punishments (Heald 2005: 280). First it appeared that cattle raiding cooled down after the establishment of this substitute for the police, but this just turned out to be a short improvement as the late 1990s showed more incidents of cattle raiding again in Tarime district. Although the Sungusungu groups may have improved stability in the region, they seem to lack the capacity and integrity to eradicate cattle raiding on a desirable way for more reasons. Firstly, while the cattle raiders own firearms, the Sungusungu's only posses bows, arrows and knifes. Secondly, there are reports of Sungusungu groups using extreme force and even murdering perpetrators. Thirdly, some people have reported that Sungusungu leaders turn a blind eye to certain perpetrators after these people have provided them some money (Fleisher 2000).

Recent newspaper editions still report about ethnic conflicts over land access and cattle raiding in the region (e.g. Mugini 2006a and 2006b). These conflicts, together with reported exploitation of women, are some of the reasons why the Mara region still has a reputation as backward even though Tanzania's first president Nyerere was born in the region (Shetler 1995).

[24] Especially Tarime district, but massive raids also occurred in Serengeti and Musoma Rural.

4.3 Population dynamics

The total population of the Mara region for 2007 was projected to be 1,563,000 million. Of these people, by far most live in rural areas. With a projected urbanization of 13,7% in 2003 the Mara region is one of the least urbanized regions in Tanzania (URT 2003: 16). The following table gives an overview of the regional population growth and shows that the four censuses in the last 40 year display an almost constant annual population growth of about 2,6 percent.

Census year	**Total population**	**Average annual growth**
1967	544,145	
1978	723,827	2,6% (1967-1978)
1988	952,616	2,6% (1978-1988)
2002	1,368,602	2,5% (1988-2002)
2012 (projection)	1,785,000	2,7% (2002-2007)

Table 4.1: Population growth in the Mara region (URT 2003)

However, as the table below reveals, the population growth and densities differ a great deal per district.

	Percent Growth Rate				**Population density per km^2 on Land Surface**
District	1967-1978	1978-1988	1988-2002	2002-2012	2007 (projected)
Musoma Urban	6,5%	4,5%	3,3%	4,5%	-
Musoma Rural	2,0%	1,7%	2,1%	1,9%	-
Musoma Total	2,7%[25]	1,8%	2,4%	2,6%	255
Tarime	2,7%	2,8%	2,8%	3,0%	147
Bunda	-	1,9%	2,3%	2,2%	104
Serengeti[26]	2,4%	7,5%	3,3%	2,8%	52
Total	**2,6%**	**2,6%**	**2,5%**	**2,7%**	**124**

Table 4.2: population growth and density per district (URT 2003)

The relatively high population density in Musoma district is obviously connected to the fact that the largest urban centre, Musoma Urban, is located in this district. Another striking number is the relatively low population density and the temporary high population growth (between 1978-1988) in the Serengeti district. The extremely high population growth in the 1980s was connected to in-migration, caused by the insecure situation, which emerged due to the mentioned cattle raiding and additional conflicts (Christiansson and Tobisson 1989). The high growth rate of Musoma Urban points at a continuing process of urbanization, which is common in most African countries. The low population growth in Musoma Rural can be also linked to this process of urbanization. This district neighbours Musoma Urban and therefore many people might move to the city more easily.

The household size in 2002 differed between an average of 4,9 people per household in Musoma Urban to 6,1 people per household in Musoma Rural and Bunda district. Most of the rural people in the Mara Region live in homesteads. These homesteads often consist of one family, mostly including one male head, his wife or wives, all unmarried children and all married sons with their wives and children (Fleisher 2000: 22). Polygamy is practiced in the region, but this practice is slowly replaced by monogamy (UTR 2003).

[25] Includes Bunda District, which was part of Musoma by then.
[26] The surface of Serengeti is calculated minus the surface of the National Park.

4.4 Contemporary Livelihoods

Tanzania ranks the 162nd position on the United Nation Development Index (2006), which comprises 177 nations. Moreover, in the year 2000, the income per capita in the Mara region ranked the ninth lowest position of the 20 mainland regions in Tanzania in its income per capita (URT 2003). Hence, we can state that we are focussing on one an area that faces major constraints in 'development'.

There doesn't exist extensive research on average income per head in the Mara region. The Socio-Economic Profile (URT 2003: 32) states that in 2000 the annual income per capita was TSH 181.113 (US$ 226,-). However, other researchers calculated incomes in various districts at between US$ 555,- and US$679,- or US$150 and US$200 annually per household (Kideghesho et al. 2006: 938). Because these households consist of approximately 7 persons, this points at a far lower income per capita as the US$ 226,- calculated by the district. Of course, these figures only become comparable with other regions and countries after they would be combined with price assessments.

About 90% of the residents of the region depend on crop cultivation, livestock and/or fisheries. Many combine some of these activities in their homestead-based livelihoods and all components can contain multiple functions. Livestock, for example, can be used as draught animals for ploughs and transport, storing and accumulating wealth, meat production, ensuring food security, fertilizer (manure), milk consumption and sales, brideweatlh and cultural prestige (URT 2003: 25). In addition, both cash and food crops are grown.

The most common food crops grown in the region are cassava (36% of total land under cultivation), sorghum (24%), maize (23%) and sweet potatoes (14%). According to the Regional Socio-Economic Profile the main constraints in crop cultivation are unreliable rainfall in the lowlands, pests, and soil infertility of the sandy soils (around Lake Victoria). However, this report also stresses that the agricultural potential is huge, because only about 20% of all total arable land[27] is cultivated annually (ibid: 35). Between 1996 and 2002 the amount of land used for crop cultivation has increased by 38% and the harvest in tonnes with 48% (ibid: 38-44). The food crops are the main staple food for the inhabitants in the region. The production of these food crops is liable to fluctuation. In the last three years of the previous century, the region's inhabitants failed to produce sufficient staple food for the region. This situation that was (also) connected to the 1997 El Niño rains and the following drought in 1998. The only district that could generate surpluses in all the years between 1996 and 2002 was Serengeti, which is explained by its low population density and virgin soils (ibid: 58-64).

After crop cultivation, livestock is the second most important contributor to the region's GDP. It is estimates that about 51% of the region's population keep livestock (cattle, goat, sheep or donkey). According to the livestock census[28] in 2002, the population of cattle reached 1.291.576, which implies an increase of 33% in comparison with 1984. The cattle density in 2002 was calculated on 66 animals per km^2. The number of goats increased in the same period with 65% up to a total of 620.748. The number of sheep decreased with 17% in this period to a total of 179.018. The livestock sector is facing a lot of constraints. After the socialist era, the government has withdrawn from free supply of veterinary services. The extension officers are there to provide only advices and individual cattle owners have to buy the expensive medicines themselves. Moreover, especially tick born diseases (e.g. ECF, Anaplasmosis, Hearth Water and Babesioses) are a large problem. These problems are connected with the situation that more than 50 percent of the region's 113 dipping facilities

[27] From this publication it doesn't become clear whether these non-crop lands are otherwise used as pasture.
[28] During the fieldwork I was frequently told that the census numbers are not reliable because many people tend to reveal lower number of livestock out of fear for taxes or other governmental intrusion.

are not functioning. Other constraints in livestock keeping are: low rate of improved cattle breed, cattle raiding, and a lack of reliable water sources (ibid: 67-88).

Fisheries are an important source of income and proteins in the region. Especially the youths near the lakeshores practice a lot of fishing. The sector is partly commercialized and export orientated with two major fillet-packing factories that are located in the region. Other livelihood activities in the region are in: bee keeping, tourism, industry, trade and mining (gold, limestone and gemstone) (ibid: 87-95).

4.5 Institutional adaptive cycle for the Mara region

The literature on the institutional dynamics sketches a picture of a highly dynamic area. As stated already, the present cultural identities and institutions of the people in Mara are formed by many interactions between different ethnic groups and larger scale dynamics. The people managed to reorganize their institutions quite smoothly after the incorporation in the Indian trading system. This reorganization clearly took place as a result (or in the context of) of shocks and catastrophic release phases visible in (cattle) diseases, cattle raiding and famine.

The newly emerged setting soon fell under influences from the colonial rulers. Local people adapted to these influences in resistant ways constantly. The colonial influences decreased the power of the traditional authorities (the elders) and oppressed the pastoralist components from the livelihood system. Some elders tried to cope with their losses in power and resources by refusing to control the bridewealth rates and with the exploitation of women.

The first Tanzanian government inherited a chaotic institutional context and accelerated the problems with the introduction of the Ujamaa Villagization Program. Problems with cattle raiding and ethnic conflicts point at a chaotic institutional reorganization phase. The economic deprivation probably contributes to the difficulties in finding a way out from this reorganization phase and the larger scale Tanzanian reorganization from a socialist into a capitalist and democratic system has not helped to solve these problems either.

The governmental support for the locally based Sungusungu groups seems to have contributed to successful reorganization, even though these groups also contain some contested and undesirable features. The social driving variables in the social-ecological system and livelihood system seem to be the larger-scale institutional influences, population growth and constraints in livelihood activities.

CHAPTER 5: LOCAL ECOLOGICAL NARRATIVES

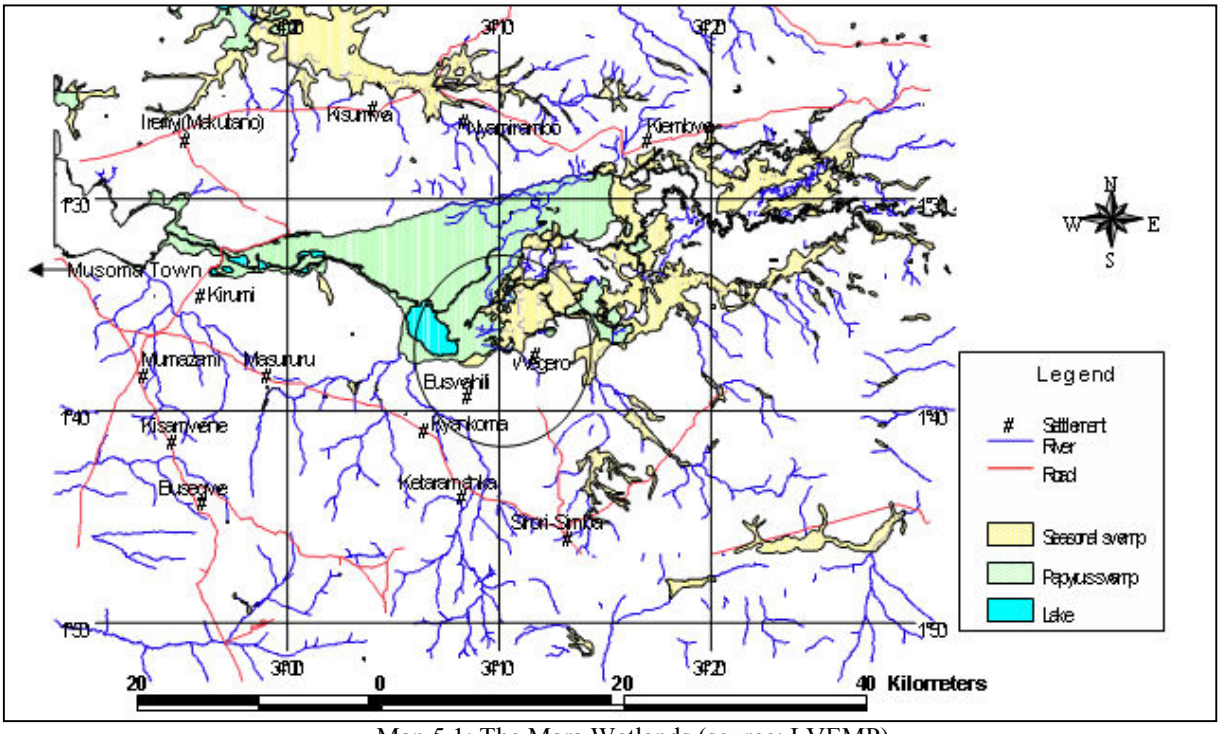
5.1 Chapter build-up and physical features of the fieldwork area

After a short introduction about the physical features of the fieldwork area, this chapter continues with local narratives about the local ecological changes in the wetland area. Subsequently, these changes are presented in figures and interpreted with the adaptive cycles. After this elaboration, I summarize the possible contributors to the wetland expansion. The following conclusion gives an overview of the findings and sketches the implications of the local ecological changes for the livelihoods in the basin and around Lake Victoria.

Physical features of the fieldwork area

Map 5.1 gives an overview of the Mara wetlands and the many streams that feed these wetlands. The black coloured streams in the wetland area show the main course of the Mara River. The oval circle represents the approximate fieldwork area, in which two of the fieldwork villages are visible: Buswahili and Wegero. Kongoto village is also part of the fieldwork area and is located in between these two villages. The fourth village of the Buswahili ward, Baranga, is located near the southern borders of the circle.

The form of the circle also comes close to the official borders of the Buswahili ward. This ward measures 170 km^2 and its borders are marked with hills that surround the territory. Only the western and northern borders of the ward consist of flatter lands. These areas rise slightly from north to south, just like most of the territory. The hills reach their most northern position near the Buswahili village centre and from there they continue in both the south-western and south-eastern direction towards Kyamkoma and Baranga respectively. In Baranga and Wegero the hills flank both the eastern and the southern borders of this ward.



Map 5.1: The Mara Wetlands (source: LVEMP)

The period of data collection for the development of this map is unknown, but it probably dates back to the 1990s. As we will see in the local ecological narratives, the division between seasonal and papyrus wetlands (in the legend of the map 'swamps'), as visible on the map, came into existence around this period.

There were no soil maps available for this research, but the local residents and the ward agricultural officer stated that most of the ward's second soil-horizon (layer) and some of the top-soils consist of clay soil. This type of soil becomes hard and contains cracks when it is dry. It absorbs water very well and becomes sticky and heavy after rainfall or floods. The local residents and ward agricultural officer sketched the following overview of the top-soils, which fill more or less the upper five feet of the ward's soil:

- The Wegero area is mostly covered with a layer of loam soil, which consists of fertile organic material.
- The same accounts for large parts of Kongoto, but the top-soils in the area between the village centre and the hills are described as dark clay, which has the same characteristics, but is more fertile than the clay in the second horizon. Furthermore, the area between the village centre and the wetland is covered with a top-layer of sandy soils. In Baranga there exists a same variety of top-soils.
- In Buswahili, the area between the centre and the wetland and the eastern borders consists mostly of clay soils and partly of sandy soils. The area between the centre and the mountains consists of a top-layer of fertile reddish clay.
- The wetland and its shores are mostly covered with a fertile layer of sediments that increased due to alluvial deposition. Moreover, some part of the shores in Buswahili and Kongoto contain a degree of salt that make crop cultivation difficult.

5.2 Local ecological narratives: Mara dryland becomes wetland

1890-1960

In this period the Wakenye settled in this area. The contemporary wetland area was covered with dryland savannah vegetation characterized by grasses, cactuses and species like the Whistling Acacia (Acacia drepanolobium). Trees could be found scatteredly on the plains and some hillocks were located near Kongoto village. Both the hills that surround the territory and the well-watered location on the plains were more densely vegetated with shrubland.

There was a large number and variety of wildlife living on these plains. Animals like zebras, wildebeest, ostriches, buffalo's, leopards and lions migrated between Serengeti and the shores of the Mara River. This river was wider in this period. The width differed per location, but on average the river was about 50 meters wide.

The streams Kyamatiko and Kwikirimito, diverting from the Mara towards the present Wakenye territory, were already there, but were much smaller by then. There were about ten floods each decade, which occurred either during the long or short rainy seasons. These floods didn't reach so far and always withdrew after only a day or five.

In the 1940s, floods started to prolong up to a period of two months. This was caused by the silting of the river which reduced its discharge-capacity. Most of the Wakenye elders blame the hippos for this process of silting.

In the 1950s, the British district executive officer visited the Wakenye villages to warn the people for more extreme floods that would inundate the entire valley in the future. His predictions were based on measurements of *"certain equipments"*. He planted a Sisal-fence to mark the territory that would be inundated. Elders reported: "*At that time we were laughing at him and didn't took him serious, but now (in 2007) we know better: the floods often come close to the Sisal-fence and sometimes even beyond it*"

1961-1970

In November 1961 the floods deriving from the Mara River were unprecedentedly in size and inundated the entire dryland plains. These floods occurred due to torrential rains, which are called the Independence Rains because they took place in the year that Tanzania was declared an independent country. The valley stayed inundated for almost a whole year.

After the floods had withdrawn there were some clearly visible changes on the savannah plains compared with before. The extreme strong currents in the Mara River had widened the meander of the Kyamatiko stream. Due to these currents the shores around the meander eroded and an inland lake was formed not far from Buswahili. Also, the Kwikirimito stream was wider and deeper. Moreover, many other streams started to appear in the area. These streams brought more water to the drylands plains in both the dry and the wet season.

From this period onwards, the wetland vegetation in the three villages started to follow different pathways. Some waterweeds[29] arrived near the shores of the Buswahili Lake, but these types had only a small impact on the landscape. They grew in shallow water and were therefore mostly found in the streams during the dry season and on the shores after the floods had withdrawn. Some people say these waterweeds came with the river, other say that they arrived from the downstream village Kirumi. Around the downstream villages the waterweeds already existed before these extreme floods.

Furthermore, the floods deposited a large amount of fertile sediments, which had been eroded elsewhere and the general inundation period prolonged after the Independence Rains. These sediments and longer inundation period provided the ideal conditions for a forest to grow. This forest appeared on the plains in the 1970s, but only matured in the 1980s and 1990s. Buffalo's and wildebeests lived in the forests. However, a lot of wildlife left to the Serengeti district in the 1960s, because the Wakenye hunted them quite a lot in this period.

In the late 1960s, institutional dynamics (which will be explained in the next chapter) caused a sudden increase in the cattle population of the Wakenye. Because the floodplains were traditionally reserved as pasture for the cattle, the growing cattle population had an impact on this area. According to some local residents, a few of the former pathways that were used for bringing cattle from the upland area to the wetland area have changed into streams. In addition, cattle accelerated the soil erosion around the Mara River and their trampling caused small holes on the plain, which became puddles with water in the rainy season. It is quite likely that these influences have contributed to the change from a dryland area to a wetland area.

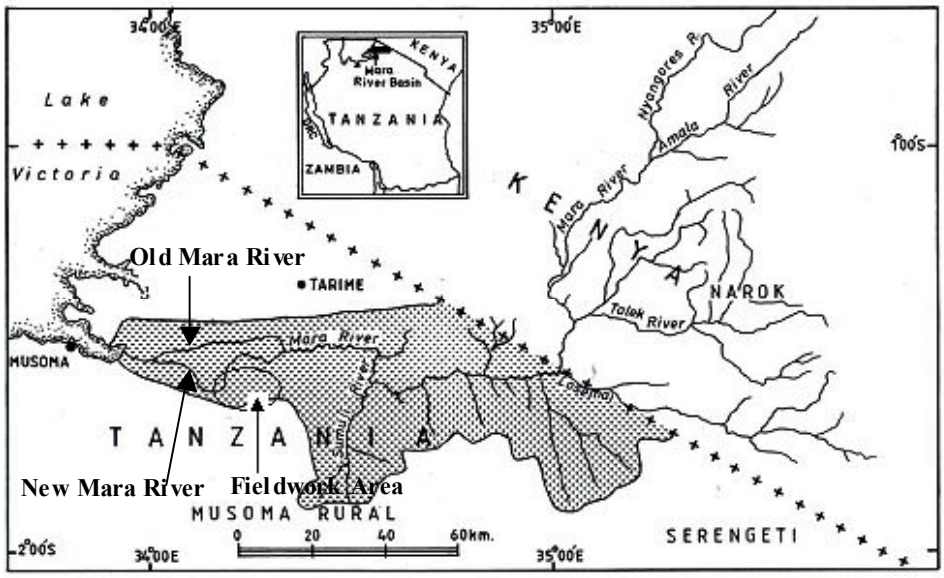
1970-1980

After the 1974 Ujamaa Villagization Program, people started to use hill forests more for construction and fuel wood collection (the next chapter elaborates in details on the social causes behind this change in land use). In Tarime district people also started to practice crop cultivation on steep hills. This caused erosion of top-soils, which ended up in the Mara River that consequently started to silt-up.

Due to this silting, the Mara River shifted its course slowly from near the mountains in Tarime into the direction of the Wakenye territory[30]. The diversion of the main course of the Mara River continued until the early 1980s. Local people refer to the contemporary rivers channels as 'Old Mara' and 'New Mara'. On the map below, the old and the new river channels are clearly visible.

[29] Locals use the word 'weeds' to define the water plants. Because these local narratives also serve to spread the local views on the dynamics I have decided to copy this word, even while this flora may be better named 'water plants' in scientific publications (to call something a weed implies a negative association).

[30] Local people in Tarime also describe this change in the course of the Mara River (Mturi 2007).



Map 5.2: Old and New Mara River (source: Yanda and Majule 2004)

In the period that the river started to shift its course, the waterweeds invaded the territory more prominently. This occurred especially in the Buswahili area, but also in and around the streams in Kongoto and Wegero. These waterweeds are locally perceived as one of the reasons why the wetland started to expand more rapidly in the years after their appearance. They reduce the water flow towards Lake Victoria and trap the sediment on the bottoms of the streams and main river channels, which are shallow enough for the weeds to grow during the dry seasons. Furthermore, they reduce evaporation of stagnant water because they block the sunrays and wind to touch the puddles with water, which remain after floods or rains. Moreover, as new and taller waterweeds invaded the area, their roots penetrated deeper into the soil. This increases the infiltration of water into the soils and makes the soil structure swampier. Furthermore, the waterweeds are blamed for having a negative impact on the water quality because they trap sediments and reduce the water flow. This problem is accelerated by fishermen who chop down the waterweeds to make their way through the wetland to the open water bodies.

The fishermen also use the waterweeds to hang their hooks. After they collect their catches, many fishermen leave the stems near the shores where the weeds take root again. Therefore, the waterweeds spread even faster. Lungfish digging is another fishing technique that contributes to the colonization of the waterweeds. People dig holes to search for this fish, which tends to hide in the mud after the floods have withdrawn. These remaining holes are filled with water, and these puddles are a suitable habitat for the waterweeds to colonize the area. The same accounts for the holes that are left behind by the collection and preparations of clay, which is used to make bricks for construction purposes.

1980-2007

In the 1980s the floods prolonged and inundated larger areas. Quite some local people argue that this change in hydrology is linked to the construction of the 'Kirumi Bridge'. In 1984, Italian engineers build this bridge over the Mara River near the village of Kirumi. The Mara River valley is narrow on the location of the bridge (it is the location where the old and new Mara River converge) and the bridge construction is said to have further narrowed the river valley and thus decreased the discharge capacity of the river.

During the 1980s and 1990s the waterweeds colonized a larger part of the wetland area and replaced former natural resources in the wetland area such as pasture and wood. Local residents cope with these dynamics by using the upland areas and hills more intensively for

their livelihood activities. This shift to the higher areas causes the degradation of the vegetation covers in these areas. Consequently, the run-off and soil erosion in these areas increased. The floods still occurred about ten times per decade, in either the long or the short rainy seasons. In this period the pathways of the colonization patterns from the waterweeds in the villages started to divert more clearly from each other. Therefore, the changes in the wetland are described separately per village.

Buswahili in 1980-2007

During the 1980s large parts of the Buswahili wetland were covered with water during the rainy season. Next to the waterweeds also the hippo and crocodile populations started to increase. The inland lake, which was formed after the Independence Rains, still expanded in the 1980s. Anyhow, the increase of open water bodies was compensated with the colonization of waterweeds that trapped sediments and thus accelerated the silting of water bodies. In the 1980s the small forest, which had emerged in Buswahili after the Independence Rains, was destroyed by the prolonged floods and replaced by the waterweeds.

At first, the invasion of the waterweeds did not have a large impact on the landscape yet, but in the late 1980s and especially in the 1990s the papyrus (Cyperus papyrus L.) invaded the area between the Buswahili village centre and the streams. In the year 1997, the El Niño rains caused another extreme flood. After these foods had withdrawn, almost the entire area was covered with papyruses. This made the open water bodies almost inaccessible for humans. The papyrus is known for its resilience towards harsh conditions. This plant starts to look yellowish after dry periods, but always regains its health after rainfall or floods. According to local people, the papyrus survives these harsh conditions because it stores water in its roots.

Moreover, the papyruses often have a length of about four to five meters high (thirteen to sixteen feet), which makes that the accessibility of the wetland declined rapidly after this weed invades the area. From the 1990s onwards, the lake in Buswahili has been silting-up and eventually became difficult accessible from Buswahili: only one channel, which is kept open by hippos and fishermen, connect the village with the lake. The hippos use the channel as a pathway to the wetland shores where they graze during the night. The fishermen use the channel to reach the lake and chop the papyruses that grow in this shallow water.

Photo 5.1: Fishermen on their way to the open water bodies through the densely vegetated and inaccessible Buswahili papyrus wetland.

Kongoto in 1980-2007

Neighbouring Kongoto village is situated more easterly from the Mara River mouth and is facing a different hydro-ecological context in its wetland area. The forest that grew on the plains after the Independence Rains was much larger in this village. In the 1980s the forest had been partly destroyed through both floods and human demand for wood. In the 1990s these processes accelerated due to the prolonged floods (accompanied by waterweeds) and a growing demand for fuel wood (see the next chapter for more details about this rising demand). In this period people also started to clear the trees from the hillocks in the inundated forest and prepared these for the cultivation of vegetables.

During the 1990s, the waterweeds colonized the area more prominently each year. Also in this village, the El Niño rains mark a big change in the wetland. Firstly, the floods destroyed both the hillocks that were used for vegetable cultivation and large parts of the forest. During the fieldwork there was only one hill left, which consisted of many large rocks. Secondly, the wildebeests and buffalos disappeared from this area after these floods. Thirdly, due to the combination of increasing waterweeds, rising populations of crocodiles and hippos, and the swampy soils after this event, it became impossible to cross the wetland and Mara River from Kongoto to Tarime district. Fourthly, during the fieldwork some areas had already become as inaccessible as in Buswahili, but the people could still reach the streams for their livelihood activities. Fifthly, since El Niño the streams in the Kongoto area have never dried up totally anymore. Even during extreme drought periods like in 2005 and 2006, some water remained inside.

During the fieldwork, a large part of the Kongoto wetland was still inundated from another extreme flood, which occurred in December 2006. Residents reported that there had not been extreme local rainfall preceding these floods (after the floods heavy rain occurred), but that there had been extensive rainfall in Serengeti district and that they presumed the same for Kenya.

These ‘flush floods’ came unexpectedly and even a few drowned human beings, deceased cattle, wildebeests and iron sheets from houses drifted in the wetland during the inundated period. After the floods there were still some dead trees in the area, but the forest was gone and replaced by waterweeds. This area differs to Buswahili in the sense that there (still) existed a large variety of waterweeds in this area instead of solely the dominant papyrus.

Photo 5.2: View from the last remaining hillock in the Kongoto wetland: Some dead trees remind us of the forest, but the waterweeds now dominate the area. Between the hills and the wetland, the populated areas from Buswahili and Kongoto are visible.

Wegero in 1990-2007

Wegero village and its wetland are located again more easterly from the river mouth. During the fieldwork, a very large part of the lowland area in Wegero was still covered with the forest that had emerged after the Independence Rains. In these lowlands the floods and the invasion of the waterweeds started to replace the forest only since the beginning of the 1990s.

Since the El Niño rains, the floods are more severe and the streams in the forest have become wider. Just as in Kongoto, the streams didn't dry up any more after the El Niño rains. The flush floods arrive unpredictably and inundate the area quickly.

During these floods the water doesn't only arrive as a back water flow from Lake Victoria, but also the other stream diverting from different rivers (Mara River, but also its tributaries like the Nyarorera) overflow and cause floods. Many large areas within the forest were invaded by waterweeds and some parts of the forest had vanished after the extreme inundation of the 2006 floods. The waterweeds in Wegero were similar as those in Kongoto: the papyrus had not arrived (yet).

Photo 5.3**:** (A) inside the wetland forest in Wegero: a thorn bush reminds us of the dryland vegetation. Behind this bush: a by cattle trampled pathway, some waterweeds and trees. (B) the Wegero wetland forest surrounded and partly invaded by water (weeds). The mountains on the other side of the wetland in Tarime district are also visible. (C) view on the entire fieldwork wetland area from Mount Wegero.

Photo 5.4: Mara wetlands: The complexity of different streams in the wetland area becomes clear on this satellite picture, just as the different types of vegetation, which are visible in the different types of green and blackish colour in the wetland area. The photo has been taken on the 31st of January in 2007. The extreme floods that occurred in December 2006 were probably just withdrawing.

5.3 Wetland changes in adaptive cycles

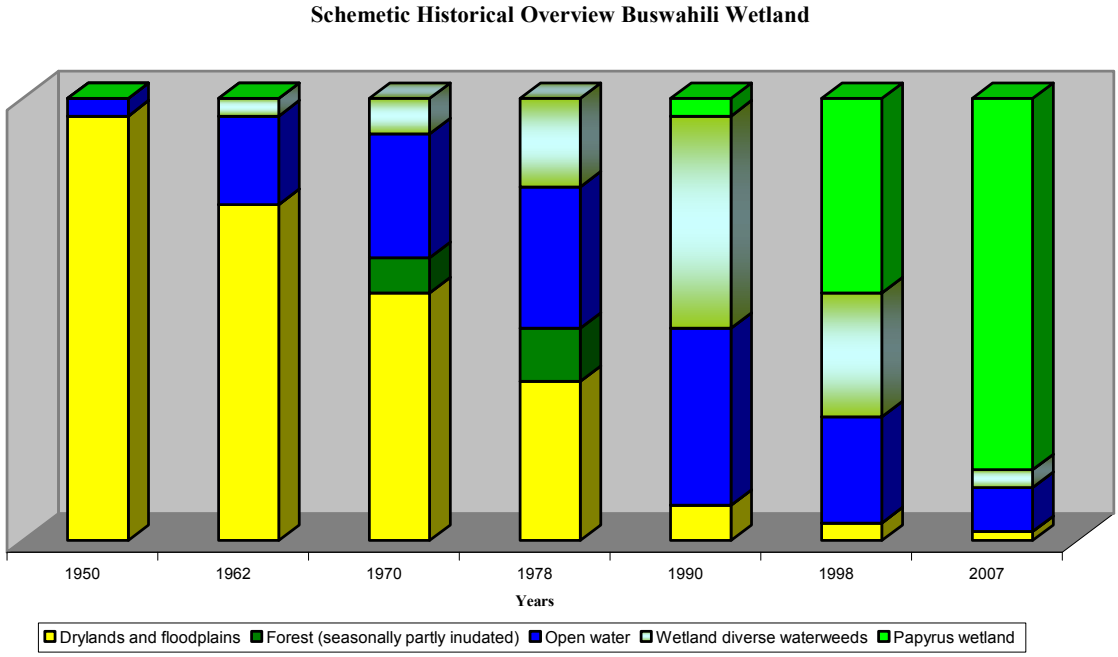
How have local ecological components adapted to the larger and prolonged floods?

The differences between the three villages reveal that hydrological changes are the main driver behind the changes in wetland vegetation. Local residents observed the first changes in this hydrology in the 1940s (more extreme and prolonged floods). The elders from the villages gave the silting of the Mara River as the reason for this change in river flow. The major change in the Mara wetlands hydrology came with the Independence Rains in 1961. Just as Mturi (2007) states, before this event there probably didn't exist something called 'wetland' in this area.

The extreme floods pushed the system through a threshold and marked the start of the release phase in the adaptive circle, in which 'creative destruction' took place. After this threshold the water volume increased on the floodplains (this may have been the caused by higher water levels in Lake Victoria, but also by the emergence of more streams in the wetland area). Consequently, the dryland vegetation evanesced and trees and waterweeds colonized the area. Moreover, the vegetation patterns in the three areas entered into different pathways depending on the water quantity.

To generate a better understanding of the changes that occurred in the wetlands of these villages I have designed three graphics. The bars in the graphics are not based on any statistical analysis, but stem from the interpretation of the oral histories. Therefore they should not be seen as absolute figures, but rather as metaphors to understand the changes. Furthermore, in these figures only the long-term changes are displayed and seasonal changes are thus ignored (e.g. in the rainy seasons when floods occur there are obviously more open water bodies). The chosen years include both years in which major changes occurred (1962, 1978, 1990, 1998 and 2007) and randomly chosen years that clarify more gradual changes (1950, 1970). In the descriptions below the graphics, the wetland dynamics are explained with the adaptive circles as explained in the theoretical part of this thesis (see section 4.1).

Buswahili



The relatively large amount of open water bodies in Buswahili can be explained by three underlying processes. Firstly, it is the most western located village in the fieldwork area and therefore receives the back water flow from Lake Victoria earlier and also faces later withdrawal of these floods. Secondly, a lake appeared in this area after the Independence Floods. And thirdly, the Mara River shifted its main course from its original northern channel into the direction of the Kyamatiko stream[31], which flows towards Buswahili and its lake. Because of these three processes, the inland lake near Buswahili (in some cases referred to as Lake Bukenye) started to expand until the year 1990. From that year onwards this lake started to silt-up[32].

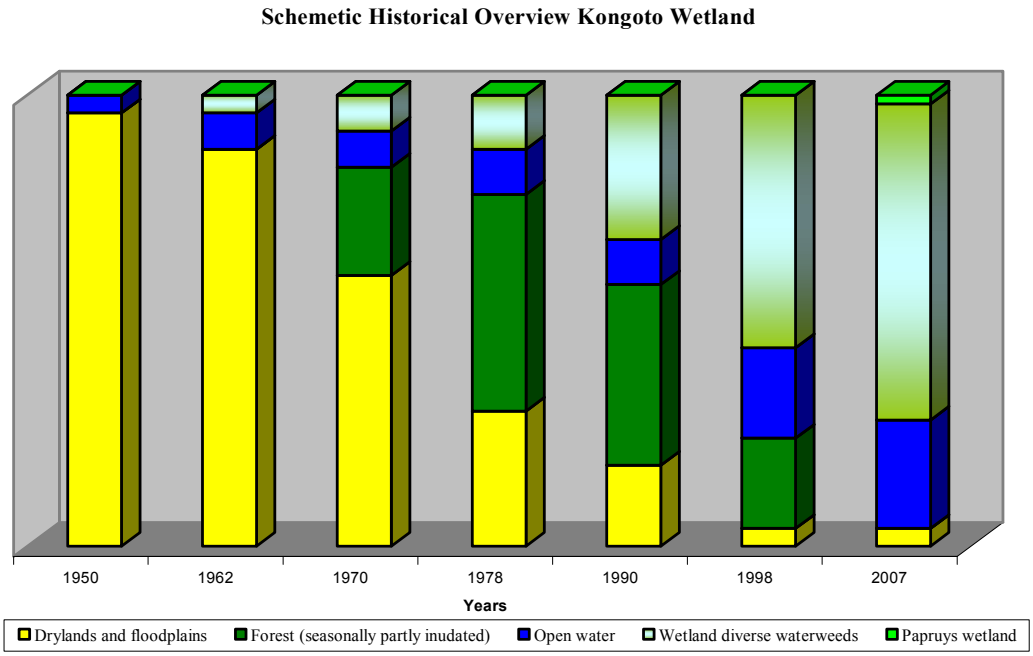
The larger water quantity caused another outcome of the reorganization phase this village in comparison with the other two villages. The forest that emerged in this village was smaller and could not mature due to the increase in water volume. A variety of waterweeds arrived early in the reorganization phase and replaced the forest already in the 1980s before it had become a mature forest. The invasion of the papyrus marked the beginning from an exploitation phase to a conservation phase, in which this waterweed invaded the area.

The El Niño rains mark a clear threshold after which the hydrological system and vegetation started to behave differently: it pushed the papyrus further through the exploitation phase. During the fieldwork about the entire area was covered by dense papyrus vegetations, which (probably) used most nutrients and thus locked or closed the system for other vegetation species.

The downstream wetland area between Buswahili and the river mouth is predominantly covered by papyrus and we have seen in the local narratives that the papyrus is known for its resilience towards droughts. For these reasons, it is quite likely that this vegetation cover will stay the same until another major hydrological change takes place.

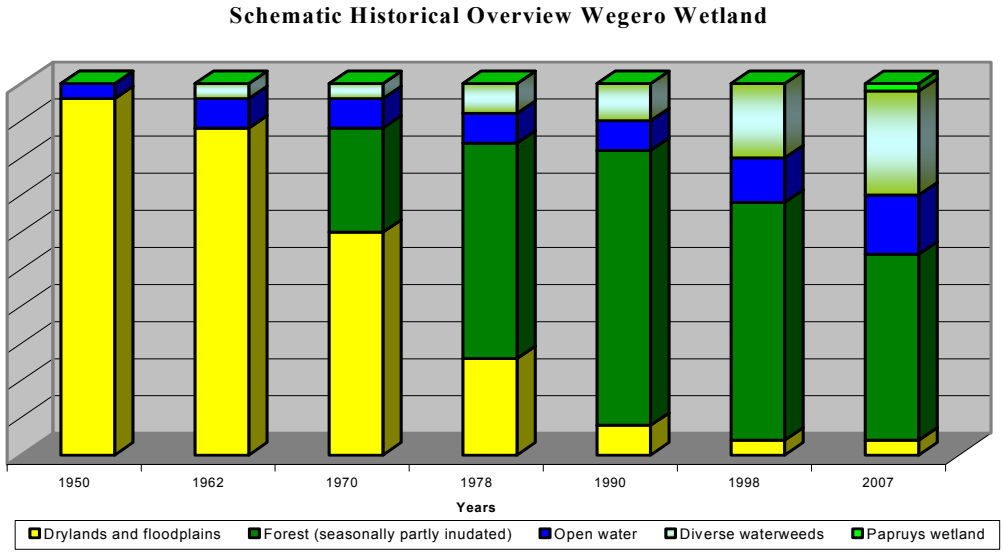
[31] On many maps this stream is portrayed as the Mara River, because the old channel has silted up and is badly visible on satellite images.
[32] This process of silting as explained in the local narratives is also clearly visible on the satellite pictures on figure 3.2 in chapter three.

Kongoto



The increase in water was less severe in Kongoto. In general, there have been less open water bodies and fewer floods. The forest that emerged after the Independence Rains coexisted for a long time with a variety of waterweeds in the reorganization phase. However, unlike as in Buswahili, the forest could mature and thus the system (with both waterweeds and forest as vegetation) went into a conservation phase in the late 1980s. In the 1990s and especially after El Niño, external variables (human exploitation and larger quantities of water) created another release phase. Therefore, this forest was destroyed just after it had matured and this release phase created space for a large variety of waterweeds to invade the area. The open water bodies expanded because the streams in the wetland received more water from the Mara River. During the fieldwork, the inhabitants of Kongoto expressed their concerns about the first papyruses that arrived in the area. They feared a similar invasion as happened in Buswahili.

Wegero



Wegero village is (again) located more easterly and is receiving the back water flow from the river mouth in a lesser extent and for a shorter period than the other two villages. During the fieldwork, the system in Wegero was still in the conservation phase. The forest that emerged after the Independence Rains was still there, but waterweeds were slowly replacing this forest. The external variables that created the release phase in Kongoto were present, but far less influential in this part of the wetland due to the further distance from the river mouth and less human encroachment on the forest. The inhabitants of Wegero did fear that 'their' forest would disappear due to the floods just as happened in Kongoto.

5.4 Possible contributors to the wetland expansion

What does local knowledge reveals about possible contributors to the wetland expansion?

Large-scale dynamics as triggers for local positive feedback mechanisms

After the elaboration on the different pathways in the wetland vegetation it is interesting to turn back to the possible causes behind the expansion and to combine the data from previous studies with these local narratives. First of all, it is an encouraging sign that all three drivers as observed by Mati et al. (2005), Mutie et al. (2006) and Mturi (2007) also come forward in the local narratives

The sedimentation and silting of the river has been emphasized in the oral histories through the explanations of changes in land use and the change in the course of the Mara River. The influence from Lake Victoria comes forward in the description that the floods stayed for almost a year after the Independence Rains. This extreme duration of inundation can be linked to the rapidly rising water level in this lake after the Independence Rains. The fast and unpredictable flush floods describe the larger fluctuations in the river flow.

However, the oral history also reveals that the wetland expansion is not purely a linear process that drives only on external variables. Firstly, the influences of the torrential rains in the short rainy seasons of 1961, 1997 and 2006 point out that the wetland expansion is not only a linear process caused by the variables as noted by the existing explanations, but also that it drives on variables that are far out of reach of human influences. These torrential rains can be understood as thresholds, which forced the system to move into different pathways. After each of these years the hydrologic system (e.g. streams, floods) changed significantly and this caused rapid changes in the wetland vegetation.

In addition, both the larger fluctuations in the river flow and the increasing loads of sediments have undoubtedly caused more shallow water bodies and thereby also contributed to these changes in vegetation. The larger fluctuations create more shallow water bodies in the dry seasons, when the rivers and streams are shallower[33] and as well in the wet season, when the floodplains are inundated. Moreover, the increasing loads of sediments in the river do not only contribute to the mentioned back water flow, but also to the silting of water bodies and thus the increase in shallow water bodies, which are the ideal habitat for waterweeds.

The change in vegetation marked an important threshold in the wetland ecology and appears to function as a positive feedback mechanism. As noted in the oral narratives the water plants contribute to the expansion as they: (a) block the sunlight and wind and thus reduce evaporation on the floodplains, (b) reduce the water flow into the direction of Lake Victoria, and (c) trap sediments in the river flow and thus contribute to silting of rivers and streams. Therefore the waterweeds are not only the result of the prolonged and larger floods, but also one of the causes.

[33] Both local residents in the fieldwork area and people living near the river mouth described the growth of waterweeds in the Mara River and streams during the lows in the river flow in the dry periods.

Moreover, two other processes that are related to these weeds seem to function as positive feedback mechanisms. First of all, the colonization patterns from the different waterweeds show a clear sign of succession from relatively small plants towards the large papyrus, which is predominately present in Buswahili and the further downstream areas. As the weeds grow larger, their influence on the water flow and evaporation increases. Furthermore, the papyrus, which is invading the area in the last (known) phase, has deeper roots than the smaller water plants. These roots increase the infiltration of water into the soil and thus also reduce the water flow towards the river mouth, and make the soil swampier.

There is another positive feedback mechanism visible in the way that local people cope with the expanding wetlands. The shift towards the upland areas and the hills for livelihood-activities is causing more pressure on the vegetation of these upland areas. I was frequently told that the shift towards the hills occurred more extremely in Tarime district. In this district the mountains bordering the wetland are located nearer to the wetland and are both higher and steeper. In the fieldwork area, the wetland is bordered by a small elevation and only after a few kilometres (depending per location) the hills appear. In the first instance, this pressure on the hills especially increased in the inundated periods, but as the waterweeds replaced forests and drylands, it became also the case for the dry seasons. The more intensive use of the upland areas and hills has contributed to a decrease in land cover because of multiple reasons.

Firstly, the trees on the hills are more intensively exploited for charcoal, fire wood and construction material. Secondly, crop cultivation is done more intensively in the upland areas and even in some cases on the hills. Thirdly, a lot of domestic animals that used to grazed in the wetland area are now grazing and browsing on the hills. This means not only that the grass cover is decreasing, but also that tree seedlings have less chances to mature due to trampling, grazing and browsing.

Especially as the wetland expanded more and the floods prolonged, the hillside vegetation didn't receive enough time to recover during the dry periods (when a large part of the wetland area is still used for these activities). Due to the degradation of the upland areas and hills both the erosion of the tops-soils and the run-off of water increase (again). It is quite plausible to state that these processes accelerate and prolong the seasonal floods and thus contribute to the wetland expansion again and subsequently force the people on the upland areas and hills.

Local and wetland scale dynamics as contributors to the expansion

The construction of Kirumi Bridge in 1984 is a plausible explanation for the riddle about the cause of the rapid wetland expansion between 1984 and 1988 as observed by Mturi (2007). According to local observations this bridge has narrowed the river where the Old Mara and New Mara River converge into one channel again. Therefore the discharge-capacity of the river has decreased and disables the channel to cope with all the water from the (already increasing) peaks in the river flows. This may have contributed to the more extreme and prolonged floods and the colonization of the wetland vegetation on the floodplains upstream from this bridge.

Another possible explanation for the rapid expansion in the mid-1980s is that the Mara River has shifted its course in the late 1970s and early 1980s. The newly emerged course of the Mara River may have had a lower capacity to handle the discharge of the river water towards the lake and obviously inundates another area than the older course. The shift of the river means that the main channel is now located in the middle of the Mara River valley, while the old channel was located very near the mountains in Tarime. It seems evident that this has contributed to larger inundations in the valley.

Furthermore, the sudden rise in cattle population in the 1960s may have accelerated gully erosion. I was told that these gullies have formed streams that both diverted the water from the Mara River in the direction of the expanding wetlands and accelerated the run-off of rainwater from the uplands towards the wetland. Thus, the wetland area started to receive more peaks and more sediments in the water supply from the Mara River as well as the upland areas and hills. In addition, in the proximity of the floodplains small puddles, caused by trampling, are clearly visible in the landscape. These puddles provide a suitable habitat for the waterweeds, increase the infiltration of water into the soil and prevent water from flowing towards Lake Victoria.

Both lungfish digging and the production of clay bricks cause similar processes. Furthermore, we have seen that local fishermen seem to contribute to the invasion of the waterweeds by their use of the waterweeds. Moreover, the unsustainable exploitation of the hill forests, which started after Ujamaa gives an explanation for the land cover change as observed on the GIS maps in section 3.2 in the previous chapter.

5.5 Conclusion

How do different scales around the wetland interact with each other and what are the consequences of these interactions for the livelihood sustainability in the basin?

The local narratives provide valuable information about the functioning of the ecological system around the wetland expansion. Firstly, there seem to exist multiple possible contributors to the wetland expansion, but it goes beyond the scope of this research to elaborate on the particular influence from each contributor. The task to gain insights in the relative contributors becomes even more complicated because the contributing forces are clearly interacting with each other. Secondly, we can surely state that the expansion should not solely be seen as a linear system, but also as a phenomenon in which both major disturbances and longer-term trends on multiple hydro-ecological scales contribute to the prolonged and more extreme inundation of the floodplains. The longer-term trends are the changing land covers in the Mara basin and fluctuating water levels in Lake Victoria while major disturbances are the extreme rains in 1961, 1997 and 2007, and perhaps the construction of Kirumi Bridge.

These major disturbances and longer-term trends result in a prolonged and wider inundation of the floodplains, which is certainly the main cause behind the change in vegetation on these floodplains. The changes in seasonal inundation have caused longer-term changes, whereby dryland vegetation is replaced by wetland vegetation. Consequently, a large part of the formerly floodplains have become more permanent instead of more seasonal wetlands. And because the hydrology is the most important driver behind these processes, the three bordering wetland areas have gone into different pathways depending on the period and level of inundation. These pathways do resemble, but differ in the outcomes of reorganization phases and pace of the sequences in the adaptive cycles.

There are at least two aspects in which the influences from the larger scales cannot be seen as a one-way effect only. Firstly, we have seen that the effects of the changing inundation and vegetation occur locally but also reach the larger scale wetland hydrology again in the form of two positive feedback mechanisms. Secondly, the function of the wetland (vegetation) in retaining sediments and filtering water also influence larger scales. In this sense, the emergence of the waterweeds (papyrus in particular) may have prevented Lake Victoria from receiving large amounts of sediments, which can cause eutrophication or other related social-ecological problems. With regard to this interaction it is noteworthy that I was told that the floods that occurred after the El Niño rains on the shores of Musoma Bay, had

not withdrawn from the shores near Musoma town. A natural resource officer of Musoma district explained this situation by pointing at the large amounts of sediments that had accumulated in Musoma Bay after these rains. He agued that these sediments came from the Mara basin and had heaped-up the bottom of this bay. Subsequently, this has led to higher water levels at the shores. This statement emphasizes the importance of the buffer function of the newly emerged wetland.

In the way that the smaller wetland components adapt to the dynamics from multiple scales, these smaller components appear to interact with these larger scales, but only don't reach the entire scope of these larger scales (the entire basin or the entire Lake Victoria). This is a clear example of an interaction between different scales, in which larger scales influence smaller scales but that this also happens the other way round (this resembles with the descriptions of the panarchy in the theoretical chapter).

Although these interactions stem from different scales they come together on the ground at the local scale. This is clearly visible in the schematic model on figure 5.1 on the following page, where about all arrows (influences) join on the local scale, and subsequently interact with each other locally. While observing the adaptive cycles we have seen that these interactions determine the pathways of the ecology.

Thus there seems to be an interaction between scales, which is not only causing and accelerating the wetland expansion, but also reducing the negative trade-offs from one area upon another. In addition, it goes beyond the scope of this thesis to elaborate on this, but it is interesting to note that the general value of wetlands in productive functions is estimated much higher than the value of grasslands (Constanza et al. 1997: 256). Furthermore, because wetlands are often referred to as cradles of biodiversity (e.g. Lambert 2003) it is quite likely that the vegetation change has had a positive impact on the total number of flora and fauna species in the area.

The larger scale influences have thus pushed the ecological components into different regimes, which provide different functions and feedbacks than in the previous regimes, but also increase its diversity and ability to reduce negative trade-offs between geographical areas. For these reasons it can be argued that these local ecological components have adapted to the changes successfully. The smaller components have shifted into different regimes and were thus non-resilient in the sense that they were unable to handle the changing external variables. But the system's ability to reorganize continuously and smoothly appears to contribute to a high degree of adaptability and points in the direction of a self-organizing capacity in the ecology.

On the other hand, both local residents and scientists (Singler and McClain 2006: 34) have observed processes of decreasing water quality and eutrophication in the wetlands. This might point out that the emergence of the wetland vegetation does not simply reduce but rather only redistributes the negative trade-offs from the land use changes on the basin scale. However, other functions and services of wetlands like ground water discharge and flood control may be experienced as advantages for the people living near the wetland. The next chapter elaborates on the interaction between the local livelihood activities and the wetland expansion and will thus shed light on the locally experienced (dis)advantages of the wetland expansion.

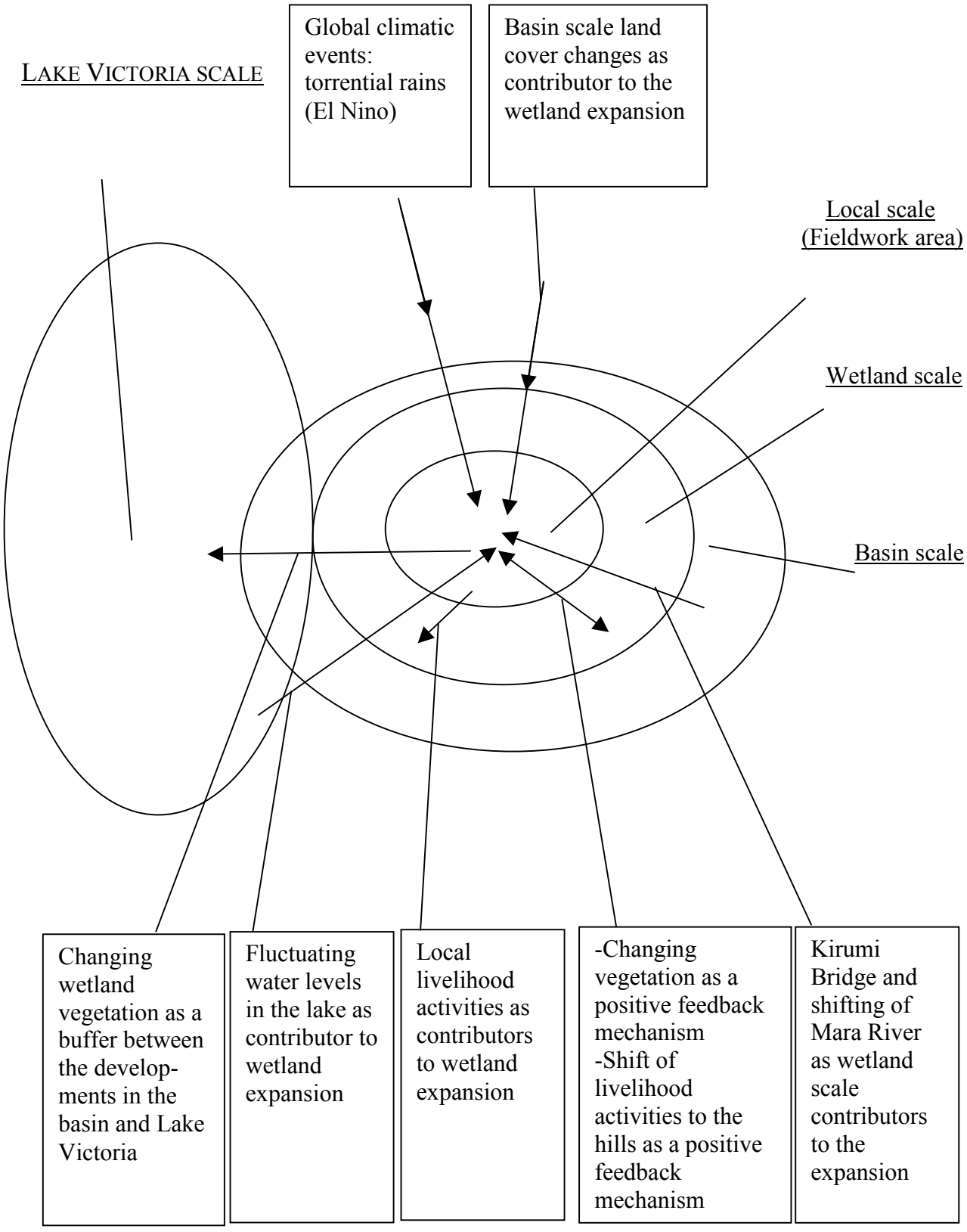


Figure 5.1: Conceptual interaction between scales: all larger scale influences come together and interact on the local scale. Additionally, there are feedbacks from the locals scale towards the larger scales.

CHAPTER 6: LIVELIHOODS BETWEEN ECOLOGICAL AND INSTITUTIONAL DYNAMICS

6.1 Chapter build-up

In this chapter the livelihoods of the Wakenye people are placed in the context of the ecological and institutional changes. In the first sections the ecological narratives as discussed in the previous chapter are merged with socially orientated narratives of local people. In these narratives, the attention will be primarily on the functioning of the interactions in the triad (institutions, livelihoods and ecology). In section 6.3, I will add some relevant data and describe the adaptive cycles for the most important livelihood activities. Subsequently, I will discuss the contrasting perspectives on the wetland expansion and return to the question about the role of the wetland in redistributing trade-offs in the Mara basin. In the conclusion, I will elaborate on the features that seem to have contributed to sustainable adaptations and unsustainable rigidities in the livelihood system of the Wakenye.

6.2 Local social narratives

1890-1960

In the 1890s the first Wakenye people crossed the Mara River in search for new pastures for their cattle. In this period another Kikurya speaking group, named Bwasi, was living on these plains. The Wakenye started a war, defeated the Bwasi and became in charge of the plains surrounding both the northern and southern shores of the Mara River. The Bwasi were pushed into the direction of the upland areas. The wetland area was mainly used as pasture for livestock. Around the 1940s the populations of the Wakenye and their cattle started to increase and the people experienced again a shortage of pasture. To solve this problem, the Wakenye started another war against the Bwasi and eventually pushed them further back into the direction of the hills. The Wakenye lived scattered on their territory that covered parts of the contemporary Musoma and Tarime districts.

In the colonial period the Wakenye cultivated mainly sorghum, millet, dry nuts and some vegetables. The Germans and British tried to convince them to cultivate maize to reduce food shortages, but these shortages occurred rarely in this period. There were not many problems, the harvests were good: "*The soils were fertile and the rains always arrived predictably. Only in drought years we suffered food shortages like in 1949 and 1950".* Ploughs were introduced in the 1940s and were found very useful because the soils are very hard when they are dry and very heavy when they are wet and thus always difficult to work on. People did, however, not need ploughs to enhance the fertility of the top layer, because all soils were fertile.

During this period the Wakenye were still living according to their traditions. Everybody believed and worked with rainmakers. These rainmakers used to predict when the rains would arrive so that everybody could prepare their shambas (small farm plots) at the right time. The traditions around the rainmakers also restricted the use of the trees on the hills. People were only allowed to use small quantities of wood for construction and fuel. "*If somebody harvested a tree from the hills illegally, the elders used to fine him a goat or a sheep, which was donated to the rainmaker. The rainmaker would then prepare a ritual on the hill to restore harmony. We were very serious about this; we believed that if the trees would disappear from the hills the clouds would pass without giving us rain. We also believed that God and the spirits were living on the mountains and in the trees*".

The rituals were directed to the trees in the hill forests, which were therefore very significant for the local people. The people all presumed that there existed a linkage between the trees and the rain. Furthermore, many people were aware that the trees on the hills function like water reserves and thus prevent a fast run-off of rainwater.

Cattle have always been important for the Wakenye: it is a symbol of prestige to own a lot of cattle. In this period there were not many cattle diseases. Before the 1950s the Wakenye always used spears for fishing, but in this period some fishermen started to use nets. They had learned this fishing-technique from other people elsewhere. At the beginning the villagers were laughing at them and asking each other: "*What are they doing? Are they playing in the water, what laziness? It was only after they saw the good catches that they understood"*. In this period there was a lot of fish in the rainy season, but during the dry season there was not enough water for all fishermen to catch their share. Therefore most fishermen also continued with animal keeping and crop cultivation.

The human health situation was stable. The people had knowledge of medicinal herbs, which were used to cure the common diseases in this period, like bilharzia and yellow fever. In the 1950s sexually transmitted diseases like gonorrhoea and syphilis arrived with the African solders that fought during the Second World War in India. The Wakenye lacked knowledge to cure these diseases. Malaria was difficult to cure, but it was not a very common disease in this period.

Most people were living self-sufficient up to a large extent, but money was already used to trade with each other and other tribes. Nearby, in Kiagata village, Indian and Arab merchants opened shops. Especially people living in Kikiromo (the contemporary Buswahili area) exchanged many items with these newcomers. Products like blankets, earrings and clothes we introduced in the region. And in return the Wakenye sold these newcomers sorghum, millet and fish. These merchants also brought the Islam to the region, but up to today not many people joined this religion. The Christians were more involved in the community. The first missionaries arrived in the 1930s and ten years later people slowly started to join the Christian religions.

1960-1970

The unprecedented Independence Floods in 1961 where a big shock for the Wakenye. Approximately 2000 people lost their houses and needed to find shelter elsewhere. Moreover, about 100 acres of almost harvestable crops were destroyed. Everybody survived the floods, but two people died as they were struck by lightning on the plains. Although the Wakenye could bring all cattle, goats and sheep in safety, the economic losses were severe.

The floods stayed for almost a year and because a large part of the territory was flooded the Wakenye were forced to search for other places to live. Many found refuge with relatives far away from here. They left to places like Mugango, Muriaza, Bumagi and Matongo in both Musoma and Bunda district. A lot of these people and their offspring are still living in these places. However, others didn't move towards these places and faced a shortage of food because the extreme rains and floods had destroyed the crops. The Wakenye survived by fishing, gifts from relatives and by selling and consuming their cattle. They also asked the neighbouring Bwasi tribe whether they could use their land temporary, but they refused. In this period the relations between the different tribes in the area were often hostile: "*we didn't share so much with each other*". After the floods had withdrawn many people dug holes in the ground to search for lungfishes, which often hides in muddy soils. The first changes in the hydrology after the Independence Rains were positive for the Wakenye. The lake in Buswahili provided more fish all year around. Furthermore, the general increase of nearby water was highly appreciated for both domestic use and water supply for domestic animals.

The shift from colonial to Afro-socialist government in 1961 had a great impact on livestock keeping. From 1966 onwards, the African government started to provide extensive veterinary services. Moreover, the restrictions from the colonial rulers on this livelihood activity were lifted. These political changes led to a rapid and sudden increase in the cattle population that may have had a large impact on the wetland area (as described in the previous

chapter). At the same time the human population also increased. Consequently the Wakenye experienced a shortage of land once again. The Wakenye reacted on this shortage by starting another war against the Bwasi in 1968. They defeated the Bwasi again and pushed them back to the other side of the hills. After this war, the contemporary Wakenye territory came into place and most people moved to live in the upland areas permanently and thus left the floodplains. Only in the dry periods people build simple houses on the floodplains to migrate temporarily in search for pasture and water for their cattle.

Although the veterinary services from the socialist government improved the general health of domestic animals, other interventions created problems and deteriorated the conditions of the animals. In the late 1960s the government prohibited the people to set fire to the plains. Many livestock keepers were used to light fires on the plains in order to kill the ticks that transmit diseases and to let the grasses re-grow more rapidly. This intervention had a great impact on the health of cattle: "*Because of this new regulation the thick born diseases in the cattle increased rapidly. It was only because the government was also providing medical care for cattle that this increase in diseases was not experienced as a big problem".*

1970-1980

The Ujamaa Villagization Program of the national government in 1974 had a large impact on the Wakenye. All people were forced to live in village centres, where they grew some individual crops. The majority of cropland was planned around the village centre where the communal lands were located. This was a very important aspect in this socialist program. The program did strengthen the bond between the different (ethnic) groups in the region. Before Ujamaa there were many conflicts between different groups, but after this program people learned how to appreciate each other. The borders between the villages and tribes were also clearly marked after Ujamaa and the name of Kikirome village was changed into Buswahili. Furthermore, Ujamaa brought some medical facilities and shops to the village centres.

However, this intervention was accompanied with many disadvantages. First of all, due to the more centralized setting people could trade more easily, but also human and livestock diseases started to spread more rapidly. In addition, the program had a negative impact on crop cultivation. In the period that the people had to move to the village centres the crops were ready to harvest, but nobody had time for this because of the forced eviction. Consequently many people faced food shortages. Moreover, the communal shambas (farm plots) were relocated to the areas near the village centres. The community did not harvest large quantities since the fertility of the soils was lower in these areas. Many people sold fish or cattle to cope with these food shortages.

The sudden move from a scattered to a centralized population pattern also had a great impact on land use. Suddenly everybody needed building materials for new houses. People therefore started to exploit the trees in the hills forests. It was impossible for the elders to fine these people according to the traditions, because everybody knew that they really needed the materials. Moreover, the more centralised setting increased the pressure on certain forests that were located near the village centres.

Fortunately, in this period the Wakenye started to use more dried clay bricks to build their houses. Clay became widely available due to the expansion of the wetland. People who had worked for the colonial government introduced the building technique in the area, but it was only since Ujamaa that the villagers started to use it more frequently. Intensification of this building technique prevented the people to exploit the hill forests more intensively. After Ujamaa the hills in Tarime were also used for agriculture. This caused soil erosion and accelerated the silting of the Mara River.

When the consequences of the Ujamaa Villagization Program became visible, the elders tried to restore the traditions regarding tree usage in the hill forests, but the younger generation thought that this was "*old fashion*" and that it should be abandoned. Furthermore, many people had joined the Christian religions and didn't believe anymore that God, the spirits or ancestors dwelled in the trees on the hills. This shift in religious beliefs was one of the reasons why the Wakenye stopped working with rainmakers. However, the most important reason for them to stop working with the rainmakers was that: *"they started to cheat"*. Already in the 1950s and 1960s some were cheating, but this increased in time: "*We used to provide them goats and sheep, but then they still didn't provide any rain*"

In the 1970s cattle raiding became a large problem in the wider region. About 30 cattle per year were stolen from the Wakenye. In the 1980s the raiding decreased locally. After this short rise in cattle-theft, theft of smaller animals like goats and sheep continued to be a problem until 2007 and cattle raiding continued occasionally till into the 1990s.

During the same period the waterweeds started to become a problem for the people. This occurred especially in the Buswahili area, but also around the streams in Kongoto and Wegero. The weeds decreased the open water bodies that were used for fishing, fetching water, and livestock drinking and they also replaced former pasture and deteriorated the water quality.

1980-1990

Ironically, the moment that most people stopped working with rainmakers the rains also started to become unpredictable. From 1980 onwards, both torrential rains and droughts are more common and the arrivals of the rainy seasons have also become more variable. This increasing rainfall variability causes more frequent harvest failures that lead to food shortages. Before this period, the timing of the rains to arrive was usually the same, and the amount of rain was often good for the crops. Since the moment the Wakenye stopped working with the rainmakers the individual timing of preparing the fields became vital for a good harvest. "*It is always a gamble, since nobody knows when the rains will arrive*". Many people say they don't know the causes behind the changing rainfall patterns. Others explain the changes by pointing at global climate changes or at the locally decreasing tree covers.

In this period the national government changed its policies and the veterinary services from the socialist government were slowly abandoned. Since 1984, the available medical care for cattle has only decreased and become gradually more expensive. Especially tick born diseases became a large problem because the facilities to use cattle dips became too expensive.

In the 1980s the human population increased rapidly and in spite of the decrease in veterinary services the cattle population still continued to increase. People started to harvest more trees on the hills to use for construction purposes and fuel. Many people increased their use of fuel wood because the community was slowly thought that boiling water is vital to prevent diseases. The general increases in demand for wood made the people to exploit the hill forests further. In addition, in Kongoto village the forest that emerged on the floodplains after the Independence Rains became a target for wood harvest. In Wegero, people didn't venture so much into this wetland forest to harvest wood, because they were afraid for the many buffalo's that lived inside this forest. And in Buswahili, the prolonged floods already destroyed the smaller forest.

The continuing expansion of the waterweeds has decreased the pasture, open water bodies and water quality, but during the decreases in open water bodies were at least compensated by prolonged and larger floods and the expansion of the lake near Buswahili.
In the same period, the populations of dangerous animals like crocodiles and hippos increased rapidly. Crocodiles became a problem for both cattle keepers and fishermen. In 1985, for

example, there were about 70 vital crocodile attacks on cattle, and during this decade crocodiles killed three fishermen. The hippos cause also fears, but they cause fewer problems and are also more valued by the Wakenye for two reasons. First, they keep the open water bodies accessible with their pathways from these water bodies to the mainland where they graze at nighttime. Second, occasionally hunters arrive in the area and the Wakenye appreciate the hippo-meat as a delicacy.

Next to a further increase in malaria also other diseases like HIV[34] and dysentery arrived in the region. Bilharzia didn't increase so much, but locals explain this by the increase of people that boil water to prevent diseases. Otherwise the increase in stagnant water in the wetland would have probably caused also an increase in this disease.

1990-2007

In the previous chapter we have seen that the waterweeds started to expand further during this period and that they replaced former pasture, forests and open water bodies. Consequently, the people shifted cattle grazing to the upland areas. Especially the El Niño rains in 1997 were a turning point in the way people herded livestock. Before these rains, the livestock keepers used to bring their cattle in the morning to the plains around the Mara River. The animals were left there grazing and drinking on their own. People collected them again in the evening. Because of this land use, the Wakenye didn't grow many crops in the area around the floodplains (otherwise the cattle would destroy the crops).

This situation changed through the rapid wetland expansion after the El Niño rains. The muddy soils made the area unsuitable for grazing because the animals simply sunk away and a lot of pasture was replaced by waterweeds. Some of these waterweeds are also used as cattle feed, but these do not replace all the lost pasture. Consequently people shifted their herding practices towards the upland areas. Next to the effects on the hydro-ecology as explained in the previous chapter, this shift in land use also made the cattle to destroy crops more frequently because they now grazed in the same area as where these crops were grown. For this reason, conflicts between crop cultivators and animal keepers increased and the village governments formulated additional bylaws, which forced people to always accompany cattle. During long dry periods, the inhabitants of Kongoto and Wegero still bring their cattle to the wetland area for grazing and drinking, but during the wet periods they have to accompany their cattle when grazing in the upland areas.

Furthermore, mosquitoes became a large problem in the villages. During and after sunset, any outside activity is almost always accompanied with the annoyance from mosquitoes or measures to keep them away. Malaria became the number one disease in the area with an annual average of reported cases that equals half of the human population[35].

Some people also started to cultivate vegetables and staple crops on the wetland shores. These farmers highly appreciate both the fertile sediments that drifted on the shores during the floods and the higher ground water levels. Moreover, also the vapour from the evaporation of the water in the wetland is said to increase the moistness and harvests on the shores. However, the wetland shores are risky for cultivation because of salty soils, hippos, cattle and unpredictable flush floods that all frequently destroy the crops. To cope with this

[34] During the fieldwork, the local doctor suspected that about 5 to 10 % of the fieldwork population might be affected with HIV, but he was only sure about more or less 30 cases in this area.

[35] This is an annual average of 3775 cases between 2000 and 2006 in the main local dispensary. This number equals half of the fieldwork population, but it may not sketch the whole picture. Baranga has its own dispensary, but occasionally people from this village and from outside the ward also visit the mentioned dispensary and are thus included in this number. Moreover, most people with malaria symptoms are also diagnosed as having malaria, while there are no blood tests conducted. However, villagers also said that they sometimes don't go to the dispensary if they have malaria because they don't distinguish it with normal fever. Since May 2007 each homestead has to contribute annually TSH 10.000 to gain access to the medical services, but before the service was free of charge for the villagers.

combination of high opportunities and risks some people shifted a part of their agricultural activities to the uplands while they continued to use the wetland shores for some agriculture.

This is seen as suitable risk management because the area around the lower plains near the wetland receives more water and thus provides better chances for successful harvests during drought years. Accordingly, the upland areas are more suitable for cultivation in extreme wet years when flush floods destroy the crops in the wetland area. This strategy is widely used in the wetland forest in Wegero and to a lower extent in Buswahili and Kongoto, where salty soils and other land uses (pasture) discourage farmers to cultivate near the shores. To make the wetland area accessible for crop cultivation farmers occasionally burn parts of the wetland vegetation. Some fishermen also use fire to strip the vegetation for re-opening water bodies.

Another influence from the wetland expansion is the rapid increase in the population of the Red-Billed Quelea (Quelea quelea) and other weaverbirds. In particular this Red-Billed Qualea is notorious for eating and destroying almost harvestable sorghum and millet. Locals even reported that the government had sent an airplane with pesticides to the wetland to kill these birds during the late-1990s.

Next to this changes that counted for all three villages, most processes concerning the wetland expansion are different per village. Therefore, the next sections summarise the changes per each village separately. In addition, because the remaining part of this chapter and the following chapter elaborate more in detail on the institutional changes that happened in this period the focus below is almost entirely on the interaction between the wetland expansion and the local people.

Buswahili in 1990-2007

The invasion of the papyrus as explained in the previous chapter brought both advantages and disadvantages for the people in Buswahili. Some inhabitant already knew how to use waterweeds for mat-making since the 1960s, but only since 1984 they started to produce more mats. In this year the population experienced a drought year and some villagers tried to sell mats to other people. Many villagers were wondering why people were making those mats, because it was tradition to sleep on cow skins. One mat-making woman stated: *"they even thought that we were crazy"*. In 2001 there was another drought and some people coped again with food shortages by making and selling mats. However, this business only really started to take off in the year 2003. In this year the national government allowed private small-scale gold mining in Buhemba, which is located about 30 kilometres from Buswahili. Consequently, many people from Tanzania and Kenya started to migrate to Buhemba. Since 2003 about 30.000 of these gold seekers arrived in Buhemba each year[36]. Most of these people lack proper shelter and are therefore in need for easy construction materials to build simple houses. The mats are very suitable materials for this. And as the mats are exposed to rain, wind and sunshine they only last for about six months. Therefore, the people in Buhemba need new mats continuously, and the mat business thus renews it self constantly. During the fieldwork, about half of the population of Buswahili was involved in this mat-making and transport to Buhemba gold mine.

Besides mat-making most of the other recent changes in the wetland ecology were experienced negative for the villagers. The invasion of the papyrus in the area between the open water bodies and the village centre made the open spaces almost inaccessible for the fishermen in the dry periods. For this reason, some fishermen stopped with fishing as an all year round activity in this period. In Buswahili and near the riverbanks it also became impossible to access open water bodies for cattle to drink and to fetch water for domestic use.

[36] This number was given by the Sungusungu leader of Buhemba and not by the official village or district government.

Only when the floods are present, it is still possible to fetch water and catch fish near the shores. Otherwise people have to go through the mud and waterweeds to reach these wetland resources. Besides these very toll papyruses the wetland is also full with mosquitoes and dangerous animals like hippos, crocodiles and snakes.

As noted above only a few people in Buswahili cultivate near the wetland shores. This is also connected to a former bylaw from the village government that prohibited this cultivation (this is further explained in the following chapter). However, there are three vegetable gardens, which are irrigated with hand pumps and buckets. This has become increasingly more difficult with the invasion of the papyrus, because the open water bodies are often out of reach. Moreover, during the fieldwork locals reported that a man from elsewhere had used a *"machine"* to strip the vegetation in the streams between the Buswahili Lake and the river mouth. This has led to stronger water flows towards the river mouth and thus decreased the water level in the Buswahili wetland. The locals presumed that this man came from a downstream village and that he had certain interests in increasing the water quantity downstream. This action further decreased the water availability for the vegetable gardens.

In the year 2000 a plan was launched to expand the secondary school in Buswahili. As the location of the school was not far from the wetland people feared that the expansion would eventually destroy the school. Consequently, the government decided to change the location of the new school towards the upland areas. On the other hand it must be noted that many people in Buswahili don't fear a rapid expansion of the wetland, because the wetlands shores are located near an elevation of the territory.

Kongoto in 1990-2007

In Kongoto village, the forest, which emerged after the Independence Rains, was much larger than in Buswahili. The people used this forest for charcoal and firewood collection. As mentioned in the previous chapter some villagers started to cultivate vegetables on the hillocks in this forest. These people have experienced a few good harvests, but the unpredictable flush floods also occasionally destroyed the crops. On top of this, hippos and grasshoppers that sometimes invaded these fields also reduced the harvests. Next to vegetables, one man from the Luo tribe[37] manages to cultivate paddy in the Kongoto wetland successfully.

The El Niño flood in 1997 destroyed the remaining forest and vegetable gardens. After this flood, the changes in the wetland area had a negative impact on the villagers. The area became more permanent wetland, which is a good habitat for Guinea worms to lay their eggs. These worms can penetrate both cattle and humans and cause diseases. Moreover, as the habitat changed, it became less accessible for humans. Before the El Niño floods the residents used to cross the wetland to visit relatives at the other side of the Mara River in Tarime district. After these floods, the general increase in waterweeds, hippos, crocodiles and wider streams made such a passage impossible. This inaccessibility is also a problem for fishing and for fuel wood collection. The people can only harvest the remaining trees during longer dry periods (mostly from between August and October). Before the 1990s the government prohibited wood collection in the hill forests through formal bylaws, but since the wetland forest had disappeared the village leaders started to tolerate the use of these resources because they realised that there were no alternatives for the people.

There were also advantages for the Kongoto residents. Since the El Niño rains, the streams in the wetland have never dried up anymore, while they all used to dry up during the

[37] The Luo live northwest from the Wakenye territory. A few Luo men migrated to Kongoto and Wegero to continue fishing in the wetland. In their downstream home village, Mara Sibora, fishing became impossible due to the invasion of the waterweeds.

dry seasons. Even in drought periods like in 2005 and 2006 there remained some water inside. This is experienced as a big advantage because before everybody had to walk to the Mara River to fetch water during the dry season.

In Kongoto there were only three people involved in mat-making. The papyrus, which is the ideal material for mat-making is not much present in Kongoto and the villagers do not walk to the Buswahili area to collect the papyrus. There exist a large variety of other waterweeds in this area. These waterweeds are used for different activities such as: hanging fishing-hooks, food for cattle and humans, fuel and thatching.

Wegero in 1990-2007

During the fieldwork, a very large part of the lowland area in Wegero was still covered with the forest that emerged after the Independence Rains. Within this forest there are two small settlements: Kyamakanga and Guta. Especially in the dry season both fishermen and large cattle keepers move to these settlements to make a living. They originate mostly from Wegero village, but also come from Baranga and the Wakenye territory in Tarime District. In Guta there were still possibilities to cross the wetland to Tarime District by canoe.

Other ethnic groups from Serengeti district also use the area around Kyamakanga. This area used to be on the traditional boundary between the Wakenye and the Nguruimi groups in Serengeti district. During Ujamaa the modern boundaries between the wards (and ethnicities) were drawn, but even though Kyamakanga is officially in the Buswahili ward, the inhabitants of this ward still allow the Ngurimi people to live in Kyamakanga as this was traditionally their territory.

The people in these settlements practice all livelihood activities within the forest. Especially for large cattle keepers it is necessary to move to the forest in the dry season because the streams within the forest (diverting from the Mara River) are the only permanents water sources in the region and the area also provides pasture.

In the lowlands of Wegero the floods and the invasion of the waterweeds started to replace the forest only since the beginning of the 1990s. On top of the same problems as in the other villages these waterweeds reduce available cropland in the forest. Within the forest many large spaces started to be invaded by waterweeds and some parts of the forest have died due to the floods. The waterweeds in Wegero are used for the same purposes as in Kongoto: large-scale mat-making as in Buswahili is not practiced due to the absence of the papyrus.

The unpredictable flush floods frequently destroy almost harvestable crops and many people are discouraged to continue crop cultivation near the wetland or apply the previously noted risk management. The human encroachment of the forests is said to be less intense as in Kongoto because of more effective bylaws from the village government, which successfully restrict charcoal burning and fire wood collection.

Since the El Niño rains, floods are more severe and the streams through the forest are wider. This has been positive for fisheries. Especially the catfish juveniles (Visombe) increased enormously. They arrive with the floods and are easy to catch in closed puddles and small streams, which are prevalent after the floods withdraw slowly. These catfish juveniles are very marketable because fishermen around Lake Victoria use them as bite for the Nile perch. Some locals stressed the importance of catching these juveniles while the area was inundated because: *"otherwise many get trapped in remaining puddles, dry up, die and are eaten by birds"*.

Just as in Kongoto, the people in Wegero enjoy the permanently water containing streams since El Niño. The wider and longer inundations also create problems. It became increasingly difficult to fetch wood for domestic use, the cattle often cannot enter the forest for grazing, and the Guinea worms affect animals.

6.3 Population, community, markets and gender in Buswahili ward

Population growth

The elders of Buswahili and Kongoto emphasized a rapid population growth in the 1980s in particular. The official census data for Buswahili village in the table below confirms this statement.

Village	1978	1988	2002	Average annual Growth 1978-1988	Average annual Growth 1988-2002
Buswahili	1257	1667	1868	2,9%	0,8%

Table 6.1: Historical census data for population of Buswahili. The data for the other villages was not obtained.

However, the numbers obtained from the village government for the years 1997 and 2006 as presented below in table 6.2 contradict with the census numbers. According to the 2002 census, Buswahili had 1858 inhabitants, Kongoto 1307, Wegero 3060, and Baranga 2583. In table 6.2 we see that the numbers from the village governments can impossibly correspond with these numbers. Only for Baranga the numbers between the census and village governments seems to correspond. This raises question marks with the validity of these numbers. A district officer stated that the village representatives do not administrate the numbers punctually, but of course the census data collection might also contain errors. I've decided to use the numbers from the village governments because they are more up to date.

The table below suggests that the population growth in Buswahili has indeed been reduced enormously. This is not the case for Wegero where the numbers point at a rapid growth between 1997 and 2006 and also in Kongoto and Baranga the population has grown substantial during these years. The population densities also vary locally. Buswahili and Wegero have the highest densities, while the numbers show lower densities for Baranga and Kongoto. People in this ward live in homesteads with an average of 5.5 members (according to the 2002 census). There was no reliable data about the number of homesteads per village.

Village	1997	2006	Average annual Growth 1997-2006	Km^2	Population densities per km^2
Buswahili	2167	2337	0,8%	45	66,7
Kongoto	1001	1216	2,0%	25	51,9
Wegero	2779	4002	4,1%	60	73,3
Baranga	2434	2933	2,1%	40	48,6
Total Ward	8381	10488	2,5%	170[38]	61,7

Table 6.2: population growth (1997-2006) and densities

Market-access, infrastructure and education

In all village centres there are about eight shops and hoteli (restaurant, bar or pub) that sell mainly items that otherwise would be purchased in the urban centres (e.g. soap, drinks, matches etc). The shopkeepers supply their shops by using the two small buses that drive to Musoma town and back daily. This journey to the major urban centre takes about two hours on a rough and bumpy road that becomes almost inaccessible after rainfall. The departure time of the buses often delays because the drivers understandably prefer to wait until the soils are dry again to reduce the chances to get stuck. The buses are usually overcrowded. Also the road between the villages becomes quite swampy and inaccessible for bicycles and cars after rainfall. The second urban centre is Buhemba gold mine, which is only 30 kilometre from Buswahili, but connected by a road that is inaccessible for cars. This town does not have very

[38] These numbers about the sizes of the territory were provided by the ward agricultural officer, who had received it from national officers *"a few years ago"*. My impression is that part of the territory that is nowadays covered by the expanded wetland is 'correctly' not included in this number (this area is inaccessible for humans).

extensive facilities and is mostly visited for the Saturday markets. The people sell their mats, fish and other products on this market. Some people even use one full day to cycle to Serengeti district in order to buy diesel, return home for the night and subsequently cycle to Buhemba to sell this diesel that is needed by gold miners. A monthly held market in the neighbouring village of Kiagata also provides trading possibilities. About all adults from the Buswahili ward use this market to sell or purchase products.

Each village has one or two primary schools and most villagers have completed this form of education. In addition, in both Wegero and Buswahili there are secondary schools, where students can complete their study up to form four. In order to continue and finish the secondary school, students will have to follow the so-called advanced level elsewhere in the country. However, it is rare to find somebody in the villages who has completed form four. The majority of the people drop out during the first years of secondary education. According to the village leaders and teachers this is because children around this age are often expected to perform livelihood activities.

Community, gender and family ties

Although the Wakenye clearly refer to themselves as one group, the residents of each individual village share far more kin ties with each other than with residents in the other villages. Many people that meet each other for the first time start to find out whether there are any kin ties between the two. If this happens to be the case, they usually start to laugh out loudly. Many men introduce themselves by giving the name of their grandfather. Before the 1980s polygamy was widely practiced and the family names of the fathers from that period are therefore very commonly known.

Understanding the family ties in the villages is complicated for outsiders. For example, uncles and aunts of the same generation of the parents of someone are considered as having the same role as these parents and are therefore also called father or mother. This also means that the child has to behave accordingly these roles. With this regard, it is interesting to note that one of my interpreters sometimes didn't want to translate certain arguments when the interviews became a bit more sensitive. He told me that I was 'allowed' to discuss these issues or raise certain arguments, but that he couldn't assist me with this because he was expected to act according his role towards to his 'parents'.

As noted in the methodological chapter, unequal power relations between man and women were frequently noticeable. For example, when men arrived in a homestead, women often offered their chair to the men. I was told that it is the duty of females to make the stay of male visitors as comfortable as possible. According to the traditions, women also have to inform their husband when they are going to leave the homestead, while this situation doesn't count the other way round. About this issue I was told that it happened more frequently that women stood up to these inequalities. For example, some women occasionally lock the door of the house when their husband is not at home around bedtime. When he arrives later and knocks on the door, she first doesn't give a move, and only at the moment her husband starts to panic and make a lot of noise, she opens the door with a sleepy face.

There were more signs of changes in traditional power relations. Polygamy was practiced, but clearly more often among the elderly people and less by the younger generation. Livelihood activities that traditionally belonged to female responsibilities (e.g. fetching water) are also performed by men. Females fill positions in the village government, but I observed and was told that the degree of real participation in the governments' decisions depended on the individual character of the women. Some of these female participants didn't participate so much because they didn't like to speak in front of men as the traditions prescribe them, while others didn't seemed to be bothered by this. The reports about female circumcision were ambiguous: some say it was commonly practiced, other that it was only exceptional.

6.4 Livelihood activities in adaptive cycles

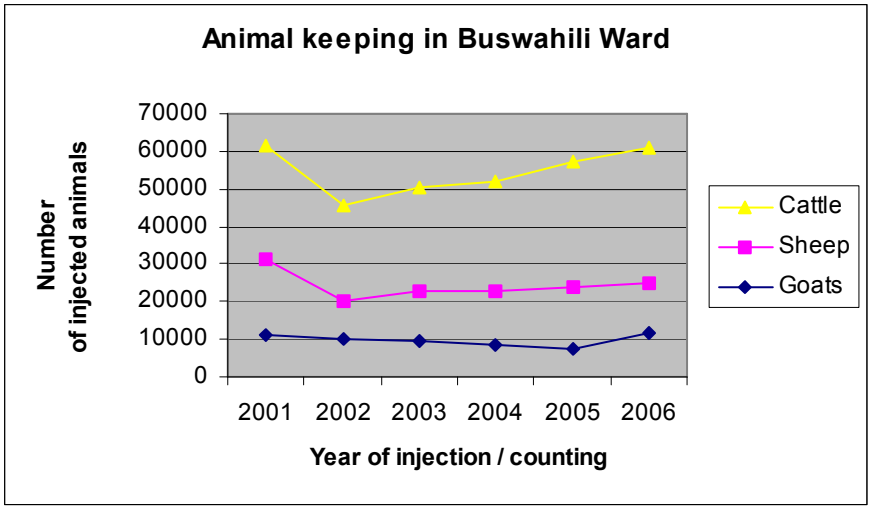
Animal keeping among the Wakenye

Ownership and functions

The Wakenye keep cattle, goat, sheep, donkey and chicken for their livelihoods. Sheep and chicken are mostly used for their meat. Donkeys are used as draught animals. Sheep and goats are used for meat, food security, storing and accumulating wealth and the latter also for domestically consumed milk. Cattle are the single most important animals and used for multiple purposes like: draught animals for ploughs and transport, storing and accumulating wealth, meat production, ensuring food security, fertilizer (manure, although not commonly), milk consumption and sales, bridewealth [39] and cultural prestige. According to widely practiced traditions, the homestead leader (often the oldest male) is the owner of all animals, except of the chicken, which are traditionally possessed and looked after by the children. Because of the importance of cattle this section focuses mostly on cattle keeping.

Animal populations: social and geographical distribution

Because of various reasons it continues to be a difficult task to grasp the actual number of animals from Kurya people. Both local residents and officers emphasized that the Kikurya speaking groups often don't give the real number of animals as possessed by the homestead because they fear taxation or other government intrusion. The numbers used for the graphic below come from the ward agricultural officer who claims to vaccinate all animals after an outbreak of diseases and uses a syringe that counts the number of injections. These numbers are sometimes twice as high, but also sometimes a bit lower than the numbers provided by both the district and the local government. This is a huge difference that can also be explained by the fact that many people that live further from the Mara River are known to bring their cattle to relatives that live around the Mara River in the dry season, because of the permanent availability of water.



In spite of the problems around counting the animals, the trends as visible in the graphic resemble to the narratives of local residents. Most residents were convinced that the cattle population had started to decrease a bit since the year 2000, expect in Wegero where the cattle population had increased. This increase in Wegero is also the single reason for the

[39] The Wakenye also use other forms of payment for bridewealth nowadays like cash, sheep and goats, but cattle is still the most used medium of exchange and the bridewealth rate is also expressed by the number of cattle.

general increase in the ward because in the other villages the numbers of the ward agricultural officer stayed about the same in the last five years. This might be connected in the higher population growth in Wegero compared with the other villages and to the relatively higher number of cattle per capita as shown in the table below. In addition, the declining goat population was also emphasized by the locals, who said that diseases were the main reason for this decline (the increase in 2005 was not mentioned). Most locals stated that the sheep population had not declined, while the numbers of the agricultural officers show a sharp decline between 2001 and 2002. In the table below, the numbers of 2006 are combined with the numbers of the human population and the size of the territory.

Animal Village	Cattle per km^2	Average number of cattle per person	Sheep per km^2	Average number of Sheep per person	Goats per km^2	Average number of goats per person
Wegero	366,7	5,5	25,0	0,4	63,3	0,9
Buswahili	68,6	2,7	133,4	2,6	68,9	1,3
Baranga	171,4	2,3	95,1	1,3	70,2	1,0
Kongoto	123,4	2,5	83,4	1,7	76	1,6
Ward	*211,7*	*3,4*	*78,8*	*1,3*	*68,3*	*1,1*

Table 6.3: Animal keeping in social and geographical perspective

From table 6.3 we can learn that there are large differences in animal populations on the local scale. Similar differences were also mentioned in open interviews with the ward's residents. Many people pointed out that most of the cattle in the ward are kept in Wegero and Baranga, which is also visible in the numbers. Moreover, there seems to be more sheep per capita in Kongoto and Buswahili.

On top of the geographical differences in numbers of animals kept, there are also social diffractions. In the table below the numbers of animals as given by the approached homestead leaders is displayed. The positive skewness points at an unequal distribution of animals among the homesteads in which a few posses far more cattle and other animals than the average (and thus also a few far less). It is important to note that the sample[40] for this data collection has not taken been randomly and that it contains an uneven high number of large cattle keepers[41]. Eleven of these large cattle keepers together possessed 3250 cattle. This is an average of 295 cattle per homestead of these large cattle keepers. Moreover, these same homesteads mostly also possessed higher numbers of other animals compared with the other homesteads. These numbers underscore the unequal distribution of animals among the homesteads. It was not an easy task to find out how many large cattle keepers were living in the villages. In Wegero, many people own large quantities of cattle (50-120) and consequently it was difficult to make a distinction between large - and small cattle keepers. I was told that in both Buswahili and Kongoto about six homesteads own more than 100 cattle. In Baranga, I was told that there were about 16 homesteads that posses more than 100 cattle.

	Cattle	Goats	Sheep	Donkey
Average number per homestead	66	16	18	1
Skewness	2,8	2,6	2,0	2,2

Table 6.4: Domestic animals per homestead: given by 72 homestead leaders in Buswahili, Kongoto and Wegero.

[40] The way the sample has been taken is explained in detail in chapter two

[41] Regarding the degree of representativity of the sample I estimate that in the fieldwork area (thus excluding Baranga) about 3 percent of the homesteads posses more than 100 cattle, my sample contains 15.3 percent of these large holders (see appendix for the improvised calculations regarding this statement).

Obstacles, prices and institutions

The combination of a lack of pasture, increase of diseases and decrease in veterinary services is making animal keeping less profitable because of various reasons. It is said that these factors reduce the lifespan, milk production and the calving frequency from the cattle. Local people argue that instead of the possible four litres a day most cattle only provide about two litres per day in the rainy season. Both local cattle keepers and the ward agricultural officer estimate the average lifespan of their cattle on approximately 23 years instead of the, according to them, normal 30 years.

Because of the variety in diseases, the impact of these diseases on the expenditures of the animal keepers is difficult to measure, but residents said that the Guinea worms for example are causing a serious increase in expenses. De-worming is possible with a medicine called Trodax that is very expensive. It is said that to cure between ten and twenty cattle, people have to spend up to TSH 300.000. Moreover, during the fieldwork, cattle were not consumed and at low price because of Rift Valley Fever[42].

AVERAGE PRICES OF ANIMALS IN MAY 2007

Cattle

Small: TSH 70.000
Large: TSH 250.000

Goats/Sheep

Small: TSH 6.500
Large: TSH 30.000

(Source: ward agricultural officer)

During periods of shortage of pasture, herders sometimes bring their cattle across the borders of the Wakenye territory. However, they rarely go that far because they don't practice a nomadic lifestyle and thus usually also have to take care of other duties near their houses. As noted in the local narratives, temporary migration within the Wakenye territory is common. The village leaders stated that the use of pasture in other territories is often allowed by ethnic groups that occupy these areas. Especially when the herder possesses a document from his village government, which states that there is a shortage of pasture in his home territory, most authorities allow other groups in accessing their territories. However, this institutional flexibility is probably related to reciprocally relations between certain groups because NGO representatives argued that in the Mara region many groups normally don't allow others on their territory.

Adaptive cycles of animal (cattle) keeping

The above descriptions portray animal (and especially cattle) keeping as an important cultural and economical livelihood activity, but at the same time also as a sort of a 'plaything' from institutional and ecological dynamics. While the colonial government oppressed cattle keeping, the Afro-socialist government did the opposite. Due to this shift in policies, cattle keeping went through a release phase, omitted any kind of reorganization phase, and jumped directly in the exploitation phase, which was partly driven on external aid (subsidizing of veterinary services).

However, in the same period, institutional changes (prohibition of setting fire and Ujamaa) pushed the activity into the direction of a conservation phase, but these institutional changes have only impacted the cattle keepers after the Tanzanian government started to abandon their subsidizing programs in the 1980s. In the 1990s, the waterweeds and swampy soils in the wetland replaced pasture and brought more diseases. These ecological changes added to the pressure on this livelihood activity to undertake a release phase (after which reorganization could take place), but according to the information derived from local residents and the ward agricultural officer this phase is taking off very slowly. The numbers in

[42] This is a vital zoonosis spread by mosquitoes that affect primarily cattle, but also can be passed to humans. The disease is spread through mosquito's that increase rapidly after heavy rainfall. For this reason outbreaks occurred in East Africa in 1998 and 2007 and caused hundreds of vital cases among humans and many more in cattle (Wikipedia 2007).

Buswahili and Kongoto point at an increase in sheep and a stable cattle population, while the cattle populations in Wegero and Baranga are still growing. There is a plausible connection between this local geographical differentiation and the paces of the adaptive cycles in the wetland ecologies: in Buswahili and Kongoto the pasture has declined dramatically in the last two decades, while this has not been (so strongly) the case for Wegero and Baranga. This suggests that the people of the latter two villages have less reason to reduce their cattle stocks.

The reason why the release and reorganization phases don't take off more rapidly is obviously connected to the multiple purposes that cattle have for the Wakenye These make it difficult to find a substitute for cattle. However, during the fieldwork many villagers explained that an increasing number of people are investing money in housing and even sometimes started to use bank accounts to store wealth, instead of buying cattle. Anyhow, these changes in the way of storing wealth do not replace the other functions of cattle.

The negative trade-offs from cattle on the environment (e.g. gully erosion, destroying crops, disabling hill forest from recovering and contamination/silting of water bodies) may contribute to the arrival of a release phase because these trade-offs create heavily loaded discussions among the villagers and thus an additional pressure on this livelihood activity. In the village assemblies people discuss these issues and large cattle keepers are regularly criticised. They were said to respond by accusing the criticisers of being jealous of their wealth. This is a clear sign of a reorganization phase in the institutions (norms) around cattle keeping, in which different discourses are present at the same time. These changing institutions may become vital for the future developments in the adaptive cycle of this livelihood activity.

Crop cultivation

Land ownership and type of cultivation

In the table below, the cropland ownership and the types of crops cultivated during the fieldwork, which took place in the long rainy season, are summarized. The average size of the shambas per homestead is 7,7 acres, with a skewness of 0,9. This points at a lower inequality in land ownership compared with the numbers of animals kept per homestead.

	Millet	Maize	Sorghum	Other	Fallow	Total cropland
Total acres	183 (33%[43])	165 (30%)	71,5 (13%)	48,3 (9%)	80,8 (15%)	548,5
Average acres per homestead	2,7	2,3	1,0	0,54	1,1	7,7

Table 2.5: Land ownership and crops grown in long rainy season of 2007 (N=72).

The crops that are both sold on the market and used for domestic consumption, millet and maize, fill most of the space of the available land. Sorghum is also used for domestic use, but more often processed into local alcoholic and non-alcoholic drinks, which are sold on the market. Among the other crops there is some paddy (rice), sweet potatoes, vegetables and cassava. The amount of fallow land is larger in the short rainy season, when many people grow fewer crops because of the larger rainfall variability during this period. Traditionally and also observed during the fieldwork, the ownership of the cropland is in the hands of the male head of the homestead. Contrary to some descriptions of the Kurya in general (Rwezaura 1985), among the Wakenye both man and women work on the shambas. About all the respondents used ploughs on the farms and only a few used manure or other fertilizers.

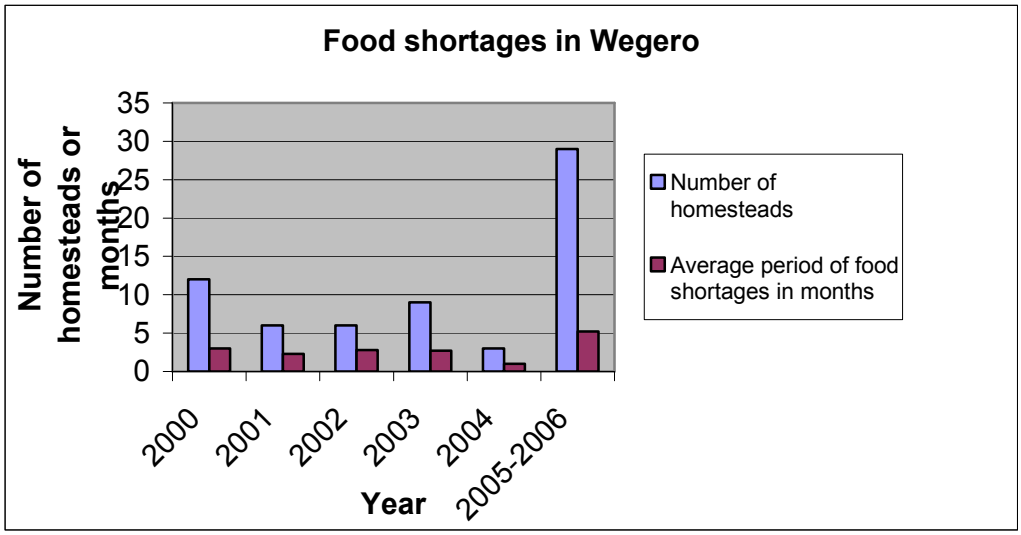
[43] Percentages refer to total amount of the type of cultivation of total amount of cropland as possessed by homesteads.

Constraints and harvest failures (food shortages)

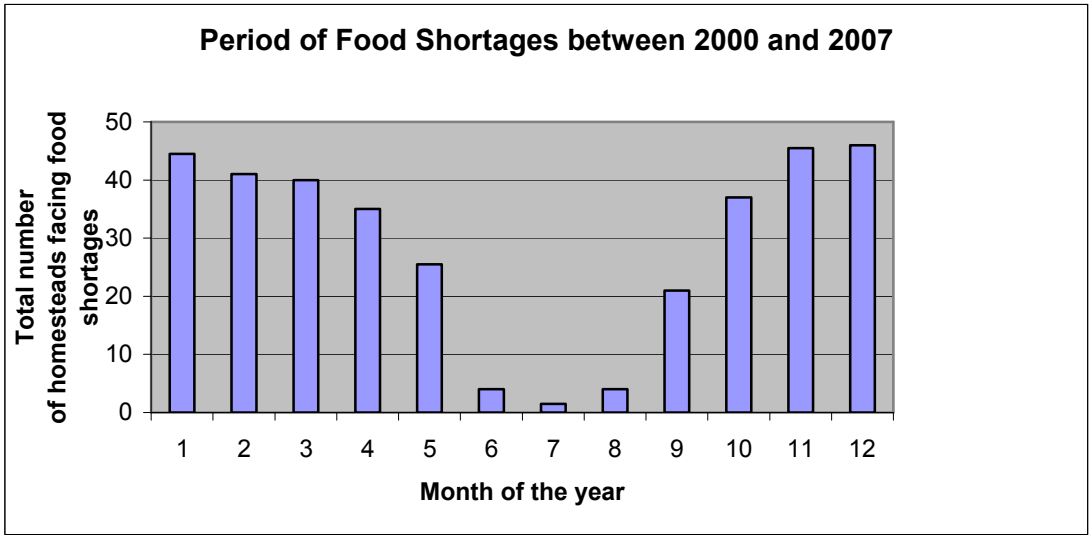
The most heard constraints of farming are: climate variability, hardness of soil, low fertility of the soil (although also many stressed that their soils were fertile), birds, pests in the storage and on the field, poor seeds and poor agricultural tools. Because the crops provide the main staple food for the locals, the failure of these crops is also the main cause behind food shortages.

During the fieldwork first 44 homesteads leaders in Buswahili and Kongoto were asked in which years their homestead experienced food shortages. Food shortages are here defined as: *having no money or available food in the homestead*. This data and further inquiries revealed that during certain periods about the entire Wakenye population faced food shortages. In 1961 and 1974 the floods and Ujamaa caused massive crop failures. In the years 1984, 1992 and 1994 extreme droughts were the reasons behind large-scale food shortages. In 1997 the torrential El Niño rains destroyed most crops of the Wakenye. The following drought in 1998 further worsened the situation. In 2001 another drought caused problems for many but not for the entire population and in 2005-2006 a drought during two succeeding rainy seasons caused massive crop failures again. In the periods between these disastrous years, individual homesteads also occasionally faced food shortages. These shortages were said to be caused by rainfall variability, which mostly occurred in the short rainy season. In these cases the wrong timing of preparing the field (or in the arrival of the rains) caused the failure of the harvests.

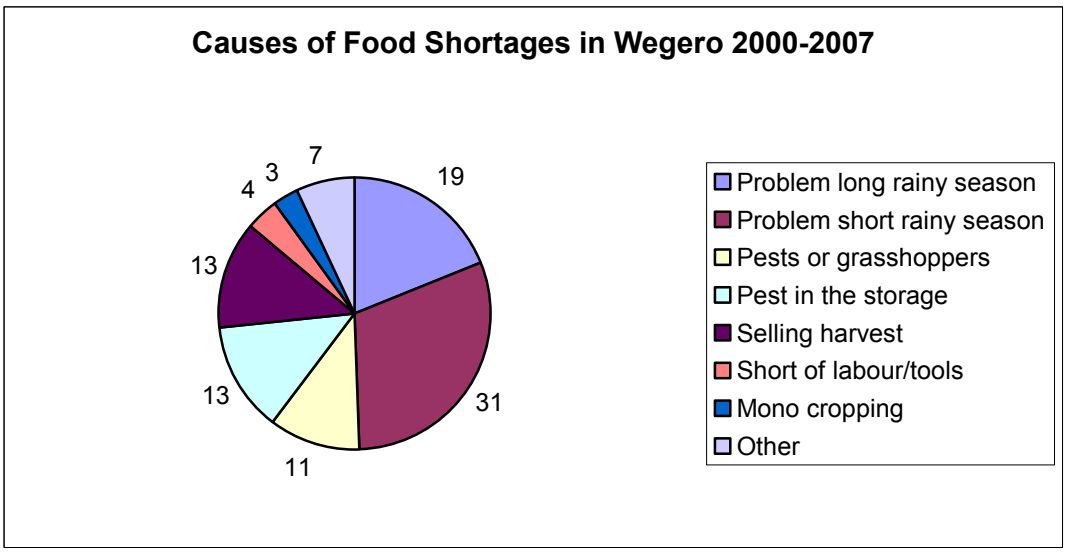
Generally, the respondents pointed at the failure or timing of the short rains as the largest cause behind food shortages. However, these answers are at odds with the common timings of the food shortages that were explained to be in the same period as the short rainy season. To clarify this ambiguity 30 homestead leaders in Wegero village were asked more details about their food shortages. In the graphic below, the average period of the food shortages during the last six years from these homesteads are displayed.



On top of this information, there have been inquiries about the causes and timing of the food shortages. The following graphic represents the months in a calendar year in which the food shortages are experienced for all examined food shortages between 2000 and 2007.



From this graphic it becomes clear that many food shortages already start in September, which is about three months after the harvest from the long rainy season, and just before the take-off of the short rainy season. Eventually the food shortages increase in the short rainy season and only seem to decrease slightly after the harvest of the short rainy season. Only after the harvest of the long rainy season, the shortages virtually disappear again till September. From this data we can learn that there must be other important reasons than rainfall variability during the short rainy season for the experienced food shortages. In the pie chart below, the accompanying causes behind these food shortages as explained by the homestead leaders are shown.



It must be noted that respondents also gave multiple causes for one food shortage and that the weighted influence per factor could not be assessed during this study. For example, it happened a few times that the harvest was reduced due to rainfall variability and that the remaining part was sold to pay for the children's school fees.

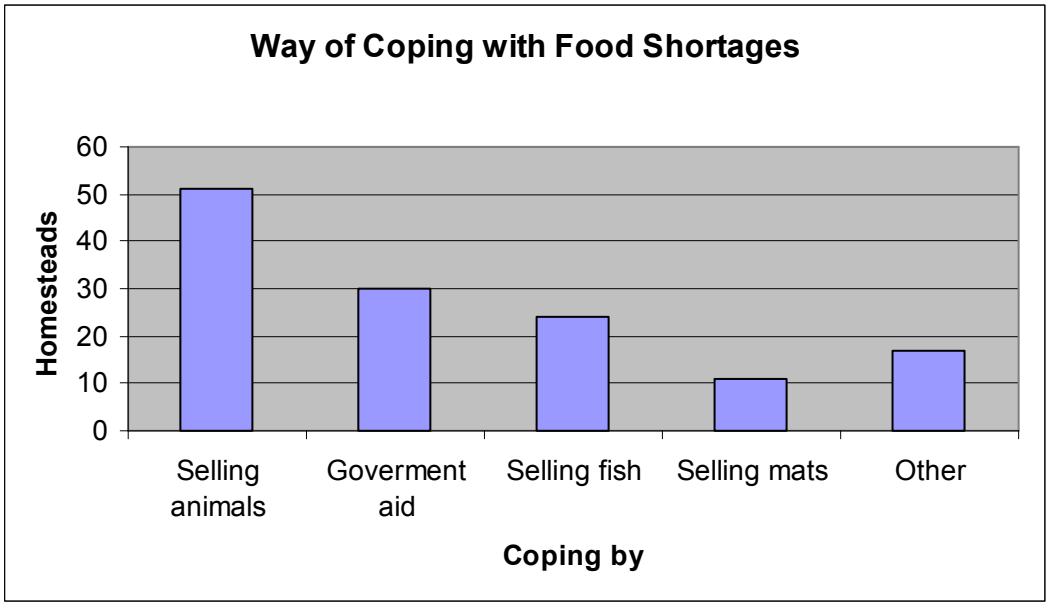
From the pie chart we learn that the most prominent cause of food shortages is still connected to the rainfall variability during the short rainy season, but also the variability in the long rainy season seems to be a large problem. This is clearly linked to the failure of the

short rainy season in 2005 and the failure of the long rainy season in 2006, after which most of these food shortages occurred (see figure 'food shortages' on previous page).

However, 50 percent of all contributing factors are related to other factors than rainfall variability. Pests in the storages and on the field contributed to 13 food shortages. A few elders and also the ward agricultural officer explained that the pests in the storage often occurred because people harvest their crops when they are still wet from the rains. This action might be linked to an urgent need for the harvests after the long rainy season.

Selling the harvest is another additional reason for food shortages. From the 13 respondents that sold their harvest, and experienced food shortages afterwards, eight explained that they sold the harvest to pay for school fees for the children. The seven other reasons for food shortages include some factors related to the wetland expansion such as: flush floods, or hippos and cattle that destroyed the crops.

In the table below the ways that people coped with food shortages are presented. The table clarifies the importance of the other livelihood activities for food security.



From this table it becomes clear that selling animals is the most frequently used way to obtain money to buy food. Government aid was given in the years 1998 and 2006. The wetland resources also provide an important role in coping possibilities. Among the other ways of coping three respondents said that they made and sold clay bricks, and others borrowed money or relied on gifts of relatives.

Adaptive cycles of crop cultivation

Because of the use of multiple crops it is somehow difficult to draw the adaptive cycle for crop cultivation in general. However, broadly speaking the crop cultivation started in an exploitation phase when the Wakenye arrived in the area. By then, all the soils were fertile (not much used yet by the Bwasi) and after the introduction of the plough the labour on the field became easier. Ujamaa can be seen as a temporary interruption in the adaptive circle, which afterwards seems to have moved slowly into a conservation phase. The population grew first rapidly and later substantial, shifting to new lands became more difficult and the croplands became more intensely used.

In the same period the wetland expanded and more upland became needed for pasture. During the fieldwork, the village leaders all emphasized the difficulties in developing a land

use plan in which they have to reserve certain land for crops and other parts for pasture. These difficulties are connected to disagreements between the villagers about the usage of land[44]. Moreover, in Wegero and Kongoto, the governments revealed that they still could give out some land to newly formed homesteads, but that this was becoming increasingly difficult. Thus there seems to be a growing pressure on the available land, which is caused by the combination of the wetland expansion and population growth. On top of this, the experienced larger rainfall variability and the larger populations of Weavers that destroy the harvests are causing harvest failures.

All these factors seem to have pushed crop cultivation into a conservation phase, which results in disastrous release phases on smaller scales in cases that harvests are low or fail entirely. Crop cultivation does not seem to be causing (too) many negative trade-offs towards other livelihood activities. The competition over land use, some soil erosion and occasional burning of waterweeds are potential negative for others. The latter two activities may also cause negative trade-offs towards other geographical areas, but that could not be assessed into detail during this research.

In addition, just as the institutions around cattle, also the institutions around crop cultivation appear to be in a reorganization phase. While the rainmakers were pointing out the right timing of sowing before the 1980s, all individuals nowadays face these dilemma's themselves. Moreover, as the soils are used more intensely and rainfall variability increased, there is a need for different ideas (institutions) about cultivation, which seem to arrive slowly. Some people started to use manure, but the majority was either not aware of the possibility to use this as fertilizer or were convinced that the soils were still very fertile. Most elders and the ward agricultural officer emphasized that the soils always have been very fertile but that this fertility had decreased due to intensive use and that the harvests are nowadays lower compared with before.

Furthermore, some signs of a reorganization process are directly linked to the wetland expansion. The experiments with using the newly available (ground) water (e.g. cultivating near the shores, paddy and vegetable cultivation) reveal that people are searching the right inputs in the newly emerged context. The experienced difficulties (flush floods, hippos and grasshoppers) show us that this is a process of trial and error. The reorganization activities are thus not without risks, but the initiatives can also push some smaller components of crop cultivation into desirable exploitation phases. In this perspective, the interaction between institutions (knowledge and ways of doing) and the actual livelihood activities are prominently present again.

Fisheries

Fishermen and functions

In each village there are about 50 'full-time' fishermen active. In the dry season this number goes down a bit, while in the number of fishermen rises again in the rainy seasons and especially after the floods occur. Most fishermen go fishing about three days a week and perform other livelihood activities on the other days of the week. Besides these 150 fishermen, there are also some other people who only fish in the inundated periods, and those who only go out for catching the juveniles (especially in Wegero). On top of the income of the fishermen, the fish resource also provides an important source of protein. Some non-fishermen were very positive about seasonal inundations, because the fish prices drop significantly in this period.

[44] See for more details on these plans in section 7.2.

Fish stocks, prices and institutions

All fishermen consulted for this research emphasized that there have always been five types of fish in the wetland: the lungfish (Kamongo), the Nile perch (Gogogo), larger size tilapias (Sato), smaller size tilapias (Foeroe) and catfish (Mumi). Most fishermen are aware that there exist subspecies of these types of fish, but don't use category-names to define these.

The fish stocks have always been highly fluctuating between the seasons. The fish prices follow the availability and are thus high in the dry periods and low in the inundated periods. In addition, aspects like fishermen skills and luck also make the catches highly variable. Moreover, some fishermen argued that the courage to go deep into the wetland and face the dangerous crocodiles, hippos and strong water currents determines the catches. The fish is sold locally to domestic users and to businesspeople. The latter sell the fish in Kiagata, Buhemba and even in Musoma if there is plenty of supply.

Estimated fish catches and prices
-*Catches in dry period:* approximately 7 kg per day, sold for about TSH 500 per kg.
-*Catches in inundated period:* approximately 50 kg per day, sold for about TSH 300 per kg

(Source: local fishermen)

Local fishermen revealed that the fish populations of the Nile perch, tilapia, and catfish have declined since the year 1990. They blame the decrease of open water bodies caused by the invasion of the water weeds and sedimentation for this decline: "*These fish species prefer open water bodies and don't like the muddy places and therefore they have decreased dramatically the last years"*. On the contrary, the lungfishes have increased rapidly since the wetland started to expand: *'The lungfish prefers the mud"*. This type of fish became also available during the dry season, because it often hides in the mud after the water has withdrawn. Catching lungfishes was even mentioned as coping strategy in times of severe droughts, like in 2005-2006.

Besides the changing habitat, also the changing fishing techniques are blamed for the decreasing stocks of the 'open water' fishes. One elder stated that they could only catch up to 15 or 20 fish per day with spears, but that they caught about 200 fish with their nets that they started to use after the 1950s. During the fieldwork, it was said that the declining fish populations had reduced the catches back to about 15-20 peaces per net in the inundated period. Additionally, some people blame the use of nets with narrow holes that also catch the juveniles for the declining fish stocks. These nets are used both locally and in other villages around the wetland. The catfish juveniles are a highly marketable product because they are used for bites in Lake Victoria. During the fieldwork it has been observed that the by-catch of these juveniles (e.g. smaller sizes tilapia) was left on the shore and consequently died. Both some elders and contemporary fishermen emphasized that the catching of juveniles and fishing with chemicals (elsewhere) were important reasons for the declining stocks.

Despite the decreasing fish stocks, there don't seem to be any local attempts to organize regulating institutions. All fishermen emphasized that everybody was welcome to fish in the wetland. Some fishermen complained about the increasing number of fishermen from elsewhere that especially came during the inundated periods. There were houses or 'campsites' in the wetland that are only used by certain people, but besides this there doesn't exist any regulation. Fishermen stay a few days in these campsites to reduce the time and energy used to reach the suitable fishing spots (that are inaccessible due to waterweeds). In this period they catch large quantities of fish that they preserve in bags that are stored under the water. Especially the lungfish is said to be able to survive long periods without much water, space or food. In the forest in Wegero people also dry fish to conserve it for later use.

Adaptive cycles of fisheries

The combination of the introduction of new fishing techniques and prolonged and larger floods (which occurred since the 1940s) seem to have pushed the fisheries in an exploitation phase. After the floods of 1961, the increasing open water bodies contributed to the desired external variables in this exploitation phase. More people got involved in fisheries and started to fish the whole year around. The first signs of the conservation phase came with the arrival of the waterweeds in the late 1970s. In the 1980s, the waterweeds invaded the area, but also the floods reached further and stayed longer, and therefore the amount of open water didn't decrease in this decade. This situation changed in the 1990s when the waterweeds and silting of water bodies pushed most of the fishery components into conservation phases.

During the fieldwork, most fishermen in Buswahili and Kongoto were complaining that the fish stocks were decreasing and that the waterweeds were making their job more difficult. Some fishermen laid down their tools, while a few others experienced benefits because they saw the prices rising due to the lower supply. This means that especially in the dry season, the fishermen that still enter the wetland under the tough and dangerous conditions (diseases, hippos, crocodiles and mosquitoes) do experience benefits, because they can sell their catches for better prices. In Wegero the increasing amount of water is positive for the fish populations, but also here the waterweeds obstruct fishermen in their work. These waterweeds also make fishing with net increasingly difficult and therefore fishermen start to use more hooks. Moreover, the weeds also increase the negative trade-offs from fishing towards other livelihood activity, because (a) fishermen chop (and occasionally) burn them and (b) they contribute to the invasion of these weeds by leaving the stems (used for hanging hooks) near the shores.

All together the fisheries in general seemed to be in the conservation phase and fringed between the use of exploitive techniques and ecological dynamics. The increasing stocks of lungfishes in general and juveniles in Wegero are signs of certain components in exploitation phases that compensate the losses of other types up to a certain extent, and thus prevent a release phase in the fisheries as a whole to occur. Moreover, there is a small sign of a reorganization phase: one man in Kongoto has started a fishpond, but his initiative is not much appreciated in the village: people are laughing at him.

The use of forest resources

Use, prices and availability

Most of the people spoken to in this research use both firewood and charcoal as fuel. About all the respondents in Buswahili harvest their firewood on the hills. The residents of Kongoto use the hills in the inundated periods and the dead trees in the wetland during the dry periods. This same pattern is visible in Wegero, but in this village the wetland forest is still (partly) in tact. About all respondents complained about the availability of firewood. The charcoal that is used by the villagers comes from hill forests that are located both in and outside the ward. All respondents stressed that the prices have gone up in the last ten years from about TSH 2500 around 1997 to about 7000 per large bag in 2007. This rapid increase was said to be caused by the shortages of trees and teaches us that this shortage also counts for larger scales beyond the fieldwork area[45].

[45] This rise in charcoal prices cannot be (only) caused by the general inflation in Tanzania, because this inflation has only been on average approximately 5.5 percent per annum in this period. (http://www.indexmundi.com/tanzania/inflation_rate_(consumer_prices).html) (Accessed on 5 Nov. 2007).

Adaptive cycles of use of forest resources

The local narratives teach us that the changes concerning forests resources cannot be seen as apart from the changes in institutions and ecology around these natural resources. Before the 1970s, the hill forests were intact and protected by traditional institutions that were connected to the wider agricultural system and backed up by certain beliefs and taboos. The forces of colonial rule (as explained in chapter four), Christianisation, modernisation and the cheating (or failure) of the rainmakers had already lessened the strength of these institutions, and pushed them far into a conservation phase.

When the Ujamaa Villagization Program reached the area, the elders had to tolerate the use of the hill forest, and consequently the institutions entered a release phase[46]. During this phase the institutions regarding hill forest vanished and a growing population 'gained' open-access to the hill forests. However, the consequences of this deforestation were not clear yet in this period, because the ecological adaptations started to provide forest resources in the wetland area. Moreover, this happened in a period of an institutional vacuum in which the traditional 'reasons' to sustain the tree covers had vanished, but where not replaced yet by new arguments to appreciate and sustain tree covers.

This combination of increasing demands and an institutional release phase has pushed livelihood activities concerning fuel wood and construction materials into unsustainable exploitation phases. This exploitation phase could hold on quite a long time because the regime shift in the wetland provided forest resources for the people. These resources prevented the hill forests in Kongoto and Wegero from unsustainable exploitation till the late-1990s, when El Niño pushed the wetland ecology into another regime (waterweeds). This event forced the people (and domestic animals) to shift to the hills for pasture and forest resources. In Buswahili the hill forest were already heavily degraded during the 1980s: probably because the wetland forest did not last long in this village.

To sum up, during the fieldwork the forest resources were found to be scarce and livelihood activities concerning these resources appeared to be far into conservation phases, which also becomes clear in the rising prices of charcoal. On top of these rising prices and increase of necessary time to fetch wood, the scarcity of trees also creates negative trade-offs towards other livelihood activities. Locals and officers link the disappearance of tree covers to: (a) changing rainfall patterns, (b) a faster run-off of rain water (negative for crop cultivation), (c) an increase in soils erosion that ends up in the streams and wetland and (d) more wind erosion in the dry period leading to dust storms that contribute to diseases (e.g. eye infections and Acute Respiratory Infections). Moreover, as we have seen this increasing scarcity is also interconnected to animal keeping. The institutional changes regarding the rainmakers have thus clearly contributed to social-ecological pathways that provide their feedback to the livelihoods.

Interestingly, the village government of Wegero managed a strict regulation on charcoal burning in the wetland forest during this period of scarcity. Some respondents even complained about these strict regulations because they decrease the availability. Furthermore, because of the scarcity and high prices of fuel wood, some local residents started to grow trees on their former shambas. This can be seen as a clear sign of the beginning of a new reorganization phase, in which people find other ways to organize the necessary resources.

[46] Interactions between larger scale governments and local traditional institutions (based on observations of the ecology and on certain beliefs and taboos) turned out destructively for the local institutions in more areas around the globe (see Berkes and Folke 1998).

Mat-making

Income and access

About half of all Buswahili homesteads generate part of their income by mat-making or transport. The prices and the number of mats that one person makes per week, differ between the rainy seasons, when the area becomes too swampy to collect the papyrus, and the dry seasons, when the recourses are more easily obtained. Most people emphasized that they make about 5-10 mats per week (sold for about TSH 900 each) in the rainy season and about 10-15 (sold for about TSH 400 each) during the dry season. These people make the mats supplementary to their other livelihood activities. Next to the mat-makers, others are involved in cycling the mats to market in Buhemba. This journey takes more or less the whole day and these businessmen make between TSH 5000 and TSH 10.000 per day. Also in downstream villages (where the papyrus is the dominant vegetation) people are involved in mat-making for Buhemba (e.g. in Kwisaro and Ryamisanga).

As mentioned in the local narratives, the residents of Kongoto and Wegero are not much involved in this business because the papyrus did not invade these areas (yet). However, especially the Kongoto villagers would be able to cross the Buswahili border and collect materials very easily because this is only a short distance (depending from the location but at most half an hour walk). A Buswahili resident even suggested that her Kongoto neighbours could come and collect these resources with a cart but stated that they simply don't do it. In Kongoto, people were laughing a bit when I asked them about mat-making and stressed that the materials were very far away. Thus even though the resource seems to be 'open-access' people don't use it because of the larger distance, but maybe also because other factors such as routines or community norms that discourage them to engage in new livelihood activities.

Adaptive cycles of mat-making

There was a lot of scepticism when the inhabitants of Buswahili came in touch with mat-making for the first time. This points at an institutional reorganization phase. After the papyrus colonized the wetland area, mat-making became a more obvious livelihood activity and thus also more accepted among the villagers. In the year 2001, some people experienced food shortages and started to make the mats as a source of income. A few years later the decision from the national government to allow small-scale gold mining in Buhemba really pushed this livelihood activity into an exploitation phase.

This exploitation phase also depends fully on this small-scale mining in Buhemba and is sustained by the rapid mouldering of the materials (thus renewal in demand). This desirable phase might thus not hold if the in the mining business collapses. If the degree of small-scale mining reduces rapidly, because the miners don't find gold anymore, or the government wants to have a large company in that particular territory again, the mat-making business might go through a release and eventually through a reorganization phase. Thus, the continuation of this livelihood activity relies also on the outcomes of this reorganization phase that might happen in the future. And these outcomes depend again on a combination of the ability of the local people to find new markets and the availability of these markets.

6.4 Contrasting perspectives on the changes in the wetland ecology

Importance of the wetland functions and services

It is, first of all, important to note that the services and functions of the expanding wetlands reach different geographical scales. Some functions (e.g. trapping of sediments) probably reach up to the inhabitants around Lake Victoria, while most services are used predominately locally (except mats and occasionally fish). Other functions like ground water discharge are not widely used by inhabitants and regarding flood control more research should be conducted to make a statement about its value. It is quite likely that the swampy soil in the wetland functions as a large sponge that reduces the floods significantly, but it is not clear which areas would receive floods if the wetland wouldn't function as a sponge.

Furthermore, the conducted questionnaires reveal that the homesteads in which certain wetland activities are practiced (fishing, mat-making and clay-bricks making as income generating activities), in general posses fewer animals and less cropland. To provide insights in the strength of this correlation the statistical data program SPSS is used to calculate two variation analyses.

These analyses reveal that the value of the total number of animals[47] kept by homesteads in which a person conducted wetland activities is on an average 18.5 percent lower than in homesteads where these activities are not practiced. Of course, the somehow disproportionate numbers of large cattle keepers (that don't practice wetland activities) push this percentage upwards, but without these 11 'outliners' this percentage is still 7.2 percent. And the same homesteads also own 22.2 percent[48] less acres of croplands than the homesteads that don't conduct these livelihood activities.

This suggests that homesteads which rely on these wetland resources also strongly depend on these resources because they often lack other resources (land or animals). Combining this data with the insights into the importance of the wetland for the (large) cattle keepers, we can state that the wetland is of great importance for both large cattle keepers and villagers who posses only small amounts of land and numbers of animals. Thus it is tempting to state that both the 'rich' and the 'poor' in the villages depend on the wetland resources in their livelihoods[49].

However, while making this statement, it is important to note that even though poverty is often associated to a lack of physical needs, the state of 'being poor' is also linked to many more factors than just economic assets own by the homestead. For example, the scale of the assessment is also important because gender and other 'positions' in these homestead units may determine access to resources. As mentioned previously in this chapter, the power relations between the sexes are unequal in many aspects and women clearly have less power over and access to resources. This research does not include all these factors and therefore this cannot be called a definite poverty assessment[50].

[47] This value is calculated by multiplying the prices for large animals with the numbers of animals possessed by the homesteads. And it only contains the value from cattle, goats and sheep and thus excludes donkey, chicken and dogs.
[48] From these three correlations only the one without outliners is not two-tailed significant (see appendix). It should be noted that the data about the number of persons that live in a homestead were not obtained and that, therefore, this analyses contains some uncertainty.
[49] In the questionnaires the respondents were also asked for the number and type of houses that they possessed. From these answers it becomes clear that the people that rely on the wetland resources also don't posses better or more houses in which they might had accumulated capital.
[50] On top of this scale related differentiation, poverty is only one concept to measure well-being: vulnerability and deprivation are also closely related to it (Chambers 1995).

Varying influences over the decades

The wetland expansion as a whole has affected the local livelihoods both positively and negatively. Moreover, these influences have also been variable over the decades and different for different types of users. Most locals experienced the disadvantages more intensely than the advantages during the period of fieldwork. However, these disadvantages should be understood in the light of the advantages in previous phases of the ecological system.

The population has been growing steadily during the decades of the expansion and people first happily filled the livelihood niches around the newly emerged forests and expanding water bodies. Only after the ecological system started to go through regime shifts again, these niches vanished and this is obviously experienced as a loss. For this reason, we can generally state that locals have first experienced an exploitation phase in which abundant resources were available. From a local social perspective, the ecological dynamics pushed most of the resources into a conservation phase from 1990 onwards.

Because of these changes over the decades and the differences in the distinctive livelihood components, it remains a complicated task to formulate one single conclusion about the influence from the longer-term wetland expansion on the livelihood activities. The following concluding sections give a description of the most striking aspects of the wetland expansion. These statements are backed up by the results of 72 questionnaires in which homestead leaders gave their judgments on the way the wetland expansion has been affecting their livelihoods. Next to the changes over the decades, the geographical differences and the multiple perspectives on different social-ecological component are the most eye-catching social aspects around the wetland dynamics.

Geographical differences

In the local narratives about the ecology and livelihoods the geographical differences already came forwards. These differences are underscored by the answers given in the questionnaires. In the table below the answers of the homestead leaders on the question how the wetland expansion is affecting their livelihood are displayed. The homestead leaders were given the opportunity to answer 'positive' and 'negative' at the same time in case they experienced both advantages and disadvantages[51].

Village	Very positive	Positive	No affect	Negative	Very negative
Buswahili (N=26)	0	13 (50%)	1 (4%)	24 (65%)	6 (23%)
Kongoto (N=18)	0	2 (11%)	0	16 (89%)	2 (11%)
Wegero (N=28)	0	22 (79%)	0	24 (86%)	3 (11%)
Total (N=72)	*0*	*37 (51%)*	*1 (1%)*	*57 (79%)*	*11 (15%)*

Table 6.5: Judgements from homestead leaders on the influence of the wetland expansion on the livelihoods.

The table teaches us that the respondents in Wegero and Buswahili experience both positive and negative influences from the wetland expansion, while the respondents in Kongoto especially mentioned negative influences. Moreover, generally speaking, the negative influences from the wetland expansion were more often and more strongly emphasized than the positive influences.

[51] Percentages in the table refer to the percentage of homestead leaders that gave this answer, not to the percentage of the total number of answers. This number is much higher: many respondents mentioned positive and negative aspects.

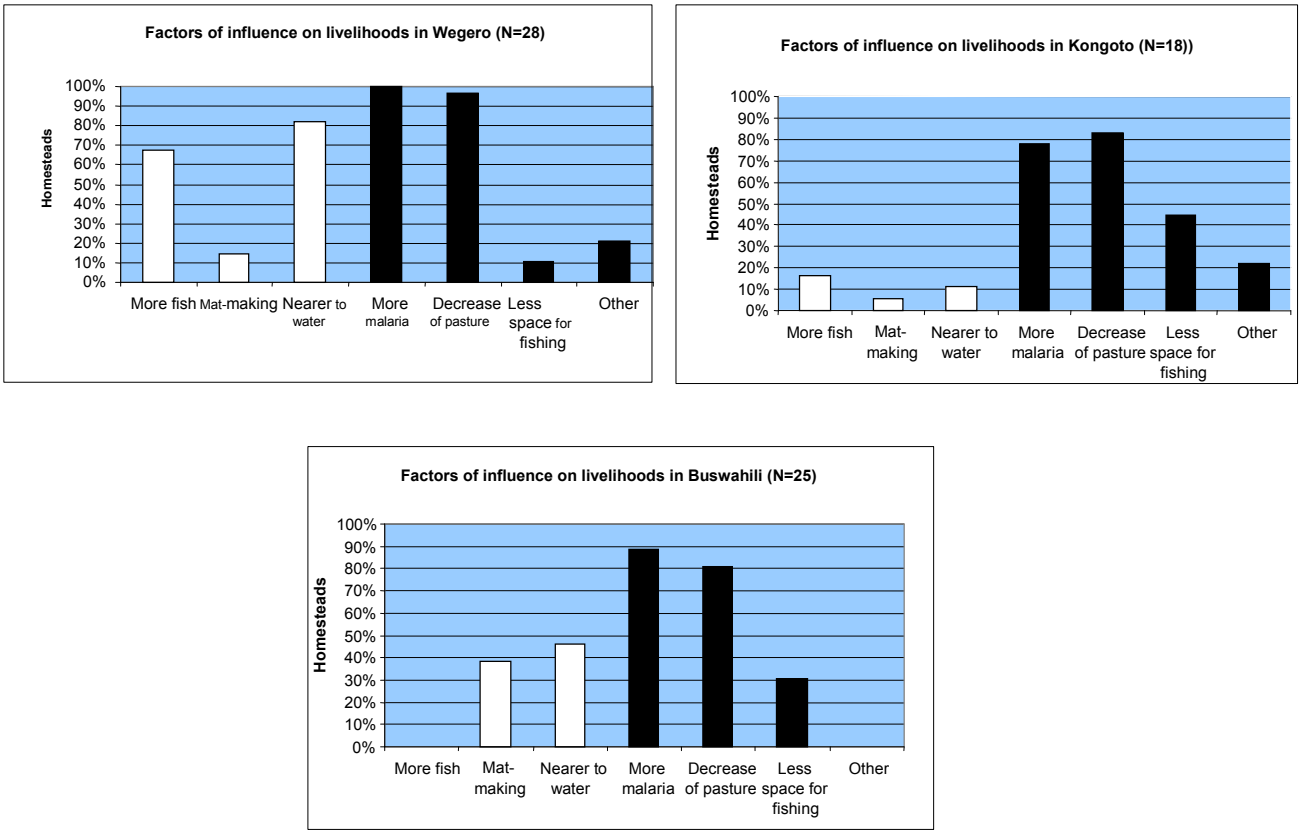


Figure 6.1: Factors of the wetland expansion that influence livelihoods

In figure 6.1 we can see that the decrease in pasture and increase in malaria are the most frequently mentioned negative influences from the wetland expansion on the livelihoods. The decreasing spaces for fishing are experienced in both Kongoto and Buswahili where the waterweeds have already colonized the wetland area. Many homestead leaders in Wegero and some in Kongoto see the rising fish population as an advantage. The ones in Kongoto that mentioned this advantage were no fishermen themselves (as we have seen most fishermen in Kongoto mentioned a decrease in fish population). This advantage is not mentioned by the homestead leaders of Buswahili, probably because the silting of water bodies and invasion of the papyrus seem to cause rather a decline in the fish population in this village. The number of respondents that mentioned the advantage of being closer to water is at odds with the information from the open interviews, because this is mentioned more often in Wegero and Buswahili, while the local narratives pointed out that these advantages was most prominently present in Kongoto and Wegero during the period of fieldwork. This might be an error in the data collection, because a few respondents in Kongoto emphasized this benefit very clearly with saying things like: "*Everybody has benefited from this expansion, because there is more water now".* The high rate of mat-making in Buswahili is probably causing the large number of mentioned positive influences in this village. The other influencing factors mentioned by the respondents are all negative and comprise five times a reference to the Guinea worms that cause diseases in cattle, and further to lost croplands and the increase in dangerous animals.

Interestingly, the geographical differences resemble with the variability over the decades. For example, the people in Buswahili rejoiced the increase in open water bodies between the 1960s and the 1980s, while the people in Wegero did the same during the period of fieldwork. And the people in Kongoto faced a similar situation as the people of Buswahili in the 1990s. 'Their' forest and pasture is replaced by waterweeds, which also decrease open water bodies and make these less accessible.

Components in multiple social perspectives

From both the local narratives and from the questionnaires it becomes clear that there exist contrasting perspectives on the social-ecological components around the wetland expansion. The tables that are discussed below underscore this social complexity.

In the table below we can see that the locals see the invasion of the waterweeds predominantly as a negative aspect of the wetland expansion. Also with regard to this question the respondents could answer both positive and negative at the same time[52].

Village	Very positive	Positive	No affect (neutral)	Negative	Very negative
Buswahili (N=26)	0	12 (46%)	0	10 (38%)	9 (35%)
Kongoto (N=18)	0	5 (28%)	0	12 (67%)	3 (17%)
Wegero (N=28)	0	4 (14%)	1(4%)	22 (79%)	2 (7%)
Total (N=72)	*0*	*21 (29%)*	*1 (2%)*	*44 (61%)*	*14 (19%)*

Table 6.6: Judgement of homestead leaders on how the increase in waterweeds influences their livelihoods.

Those who mentioned the waterweeds as positive for their livelihoods were mostly involved in mat-making. Others occasionally emphasized that some of the weeds are used as fuel and cattle feed during the dry season when pasture is scarce and the wetland is accessible for cattle.

The table below teaches us that the proportion between the mentioned positive and negative influences of the increase of water is the other way around compared with the waterweeds.

Village	Very positive	Positive	No affect (neutral)	Negative	Very negative
Buswahili (N=26)	2 (8%)	15 (58%)	2 (8%)	4 (15%)	1 (4%)
Kongoto (N=18)	0	5 (27%)	2 (11%)	11 (61%)	2 (11%)
Wegero (N=28)	2 (7%)	22 (79%)	0	14 (50%)	0
Total (N=72)	*4(6%)*	*42(58%)*	*4(6%)*	*29(40%)*	*3 (4%)*

Table 6.7: Judgement of homestead leaders on how the general increase in water influences their livelihoods

Many people perceive the increase of water as positive because it provides water for both the domestic animals and household needs, and it contributes to larger fish stocks. The negative judgments on the increase of water were related to the accompanying increase of malaria, decrease of pasture and increase of waterweeds.

In the open interviews and questionnaires, flush floods were also mostly perceived as positive because they provide large open water bodies for domestic animals to drink, domestic use and fisheries (also non-fishermen perceived them as positive because the fish-prices drop significantly during floods). Those who perceived the flush floods as negative had lost crops due to these floods or pointed out that the floods contribute to a rapid colonization of waterweeds.

[52] These percentages refer to the percentage of the homestead leaders that gave this answer, not to the percentage of the total number of answers.

Table 6.8 on the following page contains a summery of the knowledge regarding the multiple social perspectives on the ecological components as obtained from the open interviews and questionnaires. With regard to this table it is important to note that we have already learned that various of the in the table mentioned components interact with each other, and that thus the positiveness and negativeness of these aspects are even more difficult to analyse in reality. The table reveals that there exist a high degree of social complexity or ambiguity around the social-ecological different component and processes. Moreover, it must be noted that I have portrayed the invasion of waterweeds as a general negative influence: the nuances about this are just discussed around table 6.6.

6.5 The role of the wetland as reducer or distributor of negative trade-offs?

Difficulties and ambiguities in assessing the impact of wetland changes

In the previous chapter I brought up that the ecological adaptations in the wetland area may function as either reducers or redistributors of (negative) trade-offs of livelihoods in the basin. In chapter three about the Mara basin we have seen that in the upstream areas, the trade-offs that occur trough the river flow lead to conflicts between people with different interests. At the moment that these trade-offs (larger peaks and soil erosion) flow into the Mara wetlands, they merge with many other forces that influence the ecology, and are eventually socially redistributed through the adaptations of the wetland ecology. However, as we have seen above, the trade-offs from the livelihoods in the basin scale towards the river mouth are not simply reduced. The impacts from these trade-offs and the related ecological adaptations on the local livelihoods are difficult to describe with general statements for three reasons of which two are closely related.

Firstly, because of the multiple contributors to the wetland expansion, we are facing a large degree of uncertainty about the actual contribution of land use changes to the ecological changes in the wetland. Secondly, the local social divisions in advantages and disadvantages are strongly linked to the pace and character of the adaptive cycles in the ecological system. The ecological regimes shifts caused creative destruction in an ecological sense, but also for the social system in the form of highly fluctuating natural resources. The advantage for one livelihood activity is the disadvantage for another. For example, pasture has decreased dramatically and has been replaced by waterweeds, which are used for many other purposes.

This also explains the third reason why it is hard to formulate general statements about the role of the wetland: the local heterogeneity in dependencies to specific natural resources. The waterweeds are used by other homesteads that posses fewer animals and thus also rely less on the availability of pasture[53]. In this sense, it may be that the 'poor' have gained more than the 'rich', because the latter (i.e. large cattle keepers) seem to be more rigid and thus trapped in their livelihoods patterns.

The most important insight that we gain from this elaboration is that the degree of positivity or negativity of trade-offs is related to the specific resources dependency and the adaptability of the resource users. For this reason, the impact of the changing wetland ecology on the livelihoods is extremely difficult to assess. Moreover, as is discussed below, some negative features may even have some positive side effects when we pay attention to the current state of the institutions.

[53] A variation analysis reveals that the value of the animals possessed by homesteads, where mat-making is one of the income generating activities, is on an average 41% less than with homesteads that don't perform this activity. Without the 11 large cattle keepers as 'outliners', this percentage is 11% (see appendix for details).

Social-ecological components	*General and potential positive aspects for local wetland users*				*General and potential negative aspects for local wetland users*		
Flush Floods	Water for domestic consumption	Water for cattle	Water for fisheries	Flush silting water bodies	Destroy crops	Destroy properties (e.g. canoes and hooks)	Contribute to wetland expansion
General increase of water	Water for domestic use	Water for cattle	Water for fisheries		Decrease pasture and forests	Increase of malaria	Increase of waterweeds
Decreasing land covers and erosion	Provide fertile soils for wetland crop-cultivation	Contribute to flush floods			Silting of open water bodies	Decreasing water quality	Contributes to flush floods
Increase of hippos	Used as source of protein	Keep water bodies accessible			Contribute to silting	Dangerous for wetland activities	Destroy crops
Increase of crocodiles[54]						Dangerous for wetland activities	
Increase of waterweeds	Used for Mat-making	Used as cattle feed	Used for thatching, and fuel wood	Used to hang fish-hooks	Contribute to silting	Decrease water quality	Replace pasture and forest
Cattle near wetland	Multiple functions for Wakenye	Contribute to making of open water bodies			Contribute to silting	Decrease water quality	
Clay brick making	Good building materials	Substitute for trees			Leaves holes that are habitat for water-weeds		
Fishing practices	Valuable source of protein	Valuable source of income			Leave holes that are habitat for water-weeds	Contribute to waterweeds	Contribute to decreasing water quality

Table 6.8: Social local perspectives on the different social-ecological components around the expanding wetlands

[54] Crocodiles are not eaten by the Wakenye. When I asked locals about this, they reacted as if I was joking and told me that one will die or get very sick after eating crocodile meat.

No tragedy of the commons?

There is another point to be made about the redistributive function of the ecological adaptations. We have seen that there exist no clearly defined institutions that regulate access to the wetland resources. In the theoretical chapter we have seen that such an open-access situation is often associated with overexploitation and social-ecological problems. I have already mentioned some plausible social aspects that can explain why the wetland has not been totally exploited during this absents of institutions. These reasons are: habitual behaviour, distance and the ethnic divisions in land use.

The features of the local ecological adaptations to larger scale influences (as described in the previous chapter) also seem to reduce the possibilities of overexploitation for two reasons. First of all, in these adaptations there is a high pace in destruction and renewal. The systems have passed various reorganization phases in the adaptive cycle and did not get stuck into one phase that is undesirable for all users.

Even though these fluctuations in natural resources create problems for livelihoods, we have seen that they also create opportunities. The current state of the Buswahili wetland seems to be more 'locked into' a certain pattern and will probably not change significantly anymore but mat-making (up to now) compensates the losses from a collective perspective. The constant renewal in the other phases contributes to a prevention of overexploitation of resources. Even when one of the forests or drylands would have been totally degraded, the hydrological changes would have caused creative destruction anyway.

This point is even better visible in the seasonal changes (i.e. floods) that bring new water and fish each year and thus renewal of resources. These floods and strong current divide the resources spatially during inundation. This means that even when the wetland would be overexploited on one location (e.g. in fish and water), it will be unclear where and whether these trade-offs would affect people elsewhere.

Furthermore, this redistribution aspect of the wetland is combined with an increasing inaccessibility (due to swampy soils, waterweeds and dangerous animals), which discourages people to move in the area. This inaccessibility, combined with the constant seasonal and longer-term renewal, may have thus prevented another tragedy of the commons (like occurred on the hill forests). During the fieldwork, fishermen complained a lot about the waterweeds and asked me to remove them with chemicals. When I raised the argument about the protective role of the waterweeds to fishermen, many of them surprisingly agreed with me that these waterweeds protect the fish stocks for unsustainable exploitation. However, some fishermen argued that in case that the waterweeds would disappear and the wetland would turn into one open lake, their government would start to enforce regulations on fisheries (the capability of these governments to organize this kind of regulations will be discussed in more detail in chapter seven).

In spite of these arguments for the appreciation of the ecological adaptations in the wetland, it is still important to remember that these arguments won't make too much sense for (large) cattle keepers that have lost pasture, someone who has seen his harvest devastated by hippos or floods, a fishermen who has more difficulties of reaching his fishing spots, or someone who is suffering from malaria. These examples do show that the local livelihood system is not adapting successfully to the changes uniformly.

New opportunities and social-ecological engineering?

Interestingly, various changing functions and services in the wetland ecology do provide new opportunities for a number of livelihood activities. Some of these activities were in exploitation phases, but the majority was (still) in reorganization phases. These activities show the potential to 'embrace the changes' as they are. If the local livelihoods become capable to fulfil this potential and to improve their livelihood sustainability, they also

contribute to the sustainability of livelihoods both upstream and in the wider Tanzanian basin in the sense that the trade-offs of those livelihoods are then not seen as negative anymore. In other words, the character of a trade-off (positive or negative) depends also on the adaptability of the receiving party. This raises questions about social-ecological engineering to help to shape the circumstances more in favour of the riparian wetland villages.

Locally, there exists a large tendency towards large social-ecological engineering projects. For example, many people suggested dredging the Mara River in order to reduce the floods and thus the wetland expansion. Others suggested a wildlife reserve for the hippos and crocodiles or to reserve land to cultivate the papyrus for mat-making, while other parts of the wetland could be reclaimed for grazing. Furthermore, there were many voices for both large and small-scale irrigation projects. The observed preferences for large-scale projects are probably connected to a combination of a strong desire to 'get ahead' and the unusual visit of a European man (the author) who was presumed to have the power and resources to organize these projects.

From table 6.8 it becomes very clear that social-ecological engineering projects with an influence on some of the social-ecological components will produce both positive and negative trade-offs for the people that use the wetland functions and services. For example, when hippos are all concentrated in wildlife reserve, the open water bodies may silt-up or become inaccessible, which will have a large impact on the (fish) ecology and subsequently on the fishermen and protein users around the wetland. The same accounts for large-scale irrigation projects. Moreover, dredging the Mara River may cause large-scale problems for the people near the river mouth, because they may receive more polluting sediments. In the recommendations for policies in section 8.5 I will return to this kind of examples for interventions and discuss the difficulties of social-ecological engineering more into detail.

6.6 Conclusion

What features in the social-ecological system have contributed to either sustainable adaptations or unsustainable rigidities in the livelihood system around the Mara wetlands?

Features that have contributed to sustainable adaptations

Broadly speaking, there are three distinctive ways how the livelihoods of the Wakenye adapt to the dynamics and maintain or increase their sustainability. These ways are linked to the organization on the scale of the homestead, the ability to find new livelihood activities in the newly emerged context and the capacity to reorganize the livelihood activities in conservation phases.

First of all, most homesteads keep their degree of sustainability high by performing different activities and thus decreasing the dependency on each of them (and thus increasing the ability to cope and recover from stresses and shocks in individual activities). Secondly, a few people have started to reorganize activities in conservation phases (tree farms, fish pond, use of manure and discussions about cattle keeping). And thirdly, people have also found new activities in the newly emerged context and pushed them into exploitation phases (e.g. juvenile catching, mat-making). Besides these examples, the other newly found livelihood activities are still in reorganization phases (using the availability of water for farming: vegetables, paddy etc.).

These three types of adaptation are encouraging for the sustainability of the livelihoods because they also function as a synthesis*: the newly found activities increase the livelihood options and make diversification of the homestead activities easier and thus increase the livelihood sustainability*. Moreover, additional attention in the homestead can go to activities that have more potential than the 'traditional' livelihood activities. This shift was

also visible in for example: (a) fishermen that laid down their tools and have started to focus on other activities (e.g. diesel trading with Buhemba and charcoal burning) and (b) homestead leaders in Wegero that revealed that they were working less on the shambas while they invested more time in juvenile catching.

Thus, there are some sign that livelihoods adapt successfully to the newly merged context, gain renewal and slowly abandon or reorganize livelihood activities in conservation phases. The most successful adaptations that have led to exploitation phases (mat-making and juvenile catching) clearly rely on renewed opportunities that arrived due to a *combination of the emergence of markets and specific natural resources* (thus commoditization of newly emerged natural resources).

Moreover, about all newly introduced innovative techniques and ideas (e.g. clay bricks, mat-making, and fishnets) came from outside the community. This underscores the idea that successful adaptations often rely on *interactions between scales* (or geographical areas). Though, it must be stressed that this only works if locals are *alert with regard to enterprising opportunities and show a high degree of agency with regard to community norms* (because every time when people started to reshape or to initiate a livelihood activity, other villagers have been laughing at them).

Features that have contributed to unsustainable rigidities

The above-mentioned low institutional bias for renewal belongs to the aspects that have contributed to unsustainable rigidities and may be linked to the way in which the Wakenye historically coped with scarcity: an expansion of the territory. For this reason, this group of people may never have needed to renew their livelihood system rigorously.

However, the two main direct causes for the conservation phases of the four main livelihood activities are found in the impact of larger scales influences: fluctuating natural resources (caused by multi-scale wetland dynamics and changing rainfall patterns) and an institutional reorganization phase that has also been triggered by larger scale institution change. The combination of these two factors has created local scarcity in common property resources (forests and pasture) during an institutional reorganization phase. As I will argue below, *the timing and combination of these dynamics may have caused serious problems for the adaptive capacity of institutions and the emergence of solution for the increasing scarcity and the accompanying conservation phases.*

In the theoretical chapter it is stressed that governance of common property recourses has to take place by collectively agreed institutions. In the local narratives we have seen that these collective institutions have collapsed during Ujamaa, after which the power of the elders and rainmakers declined rapidly. Throughout the first period after Ujamaa, reorganization was not necessary or not 'triggered' because (a) the changes in the wetland ecology provided predominantly more resources, (b) the subsidizing of the government compensated the increasing medical costs for cattle and (c) the hill forests became accessible for the villagers.

However, the high population growth in the 1980s resulted in more unsustainable exploitation of these resources. In the 1990s, this unsustainable exploitation merged with the described ecological regime shifts in the wetland and the vanishing of national subsidises. This combination of dynamics has pushed four important livelihood activities into conservation phases. In some specific cases, the village governments have solved specific symptoms partially (e.g. cattle destroying crops), but in most cases tolerance in bylaw violations appears to be understandable in this situation of scarcity. This failure in redesigning the institutions is not only connected to the above mentioned timing of destructive events and the phenomenon of scarcity itself, but as I argue below also to the way that people cope with scarcity.

The sudden rise in scarcity of resources (and land) during the 1990s (especially after El Niño) has not only pushed four individual livelihood activities into conservation phases, but also reinforced (negative) trade-offs between these livelihood activities. These trade-offs connect various livelihood activities with each other and consequently keep them more firmly into scarcity traps. This is visible in the positive feedback mechanism in the shift to the uplands and hills (concerning pasture and forest resources) as mentioned in the previous chapter. In the social local narratives we have learned that this feedback mechanism has also been fuelled by the vanishing of the traditional institutions and the lack of power of the newly designed bylaws to prevent this shift to the upland areas and hills during times of scarcity. Moreover, this shift accelerates the pressure on the available land and resources and consequently multiple trade-offs between livelihood activities have appeared, such as: (a) animals that disable the forest resources to recover, (b) a faster run-off of rainwater, which is negative for crop cultivation and contributes to erosion, that subsequently contributes to (b) the accumulation of sediments in water bodies that contaminate the water and reduce space for fishing, (c) there is a plausible connection with changing rainfall patterns that affect all livelihoods, (d) more scarcity of agricultural land and (e) cattle that frequently destroys crops in the upland areas[55].

These trade-offs originate from the way that people cope with the ecological and institutional dynamics. This shows us that the way people cope with scarcity contributes to trappedness of livelihood activities. Moreover, the combination of this competition for resources and the ecological degradation points at a 'tragedy of the commons' that goes beyond the commons because it also affects privately owned croplands.

It is not an easy undertaking to reshape the institutions concerning these resources and trade-offs, because it would be a harsh task to exclude large cattle keepers (in order to enable the hill forests to recover). Especially after El Niño, these large cattle keepers have lost a lot of pasture and therefore it seems difficult to exclude them from other common property. The observation that in this case, the 'rich' are strongly affected by ecological change does not mean that the problem is more easily solvable, because their attachment to cattle (or to prestige) seems to be too strong to reduce their stocks and to release the undesirable conservation phase.

From this elaboration we can learn that unsustainable rigid features seem to be stimulated by (a) *multiple functions of livelihood activities (cattle),* (b) *competitions in land use accompanied with negative trade-offs between livelihood activities in conservation phases,* (c) *scarcity combined with an institutional reorganization (or vacuum), and by* (d) *a low degree in homogeneity of resource dependency*. All these features contribute to the difficulty of designing and enforcing any regulating institutions that would influence livelihoods so that they adapt more sustainable to the newly emerged context.

<u>The state of the livelihood system?</u>

Although we have seen that there is a certain degree of renewal in the livelihood system, it is important to note that all new activities are seen as supplementary to the main or 'traditional' livelihood activities. The latter activities all appeared to be in conservation phases.

[55] Point b and c in this elaboration clearly go beyond the fieldwork area, because changing rainfall patterns and silting of water bodies occur on larger scales and also because of larger scale influences. However, about the patterns that I describe as the causes of the shift to the uplands and hills, I was told that similar processes also occur in the wider Mara region (vanishing of institutions and shift to the hills after the wetland expansion). Moreover, these trade-offs of the livelihood activities of the Wakenye also reach beyond the fieldwork area: I have stressed the importance of tracking trade-offs in the theoretical section about livelihoods (1.7).

For this reason we cannot speak about a regime shift in the livelihood system, even while the wider institutional and ecological systems have clearly gone through regime shifts.

The four main or 'traditional' livelihood activities have evolved in previous ecological and institutional regimes and appear to be trapped in conservation phases. This trappedness reduces the sustainability of the livelihoods and creates a mismatch between these livelihoods and the newly emerged context.

These problems in reorganizing the regulating and innovating institutions around livelihood activities contribute to the persistence of undesirable conservation phases and explain why these are not 'released' or reorganized yet. Only some minor attempts to reorganize these activities have been observed in tree farms, use of manure and a fish pond.

In spite of the complexity regarding the interconnectedness between the social-ecological components, interventions are not impossible in this social-ecological system. However, intervening agents have to be aware in the complexity and interconnectedness between certain components and maybe choose to intervene in components that are not so strongly interconnected to wetland dynamics, such as crop cultivation. This livelihood activity provides the major staple food to the people, and at least some of the causes of food shortages seem to be (simply) reducible through renewed inputs of knowledge or means. In the next chapter, we will examine interventions and attempts to improve the sustainability of the livelihood system.

CHAPTER 7: CONTEMPORARY INTERVENTIONS AND COOPERATIVE GROUPS

7.1 Chapter build-up and the governmental structure

In this chapter I describe how recent interventions and the establishment of cooperative groups have worked out for the locally based livelihoods and institutions. Each section consists of a description of interventions or cooperative groups that share similar characteristics. These descriptions are, when applicable, accompanied with information about the observed problems and with suggestions for 'the way forward'. On top of these descriptions, the adaptive cycle is again used as an explanatory metaphor to describe the way these interventions have worked out for the local components. The information regarding government policies is obtained from officers that are employed at Musoma district. For details about NGO interventions interviews with local people and NGO representatives have been conducted.

The efforts of NGOs and the government are examined only on the scale of the fieldwork area and not on broader scales. Because of this spatial limitation it must be noted that the evaluations of the interventions lack ecological validity[56] as complete evaluations, but they can nevertheless: (a) provide insights for the representatives to reflect critically on their own efforts, (b) generate ideas for further research, and (c) give an impression of the problems and opportunities of certain types of interventions and institutions in the area. The conclusion of this chapter focuses on the difficulties and possibilities of intervening successfully in the already mentioned institutional organization phases.

<u>The governmental structure</u>

In Tanzania there are six layers of governmental administrative bodies, which can all act on their geographical scale and according to their place in the hierarchy. The district administrations (as mentioned in section 4.1) are split up in smaller administrative units. In general, the larger the geographical scale of the administrative body, the higher the hierarchical position in imposing laws on smaller bodies. For example, the national administration can lay down laws on the district units. The latter are then responsible for enforcing these laws in their district.

On the other hand, there is autonomic space for smaller administrative units to create legislation for the scale of their territory. For example, the Mara regional administrative unit has only an advisory role in the governance of natural resource of the districts. The districts implement their own bylaws and enforcement guidelines. Also village governments can design bylaws for certain issues like natural resource management and the use of alcoholic drinks. These village bylaws are registered in the corresponding district administrations.

The ward and division administrations communicate new legislations from the district towards the people in their territory. This communication goes two ways, because initiatives and problems faced by the villagers of the ward are also addressed in the district (through the ward and division administrations). In addition, these administrative layers are important for providing services towards the people. For example, in the ward administration there is a health officer (doctor), agricultural officer and a development officer. These officers have the responsibility to provide the ward's inhabitants with services and advise. However, the fact that they are employed at the district emphasizes the importance of the district administrations, which are described by Juntunen (2001: 52) as the principal administrative units. According to the official national website: *"The district councils are mandated to play the two main functions of administration: Law and order, and the economic and development planning in the district"* (URT 2007).

[56] This term is used in science to express the validity of certain statement regarding their scale.

The village governments are elected democratically every five years. The winning party delivers the chairman of the village committee. He is the official leader of the village. The village committee consists of approximately 25 members who all have their duties in different sub-committees such as: social security services, financial and planning, land distribution, infrastructure, agriculture or water management. In addition to this democratically elected government there is a village executive officer, who is selected and employed by the district and responsible for the official affairs in the village. Furthermore, villages are split up in different sub-villages in which always one person has the responsibility to communicate issues with the village leaders (chairman and executive officer). Another aspect worth noting is the ability of village governments to oblige people to participate in collective development activities (e.g. building schools) and fine the villagers who refuse to cooperate. These implementations are only possible after approval of the general assembly of the village government.

It is important to stress that even though the elected village government is the official village authority, the male elders play an important role in village politics. The elders meet regularly to discuss problems and introduce themselves as the *"keepers of the territory"*. According to some inhabitants of the villages the elders are the actual leaders of the village. A twenty year young male told me: *"When there are important decisions to make, the elders give advises and the government will have to follow these advices"*.

7.2 Government interventions in property rights

Governmental institutions on wetland use (and fisheries)

The national government of Tanzania has created general legislation for both the use of wetland resources and fisheries. The enforcement of these laws is under the responsibility of the districts. The legislation on wetland use in general is set forth in the Environmental Management Act (2004) of the Ministry of Environment at the national scale.

On top of these regulations as quoted in box 7.1, law 56 (5) of this act states that: *"The minister in consultation with other sector ministries may make additional regulations and guidelines on the sustainable management of wetlands protected under this act"*. This law is probably connected to the international Ramsar convention that provides frameworks for sustainable wetland use to national government. Since the year 2000 Tanzania has designated four wetlands as 'sites of international importance' and thereby signed this Ramsar convention (Ramsar 2007c). The Mara wetlands are not included in the four wetlands and during the fieldwork, there were no additional regulations or guidelines formulated for this wetland in Musoma district.

Furthermore, besides wetlands, also swamps[57] are mentioned in this environmental act. Swamps are prescribed as *"environmental sensitive areas''* (ibid) and should be either protected or conserved. A natural resource officer from the district administration explained that this means that there should be a management plan, which takes care that the swamp is managed sustainable. Moreover, there exist further legislation for human activity that is "*likely to compromise or adversely affect conservation of diverse water sources*" (ibid), but wetlands in particular are not mentioned here (while other water sources are mentioned by name: ocean, lake etc.). The same act also restricts human activity such as crop cultivation within distance of 60 meters from a river or lake, but wetlands are also not mentioned in this case. The district officer noted that in case of drainage for irrigation purposes, there probably wouldn't be any difficulty to get permission from the minister as long as the irrigation is part of a sustainable development plan.

[57] A differentiation between swamps and wetlands in this act has not become clear for me, but it may be included in the act. However, these terms often refer to a similar habitat.

BOX 7.1: NATIONAL SCALE WETLAND LEGISLATION

In the Environmental-Act (2004: 41-44) it is stated that according to law 56 (4): *"the conditions prescribed under section 55 (2) shall apply mutates mutandis for wetlands".*
In 55 (2) is declared that: *"The (district) councils and local governments are responsible for environmental matters and shall issue guidelines and measures for the protection of ocean, rivers, riverbanks, lakes or lakeshores.*
It shall be an offence to carry out any of the following activities without prior authorization or permits issued by the Minister:

a) *Use, erect, construct, place, alter, extend, remove or demolish a structure in or under an ocean or natural lake shorelines, riverbank or water reservoir, riverbank.*
b) *Excavate, drill, tunnel or disturb the shoreline of ocean or natural lake, river bank or water reservoir.*
c) *Introduce or plant, any part of a plant, plant specimen, whether alien or indigenous, dead or alive in a ocean, river, river bank, lake or lakeshore.*
d) *Deposit a substance in a river, river bank, lake or, lakeshore, shoreline or wetland or in or under its bed, which is likely to have an adverse environmental effect on the river, river bank, lake, or lakeshore.*
e) *Direct or block a river, river bank, lake, lakeshore, or shoreline from its natural course.*
f) *Drain a river or lake."*

The district is also responsible for the implementation of national regulations on fisheries. In 2005 the national government introduced a law that restricts the capture of fish with specific sizes. Regarding this law catching Nile perches with a size below 50 or above 85 centimetres is prohibited. The same accounts for Tilapias with a size below 25 centimetres. However, the district officer revealed that only fishermen that are caught with a substantial number of banned fish sizes are being fined. The other types of fish are allowed to be caught in any size, but there exist further legislation on the use of fishing nets. The mesh sizes should be three inches or larger and when stretched five inches or larger. Moreover, the use of beach seine nets (people drag these nets around the shores on the bottom of the water body) is prohibited.

The district officers in the Mara region focus their attention especially on the fisheries in Lake Victoria. During the fieldwork there were only 12 staff members in Musoma district who were mainly occupied with registration and involving the community in sustainable fisheries. Officially, fishermen need a license to fish, but there are no quotas regarding quantities. The national government employs a patrolling team of about 10 officers, who (also) mainly focus on the fisheries in Lake Victoria. The community is involved in sustainable fisheries through the establishments of Beach Managements Units, in which local residents regulate their own fisheries. Officers occasionally visit the fishermen around the Mara wetlands to inform them about the regulations, but additional measures or checks on wetland fisheries are rarely conducted.

Government efforts in improving the land cover

In the previous chapter the activities that lead to land cover degradation have been described into detail. The efforts of the government to improve the land cover focus both on restricting some of these activities (especially charcoal burning) and on stimulating reforestation. Two changing policies on the national scale seem to be of great importance for the policies in land use that are implemented by Musoma district.

The first change in national policy implied a turning point in the official property right system. The Land-Acts (Land - and Village Acts) of 1999 tolerate customary occupation of land and even places customary tenure on the same level as granted rights of occupancy (Shivji 1999). According these acts the official ultimate owner of all land is the President, who divides the responsibilities. The land that belongs to village territories comes under the administration of the village council, which acts as an agent under the commissioner (ibid). This means that the village governments have to prepare land use plans and take the responsibility for land management. Moreover, villagers have gained the possibility to be issued with certificates of customary rights of occupancy. This change implied both a decentralization process and a change in property rights from a traditionally governed or more or less open-accessible territory towards a village government or private property.

The transition in property rights forced the district and village governments to reinvent their natural resource policies. For example, before 1999 charcoal burners and dealers applied for a license for their business at the Musoma district. Government taxes were included in the cost price of this license. Eventually the charcoal burners and dealers calculated these taxes in the consumer prices. The main problem with this system was that the district lacked capacity to check the licenses of all charcoal burners and dealers. Therefore, many of them worked without such a license and still calculated the tax money in their prices. Moreover, the district generated money by giving out permits, which might have worked as an incentive to give out permits rather than to conserve the land cover.

The institutional construction around charcoal burning has changed after the introduction of the Land-Acts. The village governments have to design land use plans in which they can reserve a certain territory for charcoal burning. Before the trees on this location are officially allowed to be harvested, a district forest officer first has to check the appropriateness of the land use plan. His judgment on the appropriateness will only be legal after he has discussed it within a special committee where the district commissioner, a district development officer, a water management officer, a natural resource management officer and the involved village executive officer and chairman take seat. In addition, after this committee has agreed collectively, the charcoal burner is obliged to plant new seedlings at the same moment he harvests them. Only after these seedlings are being planted, the transport-permit for charcoal is given out by the district.

The second large-scale change in natural resource management was also initiated by the national government. In the year 2006, the national administration gave the order that every district should plant 1.5 million of seedlings each year. Musoma district lacks financial resources to organize this tree planting and therefore started to involve the residents with a bylaw. In this bylaw all homesteads are obliged to have at least 30 trees on their property (shamba and homestead). These trees may be either natural vegetation or trees that are planted by the people themselves. The village government is the central authority to enforce this bylaw in which offenders will be fined or even imprisoned (after more violations).

This bylaw focuses mostly on reforestation of the flat lands and not on reforestation on the hills and mountains. The district officers advise villagers to use these hills and mountains not intensively, because even when they are bare, only about five years of non-intensive use can bring clearly visible changes in land cover. Non-intensive use of the mountains means, first of all, restrictions on the use of fire, which is lighted for charcoal burning and is seen as

the main disturbance of natural vegetation patterns. In addition, only limited dry wood collection and cattle grazing should be allowed. In line with this advice, the district is involved in organizing Joint Forest Management Plans. Here, officers encourage the villagers to make such a 'low intensity management plan' themselves. In these cases a committee is formed that decides, for example, how much wood can be taken out of the forest for construction purposes. The district officer summarizes the advantages for local people by pointing at: the long-term availability of wood for fuel and construction, pasture for cattle, traditional medicines, and materials for roof thatching.

In addition to national and district government legislation, the village governments have also designed formal bylaws to prevent deforestation. During the fieldwork there was a large variety of formal bylaws to prevent deforestation, for example (not exhaustively): in Kongoto any living tree harvesting is outlawed; in all villages tree harvesting near the streams is prohibited; in Buswahili tree harvesting on the hills is not allowed; and in Wegero all homesteads are obliged to have at least ten trees on their properties. The penalties for violation of these laws are small fines. Every sub-village representative has the duty to communicate law violations to the village executive officer who is responsible for the official fining. If the perpetrator is unwilling to pay the fine, the village based Sungusungu[58] group has the task to deliver the person to the police.

Observed results and difficulties of the government policies

From the above it has become clear that the village governments have an important role to play in the newly formed formal institutions. Village governments have became the official 'guardians' of the territory and the administrative unit that is responsible for certain law enforcement. During the fieldwork all three villages were still in the process of preparing a land use plan. It turned out that the village leaders faced problems in integrating the wishes and demands of the local inhabitants in these plans. Most of the non-cropland in the villages is used as pasture. Therefore, attempts to reserve particular land for other purposes often mean a loss for (large) cattle keepers. This makes it difficult to design land use plans, which are satisfactory for both large cattle keepers and other villagers. Separating the land used for pasture or crop cultivation is also important because this can reduce the conflicts that occur when cattle damages crops.

Shivji (1999) argues that the process of adjudication and titling regarding the land rights of villagers is time-consuming and managed bureaucratically in administrations beyond the village scale. However, I have not been able to verify whether these statements counted for the situation in Musoma district.

The enforcement of the 'thirty trees per homestead law' will (also) lean on the capability of the village governments (because the district lacks the capacity to check all homesteads). The natural resource management officer emphasized two problems with this structure. Firstly, in most villages almost everybody is actively involved in the extended family. This means that, in a sense, everybody in the village is somehow related to everybody else in the village. Consequently, the village leaders will have a certain relationship with all perpetrators within the village. Subsequently, it is obvious that these relationships can easily influence the practical law enforcement.

Secondly, it is difficult to inform the local inhabitants and village leaders about the exact details of new legislation. In this respect, the officer referred to the 'lawyers language', which is used by the national government to communicate legislation. These written legislations, like the mentioned wetland policies, are usually not provided to the smaller administrative units and even when it would be provided, the leaders would probably not be

[58] This is a village-based 'substitute' for the police; see the end of section 4.2 for further details.

able to understand the 'lawyer language'. The communication about legislation between the district and smaller administrative units is mostly done vocally. Usually, this takes place on organized meetings between district officers and the leaders of the division, wards and villages. After such a meeting, the village leaders communicate the new legislation with the inhabitants of the villages. During the fieldwork it was observed that villagers and local leaders often misinterpreted laws. For example, one village executive officer was convinced that buying and selling of land was prohibited because the village government is the official guardian of the land according to the Land-Acts 1999. However, according to a district officer this legislative construction was only meant to protect the common property and not to reduce the possibilities of buying or selling of individually owned land. This means that buying and selling of land appeared to be legal. In other cases, villagers misunderstood details of legislation. For example, a lot of people thought that they were going to be forced to have 50 trees on their property instead of 30. Similarly, the villagers understood that they were officially not allowed to cultivate within a distance of 100 meters from the wetland. This was a local interpretation of the national legislation that prohibits cultivation within a distance of 60 meters from a river or lake that even doesn't seem to count for wetlands. These misunderstandings can easily arise out of the vocal communication structure.

Furthermore, during the fieldwork local leaders also revealed difficulties in law enforcement. A village executive officer stated that it is within their culture not to be too strict on bylaws: "*If you are too strict here people will see you as a madman and then you loose all your authority. It is just like the bible, it is a good book, but if you follow all the rules you go crazy".* This cultural aspect makes any decision on law enforcement a dilemma.

Moreover, combining the village bylaws with the data presented in the previous chapter about livelihoods makes clear that some of the village bylaws appear to be impossible to implement. In Kongoto, all living tree harvesting is prohibited, but fuel wood is the only available source of fuel for the villagers. In addition, we have seen that the wetland expansion is causing rapidly changing stocks of natural resources, which eventually create sudden shortages in natural resources.

The dynamics raise the question whether any strictly fixed institutions contain the possibility of effective management on natural resources. For this reason the previously noted cultural tolerance towards law violations clearly serves a purpose: strict law enforcement denies access to necessary resources. This problem was also observed in Wegero village. As noted in the previous chapter, the village government manages to enforce the bylaws regarding charcoal burning in the wetland forest. However, while it is tempting to call this a success we should not forget that the hills were intensively used and consequently predominantly bare or vegetated by smaller bushes. Moreover, villagers complained about the low availability of fuel wood.

These observations take up with the recent academic insights described in the theoretical chapter: dynamic ecological systems require dynamic institutions. This conclusion is underscored by the local functioning of the national institutions on fisheries. In the previous chapter we have seen that the Visombe (catfish juveniles), which are used as bite for the Nile perch) are an important source of income for the people and that catching those juveniles is probably only partly negative for the fish ecology in the wetland. Transportation of these juveniles is mostly done at night (by locals and other businessmen) because it is said that otherwise the police in Kiagata frequently demands money from the transporters of these juveniles (either corruption or official fining). The juvenile business is thus influenced by these institutions, while some of these fishes would have dried up and died in the puddles and streams that are cut of from the main streams in the wetland. On the other hand, it must be noted that if the juveniles would be left alone, many may survive and mature, enrich the ecology and potentially become available in a later stadium as a source of protein and income.

Influence of governmental institutions on local adaptive cycles

The most prominent features from the governmental legislations are their lack of power to implement their imposed regulations on the local scale. The observed efforts in decentralisation might help to empower these institutions, but also the decentralized administrative bodies (e.g. village) face major difficulties in law-enforcement.

It is important to note that many efforts of the larger scale administrations try to adjust the property rights in order to create more sustainable use of resources. For this purpose the Land-Acts have formalized or structured a kind of common property on land use by making the village the principle ruler over the land. The national and districts efforts aim at changing some resources from common property (or practically open-access) to private property (e.g. obliging 30 trees per the homestead) or state property (some fish sizes[59]).

Presumably, this direction of policy is connected to the high degree of unsustainable exploitation of common pool resources that have shifted towards open-access resources because the traditional institutions have been vanished[60]. The shift to private or more official common property probably serves the purpose to slow down this unsustainable exploitation.

The Land-Acts have clear influences on the reorganization phases of the local institutions. The attempts to establish land use plans seem to speed-up the reorganization activities, because the local village leaders are forced to discuss and conclude about land use issues with the villagers. Although none of the villages had completed the land use plans, discussions around these decisions would probably help to speed-up the evolution around the institutions and to eradicate the lack of clarity around the desirability and legality of certain land use issues. It is quite likely that without these Land-Act discussions, debates about certain difficult land use issues would be postponed or entirely avoided.

The other legislations aim at slowing down unsustainable exploitation of natural resources or improve renewal of these resources, but do not have a visible effect on the local situations (yet). The 'thirty trees bylaw' is not in use, but will probably face difficulties in its implementation. Moreover, it is questionable whether this enforcement will really help villagers, who face frequent food shortages, to focus on efforts in improving the tree cover. In addition, some problems that arise out of the shift to the hills as a way of coping with the wetland expansion (e.g. trampling, grazing and browsing) are not solved, except when Joint Forest Management Plans would be implemented successfully.

The regulations of fisheries do not affect the catches at all, because the local police and village governments lack the knowledge, desire, or power (and maybe integrity) to enforce the rules. In addition, the regulation doesn't fit on the local ecological dynamics. After all, not all juvenile fishing is harmful for the fish ecology. Moreover, an actual enforcement would also affect the Nile perch fishermen around Lake Victoria. As a result, the regulation is only transferring money from villagers to the local police, but as the juvenile transport is mostly done at night and the business is profitable enough to deal with these occasional 'fines', the regulations do not appear to affect the locals in performing this livelihood activity. Thus, the regulation doesn't seem to have any affects on the adaptive cycles of the juvenile catching.

[59] Even though the fish stocks with the specific sizes are not official state property, in practice, this government regulation outlaws the catching of these fish sizes for all residents. This can be seen as if the government claims an ownership role regarding these fishes.

[60] Although not covered in this research a larger scale diminishing of these institutions in Tanzania is plausible.

A way forward in governmental efforts?

The difficulties in implementation of government legislation illustrate problems with the externally designed approaches[61] as also mentioned in the theory of this thesis. The problems that the official administrative bodies are facing in a shortage of (higher educated) staff members and resources add to the problems. Simultaneously most local problems seem to be difficult to solve with any externally designed approach. Even the most decentralised authority (the village government) has problems with laying down laws on the people. This insight stresses the importance of the role of the local residents and the users of resources in designing and enforcing regulations.

This statement is underscored by the insights that only the people who catch the juveniles are able to judge whether or not these fishes have chances to survive, and that only people who know the history of the wetland forest can understand the current difficulties of the inhabitants of Kongoto regarding their forest resources. This means that only the actual users of the resources seem to be able to design and enforce 'fitting' institutions that would really help to make user patterns more sustainable for local users and the larger livelihood system. The district government already acknowledges this and the Joint Forest Management Plans are promising for the future, but could not be examined during this research.

7.3 Subsidizing and education: trial and error in institutional reorganization phases

LVEMP: cooperative tree planting groups

The first phase of the LVEMP (Lake Victoria Environmental Management Program) was coordinated by the vice president's office and for a large part financed by the World Bank. This section discusses the Catchments Afforestation Program that was designed as a pilot under the Land Use and Wetland Management components from the larger scale LVEMP. This program started in 1997 and functioned in the Mara region from 1999 until 2006. In the last year the district administrations took over the responsibility for one year, and during the fieldwork the program was on hold because the second phase of the broader LVEMP was in the preparation phase.

The main aim of this afforestation program was to improve the tree cover in order to create benefits for the local communities and to reduce the erosion of top-soils that flows into Lake Victoria (and is causing an increase in the Water Hyacinth and eutrophication). For this purpose, village based tree planting groups were established and educational seminars were conducted to teach the riparian communities about the importance of trees. In the general program broader efforts existed, but these were not observed in the fieldwork villages.

The initiatives behind the actual implementation of the program came from the World Bank and were used before in Australia. The first steps in the programs were to organize educational seminars in the villages and to form tree-planting groups. The purposes of the seminars were (a) to educate the local communities in the importance of trees, and (b) to form tree-planting groups and teach the members how to nurture trees.

The groups received technical advises but were expected to organize their own nurseries. After the groups nurtured their seedlings, a representative of the LVEMP came and paid the group TSH 100 for each seedling, which was ready for planting. Subsequently, seedlings were given for free to the villagers who could plant them on their property or elsewhere.

[61] With these approaches I refer the so-called 'top-down' approaches, but for reasons mentioned in the theoretical chapter I do my best to avoid this term. 'Externally designed' indicates that the approach is designed outside the fieldwork area.

Observed results and difficulties of the LVEMP

In all three fieldwork villages LVEMP tree planting groups were established and large numbers of seedlings were provided to the community. During the fieldwork people frequently told me things like: "*This used to be a bare place, but since we started with tree planting it is better*". In addition, the results of the education efforts were observed in the fact that about all local inhabitants seemed to be aware of multiple functions of trees for the community. Most villagers could easily summarize benefits of a substantial tree cover (i.e. rain catchments, fuel wood, shade, construction materials and reducing the run-off of rainwater). According to the village leaders this awareness was the result of LVEMP and additional governmental efforts in education.

The numbers of seedlings that were given to the community speak for themselves. Before the LVEMP arrived in Wegero there already existed a tree-planting group, which sold about 800 seedlings per year for TSH 100 each. The input of the LVEMP boosted the productivity of this group. The chairman of this group stated about the pre-LVEMP period: "*In this period we lacked equipments and knowledge, and we also did not give people advises on how to nurture the trees*". After the LVEMP arrived the groups started to professionalize. For example, the groups were educated to use manure, plastic bags, to advice the people to replace the seedlings in 2 feet by 2 feet holes, and to make artificial fences to prevent the seedlings from being grazed or trampled in the first period after planting.

Furthermore, the financial incentives had a clear effect on the quality and quantity of the output from the group. The members started to invest in equipments like plastic bags and the group provided about 100.000 seedlings per year during the four years between 2002 and 2006 (instead of the 800 of before). The group members acknowledged that especially in drought periods many of these seedlings did not survive, but they were always trying to grow and to give out the seedlings during the short rainy season so that the seedlings would be well watered (this was also an advice from the LVEMP).

The largest disappointment of the group members was that they never received their remuneration from the LVEMP in 2004 and 2005. They had phoned the LVEMP several times, but were told that there was no money available. The secretary of the group even considered to go to court and in order to claim the money, but he wasn't too sure about his chances, because the LVEMP-contract lacked a clear connection between the specific local group and the LVEMP. In addition, the contract was not signed by the village executive officer who should or could have formalized this kind of agreements.

After the group members didn't receive their remuneration for the second time they laid down their tools. The group in Wegero also tried to register with the district administration in order to formalize their activities, get access to loans, and to become 'visible' for other organizations that want to invest in tree planting. However, they never managed to accomplish this. The group needed a bank account, formal leaders and to pay a registration fee, which was found too high (the secretary didn't remember the registration fee). The group already had a constitution, but the officers did not find this one appropriate. In addition, they revealed that district officers had to send papers to places like Dodoma, which made it all too complicated.

In Kongoto the tree-planting group only grew and gave out 'free' seedlings in the year 2003. The LVMP never returned with the money and when the group members phoned the office they were told that their contact person had moved to another department. Therefore the group decided to see their efforts as selfless service and gave out the trees for free to the community. In the following year they could not afford any money for seeds, manure and plastic bags anymore and consequently laid down their tools.

In Buswahili the LVEMP arrived in 2004. In this year the group raised 100.000 seedlings, which were given out to the local inhabitants. In the following year the group gave

out 88.000 seedlings. In 2006 they had started again with the nursery activities, but their open nursery was nearby the wetland and inundated unexpectedly due the extreme floods. About 88.000 seedlings were destroyed and therefore they only gave out about 5.000 seedlings in that year. The LVEMP did not provide compensation for these losses.

Even though the numbers and reports of the locals point at initial successes of the program, the financial incentives in the tree planting program had a clear adverse effect on the existing market and institutions around tree planting in general. A NGO representative revealed: "*this program is destroying the market, and has nothing to do with any demand driven extension from the communities themselves*"

Another NGO representative experienced these difficulties in the field: "*When I provided the community with tree seeds and the knowledge how to raise them, they were asking me how much money they would receive by planting them?*" This representative had to put in efforts to explain that the trees will be for the benefit of the community and that the trees should thus be seen as a payment themselves.

Both the problems in dependency on financial incentives and the failure of paying the groups were acknowledged by the responsible officer. The failure in paying the groups was caused by "*administrative problems"*. The program had not reserved finances for an evaluation of an external consultancy. After the officers were told that they could not evaluate themselves, part of the money that was reserved for the tree planting groups had to be spent on an external consultant.

During the program the responsible officers have tried to overcome the high degree of financial dependency of the program by cutting down the subsidies from TSH 100 to TSH 80 per seedling. After consulting the villagers it was concluded that locals could and would be able to afford TSH 20 to buy a seedling for their own use. However, this turned out to be an overestimation of the local market as all the seedlings were overgrown by weeds after the groups failed to sell them.

World Wildlife Fund (WWF): using the government structure for environmental education

The WWF program in the Mara region is part of the larger WWF transboundery Mara basin program. According to the Musoma representative the main environmental issue in the basin is the water quality of the Mara River and wetlands. Therefore, the WWF focuses especially on improving the land covers and changing local land use to prevent erosion. However, in the riparian villages there is also a lot of attention for improving the fishery sustainability. In the WWF approach there exist emphasis on raising environmental awareness among the local people. This is underscored with one of their slogans: "*Environmental education to improve livelihoods*".

The WWF staff often brings together a variety of government members and officials like (not exhaustively): the division secretary, ward and village executive officers, village chairman and the village water committee chairman. Within these meetings, problems and solutions concerning erosion and unsustainable fisheries are discussed. These meetings turned out to have influenced the leaders because in some cases the village governments have designed new bylaws after these discussions.

However, the WWF representative emphasized that only designing these bylaws is not enough: "*We have to make the people understand the reasons behind the bylaws: if they don't understand the reason for the bylaws, they continue their way of doing when nobody is watching*" Therefore they put a lot of emphasis on education. Anyhow, this approach is also not without difficulties as some people were said to be more or less sleeping during the educational seminars. Furthermore, the representative stated: "*It is difficult to persuade locals to start natural resource conservation, because in the first instance conservation is always a*

loss". In addition, it is difficult to really raise awareness in the region: "*Many people think… if the resources here are degraded, we just go somewhere else. It is our (WWF) aim to make people think about what will happen if all resources are depleted"*.

Next to these field visits, the WWF also organizes larger scale environmental-educational seminars. During the fieldwork the impact of two of these seminars have come forward. The 'Bunda seminar' (2002) was organized by the local WWF and visited by both villagers and representatives from the village, ward and division governments. The 'Uganda seminar' (2007) was organized by the broader Lake Victoria Environmental Education program from the East Africa regional WWF program.

The seminars aimed at raising environmental awareness and were providing general knowledge on natural resource management. During the Uganda seminar the participants were also shown a successful wetland tourism project. Moreover, on both seminars there has been attention for forming cooperative groups to start vegetable gardens, other income generating or environmental conservation efforts.

Next to these educational efforts the WWF also puts in efforts in tree planting. In Buswahili village, for example, a part of the hill near the primary school has been reforested. The WWF did provide the knowledge and seeds for this program. Moreover, they also provided knowledge to make firewood - or charcoal stoves from clay. These stoves increase the heat efficiency and thus the decrease the necessary fuel wood. Furthermore, the WWF staff is also involved in larger and broader institutional efforts in natural resource management and research on the water quality in the Mara Basin.

Observed results and difficulties of the WWF program

In the fieldwork area the WWF is only active in Buswahili village. As already mentioned, the hill near the primary school has been reforested with the support of the WWF. Locals reported that the location was well chosen because the local primary school kids did an excellent job in chasing animal herders away from the side in order to protect the small trees from being trampled and browsed. The stoves are also a success: Locals averaged that around 50 percent of the homesteads in Buswahili already used them.

Government members and inhabitants from Buswahili have also attended the Bunda and Uganda seminars. The knowledge obtained on these seminars was directly used in the formulations of village bylaws. A member of the Buswahili government revealed that they had learned from the Bunda seminar that cultivation near the wetland shores might cause erosion and subsequently detoriate the water quality. This insight made the village government to decide to reserve the wetland shores as pasture for the animals (this had been already the case traditionally, but now it was re-enforced by formal bylaws).

During the fieldwork it has been observed that most inhabitants were aware of this bylaw. I was often told that there was nobody cultivating near the wetland because it is prohibited. There were only four small farm plots present near the wetland shores and by far most of the area was left for grazing. However, as is stressed in the previous chapters of this thesis, intensive cattle grazing, trampling and drinking near the wetland shores is also causing erosion and thus an increase of sedimentation (and manure) in the wetland. Therefore, it is at least questionable whether cattle grazing is a more favourable land use option near the wetland compared with crop cultivation. In Buswahili, the wetland shores are non-steep slopes and especially if crop cultivation goes hand in hand with erosion control (e.g. sediment traps), it is quit likely to create less negative trade-offs than cattle grazing and drinking.

The village leaders who had just returned from the Uganda seminar acknowledged this insight. On this seminar the visitors were taught how to prevent erosion through sediments traps and advised to start vegetable gardens near the wetland shores, which can be irrigated with hand pumps. In addition to this change in policy, the executive officer revealed plans to

establish cooperative groups to conserve the wetland, as he was made aware of the importance of the wetland resources for the livelihoods of the villagers.

Furthermore, after seeing the success in wetland related tourism in Uganda the executive officer was enthusiastic to start a tourism project in Buswahili. This enthusiasm was driven on the observed economic possibilities of tourism. However, the eagerness to start a tourism project may be based on false hopes because there are various arguments why the suitability of Buswahili as a tourist destination at present is to say at least discussable or questionable. We have seen that the wetland is almost inaccessible during the drier periods, and that is exactly the period when the tourists visit this region. In addition, mosquitoes make the wetland area on daytime and any outside activities after sunset elsewhere unbearable. Moreover, major tourist draws in the form of wildlife such as crocodiles, hippos and deer are quite difficult to spot. Furthermore, the dirt road from Musoma to Buswahili is far from in a good shape and might make the journey, especially during the wet season, quite uncomfortable for tourists.

Another difficulty with environmental education, which takes place through the government structure, was emphasized by the secretary of the Buswahili village water-committee. She explained that the WWF is providing money for the committee members to visit the seminars. The aim of the WWF is that these members will spread the knowledge among the people after they return from the seminars. However, the people know that the visitors of the seminars receive some kind of a payment from WWF and, therefore, they react with jealousy, saying things like: "*You receive money to go to those seminars, so then you should now pay me also to listen to you*".

In addition, there are more problems with communication: alternative resources are not available and the right attitude of the people appears to be lacking: "*Even if people understand that certain activities are not sustainable, I can not prohibit these activities as they simply ask me: but where can I go then to make a living? It is very difficult for me to communicate with the people. They are not interested in conserving. This attitude becomes clear with the multi- purpose dam at the moment. Since the water tap is broken it is polluted and diseases appear, but everybody is simply waiting till IFAD*[62] *comes to repair it. They don't see it as their own resource, lack education and self-motivation*".

Ward administration: educating the people for development

Both the village and ward leaders put a lot of emphasis on "*educating the people*" in their tasks. The Buswahili ward executive officer explained that the ward has an important intermediary role in communicating the legislation from the district administration towards the locals.

Before 1996 they faced many problems in this communication because the information only went one way from the district towards the ward inhabitants. This means that the officers in the district and the local people did not exchange ideas. The ward executive explained that he and also district officers were often not able to answer the questions that the people raised about new legislations and initiatives. Also the timing of introducing topics was often not suitable, for example, the district asked ward officers to discuss issues like clean drinking water with the people during the rainy season.

In 1996 president Mkapa introduced the so-called 'participatory development approach' in Tanzania. In this approach the governments have to act as facilitators of development instead of merely intermediaries of new legislations. Since the introduction of this approach, the village representatives from the sub-villages are the first to discuss topics with the people, because they are the closest to the people. Furthermore, district officers

[62] IFAD (International Fund for Agricultural Development) was the main financer of the project that led to the construction of a multi-purpose dam; see later this chapter for detailed information about this project.

sometimes started to visit the villages to explain issues and new laws. Sometimes people don't understand the new legislation directly due to a lack of education or conservatism. In these cases "*we and other people will continue to educate them*".

The most important educational topics introduced by the ward seem to have their foundation in a discourse of 'modernity versus traditionality'. The following quote from the ward executive officer is an answer on a question about the nature of the most important constrains for development in the ward. *"We have to educate the people to use the resources in an efficient and sustainable way. Men sometimes feel ashamed to do certain work if this traditionally belongs to the woman tasks. Because of these traditions we don't use the resources rationally. Many people still keep cattle for prestige instead as resources and polygamy is causing overpopulation. Also people still have to learn that mono cropping is not good."*

Other constraining factors were explained to lie in alcohol abuse and laziness. Next to these cultural aspects as constrains towards development also more physical factors were mentioned. Rainfall variability and the hardness of the soils type make crop cultivation a difficult activity.

During the fieldwork there have been no efforts to observe the results from the educational efforts of the ward and village governments. Therefore, the next section shifts its attention directly to the influences of the previously discussed interventions on the local adaptive cycle.

Influence of the interventions on local adaptive cycles

The LVEMP has clearly affected the ecological and livelihood cycles in a positive way. The rapid increase of (planted) trees can be seen as an ecological exploitation phase of the tree cover and the statements of the villagers reveal that this has improved the tree cover as a whole. The livelihoods already benefited and will benefit from this exploitation phase in the future, because it provides a short release in the conservation phase of livelihood activities concerning forest resources.

However, it must be argued that this release is only of a short time-span and that the problems are rather postponed and not solved by this intervention. The combination of the use of financial incentives and the failure in providing these incentives seems to delay and obstruct any possible institutional reorganization because it has created an exploitation phase, which fully depended on the financial incentives. Therefore, the system returned into the reorganization phase just after the incentives had stopped.

This is a classical example of how certain interventions can be appropriate on one geographical location (maybe Australia), but are not fitting in another local context. This 'subsidizing' intervention might have worked better in case the institutions were in a conservation phase, and if preservation of some kind of tree planting would have been a (temporary) solution in preventing a disastrous release phase. But for institutions that show features of reorganization phases, other types of interventions may be more appropriate. For example, the educational efforts from LVEMP have been successful in raising awareness about the importance of trees, and have thus provided a better institutional foundation for designing and enforcing regulating institutions.

The outcomes of the WWF seminars also provide examples of the functioning of the local institutions in a reorganization phase. The interventions in this reorganization phase can be compared with balls shot into a pinball machine. Even perfect shots can throw back in an unexpected way. Although the shots of knowledge of the WWF were perfectly aimed, they still didn't hit the target because the local dynamics around the implementation of this knowledge appear to be unpredictable and context-specific. This unpredictability is caused by two factors. Firstly, the lack of capability from the implementers to use the knowledge in their

local context makes large-scale seminar education difficult. Secondly, in other cases the implementers faced resistance from their fellow villagers, which points at the difficulty of educational efforts that take place as externally designed approaches, which have to transferred through the government structures ('top-down' or externally designed approaches don't work, even not on the scale of the village).

The influences from the stoves and reforestation initiatives are positive for the adaptive cycles. The stoves reduce the unsustainable use of the hill forests and thus stretch-up the potential in the conservation phase regarding the use of these resources. The reforestation project has pushed the vegetation into an exploitation phase that will result in exploitation possibilities for the livelihoods in a later stadium.

The educational efforts of the village and ward governments also shed light on the dynamics during institutional reorganization. Traditional and rational or modern ideas seem to be perceived as opposites and the governments are clearly in favour of the modern ideas. They are even ready to 'educate' the people and try to push through ideas of modernizations against traditional values that are perceived to obstruct development. In this sense they are thus speeding-up a reorganization phase. This can turn into positive perceived changes, but also can have negative consequences when the modernization ideas are not the most desirable solution for all people. In the local historical narratives we have seen that the vanishing of certain traditional institutions created problems in various other components because the role of some these institutions was not fully understood by the entire community (the declining power of the rainmakers has influenced the institutions regarding forest resources).

A way forward in afforestation efforts?

From the above it becomes clear that phase two of the LVEMP should reinvent its implementation strategy for the afforestation program. To improve the new program, it is first of all useful to place the failure of the earlier mentioned group to sell the seedlings for TSH 20 to local people in the context of the broader social-ecological system. In the previous chapter we have seen that most food shortages are experienced in the short rainy season. This might be a logical and understandable reason why villagers did not buy the seedlings in or directly after this period. Moreover, the history of providing free seedlings might have destroyed the market and thus the willingness to pay for seedlings.

The failure of the group to sell the seedlings resulted in wastage because the seedlings were overgrown by weeds. This wastage was not only caused by the failure to sell them to individuals, but also by a lack of anticipation to plant the seedlings elsewhere in a sort of collective program. It is possible to put in efforts to tackle this lack of anticipation. The redundancies in policies, as mentioned in theoretical chapter, can be an outcome to tackle this lack of anticipation. The program could, for example, oblige the group to plant the non-sold seedlings within a collective approach. This obligation could be included in the contracts and the village government can allocate an area where the group members (or other villagers) should plant their seedlings in case they don't sell them.

This extension of the contracts can, of course, lead to a situation in which the villagers don't buy the seedlings anymore because they may think that they will experience the collective benefits of the trees anyway. With regard to this potential error, the 'thirty tree bylaw' from the district that was in the pipeline during the fieldwork could be an outcome. During phase one of the LVEMP, the Wegero village government did introduced a similar bylaw, which obliged each homestead to keep at least 10 trees per homestead. According to the government leaders and elders of this village, this bylaw motivated the villagers to nurture the seedlings with more care and also to sustain the trees better in a later stadium. In this redundant construction the 'stick' (law) and the 'carrot' (benefits from trees) will function complementarily.

Because of the problems that derived from subsidizing, the tree-planting groups in the fieldwork area have been confronted with the question how much they estimated that local inhabitant would afford for a seedling and what they needed to reinvigorate their activities. The group in Kongoto estimated that the villagers would afford about TSH 50 per seedling and stated that they were ready to start selling the seedlings for this price if they were facilitated with the necessities for seedling nurseries (e.g. seeds, plastic bags, wheelbarrow for transporting manure, and hand pump for irrigation). The group in Wegero emphasized that they were selling seedling for TSH 100 before the LVEMP arrived and were ready to continue within a new approach only after they had received their money for seedlings that they raised in 2005 and 2006.

To sum-up, a way forward in afforestation efforts can be found in a stronger focus on facilitating the tree planting groups with the necessary equipment and knowledge, and in designing appropriate redundant bylaws. These bylaws may have the potential to catch-up with the failures in the other social and market mechanisms. In this situation the government (national, district and village) policies and the LVEMP afforestation program could function as a symbiosis instead as distinctive efforts. Furthermore, the timing of raising the seedlings should be re-discussed. Next to the already mentioned problem of food shortages, the higher rainfall variability during the short rainy season can be seen as a less desirable feature for this period. However, as the LVEMP officer stated: during the long rainy season many villagers are very busy with their work on the shambas and thus might lack time for tree planting. In this sense it might be better to let the locals decide in which rainy season they want to conduct their nursery activities.

A way forward in environmental education?

The most prominent observed problems in the WWF education efforts lie in the failure of local people to implement the general knowledge in their specific context and in the communication difficulties between the local implementer and her fellow villagers. Possible solutions for these errors lie in more tight feedbacks, applying adaptable knowledge management, and more direct involvement of the representatives.

The first two solutions would imply that the WWF stays very closely involved with the community after the seminar in order to remain updated about the way the knowledge is used. Of course, the seminars could spend more time on the process of applying general knowledge in case specific contexts[63].

More direct involvement could be translated in context specific environmental education on the location instead of the massive seminars. This is in line with an idea from the water committee secretary in Buswahili. She suggested the NGOs to visit the village and to sit down with the inhabitants of every sub-village to discuss the issues. These suggestions will, however, also make NGO-efforts more labour intensive and involve the NGOs directly in the challenge to motivate the users of natural resources to use their resources sustainable.

The ideas to start wetland related tourism in Buswahili might fit well in a larger scale plan. Such a plan would especially have large chances of success if it would improve the infrastructure and connect the world-famous Serengeti National Park with Buswahili. But even with larger scale developments, some creative thinking and financial support would be probably needed to raise the comfortable level or attractiveness of a tourist trip to the Buswahili wetland area.

[63] It is important to note that the seminars were not visited during this research and that it remains unknown whether or up to which extent the seminars paid attention for applying general knowledge in a specific context.

7.4 Struggling collectively to improve livelihoods

Informal Fishermen groups

There are informal fishermen groups functioning in all three fieldwork villages. Most of the fishermen that practice fishing as their main source of income do participate in these groups. The groups all have about 45 members. There exist formal positions in the groups like secretary and chairman. These people chair the meetings, which are held about once in every two months. The issues that are discussed within these meetings are similar between the villages and as diverse as: declining fish stocks, moral behaviour, theft, problems with crocodiles and fish prices. In addition, some group members practice money rotation.

Moral behaviour refers to incidents of fishermen refusing to pay for food, which is served by women on the spot where fishermen leave the wetland and sell their catches. These incidents were the main reasons for the establishment of these groups. According to people spoken to during the fieldwork, this kind of incidents has declined rapidly after the groups started to function in the 1990s.

There are no set prices for fish in the villages. On the shore, fishermen negotiate the prices with either business people who sell the fish somewhere else or people who buy it for domestic use. However, within the groups, the fishermen discuss guidelines for the price to avoid large differences and heavy price-competition. The cases of theft were mostly related to disappeared (full) fishnets, hooks and canoes. The groups try to overcome these problems by discussing who might be the perpetrators and installing safety guards.

In addition, the secretaries of the groups that are based in Kongoto and Wegero emphasized that they perceive the capturing of juveniles as an additional reason for the declining stocks of some species. However, they felt hat that their groups are not entitled to try to stop this type of fishing, because the groups are not formalized. Moreover, most of the people that catch the juveniles are no members of the groups because they don't practice the 'real fishing' between the waterweeds in the wetland. The groups had not done any efforts to register with the districts administration.

Buswahili: cooperative vegetable gardening

In the year 2004 six women, all around 25 years old, decided to start a vegetable garden on the wetland shores. In order to buy a hand pump (TSH 300.000) they sold two pieces of cattle. Since 2005 the group is cultivating about one acre of vegetables such as watermelon, cucumber and tomatoes. In 2005 they had a good harvest, which they sold for TSH 150.000. In 2006 grasshoppers destroyed the entire harvest.

Next to these grasshoppers, the large number of cattle near the wetland is also a problem because they destroy the crops. Therefore, the group members now rotate as 'watchman' (or woman in this case) to prevent cattle from entering the field. They don't see the construction of a fence as a solution because this one will be taken with the water in the inundated period. The group uses manure as fertilizer and the (social-ecologically dangerous) Thonix as a chemical to prevent grasshoppers. The group members didn't practice any erosion control. In spite of the encountered problems, the woman I have spoken to said to be very happy that they started the garden.

Kongoto: cooperative vegetable gardens in the wetland

Since the 1990s various people have been cultivating vegetables in the Kongoto wetland area. In 2006 a group of 12 people in Kongoto united their ideas to start a collective vegetable garden in the wetland. The groups requested and received advice from the ward agricultural officer and started to plant vegetables on eight acres in November 2006. A collective bank account was opened and everybody contributed a small amount of money to

start. Subsequently, the group even took oxen and a plough inside of the wetland and prepared the soil with manure, before sowing.

After a short period the first vegetables sprouted, but at the beginning of December the extreme floods destroyed all the crops. Before these floods, hippos, monkeys and cattle already turned out to be a problem as they also damaged the crops. To tackle this problem the group members had build a small house where always one person stayed to patrol the field. This watchman could keep away these larger animals, but also small-unidentified insects started to damage the crops. Moreover, the use of the hand pump for irrigation demanded a lot of effort and energy.

The group is planning to plant sugarcane on the same elevation where the garden is located in order to prevent erosion, but does not uses additional techniques to control erosion of the top-soil. The secretary emphasized that they are eager to cultivate paddy in the wetland, but he perceived that they lacked modern equipment (e.g. water supply pipes, electronic pumps, small tractors) for this undertaking. The group didn't use any chemicals, but if they could afford these, they would certainly start using them.

In spite of the risks of floods, the group will continue their efforts. During the fieldwork they were waiting for the water to withdraw to prepare the garden and give the project another chance.

Buswahili: Collective chicken keeping and vegetable gardening

Six inhabitants of Buswahili visited the WWF Bunda seminar in April 2005. During this seminar the WWF staff explained the benefits of starting cooperative groups and provided the idea to start vegetable gardens or other activities. After this seminar eight males and four females in Buswahili started a chicken farm and vegetable garden in order to uplift their livelihoods.

All members have contributed TSH 2000 per week and during the fieldwork the bank account had grown to TSH 120.000. Part of the collected money has already been used to buy chicken. The eggs of the chicken are sold and eventually also the chicken are planed to be sold. In the beginning of 2007 the chicken-shed was destroyed by a big storm and all the chicken had to be brought to another place.

Next to the collective chicken keeping the group has started a vegetable garden of two acre near the wetland. They had expected to harvest vegetables worth about TSH 1000.000, but only yielded a value of TSH 100.000. This disappointing harvest was explained by three problems that were encountered in the farming activities.

Firstly, the group bought a hand pump to irrigate the garden, but soon they found out that the use of this pump was too heavy for them. Consequently, they started to irrigate by using buckets, which means they had to go through the muddy wetland to find open water bodies. This work demanded a lot of effort and was dangerous as they were exposed to many diseases in the wetland. After one of the group members became infected with typhoid, which they linked to this activity, they discontinued irrigating.

The second reason for their disappointing harvest was a salty soil that damaged the crops. And thirdly, several of unknown diseases reduced the harvest and the group members lacked money to buy chemicals to combat these diseases. However, the group used money to buy fertilizers, which were used on the (already very fertile) wetland shores. Furthermore, they practised erosion control in the form of sediment trapping, a technique that they had learned on the WWF Bunda seminar.

The secretary of the group appreciated the collective activities especially for the possibility to exchange ideas. She regretted their lack of knowledge about vegetable gardening. After the seminar they had only the knowledge to start, but after this take-off the real test begun. The group lacked knowledge on how to identify and combat the pests, how to

cope with salty soils and were not aware that the soils near the wetland were fertile enough to cultivate without additional fertilizers. Also the idea to use manure as a fertilizer was unknown for them. The group had tried to consult the ward agricultural officer for their problems, but failed to meet him as he was very busy and not showed up at the appointment.

The secretary emphasized that she was grateful that the WWF seminar had initiated the idea for collective activities. But she also stated that the groups lacked both agricultural knowledge and the knowledge to manage the group financially. For example, she didn't know how to get loans or how to register in the Musoma district.

Influences of the collective actions on local adaptive cycles

The above cases of vegetable gardening show a high degree in self-initiative and a capacity to organize activities collectively. In addition, the vegetable gardens point at the use of the renewed opportunities that have emerged through the wetland expansion. There are many typical features of a reorganization phase visible in this vegetable gardening such as: trial and error (water pumps), uncertainties (unknown diseases, unpredictable floods) and lack of knowledge (e.g. unnecessary fertilizers and negative trade-offs from dangerous pesticides).

The collectiveness of the activities is providing large benefits because it divides the high risks among the members and thus decreases the individual vulnerability. Therefore the collectiveness is stimulating people to continue to find the right set of inputs to push the activities from a reorganization into an exploitation phase.

The meetings of the fishermen are also a good example of local initiative and capacity to organize to prevent unmoral behaviour. The price agreements are obstructing price-competition, which can be either positive or negative for the fishermen and community (depending on the supply and demand). Moreover, the groups may have a potential to solve the problems with juveniles' catches, which are acknowledged by some fishermen.

However, the fact that in this regard nothing has happened yet, emphasizes the importance of larger scales and/or higher hierarchies in facilitating the evolution of institutions. On the other hand, it is questionable whether and or what type of regulations on this type of fishing will benefit the people collectively (also with an eye on the fishermen around Lake Victoria).

A way forward?

Although the initiatives in vegetable gardening are hopeful and the failures have not created enormous individual shocks it appears that the activities are still in reorganization phases, while exploitation phases will be more desirable. Broader speaking, the local people who take-up the initiatives seem to lack tools, knowledge, (more formal) frameworks and capital. Partly because of this shortage, they have not found the ideal set of inputs to push the activities into an exploitation phases.

However, even with larger possibilities in inputs some kind of trial and error can be seen as part of an inevitable learning process and should not be entirely avoided. On the other hand, we don't have to invent the same wheel (e.g. solution for diseases) in every village again. In this perspective, efforts from NGOs and governments have a great potential in linking this kind of groups to other groups and agents that can provide inputs of tools, knowledge, formal frameworks or capital. As we see below, these inputs can help to push activities into exploitation phases.

7.5 The power of bonding and bridging social capital

Buswahili: Mara-FIP multi purpose dam and irrigated paddy farm

The Mara-FIP (Mara Farmers Initiative Project) was a six year integrated rural development project implemented by the government of Tanzania and funded by the International Fund for Agricultural Development (IFAD), the Belgium Survival Fund and the Government of Tanzania. The main project objectives were to increase food security and reduce poverty (URT 1995).

The leaders of Buswahili approached the Mara-FIP in 1996 for assistance in constructing a multi-purpose dam (for domestic use and livestock) to tackle their problems around water supply. The villagers all contributed money depending on their number of cattle and raised all together TSH three million. Mara-FIP added another TSH 124 million and gave technical advice and support. The result of these efforts is a 16 cubic hectare[64] large dam between the hills.

The dam has never been filled entirely and the availability of water depends on the amount of rainfall, but is normally about eight and a half months per year (in the dry season it dries up). For the management of the dam a special committee is established. Access to water in the dam is provided by two water taps: one near the dam where a pipeline connects this tap to concrete drinking troughs for domestic animals and one in the village centre where a water tap is available for domestic consumption.

The second Mara-FIP project in Buswahili is an irrigated paddy farm. Already since the late-1970s one Buswahili resident has been experimenting with paddy farming on the well-watered locations near the contemporary wetland and streams originating from the hills. Most people laughed at him and *"thought he was crazy"*.

In the mid-1990s this situation changed when a regional commissioner visited the village to give advice about the multi-purpose dam. He found that both the soil type and water supply near a stream were suitable for paddy and advised the Buswahili government to start a paddy irrigation scheme. The village chairman, a district officer (who was born in Buswahili) and the former secretary of the group met to work out the ideas. The Mara-FIP program officers explained that the people that wanted to participate in the project needed to contribute all together TSH 300.000 and that they had to organize themselves in a cooperative group, of which at least ¼ had to be female. The formalization of cooperative groups was a part of the MARA-FIP guidelines (URT 1995) and consequently this group registered easily in the district administration and even registered with the national government.

In 1999 the construction work for the irrigation dam started and after one year some people begun to grow rice on the hundred available acres of land. There is a water committee that decides when the irrigation can start. After they agree on the timing of irrigation, the channel, which connects all the independent fields, is first filled and subsequently all users gain similar access to water. During the fieldwork the group had extended to 116 members who all own one or more of the in total 154 acres of irrigated land (the farm has extended since the take-off). They all had to contribute money to join the cooperative group and start their cultivation.

Observed results and difficulties of the Mara-FIP program

The multi-purpose dam is highly appreciated by the people in Buswahili because it increases the availability of water. However, during the fieldwork both water taps were out of order and there were no efforts made to repair them. The tap near the dam was broken by somebody who did not understand that he needed to open the tap by moving it clock wards

[64] 16 cubic hectares equals e.g. 100m x 100m x 16m.

and therefore he hit the tap with a rock to open it by force. Consequently, the domestic animals were drinking on the shores of the dam and thus caused sedimentation and a decline of water quality in the dam. Furthermore, the tap in the village centre was out of order because the water supply pipe between the dam and the centre was demolished by unknown people.

It is important to note that similar processes have been observed with smaller installed dams in Kongoto and Baranga that also faced problems with silting, decreasing water quality and waterweeds. Moreover, a borehole, installed by an NGO in Wegero, needed spare parts for maintenance, which were only available in Kenya. I did not managed to collect detailed data about these cases, but they all reveal that there are problems with can be blamed to either local commitment or the discontinuality of the external assistance.

The paddy cultivation is highly appreciated in Buswahili and also the accompanying cooperative group is highly valued, because it provides good seeds for affordable prices. This was not the case when the group just started. In the first years the group used seeds with a bad quality and complained with the district. Because the group was also registered on national level, some national officers heard their cry for improvement. Soon after the group had put the complaint, the national government provided the group with good seeds from Indonesia, which they still use successfully.

The irrigation scheme is said to contribute a great deal to the livelihoods of the people. Many people argue that this project is the reason why there are relatively more bricked houses in Buswahili village. In addition, even people from the neighbouring villages have applied for land in the paddy farm, but some Buswahili residents who also applied were given priority. The group leaders are eager to expand the irrigation project, but the current water source (a stream from the hills) is not sufficient for this. Therefore some inhabitants of Buswahili are talking about diverting another stream towards the irrigation project. There are no plans to irrigate from the wetland because equipment for this operation is lacking.

Furthermore, some negative trade-offs of this project are widely recognized by the inhabitants. These trade-offs include an increase of water related diseases, namely bilharzia and malaria. To prevent the first, most paddy farmers started to use rubber gumboots. Malaria continues to be a problem.

Moreover, the farmers do face some constrains and problems during their work. Especially when the paddy is still small, many waterweeds from the wetland invade the plots and therefore weeding is a daily activity in this period. In addition, the expanding wetland is the ideal habitat for Weavers that are known to eat the paddy just before it is ready for harvest. To prevent their crops from these birds, the farmers have to stay on the field all day in this period and chaise away the birds. Additional problems are rats and a few types of pests.

Because of these hardships many people first hesitated to join the paddy project. In the beginning especially many women worked on the fields. Only after the majority of the people realized that the paddy farmers received good money for their crops on the market, this livelihood activity started to become wider appreciated in the community.

Kongoto: VIFAFI (Victoria Farming and Fishing group)

VIFAFI is a local NGO that receives funding from the Austrian government. This NGO started their activities in Musoma district by focusing on woman participation in rural development, but later developed a broader target group. During the fieldwork this NGO was active in 13 villages in Musoma district.

Activities in a new village usually start with a seminar for all interested villagers. In this seminar the staff members explain the perspectives of VIFAFI and ask the inhabitants to form a group of between 20 and 40 members. In this group there has to be balance between males and females and the members also need to live in different sub-villages. With these

guidelines the NGO hopes to spread the benefits towards the entire village. After the group is formed, the members are advised to design a constitution. The VIFAFI staff assists them with formulating this constitution, which regulates, for example, the admission of new members. Moreover, the leading committee is appointed and registered in this constitution. Additionally, the village government is asked to provide about two acres of land where the group can start a collective farming project.

Before the group starts this collective farming, VIFAFI organizes seminars where they teach farming techniques such as: using manure as fertilizer, crop variations and sowing techniques. In addition, the NGO provides high quality seeds and agricultural equipments (e.g. ploughs, carts, wheelbarrows, high quality seeds, chemicals etc.) with discounts. Moreover, the groups are further encouraged to initiate more collective projects.

The group in Kongoto is active in cooperative farming since 2005 (15 acres of maize and millet), of which the profits are kept in a collective bank account. In addition, there are plans to start to keep animals collectively and for a vegetable garden (near a shallow well for irrigation). During the fieldwork most of the profits of the group were reinvested in a building, which will be used for multiple functions like: the office of the village and ward administrations, tailoring location, educational centre for learning carpentry and other skills, and a roof-gutter and water tank will provide clean water for domestic use. Furthermore, the building will be surrounded by trees, which were planted during the fieldwork. The group members are convinced that the new building will become a central point and will contribute to community development.

The profits from the collective farming projects also provide loans to the group members. This is part of a larger saving and credit groups that was initiated by the VIFAFI staff and was first for women only. The women could put their money on an account (not in official bank account but improvised by the NGO) and received interests for these savings. Subsequently, the women were also entitled to take certain loans. After the men also joined this part of the program, VIFAFI started to use the interests for the benefit of the whole group in order to fulfil the increasing need of capital.

Beside the 34 members (15 male and 19 female) the group also has 125 associated members. These people do not participate in the communal farming project, but also gain access to the reduced prices for agricultural equipments because they have agreed to the constitution. They do not have access to the loans. Next to these services, VIFAFI organizes seminars about HIV, environmental issues and meetings for the groups from the different villages to meet and share experiences.

Observed results and difficulties of the VIFAFI program

The program of VIFAFI is highly valued by the group members, a female member told me: *"Only since we received their education, we use manure, and know how to sow and we now own very good seeds and good equipment"*. In addition, the access to affordable seeds with good quality and agricultural tools was highly appreciated by more members.

The changes of the credit system created some lack of clarity among the members, who were still convinced that the interest would be for their individual benefits instead of being used for the whole group. Furthermore, the members expressed some feeling insecurity, because some had stored all their money with VIFAFI, but as far as they knew, the administration of these loans was not backed up by any legal authority (e.g. village executive officer or district).

On inquiry with the representatives it appeared that the loan and saving system was born out of a slowly evolved situation. The service of providing loans and saving possibilities turned out to be only a minor part of the NGO's program, but because of the high demand they had extended this service. In addition, group members frequently visited the office in

Musoma town to beg for some money because they faced a lack of capital to pay for the hospital admission of family members. The representative revealed that if she would refuse to share money on these moments her job would become impossible, because it would decrease the feelings of trust and reciprocity between her and the group members: *"I need to be like a sister for them, only then we can really work together. If I cannot provide them some money when they really need it, our relationship will be damaged"*.

This situation made her to decide to extent the loan and saving possibilities so that all members could save money. Everybody who has a saving account also became entitled to lend money. This made it possible for all members to visit the office and lend money in times of problems. The representative also noted that they don't want to enlarge or make the loan and saving system more legal, because it is not part of their main perspectives. They were trying to establish contacts with micro-credit organizations to fulfil the demands that they encounter in the villages.

The kind of the relationship between the representative and the group members is also important because only with a good relationship the representative can be tough to the villagers. For example, stolen or broken objects are not replaced and as we have seen people only receive financial support if they put in money themselves. These policies seemed to work as people were encouraged to replace the stolen and broken objects themselves and in fact started a loan and saving system themselves (the NGO only provided the necessary framework).

The group also encounters some problems. One large problem is that many of the official active members often don't show up at collective meetings. Many people have understandable excuses as for example: malaria, harvest period, their child was sick or the sheep were lost. However, this is creating a situation in which most of the 'collective' labour is done by a few individuals. Furthermore, the group failed to register on district level. They did not have enough members to register as an agricultural group (the official minimum is 50 members for such a group, but the secretary thought there was a minimum of 100).

Kongoto: saving and credit group

This group started in December 2003 with 17 members (eight female and nine male). The initiative came from a rich man who was born in Kongoto and had moved to Musoma town. He wanted to invest money in the groups as he hoped that the group will motivate the villagers not to sit idle while they face so many hardships in their livelihoods. The man also offered to start these kinds of groups in Buswahili and Baranga, but the inhabitants of these villages refused because: "*They did not understand how they could benefit from his plan*".

The first steps of the group were to open a bank account and to prepare a constitution with bylaws for the group. The 17 members contributed in total TSH 200.000, and the man from Musoma sponsored an additional amount of TSH 500.000. Three years later the amount on the bank account had already increased to TSH 1.2 million[65]. This accumulation of money derives from their interest system.

Normally, people receive a loan from TSH 200.000, which must be returned within four months. If a person delays the payback, their constitution forces him to pay a fine of TSH 60.000. By time of the fieldwork this had not happen yet. The success of high and smooth repayment of the loans is explained by the procedures that are followed before loans are given out. There is a committee where people apply for a loan. After this application, the committee checks whether the person is having additional creditors. Subsequently, applicants need to submit two supporters or witnesses (also members of the group) who both ensure that the

[65] Also with an eye on the average inflation in Tanzania of approximately 5 percent during this period, the value of this accumulation of capital still contains a large profit (http://www.indexmundi.com/tanzania/inflation_rate_(consumer_prices).html). (Accessed 4 Oct. 2007)

person will be able to pay the money back. Thereafter, the borrowers, supporters, the secretary of the group and the village executive officer have to sign a contract. The latter makes the document legal by law. If somebody fails to pay back the loan, the supporters are obliged by the contract to pay back the loan. When the borrower and supporters fail to pay back the money, they will be both taken to the police.

The group is not yet registered because they experienced many complications in this process. They started the registration, but were told that their registration had to pass through Dar es Salaam officers. Moreover, they had to pay "*lots of money"* to accomplish the registration. In addition, they explained that they were send to different people in the district administration, which finally made them to give up the registration efforts.

The secretary is disappointed that the group has not registered because he knows that the group will only have access to loans from the bank after such a registration. Furthermore, he emphasized that if an NGO will start operating in the district they won't notice the group. The secretary added that he doesn't see this need for registration to gain access to a legal framework because they organize such a framework legally on the local scale with the village executive officer.

The group was eager to increase the pace of money rotations, but the amount of capital for this higher pace was lacking. The investor from Musoma had promised to deliver more money, but this seemed to be a slow process. The secretary also emphasized that he didn't know to well how to use the financial resources optimal: *"I have no education to organize this, and nobody explained me how to do it. Therefore I might make mistakes without knowing it"*. Because of this lack of education and self-confidence, the secretary was even not sure whether he would venture to take a loan with the bank. Additionally, he regretted that not more people joined the group, which he explained by a lack of education among the villagers: *"Most people in the village fear investing money in this system as they don't trust that they will receive their money and profits back afterwards"*.

Wegero: woman group, creating financial possibilities to sell drinks

In May 2006, the Ministry of Education organized a seminar in Musoma town about establishing cooperative groups and starting small-scale business initiatives. A 34 year old woman from Wegero was invited as a representative of the Buswahili ward. On the seminar different aspects of establishing cooperative groups, like leadership issues and how to start businesses financially, were explained.

After the seminar, the representative has put in efforts to form a cooperative group in Wegero. During the fieldwork the group consisted of 16 female members who all contributed TSH 1000 each Sunday to the collective bank account. The group had already saved TSH 300.000, which will be used as loans for the group members.

Most of the women in the group had the ambition to sell soft drinks and beer. They are planning to do this collectively, because within such an approach they expect to run the business while continuing their normal livelihood activities. In addition to the 'self saving system' they also try to get loans from external agents. They had started a procedure to get these loans after they heard about the pledge of the current President Kikwete to provide TSH one billion for micro-credits to every region of Tanzania.

The group members had send a letter of application to the village government, which was going to be discussed within the ward development committee. Only if this committee will be confident about the capability of the group to return the loans, they will gain access to this micro-credit. To create this confident the applicants have to bring up supporters who share the responsibility for paying back the loans.

The leader of the group was very content about the training she received from the seminar and is still in contact with the lady from the seminar. The communication with the

other group members remained a bit difficult: "*It is very difficult to explain them what I have seen and learned on the seminar. It would be better if they also go to the seminar, because then they will also see and understand".* She is also invited for the follow-up seminars, but she hopes that in the future others will get possibilities to visit these seminars, because she frequently fails in explaining the group members what she has learned on the seminars.

The group had not yet designed any bylaws and regulations for giving out loans among the members, because there is not enough money yet. If they had enough money to give out these loans they will start working on these regulations. They had not yet tried to register with the district administration.

Paddy and commercial animal keeping

In the year 2004 an officer from the national government came to Wegero to explain the importance of commercializing milk and meat production. After this visit 11 villagers started a cooperative group and opened a bank account. Subsequently, they invited an agricultural officer from Musoma district. This officer advised them to start a paddy irrigation scheme (next to commercial animal keeping). The officer stated that an area just next to the wetland forest is very suitable for such an irrigation scheme, because a stream that now flows from the hills into the wetland can easily be diverted for this purpose.

The group was directly enthusiastic about this paddy initiative as they had seen how much Buswahili had benefited from this crop. During the fieldwork the village government has set aside a large area for this project. This area is located near the wetland forest and is mostly not inhabited. The group is planning to keep 40 cattle on the ranch. Group members had already visited Musoma town to have pictures taken from themselves so that they would be recognizable as the official owners of this land.

During the fieldwork the group had extended to 34 members of which each had already contributed TSH 55.000. From this money, they have bought commercial oxen and crossed these with traditional cattle.

Medical care is still a difficult issue, because chemicals are too expensive and cattle dips are not functioning. The group members hope to be able to solve this problem by shifting to commercial animal keeping and uniting the people in a group. The initiating officer from the national government has promised to help with educating a few group members about the medical care of the commercial cattle. The group members also hope to have positive trade-offs towards other people so that everybody would understand the importance of commercializing agriculture. The group had not done any efforts yet to register at Musoma district.

Water from the Mara River

During an informal visit of a Minister of Parliament (MP), the elders of Wegero discussed the possibilities of a water supply project in Wegero. From this discussion the idea for a large water abstraction from the Mara River emerged. The MP was positive about this plan and promised the elders his support.

During the period of fieldwork, the details had not been worked out yet, but broadly speaking the plan aims to abstract water from the Mara River during the high peaks and to store this water in a large tank. A pipeline will connect this tank with the village and villagers will be able to use this water. In addition, it was stated that if people from other villages were interested, they would be able to buy water from this tank. The village leaders were waiting for the MP to return and open the way for the next steps in this plan.

Influence on local adaptive cycles

The above cases all combine bonding and bridging social capital and the potential of this synthesis is clearly visible. Because of various factors, which are partly linked to bonding and bridging, but also to other circumstances, the initiative and realization of an irrigated paddy farm in Buswahili successfully passed the reorganization phase. This reorganization phase in paddy cultivation has been passed both institutionally (as something to be appreciated in the general norms) and with regard to the profits made for the livelihoods.

Firstly, the physical condition (soil and water) were discovered first by a villager and later by an officer. Secondly, the Mara-FIP project happened to be active in the region. Thirdly, a district officer with a Buswahili background was involved and has (probably) opened some doors in this process. Fourthly, locally based *"strong leadership"* managed to collect a substantial amount of money that was needed to contribute. Fifhtly, the program assisted with the registration of the cooperative group at the district and national administrations. And seventhly, the group used this registration in order to improve their situation.

The same situation accounts for the multi-purpose dam. This project is also described as a success by the villagers, even though there seem to be some problems with the willingness or collective action from local people to repair the water supply line and taps. This suggests that there is a hesitation on the local scale in continuing the collective action. First, the initiative has been pushed into an exploitation phase, but two misuses have pushed the project into a conservation phase, with silting and declining water quality as its main negative features. These features might create or contribute to a release phase in which the water in the dam would get (too) contaminated and/or waterweeds would cover the surface.

The initiatives of VIFAFI are difficult to place into one adaptive cycle, because there are many different components involved. The agricultural education and subsidizing of agricultural tools are good examples of how interventions in livelihoods in conservation phases can be successful. These interventions stimulate the farmers to reorganize their activities, which is important in the process of agricultural intensification. The potentials of certain techniques and means are already known to VIFAFI and thus simply transferred to Kongoto. This reorganization makes some components of the farming activities (e.g. sowing and fertilizing) to jump over possibly long-enduring conservation and release phases. Hence, it decreases the necessary time for finding the right inputs to push the components into desirable exploitation phases.

The flexibility from the VIFAFI representative around the demands for loans is good example of adaptable management in which the representative acknowledged the wider implications of refusing loans to inhabitants. In addition, the possibilities to save money also provide a good substitute for storing and accumulating wealth, which is traditionally accomplished by cattle keeping. Moreover, VIFAFI's involvement in the broader institutional reorganization is clearly visible in the initiative of building the government centre, and educational efforts on both HIV and environmental issues. The influences of these efforts are, however, not covered in this research.

The Kongoto loan and saving group is a good example of how a combination of bonding and bridging social capital has pushed the financial system into an exploitation phase, in which more people have access to capital. The redundant regulations around loans are preventing it from a release phase. Moreover, this group shows us that there exist possibilities to formalize locally formed agreements and thus reveals wider chances to use legal frameworks for local initiatives. There is not much known about the way the loans are used and thus of real impact on the livelihoods, but the initiative seems to enhance the financial opportunities and thus to create a shift from a situation in reorganization into one of exploitation.

The groups in Wegero did not really start their activities yet, but also provide good example of bonding and bridging in reorganizing livelihood activities. In addition, just like the Mara-FIP projects some do contain ecological engineering practices. It is beyond the scope of this research to form statements about the possible consequences of the conversion of streams and tapping of water from the Mara River, but we have seen that the wetland ecology is very sensitive to a changing hydrology. If large quantities are going to be tapped from the Mara River it might transfer disadvantages.

A way forward?

Most of the above cases sketch the contours of successful interventions and are thus examples of a way forward. The only major error seems to be the failure of repairing the multi-purpose dam in Buswahili. This failure is a good example of how both progress and regress are possible outcomes of institutional reorganization. To prevent regresses, institutional redundancies could be useful. The initiators of this dam could have organized a maintenance funds, or at least obliged all users to participate in any maintenance efforts.

7.6 Conclusion

What lessons can we learn from the contemporary efforts from external agents and local people in reshaping the institutions and improving the livelihood sustainability?

The failure of externally designed interventions during institutional reorganization

There is a lot to learn about the functioning of the mentioned institutional reorganization phases. It looks like as an LVEMP officer also stated: *"A situation of trial and error"*. The institutional reorganization phases seem to be characterized by uncertainty and chaos. There exist a large variety of discourses and institutional players of which a few are discussed in this thesis but also many have stayed on the sidelines of this research. A short inventory teaches us that NGOs, Christian institutions, modern or western ideas, traditional views, the elders, and the village, ward, division, district and national administrations all influence the institutional setting.

This local plurality of discourses and institutional players is not a problem on itself, but makes any longer-term outcomes of interventions unpredictable. Subsequently, it makes any efforts of external agents (e.g. governments or NGOs) to say at least difficult. It is a harsh task for these agents to get sufficient insights in all social (and also ecological) dynamics. This reasoning explains some of the observed mismatches between the implemented larger scale legislations and the local components of the system (e.g. juvenile catching). Moreover, the lack of (higher educated) staff in the government structure and problems of law interpretations and law enforcement of the village governments further add to the constraints of externally designed interventions.

Furthermore, the difficulties in externally designed environmental education are explainable by local reorganization phases and the externally designed character of this education. The large-scale seminars do inject knowledge that is meant to reorganize the institutions regarding (natural) resources, but cannot influence the use of this knowledge. Consequently, the knowledge is left to local interpretations and not placed appropriately in the local context.

The seminars do have the potential to reach large geographical areas, but eventually the participants who have to spread the lessons face problems in reaching their fellow villagers (Wegero group and WWF). This is undoubtedly connected to: (a) the fact that the seminar-visitors are probably the ones that are motivated to learn and change situations and (b) that they are taken out of their daily context that makes it more easy to be open for the

new ideas, because the observed community conservatism is left behind (in a spatial sense at least). This underscores the difficulties with large-scale attempts in education that are designed to reach 'many at once' and thus the problems to fit externally designed institutions on local systems.

This statement is backed up with the observed problems around the various water facilities. The multi-purpose dam in Buswahili has been accomplished by the combination of bonding and bridging social capital, but eventually lacked the local capacity to maintain the facilities in a good state. Even this large-scale injection of capital and means, that was partly funded by a collective action and improves the livelihood assets of many, has been pushed into a conservation phase because for some reasons it appeared impossible to continue the collective action. These problems are understandable when we bring in the insight that most suitable institutions evolve out of long-term evolutionary processes that occur on different scales (as described in the theoretical chapter).

The large-scale efforts on seminars or quick interventions are attempts to reach many people at once in a time - and resource efficient way. These approaches appear to be very difficult in an institutional reorganization phase. However, as I will describe below, there are various reasons not to argue for the abandoning of external involvement in the villages.

Problems with internally initiated efforts to reorganize

Next to the above-mentioned problems in externally designed initiatives, we have seen that also the internally designed initiatives face abundant difficulties. For example, the cooperative groups that operate without ties with NGOs seem to face fewer advantages and more struggles. Additionally, the struggles of these groups appear to discourage other villagers to start collective actions.

This observation was also put forth by a member of a cooperative group that doesn't has strong ties with an NGO. She mentioned that the visible problems discourage other villagers to join or start cooperative groups: *"They laugh at us and don't believe that the cooperative groups really benefit us"*. Moreover, as we have seen with the paddy farm in Buswahili, successful outcomes of collective activities can contribute to the further development or extension of these types of activities in the villages (in Wegero they also start paddy and in Buswahili the project has extended). Thus, although some difficulties are an inevitable part of the current reorganization phases, these difficulties seem to cause discouragements with villagers. These problems and discouragements could be reduced with assistance in the search for the right inputs to deal with the new and unknown circumstances (for the villagers).

Moreover, the importance of (long-enduring) external involvement in institutional reorganization phase is underscored by the observed local passiveness or powerlessness regarding natural resource management (e.g. fishermen groups regarding juvenile catches and forestry issues). This passive attitude of the villagers is undoubtedly connected to factors out of their own individual habitual reach such as: (a) the mentioned institutional plurality that leads to a lack of clarity (who is entitled to lay down rules?), (b) counteracting community norms for doing things in a different way or initiate something new, (c) the previously mentioned high interconnectedness and heterogeneity in resource-dependency (who gains and who loses?), especially if this is combined with (d) the high degree of reciprocal relationships within the villages (e.g. extended family). These difficulties also clarify the problems of law enforcement of the most centralized formal authority in the country (the village government).

Outsiders that are not entangled in these dilemmas can contribute to reduce these obstacles, but should be careful in pushing through certain ideas. This carefulness is important because they will never be able to understand all dilemma's of locals that derive from the ungraspable complexity and interconnectedness of the social relations in the villages.

Furthermore, I was very often asked (or even demanded) to start large-scale projects (e.g. wetland reclamation) that undoubtedly would have many negative side effects for certain user groups (see section 6.5 and later in 8.5). This suggests either a low degree of empathy between the villagers or a low capacity to see the possible effects of certain interventions. This is again a confrontation with problems in relying on solely internally designed initiatives.

Towards a synthesis between externally and internally designed initiatives

From the above we learn that both externally designed efforts and internally initiated efforts are accompanied with abundant problems. In this chapter we have learned that the observed problems in the reorganization phases all stress the importance of (a) redundancies in the frameworks that back-up the collective initiatives, and (b) close involvement from outsiders to help the villagers to deal with the problems. These outsiders are challenged to put aside their own views and to search for a way to trigger processes that are neither fully controlled by locals nor by themselves, but rather by an evolutionary synthesis of different ideas (we have seen that both extremes didn't work). In this sense, the suggestion of the Buswahili water committee secretary (to sit down with the locals in each sub-village) seems to be valuable.

Furthermore, a local capacity and willingness to organize collective actions is visible in a number of independently operating cooperative groups. This shows us that a potential infrastructure for involvements already exists and does not need to be preached on seminars that are held far from the village reality, but rather need to be fuelled by people who are intensively engaged with the actual daily problems of the people in reorganizing their institutions and livelihoods. Moreover, the loan and saving groups in Wegero reveals that legal frameworks are also designable on the local scale, but that the locals maybe only have to be motivated to use this possibility more frequently.

Some national scale policies seem to have learned from the problems of larger scale regulations on natural resources use because they seem to rather trigger an evolutionary process instead of laying down externally designed rules (e.g. Land-Acts). These polices appear promising, but were only in the first phase and could thus not be fully examined. This also counts for the new policies on the district scale concerning forest resources and fisheries that partly derive as a result of the Land-Acts.

In the attempt to speed-up evolutionary forces around institutions, features such as tight feedbacks (e.g. VIFAFI credit system), multi-scale linkages and redundancies all seem to have the potential to avoid regress. They can catch-up with the unforeseen and undesired outcomes of certain interventions. The power of bonding and bridging social capital and (thus) of the multi-scale features of institutions and interventions is obviously present. These features reduce individual vulnerability and increase the chances to find the right inputs in both the institutional and livelihood reorganization phases. The problems with the multi-purpose dam and the successes of paddy irrigation and VIFAFI show that high degrees of commitment, adaptability, reciprocity and redundancies on multiple scales can be decisive to push and keep livelihood activities in desirable phases.

The observed successes in bonding and bridging are reasons to perceive the experienced difficulties of the cooperative groups to register on district level as problematic. The problems that the groups face in registering on the district level are featured by perceived difficult and laborious procedures, high costs and restrictions on smaller group sizes. Inquiry with the responsible officer learned that they gave very intensive guidance to groups that wanted to register, but that there were only three staff members for the whole district. It is quite likely that this shortage of staff members contributes a lot to these difficulties. The bureaucratic procedures that forced the officer to send papers to Dodoma or Dar es Salaam were already abandoned.

To conclude we can say that institutional reorganization phases in combination with fluctuations in natural resources make it difficult but certainly not impossible to push the livelihood cycles into more desirable phases. Some interventions lacked the right features and maybe a factor of luck in accomplishing the desired outcomes, while others found their way in the institutional chaotic complexity. The successes of the latter clearly lean on a synthesis between internally and externally designed efforts and/or redundancies in policies.

CHAPTER 8: CONCLUSION AND IMPLICATIONS FOR THEORY AND POLICY

8.1 Chapter build-up

The first section of this chapter contains a summary of this research. Subsequently, the next conclusive section elaborates on some scale issues and presents the answer to the central research question. In section 8.4, I describe how the methodology and outcomes of this thesis reframe and enrich the Malthus-Boserup debate. In the last section, I sketch some recommendations for policies and research on the basin scale and do some suggestions to reorganize local livelihood activities (although the main recommendations for policies are noted in chapter seven).

8.2 Summary

This thesis describes how the social-ecological system around the Mara wetlands has changed during the previous five decades. These wetlands are mainly fed by the Mara River, which has its sources in the Kenyan Mau Escarpment. After flowing through two world-famous wildlife parks (Serengeti and Maasai Mara), it continues in the downstream Tanzanian Mara wetlands and finally flows out in Lake Victoria. The major focus of this thesis is on how the riparian Wakenye people in Northwest Tanzania have adapted their livelihoods to the changing context.

The most prominent dynamics have derived from larger scales and are found in a rapid expansion of the Mara wetlands and the vanishing of the traditional institutions[66] regarding natural resources. In order to create a wider view on the multi-scale interconnectedness around the Mara wetlands, this study merges an overview of the larger scale developments with an empirical study about local dynamics.

In the Kenyan part of the Mara basin, a combination of rapid population growth, institutional reorganization and renewed economic opportunities, has led to large-scale changes in land use. Many of these land use changes are associated with an extension of agricultural activities and are accompanied by trade-offs that occur through the river flow: soil erosion and higher peaks and lows. Upstream in Kenya and in the wildlife parks, these trade-offs are received negatively and consequently cause tensions between land users.

In downstream Tanzania, the trade-offs from upstream merge with numerous other variables that have contributed to larger and prolonged inundations. Among these variables, local land use, fluctuating water level in Lake Victoria, two social-ecological feedback mechanisms and climatic events (e.g. El Niño) seem to have contributed to a constantly changing hydrological system in the wetlands. This constantly changing hydrology has pushed the local vegetation cover into successive regimes: from dryland to forest and eventually into papyrus wetland. Because the hydrology is the driving variable in these regime shifts, the subsequence of regimes differs in time and place according to the local water quantity.

From the 1960s until the 1990s, the rapid pace of these 'creative destructive' regime shifts created mainly opportunities for the Wakenye. In particular, the enlargements of open water bodies and forests turned out positively for the livelihoods of these riparian people. However, growing populations of crocodiles, (malaria) mosquitoes, weavers (that destroy crops) and hippos are mostly experienced as threatening or harmful by locals.

Moreover, from 1990s onwards, the regime shifts in the wetland ecology turned out more negative for the Wakenye: open water bodies started to silt-up and waterweeds have replaced pasture and forests. Consequently, the Wakenye shifted their livelihood activities regarding forest and pasture resources from the wetland area towards the uplands and hills.

[66] Institutions are here defined as: *all knowledge, discourses, regulations, norms, values and ideas that influence human behaviour*.

This change in land use has led to an increasing competition and more prominent trade-offs between livelihood activities. Together with some other variables (e.g. increase in rainfall variability and vanishing of socialist subsidies), these trade-offs have contributed to undesirable conservation phases in four important livelihood activities (animal keeping, crop cultivation, fisheries and use of forest resources).

The local people haven not been able to reorganize the local institutions according to the fluctuations in natural resources. This lack of reorganizing capacity is not only linked to the rapid ecological regime shifts, but also to institutional dynamics that have derived from larger scales. The local institutional setting in the Mara region has been affected a great deal by influences of colonial rule, Christianization and modernization. Eventually, the socialist Ujamaa Villagization Program in the 1970s triggered a release phase in the local institutions regarding natural resources. Consequently, the hill forest became openly accessible for a rapidly growing population. The newly available wetland resources and subsidies from the socialist government first compensated the increasing demand for natural resources. These compensations seem to have contributed to a postponement of institutional reorganization. When the wetland dynamics became more negative for the Wakenye during the 1990s, the institutions were still in vacuum. This vacuum, together with scarcity of resources and a low degree of homogeneity with regard to the dependency towards natural resources, has made any attempt in reorganization difficult.

The regime shifts in the wetland ecology during the 1990s also provided new opportunities. Newly emerged resources have been successfully linked to newly emerged markets and people started to experiment with the larger availability of (ground) water in crop cultivation. Moreover, a number of new livelihood activities have added to the possible options of the livelihoods and hence help to diversify the activities. This strategy contributes to the livelihood sustainability. All newly found activities have derived from interaction between scales in which individual locals preferred an enterprising attitude above prevailing community conservatism.

However, even though there are some signs of transitions in the livelihood system from the Wakenye, the main livelihood activities are still practiced on an equivalent way as 50 years ago. These livelihood activities seem to be stuck in conservation phases. For this reason we cannot speak about a regime shift in the local livelihood system, while the institutional and ecological settings have undergone (several) regime shifts. This results in a mismatch between the livelihoods of the Wakenye and their context. This mismatch does create problems in the present, but also reveals opportunities for renewal. Features that seem to disable renewal or reorganization in livelihood activities are presumed to be connected to factors as a low degree of institutional bias for innovation and multiple functions of livelihood activities.

A number of interventions in the local system have improved the livelihood sustainability. These interventions introduced new livelihood resources or activities (e.g. water dams and irrigation farms), injected knowledge or means, or provided assistance in reshaping the institutions. The outcomes of interventions in local institutional reorganization phases have shown to be unpredictable: both progress and regress belong to the possibilities. For these reasons, a certain degree of trial and error appears inevitably.

However, a number of features of the interventions show the potential to prevent regress and stimulate progress. The features of the successful intervention all share a combination of bonding and bridging social capital (on multiple-scales), redundancies, tight feedbacks or intensive involvement. Bonding social capital appears to reduce individual vulnerability and bridging increases the possible inputs of knowledge and means. Redundancies, multi-scale features and tight feedbacks all function to catch-up with the unforeseen outcomes. Moreover, a synthesis between bonding and bridging on multiple scales

seems to have the potential to tackle the problems of interventions or initiatives that are designed either only internally ('bottom-up') or only externally ('top-down'). A synthesis between internally and externally designed approaches seems to be the most suitable to accomplish successfully reorganization in order to increase the livelihood sustainability.

Even though there are various reasons to describe some local components around the expanding wetland as negative for the Wakenye (e.g. increase in aquatic plants, dangerous animals and malaria mosquitoes), it is important to remain careful with social-ecological engineering. There exists a high degree of interconnectedness between the various social-ecological components around the wetland expansion. This complexity is further enlarged by the social heterogeneity in dependency to the wetland functions (on multiple scales) and services and the interconnectedness of the social relations.

In the perspective of upstream-downstream environmental justice issues, it should be noted that the effects of livelihoods upstream merge with a large number of other variables in the wetland ecology and that, therefore, any definite assessment about upstream-downstream effects stays beyond the scope of this research. However, the assumed role of papyrus (and other wetland vegetation) in trapping and retaining sediments may be of vital importance for people that live near the river mouth. It remains difficult to weight the value of this function with the observed predominant disadvantages of this vegetation cover for the riparian villages. Moreover, even though the local disadvantages of this vegetation cover seem to outweigh the local advantages (compared with the previous cover: forest), it should be noted that the 'poor' seem to have benefited more from this change than the 'rich' (the poor practice more papyrus mat-making and the rich keep more cattle, and pasture has been replaced by papyruses).

Nonetheless, it can be stated that the livelihood system of the Wakenye has not been able to adapt in a sustainable way to the highly dynamic context. A larger adaptive capacity of the livelihood systems in these villages will not only contribute to the sustainability of the locally based livelihood system. Also the sustainability of the livelihoods upstream could be improved by better local adaptations, in the sense that their trade-offs may be received more positively.

8.3 Conclusion: explaining adaptive and rigid features

The main aim from this research has been to highlight the features that have contributed to the degree of adaptability of the livelihood system. Both sustainable adaptations and unsustainable rigidities have been observed in the livelihood system of the Wakenye.

We have also seen that there are geographical differences. In Buswahili many people have adapted more successfully to the wetland expansion in the form of mat-making. Additionally, the number of cattle seemed to be stable in this village and people appeared to invest more in sheep. This can be seen as an adaptation to the new ecological situation in which the available pasture has declined dramatically. Moreover, the two Mara-FIP projects also distinguish this village from the others. Even though the VIFAFI project in Kongoto appears to be successful, the people in this village have adapted less sustainable to the changes. This may be connected to the timing of the fieldwork with regard to the regime shifts in the wetland ecology (the forest had just disappeared). In Wegero the phase of the adaptive cycle was still desirable for many villagers in the sense that they (still) benefited from the wetland forest and increase in open water.

However, broadly speaking, we can state that the unsustainable rigidities in this livelihood system are more dominantly present. The most important arguments for this statement are set forth in chapter six, in which is described how various variables have pushed the four (most) important livelihood activities into conservation phases that are accompanied by negative perceived trade-offs. We have seen that there are some minor attempts to

reorganize these activities in order to enlarge their potential, but it goes too far to perceive this as a completed reorganization or adaptation. Moreover, the recently initiated livelihood activities that derive from the newly emerged opportunities are mostly only complementary to the main activities, (still) in reorganization phases and/or accompanied by negative trade-offs. Below, I continue with an elaboration on the main research question.

What features in the social-ecological system have contributed to either sustainable adaptations or unsustainable rigidities in the livelihood system around the Mara wetlands?

Understanding scale issues and change

The first aspect that should be emphasized is that this thesis has shown that statements concerning the sustainable adaptability of a local system are bound to be relative. Such a statement constitutes the interaction between the external dynamics and internal adaptability and hence an interactions between scales. As I argue below, it is difficult to make an appropriate division between these scales.

One of the most striking outcomes of this research is that numerous larger scale influences affect the local components of the triad (livelihoods, ecology and institutions), which simultaneously interact with each other on local scales. Subsequently, the local ecological and institutional components adapt to the changes deriving from these interactions. Eventually, these ecological and institutional adaptations have interacted with each other and local livelihoods. The outcomes of these interactions shape the actual locally experienced social-ecological system that surrounds the livelihoods of the Wakenye. In the figure 8.1 the larger scale influences on the local components are displayed.

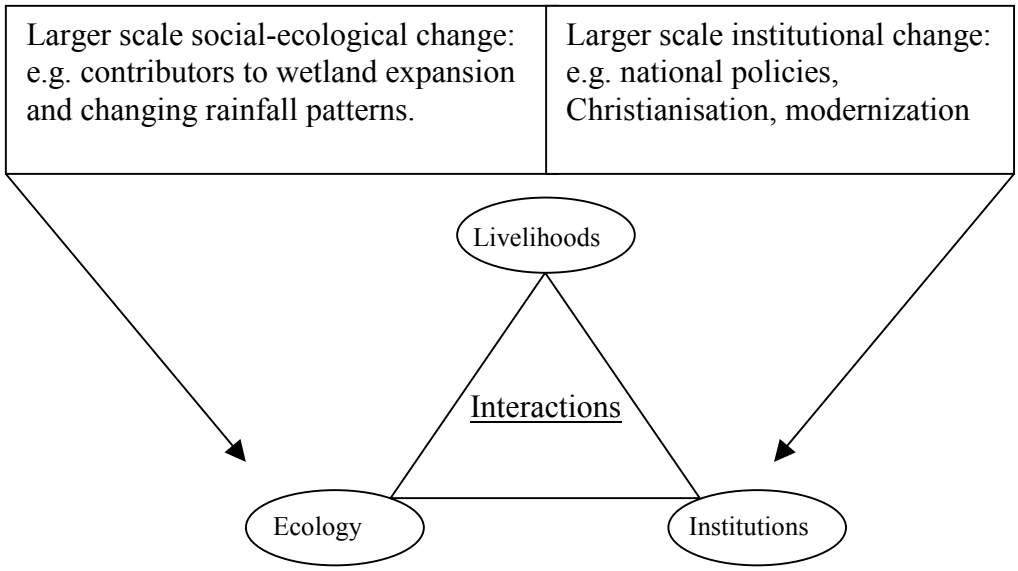


Figure 8.1: local interactions in triad and larger scale influences.

The timing of larger scale influences on local components appears to have been of great importance for the ability of these components to adapt to the changes. The wetland changes, which are mainly driven by larger scale influences, provided forest resources during the 1980s. This occurred just after the traditional institutions concerning these resources collapsed due to larger scale institutional influences. Once the wetland forests disappeared again during the late 1980s and 1990s, there were no traditional 'reasons' to preserve trees anymore and subsequently the hill forests became exploited. When the LVEMP and WWF

made villagers aware (again) of the great importance of trees, forest resources and (pasture) land had become scarce and institutional reorganization difficult.

Next to the importance of the timing of certain larger scale influences, also the outcomes of the locally observed interactions in the triad are of immense importance for the pathways of local components. For example, the positive feedback mechanism in the shift to the uplands and hills that has been the result of both the vanishing of traditional institutions and the regime shifts in the wetland ecology. These two interactions seem to have mainly reinforced the (negative) dynamics in these parts of the system.

These elaborations teach us that the nature of local interactions in the triad can be brought back to the timing and character of larger scale influences. Moreover, while local components adapt to larger scale influences and interact with each other, the larger scale influences merge with the local scale dynamics (e.g. the vanishing of traditional institutions or in the way people cope with the wetland expansion). Consequently, analyses that isolate scales or focus on only one scale are doomed to be inappropriate and any clear partition between scales or external dynamics and internal adaptability is bound to fail.

In the theoretical chapter I have depicted change as a 'creative destructive' force, but as argued above *the timing, nature and pace of change can make destructiveness to be prevailed and creativeness to be postponed. These aspects have had a determining impact on the pathways of the livelihood system and seem to be the main causes why unsustainable rigidities have appeared in the system at the first place.* In this perspective, it is fundamentally not correct to explain the observed maladaptability by pointing solely at the rigid features on the scale of the Wakenye livelihood system. It is, to say, at least questionable whether any group of people would have adapted in a totally sustainable way to the highly fluctuating natural resources and the outstanding institutional changes.

However, the maladaptability has only been visible at this local scale and I have chosen to mainly focus on the locally observed features. A way to gain more insights in the origin of the maladaptability would be a comparative study between two different groups that have experienced similar changes, but this was beyond the scope of this research. Below, the answer to the main research question is given, separated into (a) features that appear to have supported sustainable adaptations and (b) those that have contributed to the unsustainable rigidities. Of course, some features that have contributed to sustainable adaptations may also have helped preventing unsustainable rigidities and visa versa.

<u>Unsustainable rigidities: struggle in reorganizing institutions</u>

We have encountered several unsustainable rigidities in the livelihood system of the Wakenye. These can be divided in rigidities in regulating institutions and institutions that deal with the performance of livelihood activities (e.g. techniques and means).

The competition and trade-offs between livelihood activities are causing negative trade-offs between four of the main livelihood activities and simultaneously contribute to the conservation phases of these livelihood activities. *The regulating institutions seem to be unable to reduce these negative trade-offs because they are trapped in a reorganization phase*. This trappedness is explainable by a combination of factors. Firstly, highly fluctuating resources that first caused a delayed requirement for reorganization and later scarcity (because of subsidizing and temporary natural resources). Secondly, a low degree of homogeneity in resources users makes this reorganization complex. Thirdly, this complexity is further enlarged by the social interconnectedness related to (kin) ties in the villages (extended family).

These factors seem to explain the observed local passiveness or powerlessness in reorganizing in the regulating institutions (e.g. in enforcement of bylaws). Moreover, in the cases that the bylaws are enforced successfully, they are accompanied by other disadvantages

(e.g. to always accompany cattle and restriction of use of forest resources in Wegero). The externally designed legislations or education that aims to assist local reorganization, face many difficulties in their actual implementation because they: (a) do not always match on the local dynamics, (b) are difficult to communicate to the villagers, (c) larger scale governments lack power to enforce the rules, (d) work counteractive on institutional reorganization, or (e) education is wrongly understood by local residents (see chapter seven for details).

Both internally designed and externally designed interventions or initiatives to create development are facing abundant constraints. With regard to the internally designed initiatives, the problems of the local independently functioning cooperative groups also illustrate the difficulties in these attempts to reorganize.

The lack of reorganization within the institutions concerning the actual performance of these livelihood activities is problematic because it reduces the renewal in these livelihood activities. With a few minor exceptions, the Wakenye are still practising these livelihood activities as they were 50 years ago. This low degree in efforts to reorganize these activities makes that the activities remain stuck in conservation phases that are characterized with low potential (for livelihood improvements) and decreasing profits. This slow pace or total absence of reorganization can be linked to two institutional aspects.

Firstly, the *widely observed tendencies to laugh at people that try something new* and the consequential discouragement of people to be innovative and enterprising. Subsequently, this general tendency is explainable with the way that the Wakenye used to cope with scarcity historically. The local narratives show us that the Wakenye used to migrate and expand their territory (with force) during times of scarcity. This statement makes even more sense when we notice the meaning of the name Wakenye in the Kikurya language: refugee. This coping strategy may have caused a lack of community-cultural heritage to deal with rising shortages of resources in other ways than migrating or expanding the territory. The latter strategies have become impossible or at least very difficult in the contemporary institutional setting[67]. Moreover, the past decades may have been too short to build-up new community-norms and institutions that encourage other ways to deal with shortages.

Secondly, the *multiple functions of animal keeping and cattle in particular*, seem to reduce the possibilities to shift rapidly between livelihood activities according to the availability of natural resources. Some of these functions contribute not only to 'making a living', but also to 'give a meaning to live' (e.g. bridewealth and prestige). These institutions are clearly defined by more collective processes, decrease the individual desirability or possibility to change this livelihood activity and hence contribute to its rigidity.

In spite of this argument, it should be noted that the multiple functions should not be seen as a solely negative aspects, because many functions clearly contribute to the livelihood sustainability (and well-being of the Wakenye). Moreover, we have seen that neither oppressing nor subsidizing this livelihood activity has been beneficial for its pathway. The colonial rulers did the first and the socialist government the latter. During the fieldwork, people were still complaining about the vanishing of subsidies and seemed to adjust their stocks only very slowly to the new social-ecological context.

<u>Sustainable adaptations: successful institutional reorganization</u>

Besides all the failures of attempts to reshape the *regulating institutions we have also seen some initial successes*. The potential strength of local governments in designing and enforcing bylaws is visible in (a) the new bylaw that directs people to always accompany cattle as well as (b) in the successes in bylaw enforcement of the Wegero government concerning forest resources.

[67] However, among the Kikurya speaking groups, territorial conflicts continue to exist up to today (see Mugini 2006a and 2006b)

Moreover, with regard to externally designed interventions we have seen that some have contributed to the formation of suitable fundaments for successful reorganization. The LVEMP education has made the locals (again) aware of the importance of trees. The national Land- and Village Acts seem to have triggered promising attempts to reorganize the institutions regarding natural resources on both the local scale and at the district administration. Furthermore, the successful reforestation of part of the hill in Buswahili (initiated by WWF) shows us that this reorganization process may be best initiated step by step.

Regarding innovation in livelihood activities, we have learned that *interactions between scales are of enormous importance for generating renewal*. The newly initiated livelihood activities in exploitation phases (juvenile catching[68] and mat-making) are the result of local efforts in *linking newly emerged natural resources to markets at larger scales*. Moreover, all innovatory techniques have been acquired from other scales.

In addition, interactions between scales also appear to contribute to the successfulness of interventions that aim to push livelihood activities into exploitation phases. *Bridging social capital and multi-scale features* in interventions do not only stimulate interactions that increase the possible inputs, but also function as *redundancies* that reduce the chances of regress in (institutional) reorganization processes. In other words, they function as a 'plan B' in case the initial ideas turn out to have undesirable outcomes. This observation teaches us that the troubles of cooperative groups to register with the district administration should be seen as problematic.

Furthermore, interventions in general do have more chances of success if they are accompanied by *high degrees of commitment, flexibility and feedbacks between locals and intervening agents*. All these positive features in interventions stress the importance to abandon strictly applied dichotomies between *internally and externally designed approaches* towards development. A synthesis between these two polar approaches appears to be most successful. Moreover, the presence of these features seems to reduce the chances of regress in institutional reorganization.

The same accounts for bonding social capital that also increases the ability to exchange ideas for inputs in livelihood activities and reduces the individual vulnerability in case the initiatives initially fail. This is important because desirable pathways will probably not take place without failure: a process of trial and error often accompanies innovative ideas. When we combine this aspect with the earlier mentioned community norms regarding new ideas *a committed attitude of local people that can resist both discouraging behaviour of fellow villagers and initial failures is of great importance in order to create renewal in livelihoods and their accompanying institutions*.

8.4 Theoretical implications: reframing the Malthus-Boserup debate

Enriching the Malthus-Boserup debate

This thesis has shown the strength of the synthesis between the adaptive cycles and Malthus-Boserup debate. Instead of seeing the views of these scholars as two opposite pathways, the adaptive cycles provide the possibilities to gain more detailed insights in the features that contribute to particular pathways of livelihood systems. It is quite likely that most livelihood systems around the world are accompanied with both Boserupian and Malthusian features. Detailed insights about where and how certain components demonstrate Malthusian or Boserupian features enable us to understand the suitable conditions for livelihood systems to undergo Boserupian transitions.

[68] It should be noted that this exploitation phase might not be sustainable in terms of negative trade-offs. This non-sustainability can be linked again to the reorganization phase regarding regulating institutions.

By merging these cycles with other approaches, like the sustainable livelihood approach, it seems that we have found a suitable intellectual tool to understand how and where livelihood adaptability gets stuck and how activities can be released and reorganized. Moreover, the observations that factors as bonding and bridging, multi-scale features, redundancies, tight feedbacks and intensive involvement can reduce the chances for institutional regress in times of reorganization add to the strength of merging scientific debates.

All these features had been already found to be important in institutional processes regarding natural resources in empirical research (as mentioned in the theoretical chapter). By merging these insights with the adaptive cycles and the Malthus and Boserup debate, we gain better understanding in the reason why these features are important: they prevent commonly observed regresses in institutional reorganization processes.

With regard to the Malthus-Boserup debate, this thesis has widened its focus by including the fluctuations in the larger social-ecological system instead of focussing mainly on agricultural change. However, it must also be noted that the data for some assumed driving variables that cause transitions or catastrophes (e.g. agricultural inputs, population growth and migration) were either lacking, unreliable or less prominently addressed in this research. For this reason, I won't be able to elaborate with enough certainty on the question whether the fieldwork area follows either a Malthusian or Boserupian pathway.

Furthermore, even though I have concluded that the unsustainable rigidities (thus Malthusian features) seem to be more prominently present in the fieldwork area, I must admit that this can also be connected to the time-span. For example, it is only 10 years ago that the torrential El Niño rains caused another regime shift in the wetland ecology that replaced a lot of pasture. Since the same period the cattle in Buswahili and Kongoto have not increased anymore, while the stocks in Wegero still increased. This situation may point at the beginning of a slow transition (from a cattle oriented livelihood system towards a system with other characteristics) that may take another decade or so. The same accounts for the process of agricultural intensification. I have concluded that, even though harvests seem to decline, large-scale efforts to reorganize and intensify farming remain absence. However, also in this case, the pressure and scarcity of land increased rapidly after El Niño, and 10 years may have been (too) short to get such a Boserupian process started.

Nevertheless, it is interesting to return to the theoretical question as posed as an outcome of the Malthus-Boserup debate: will the carrying capacity of the earth puts a hold to the creative innovative behaviour of the human race? And if yes when? This thesis contributes to an answer to this question that constitutes of both the social and ecological adaptability.

Interplay between social and ecological adaptability

First of all, it is important to stress that in the case of the Mara wetlands, the concept of carrying capacity seems to be a flexible one because the ecological components do show a high degree of adaptability and potential in renewal. This is undoubtedly linked to the general high productiveness and high degree of biodiversity of wetlands in drylands. But, this shows us also that, when we expand our view in the Malthus-Boserup debate to the larger social-ecological system, it are clearly not only social components that innovate and renew their system (like the question above presumes). In this research, the smooth adaptability of the ecological components may rather serve as an example for the social components. Even though there are clearly contrasting perspectives on the local adaptations in the wetland ecology, we can conclude that many adaptations are remarkably suitable for the new context in the Mara basin. In the pre-1960 period, soil erosion was not a large problem and a wetland as buffer between the basin and Lake Victoria was not crucial for the ecology of the latter, but 50 years later soils erosion has become a major issue and the ecological components seem to

have adjusted to this situation. This points at a self-organizing capacity of the ecology. Moreover, the wetland ecology is more encroaching upon the people by becoming inaccessible than the other way around. In this perspective, local people do adjust their livelihoods to the rapid ecological change, but they are clearly not in the position to change the course of the ecological dynamics.

In the posed question there seems to be an image of man exploiting nature, while this thesis depicts an interplay between social and ecological adaptability, in which social and ecological components have to adjust to each other constantly. We can look upon the situation as if we are testing the carrying capacity of the ecology, but also as if the (partly socially caused) ecological dynamics are testing the carrying capacity of the social systems. Thus we can argue both ways round: (a) we have to reduce our influence on the ecology, and (b) we have to improve our social adaptability to these (partly social caused) dynamics. Regarding the interplay between social and ecological adaptability, this thesis has shown that the social components around the Mara wetland are facing more rigidities in the process to catch-up with the dynamic situation than the ecological ones. Below, I place the causes for these problems or trappedness of the social components in the wider discussion regarding transitions in livelihood system.

Sustainable transitions in livelihood systems

On the topic of sustainable transitions in livelihood systems this research supports the statements made by other scholars. The relation between the local people and the larger scale economic, ecological and institutional setting determines the adaptability of the social components up too a high degree (e.g. Zaal en Oostendorp 2002; Dietz et al. 2003). As mentioned in the conclusion, alertness and a determined attitude of local inhabitants play an important role. Regarding the larger scales, we see that on the one hand, larger scale market-possibilities, NGO efforts and the emergence of certain resources have helped successful adaptations. On the other hand, we have seen that government intrusions, larger scale institutional change and the rapidly fluctuating resources have created a difficult context for livelihoods to adapt to.

The same idea of interactions between local people and larger scales developments is underscored with the mentioned conditions for large-scale transition from sustainable into sustainable agriculture in Machakos. Locals played an important role in finding the beneficial ways to use decreasing transaction costs and high coffee prices. Moreover, this only took place after a period in which the livelihood system was characterized by Malthusian features.

Larger scale factors probably also explain why the combination between institutional reorganization phases and high population growth have created different outcomes in the Kenyan part of the basin than in the Tanzanian part. While in Kenya some people (unsustainably) exploit the newly emerged opportunities, the Tanzanian livelihood system seems to have stayed in the same regime. We have seen that the emergence of the large-scale agriculture in Kenya can be linked to the transition from communal tenure to private tenure and that in Tanzania the communal land tenure system has prevented this type of land use.

In Tanzania, or at least in the fieldwork area, it seems that the local people have not discovered large-scale new opportunities in the newly emerged institutional and ecological context yet. This can be linked to (a) the low degree of influence on hierarchically (higher) governmental decisions (that had also been the case in Machakos, see Tiffen et al. 1994), (b) local low cultural bias for innovation, (d) capricious timing, pace and nature of ecological and institutional change, and (e) unsuitable institutional and economic context.

The latter contains a very wide reference, for example to the bad shape of infrastructure, inappropriate subsidizing programs and lack of social bridging possibilities

(concerning registering cooperative groups in the district). Moreover, the communal land tenure system may also reduce the land use options and a transition in livelihood system. However, it looks like the strengths of this system lie in a reduction of negative trade-offs (in the form of land cover changes). In this perspective, it is interesting to note that people often refer to common property rights as the deemed ownership rights, but in the case of the Mara basin, both private and common property seem to have their advantages and disadvantages.

Interestingly, the livelihood system of the Wakenye has proven to be very 'resilient' in the sense that it stayed in the same regime and still persists. None of the livelihood activities has gone through a release phase and they may be able to stay even longer in the undesirable conservation phases. However, this thesis shows that in a highly dynamic context, this feature of resilience is not very desirable in livelihood systems. In such a context, the best way to deal with change is to change yourself. This stresses the importance to distinguish between the concepts of adaptability and resilience. While the latter focuses more on the system's ability to recover and to absorb disturbances (while still persisting), adaptability includes a larger focus on the capacity of a system to reshape itself (according to the changing context). This reshaping may imply a regime shift and after such a shift we cannot say anymore that a system has persisted, because it is replaced by another system (creative destruction). This does not mean that a resilient system never changes or adapts to new situations, but rather that there is a subtle difference between adjusting to a new situation and making an entire regime shift which puts another type of system in place (like in the 'wetland' ecology, where the dryland system does not persist anymore). This implies a more radical change and as stated above, such a change may be necessary for livelihood systems that are located in social-ecological systems that have changed rigorously. Thus, the desirability of resilience may differ according the pace of change and the scale of the unit of analysis.

8.5 Recommendation for research and policies

A look into the future

During the fieldwork many people asked me whether it would be possible to restore the pre-1990 conditions in the wetland. Moreover, about all elderly people described the past as the 'good old days' when harvests were good, pasture was available and fish-catches were abundant. It may be just a human habit to remember the positive aspects of the past, but it is important to emphasize that it seems impossible to regain the 'good old days' and that a shift of attention to the renewed opportunities of the present and the future may be more appropriate. Most of the pathways in the social-ecological system seem to be irreversible.

This became clear when the elders failed to restore the traditions regarding forest resources, but also in the case of the wetland expansion. Although the higher water levels in Lake Victoria have probably contributed a great deal to the wetland expansion, the receding water levels in this lake do not imply that the wetland will now disappear again. On top of the other contributors, which seem to have increased in influences during the years, the dynamics around the wetland also seem to have started to function as positive feedback mechanisms. Moreover, it seems like a utopia to rapidly reverse or adjust the large-scale land cover changes that have occurred on the basin scale. Furthermore, torrential rainfalls are connected to global climate patterns that are also far out of reach of human influence.

Thus, we have to deal with a wetland, which may even expand more in the future. This expansion is especially feared in Kongoto. Some inhabitants of this village were afraid that their village would become a peninsula, because the areas around the borders with Buswahili and Wegero are a bit lower than the rest of the territory. In Buswahili, the territory elevates quite a bit and most people don't fear a rapid expansion anymore. In Wegero, many people

said that they expected it to take a long time before their forest will be replaced by waterweeds, while some feared that this process will take place during the following years.

Change in the wetland ecology seems to have become the constant condition and there is no other way than to adapt to these changes. The rapid paces of the regime shifts make the social adaptations more difficult. Therefore, it is a good idea to put in efforts to reduce the strength of the driving variables in the wetland dynamics. This research has distinguished various variables that possibly have contributed to the wetland expansion. However, *further research on the relative contributions of these variables is necessary in order to design policies that aim to slow down the wetland expansion*.

However, this research has highlighted already some important guidelines in interventions regarding the wetland ecology. Below, I will formulate some do's and don'ts concerning these interventions. The don'ts can be of great importance because they have to guard us from interventions that may have adverse affects for the collective interest. Some potentially unwise interventions appear to be very tempting when the complexity of the contrasting perspectives on the wetland expansion is ignored.

If some groups with certain interests manage to bring forward their view on the wetland (expansion) in powerful organizations, they might create injustice for others. I already received a glimpse of these undesirable possibilities while discussing the wetland expansion with local residents, officers and representatives from larger organizations. In the sections below, I integrate these discussions, sketch some do's and don'ts concerning interventions and elaborate further on ways forward in the Mara basin.

Don'ts: dredging or using water-reservoirs to reduce flush floods

Many local residents suggested dredging the Mara River to improve the discharge-capacity as a solution for the stresses derived from the wetland expansion. Moreover, NELSAP (2007) has initiated to improve the navigability of the Mara River to make boat trips for tourist possible. This means that waterweeds in the river will have to be removed. These initiatives will undoubtedly have a negative impact on the people that live near the river mouth, because they will receive more polluting sediments.

Moreover, these initiatives may create unpredictable dynamics in the wetland. Eventually, these dynamics may affect mat-makers in Buswahili and juveniles catchers in Wegero, while it remains unclear whether other advantages from the previous phases (e.g. pasture, forest and open water bodies) will return directly. In other words, these initiatives may accelerate some changes, while the outcomes are difficult to predict and potentially negative for some people.

Another way that some people suggested to stop the wetland expansion is by installing dams and water-reservoirs. In this way, the water would be temporarily stored during the highs in the river flow and injected again in the river flow during the dryer periods. This may be a more suitable solution for the problems in and around the protected natural areas where the main importance lies in sustaining the permanent water flow in the Mara River. However, for the downstream Mara wetland, this intervention could have an adverse affect on the social-ecological components.

Local people, generally, highly value the flush floods, because they flush the silting open water bodies (which are used by fishermen but also by wildlife) and provide water and fish for the villagers. Any kind of engineering that reduces the flush floods should be preceded or at least accompanied by a significant reduction of sediments in the river flow, which appears to be the main cause of silting and local deterioration of the water quality (together with the invasion of waterweeds).

Do's: soil erosion reduction on different scales

From the above we learn that only after a substantial reduction of soil erosion, any ideas in social-ecological engineering such as removing some wetland vegetation, reducing the flush floods, dredging or making the Mara River navigable, could be recollected and re-discussed. Also for this reason, searching for the erosion sensitive spots and reducing erosion should be a priority in interventions[69]. This can be done with reforestation that also will reduce the flush floods (but now simultaneously reduces soils erosion). It is important to continue with efforts to reduce soil erosion. However, as I argue below it is important to keep an eye on the interactions between scales around the wetland expansion.

Some villagers initiated to build water-reservoirs for cattle in order to keep these animals away from the wetland and reduce sediments and manure in the water bodies. In a later stadium of the research, I observed and was told by locals, that some pathways of cattle have turned into streams in the wetland. The actual contribution of cattle in forming the streams is difficult to verify because hippos and flush floods also contribute to this process. However, when cattle would be kept away from the wetland area and other contributors to the expansion would continue, a newly emerging wetland may become a densely vegetated place without (many) open water bodies or streams.

This will be disastrous for both the ecology and local residents (for fetching water and fishing). *Therefore, this kind of local interventions should be postponed until further research reveals more about the relative influences of the various contributors to the wetland expansion (and on role of cattle, hippos and flush floods) in creating and maintaining open water bodies.*

However, near the seasonal streams further from the wetland shores, there seems to be a lot to gain in the reduction of soil erosion. Many of the shores of these streams are bare-lands and heavily used by domestic animals and humans. Simple concrete drinking troughs a few meters from these shores could certainly reduce a lot of soil erosion[70].

Basin scale integration

There are various ways to integrate policies and actors on the basin scale. The WWF in Kenya has already *organized meetings in which different stakeholders participated*. In these meetings heavily loaded discussions clarified the different perspectives of these stakeholders. These meetings could include the Tanzanian part of the basin in order to create a more realistic overview of stakeholders. Moreover, these kinds of meetings provide a great opportunity for policy makers to gain understanding of the social-ecological interconnectedness between upstream and downstream areas. This understanding should precede the design of transboundery institutions, which ultimately have the purpose to outweigh and steer the collective advantages and disadvantages of land use options.

In this thesis various statements have been made about the social-ecological interconnectedness and contributors to the wetland expansion. Most of these statements are formed on the basis of a combination of scarcely available scientific research, local narratives and personal observations. Although I don't doubt about a degree of validity in these statements, it should be mentioned that I have to stay utterly humble about my capacity to make further statements about the exact strength or impact of these interconnectedness and contributors. Before policy makers can design valid frameworks, more insights in these factors are a necessary. For this reason, *researchers and (their) scientific views should merge with the previously mentioned discussions between local stakeholders*.

[69] VI-Agro-forestry and ICRAFT have already been involved in the locating and reducing the erosion sensitive spots in the basin by using GIS applications. Moreover, the WWF puts a lot of emphasis on the reduction of soil erosion.

[70] The same accounts for many dams and shallow wells, which decrease in usefulness because of the extensive slighting of sediments caused by humans and domestic animals.

Scientific research could also focus on the hydrology to enable the possibilities of setting-up an alarm system for flush floods in the Mara basin. This would be highly valued by riparian villagers who cultivate or live near and in the wetland area, fishermen (who loose their canoes and hooks), and also by other people living elsewhere close to the river shores (think about the description in chapter five about the locally observed drowned human beings, deceased cattle, wildebeest and iron sheets in the wetland). As mentioned before, the flush floods are highly valued, but they also cause stresses and shocks for people that perform wetland activities.

Adapting local livelihoods to the social-ecological changes

The conclusion of this thesis has already described the main features that seem to help with enabling or disabling successful transitions in livelihood activities. Moreover, in chapter seven I have elaborated already in detail on ways forwards regarding several interventions. For this reasons, I will use this section to sketch some suggestions for how each livelihood activity could be reorganized in order to increase its potential (to increase livelihood sustainability). These reorganizations should be worked out into detail and will probably not be successful without some kind of trial and error. Basically, I do sketch ways to take steps in the direction of the next phases of the adaptive cycle. This kind of steps should be taken to keep up with the dynamics in the institutions and ecology.

Regarding *crop cultivation* VIFAFI has shown us a good example of how to renew certain components of a livelihood activity. Introducing new techniques and means (e.g. for fertilizers, pest control and storage) can help the process of intensification to take place. Moreover, local initiatives to use the newly available (ground) water in and around the wetland appear promising in order to deal with the larger rainfall variability. The mentioned flood warning system could help farmers near the wetland to harvest their crops on time. Moreover, farmers could be taught to use erosion-preventing measures and avoid dangerous chemicals.

Irrigation is done with hand pumps and consequently relies on limited water abstractions and a large labour-input. When locals gain access to mechanic pumps, regulating institutions should be designed, because large-scale water abstractions could clearly affect other livelihood activities (e.g. fisheries and mat-making) and other geographical areas. Moreover, the timing of large-scale water abstractions is important. During the inundated periods, water abstraction will probably not create too many problems for the other livelihood activities, because during this period the entire valley is inundated and constantly fed by the Mara River and tributaries. *However, further detailed understanding of the hydrological system, risk assessments and a strong institutional basis should precede any attempts in larger scale irrigation*.

The conservation phase in *fisheries* is partly caused by the silting of water bodies and increase in waterweeds. The mentioned recommendation for erosion reduction on basin scale may help to combat these causes of declining fish catches. Moreover, catfish juvenile catching is a profitable business, but also affects the stocks of tilapia (as by-catch) and catfish in the wetland. *A (further) introduction of fishponds may be a good solution for both the silting water bodies and juvenile catching*.

First of all, when fishponds are available, all fishermen will understand the value of their by-catches and may release them in the ponds instead of leaving them on the shore. Moreover, fishponds will reorganize the market value of catfish juveniles and offer an opportunity towards the present approach of catching and selling them. The prices for these juveniles are highly fluctuating and selling the juveniles as bite for the Nile perch will become

less attractive for the locals during low price periods. Introducing fishponds will thus influence the locally made assessments about the use of juveniles and change the dilemma's regarding capturing these fishes (as they otherwise may dry-up and die).

While introducing fishponds, the position of the Lake Victoria based Nile perch fishermen should be considered. When the supply of catfish juveniles decreases, the prices may go up and affect these fishermen. This shows us that, if fishponds will succeed, the Nile perch fishermen should be compromised with, for example, artificial bites.

Regarding *animal keeping and cattle keeping* in particular, we have seen some minor initiatives in reorganizing this livelihood activity. The introduction of commercial cattle in the Wegero seems to be a good device to reduce the stocks, because the commercial animals are said to be more expensive (thus easier to accumulate wealth) and more 'productive' than the indigenous ones. Another way to reorganize this activity can be found in creating substitutes for some of its functions, like saving and credit systems. Regarding functions like bridewealth and prestige, we are facing culturally sensitive subjects that should be addressed locally by the villagers themselves. Furthermore, other ways in facilitating cattle feed and water may reduce the trade-offs of this activity. The earlier mentioned concrete drinking troughs can accomplish this. Other ways in organizing cattle feed (e.g. by growing it) will probably require another organization in labour, in which people will be more occupied in growing and transporting cattle feed instead of herding the cattle to the available pasture.

Concerning *forest resources*, the example of successful enforcement of the Wegero government shows us both possibilities and constraints of resource management in dynamic ecologies. Firstly, villagers complained about the scarcity and the unsuitability of this bylaw and secondly, with an eye on the wetland dynamics, we are not sure whether the forest will have a long future. A few large or long-enduring inundations may destruct the forest in a similar ways as in Kongoto. In this case, the successful conservation efforts may become a futility. This statement should not be taken as a reason to exploit the forest while it still exists, but rather as an urge to reforestate more secure places, like some parts of the hills.

Problems in these reforestation efforts may be encountered in dilemmas in organizing collective actions, the use of the hills for pasture and in rocky soils. The second potential problem teaches us the importance of integrating reforestation efforts with regulating and reorganization efforts concerning animal keeping. The rocky soils show the importance of the right choices for tree species and locations on the hills. The district efforts to restrict large-scale charcoal burning and to shift forest resources from common to private property appear promising, but they do not raise the problems regarding common property regimes. Even when all homesteads will have 30 trees on their property, fuel wood collection will still take place on the hills. Moreover, domestic animals will be still browsing grazing and trampling the immature trees. Intensive and context-specific external consultancy may help to overcome the dilemmas regarding collective actions in reforestations and common property regimes. The institutional infrastructure for such an evolutionary process seems to exist already in the form of the Land - and Village Acts and the Joint Forest Management programs.

With respect to *mat-making*, it is important to remember that the present market may collapse when less gold is being found in Buhemba. For this reason, it is important to start reorganizing activities regarding sustainable papyrus and other aquatic plant utilization. By starting this reorganization in advance, a sudden collapse of the market may be less unfortunate for the people that have started to rely on this business. The locals of the Buswahili ward already use the large variety of waterweeds for many purposes. Additional inputs in the use of aquatic plants will certainly increase the local adaptability regarding the

expected following phases of the ecological regimes (more papyrus and less forest). In Kenya, papyrus is also used to make baskets and chairs. Moreover, scientific literature teaches us that aquatic plants can be used as food for humans, domestic animals and fish. Furthermore, they can be used for agricultural purposes, such as: fertilizers, compost, mulching and weed control. Moreover, the use for (biomass) fuel, paper, building materials and medicinal purposes can be introduced or extended (Little 1979). Some of this aquatic plant use can compensate resources that are lost through the ecological regime shifts (cattle feed and fuel). These two possibilities are already discovered by local residents, but there is a large chance that this utilization has not reached its highest potential yet.

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APPENDIX

Improvised estimation of percentage of large cattle keepers in the fieldwork area

The improvised calculation to estimate the degree of validity of the sample has been done as follows: 12 large cattle keepers / (3553 inhabitants of Kongoto and Buswahili) / 5.5 people per homestead) = 1,9 percent of large animal keeping homesteads in these villages. The human population in Wegero is 4002 and thus a bit higher than the population of Kongoto and Buswahili together and the number of cattle per capita (according to the ward agricultural officer numbers) is more than twice as high (5,5 instead of 2,6). This means that Wegero has probably 5,5* (1,9/2,6)= 4 percent large cattle keeping homesteads. If we add these numbers (1,6 percent of large cattle keeping homesteads in Buswahili and Kongoto and 4 percent in Wegero) and weight them according to the populations we get: ((4002 / 7555)*4 = 2,12) + ((3553 / 7555)*1,9 = 0,89) = 3,01 percent large cattle keeping homesteads in the fieldwork area.

SPSS output with Analysis of variance as done in chapter six.

The use of wetland resources and the value of animals

Between-Subjects Factors

		N
wetlandresources	0	32
	1	39

Descriptive Statistics

Dependent Variable: valueanimals

wetlandresources	Mean	Std. Deviation	N
0	31420000,00	39110965,874	32
1	6250512,82	6397379,788	39
Total	17594507,04	29303895,684	71

Tests of Between-Subjects Effects

Dependent Variable: valueanimals

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	11135378168002860,000(a)	1	11135378168002860,000	15,688	,000	,185
Intercept	24943609649693020,000	1	24943609649693020,000	35,143	,000	,337
wetlandresources	11135378168002880,000	1	11135378168002880,000	15,688	,000	,185
Error	48974902989743600,000	69	709781202749907,000			
Total	82089515300000000,000	71				
Corrected Total	60110281157746400,000	70				

a R Squared = ,185 (Adjusted R Squared = ,173)

Without the 11 large animal keepers (outliners)

Between-Subjects Factors

		N
wetlandresources	0	22
	1	38

Descriptive Statistics

Dependent Variable: valueanimals

wetlandresources	Mean	Std. Deviation	N
0	8680000,00	5384769,527	22
1	5653157,89	5266876,147	38
Total	6763000,00	5466297,449	60

Tests of Between-Subjects Effects

Dependent Variable: valueanimals

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	127654038947368,200(a)	1	127654038947368,200	4,528	,038	,072
Intercept	2862455852280702,000	1	2862455852280702,000	101,525	,000	,636
wetlandresources	127654038947368,400	1	127654038947368,400	4,528	,038	,072
Error	1635290021052631,000	58	28194655535390,200			
Total	4507234200000000,000	60				
Corrected Total	1762944060000000,000	59				

a R Squared = ,072 (Adjusted R Squared = ,056)

Regarding wetland resources and cropland

Between-Subjects Factors

		N
wetlandresources	0	32
	1	39

Descriptive Statistics

Dependent Variable: cropland

wetlandresources	Mean	Std. Deviation	N
0	9,95	4,335	32
1	5,90	3,374	39
Total	7,73	4,317	71

Tests of Between-Subjects Effects

Dependent Variable: cropland

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	289,125(a)	1	289,125	19,650	,000	,222
Intercept	4416,167	1	4416,167	300,133	,000	,813
wetlandresources	289,125	1	289,125	19,650	,000	,222
Error	1015,269	69	14,714			
Total	5541,750	71				
Corrected Total	1304,394	70				

a R Squared = ,222 (Adjusted R Squared = ,210)

Regarding mat-making and value of animals

Between-Subjects Factors

		N
matmaking	0	57
	1	14

Descriptive Statistics

Dependent Variable: valueanimals

matmaking	Mean	Std. Deviation	N
0	20512631,58	31968759,836	57
1	5713571,43	5661052,644	14
Total	17594507,04	29303895,684	71

Tests of Between-Subjects Effects

Dependent Variable: valueanimals

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2461573531054720,000(a)	1	2461573531054720,000	2,946	,091	,041
Intercept	7730638759223750,000	1	7730638759223750,000	9,253	,003	,118
matmaking	2461573531054749,000	1	2461573531054749,000	2,946	,091	,041
Error	5764870762691700,000	69	835488516328865,000			
Total	8208951530000000,000	71				
Corrected Total	6011028115774640,000	70				

a R Squared = ,041 (Adjusted R Squared = ,027)

Without the 11 large animal keepers (outliners)

Between-Subjects Factors

		N
matmaking	0	46
	1	14

Descriptive Statistics

Dependent Variable: valueanimals

matmaking	Mean	Std. Deviation	N
0	7082391,30	5428762,161	46
1	5713571,43	5661052,644	14
Total	6763000,00	5466297,449	60

Tests of Between-Subjects Effects

Dependent Variable: valueanimals

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	20110701614907,240(a)	1	20110701614907,240	,669	,417
Intercept	1757440174948241,000	1	1757440174948241,000	58,486	,000
matmaking	20110701614906,780	1	20110701614906,780	,669	,417
Error	1742833358385092,000	58	30048851006639,530		
Total	4507234200000000,000	60			
Corrected Total	1762944060000000,000	59			

a R Squared = ,011 (Adjusted R Squared = -,006)