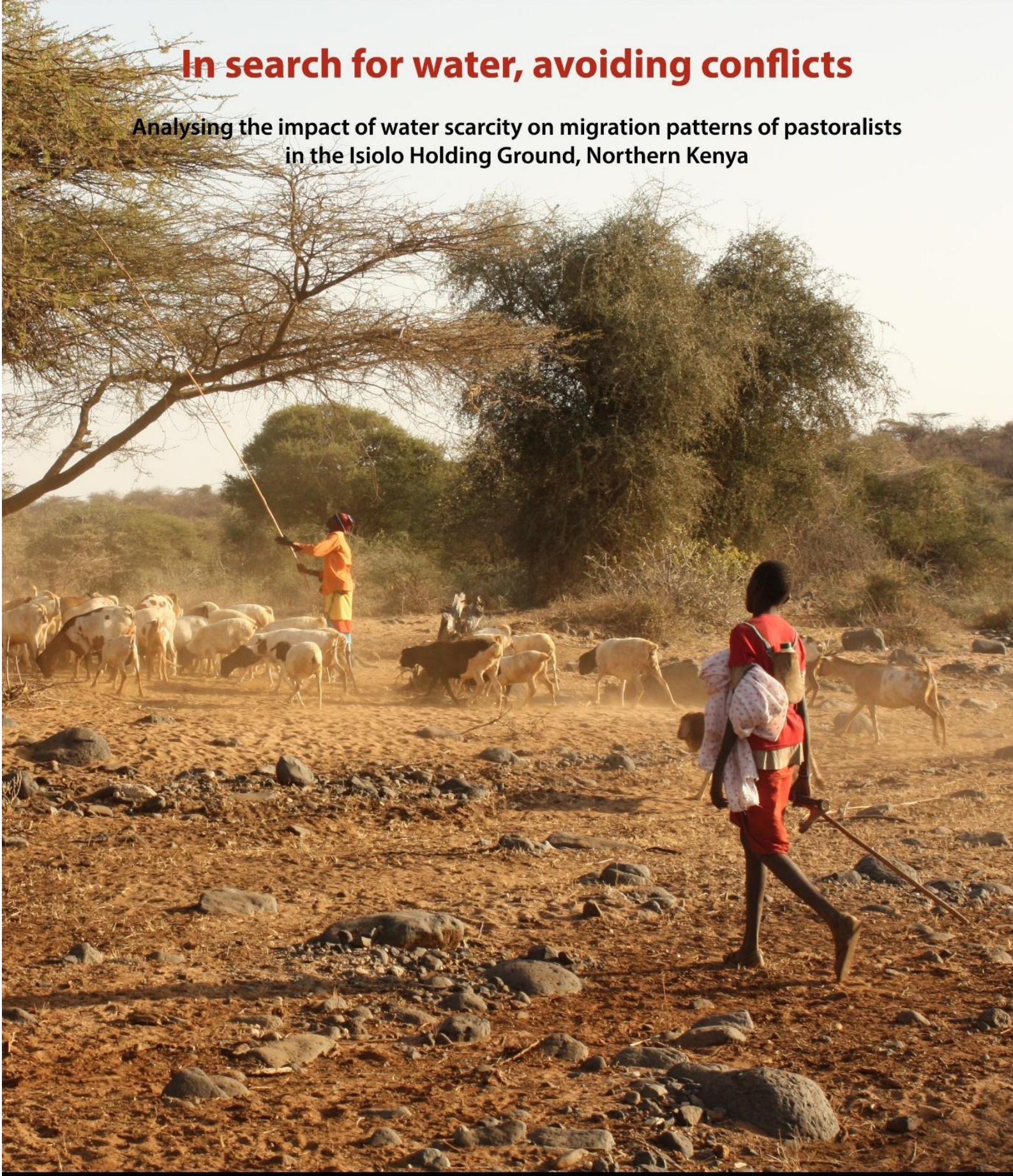
In search for water, avoiding conflicts

Analysing the impact of water scarcity on migration patterns of pastoralists in the Isiolo Holding Ground, Northern Kenya



Huub van der Zwaluw
s4045386

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Colophon

Title

In search for water, avoiding conflicts: Analysing the impact of water scarcity on migration patterns of pastoralists in the Isiolo Holding Ground, in Northern Kenya

Cover image

This photo was taken during fieldwork in July 2014. The herder standing at the Acacia tree is shaking of the fruits, to feed the goats and sheep during drought. The image captures a moment which shows how livestock keepers in semi-arid areas adapt to drought periods, when pastures are insufficient to feed the livestock. While this herder is not that far located from his home stead, other pastoralists migrated to more distant places with their cattle.

Author

Huub van der Zwaluw

Student number: 4045386

Supervisor

Dr. Marcel Rutten

This thesis was written in partial fulfilment of the requirements for the master degree Human Geography: Globalisation, Migration and Development at the Radboud University in Nijmegen.

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Preface

This thesis has been written as concluding part of the Master in Human Geography: Globalisation, Migration and Development at the Radboud University in Nijmegen. Within this specialisation, I was particularly interested in both international as internal migration. My supervisor, Dr. Marcel Rutten, helped me to combine these research interests with the interests of the Cocoon Initiative Kenya. Cocoon Initiative Kenya focuses on the nexus between natural resources and conflicts. Their interests could easily be related to my research interests for migration. Furthermore, it resulted in the possibility for me and my fellow students to conduct fieldwork in Kenya, which was made possible by Dr. Marcel Rutten and Dr. Moses Mwangi.

Writing this thesis has been made possible because of the contribution and efforts of others. First of all, I would like to thank my supervisor Dr. Marcel Rutten, who gave me this opportunity and whose comments kept me on track during the fieldwork and the writing process. Besides, I would like to thank Dr. Moses Mwangi, who helped me understand the context specific situation of the study area and population and besides, he helped me with the more practical aspects of doing research in Kenya. I would also like to thank my fellow students, Stefan Ramaker, Niels Heres, Anke Hilgeholt and Martin Neumann. They helped me during the process of this research and we were able to enjoy and share our experience in Kenya. Special thanks go to Anthony and Ericko. Not only for assisting me during the fieldwork, but also for the nice times we had on our trips by BodaBoda and in Isiolo Town. Others, who made me feel at home during my stay in Isiolo were Father William and the staff of the Catholic Pastoral Centre, in more particular, Boniface and Mary. Next to those persons who helped me during my stay, I would also like to thank those who helped me concerning the content of my research, in particular I would like to thank: Dr. Marani, from the University of Nairobi, Mr. Muggi, from the Livestock Department Isiolo, Mr. Haji, chair of the Isiolo Holding Ground User Association, Mr Karunda Kongo from the National Environment Management Authority (NEMA) and Mr. Lordman from the National Drought Management Authority (NDMA). Last but not least, I would like to thank my parents and Maaike for their support and encouragement.

Summary

In semi-arid areas, it is hardly viable to have livestock production as a way of living, without seasonal migration. This research focuses on a specific semi-arid area in Kenya, the Isiolo Holding Ground. This area is a complex area situated in the Upper Ewaso Ng'iro North River Basin. The area is characterised by an Aw-climate with bimodal rainfall. Drought occurs seasonally and differs in severity, depending on the quantity and volume of the rains. The objective of this research is to gain more insight in what the various facets of water scarcity, in relation and in combination with each other, mean for the migration decisions of (agro) pastoralists and how it forms a potential trigger for drought related conflicts in the semi-arid Isiolo Holding Ground in Kenya. This objective is reached by posing a central question and relating sub questions, focusing on the various facets of water scarcity, seasonal migration, and drought related conflict. Furthermore, this research focuses particularly on the agropastoralist Ndorobo community. However, other communities are not excluded in inquiry. The academic relevance is found in this specific spatial focus with a particular research population. Besides, this research is part of a broader set of studies on natural resource based conflicts, conducted by the Cocoon Initiative Kenya of the African Studies Centre, Leiden, South Eastern Kenya University, Kitui, Cordaid, Netherlands and World Initiative for Sustainable Pastoralism. Furthermore, the social relevance can be found in involving the perception and experience of pastoralists, which provides useful information for local policy makers.

The objective has been reached by doing an extensive literature study, after which observations and interviews were conducted during fieldwork May until July 2014. The obtained data has been analysed and linked to literature. To measure water scarcity in the Isiolo Holding Ground, the Water Poverty index (WPI) has been used, which is a comprehensive conceptualisation of water scarcity. The WPI consists out of five components, which are: *'Resources', 'Access', 'Capacity', 'Use' and 'Environment'.* It has been shown that these components interact with each other and all use a different approach to the practical conceptualisation of water scarcity. The Isiolo Holding Ground scored high on *'Resources',* but low on access and capacity. Various communities experience the degree of water scarcity differently. It has been found that various types of pastoralists make use of the Isiolo Holding Ground, whereby the Ndorobo community, mostly agropastoralists, live in settlements near the river. Next to livestock keeping as their main way of living, they also cultivate crops. The next step in this research has been executed by linking the WPI to seasonal migration. It can be stated the various components have different influence on the seasonal migration of (agro) pastoralist. The resources water and pastures, as ecological factors, are main factors influencing the migration decisions of pastoralists. Additionally, the social environmental factor 'security', which also contributes to the WPI component '*Use',* appeared to be one of the most important factors.

Furthermore, this study shows the complexity of water scarcity and migration, due to the interaction of these factors. For example, security does not only influences the component *'Use'*, but also the *'Access'* to resources. How pastoralists deal with seasonal migration differs per communities. They face various obstacles and use different strategies to move from one place to another in search for resources. It has been concluded that, compared to other communities, Ndorobos tend to move in groups. Besides, they emphasize the importance of preventing conflicts with other communities. These drought related conflicts occur when pastoralists all want to make use of the scarce resources which are still available. After a drought period, cattle-rustling is a serious issue. Pastoralists sometimes use violence to replace the livestock that has perished. On the other hand, drought related conflict might also occur when pastoralists migrate to the same places or pass each other during migration, which in turn is a possible consequence of water scarcity.

One the basis of the findings in the research, it might be useful for future research to focus on how Water Resource Users Associations (WRUAs) might impact the actual and perceived water scarcity and at the same time migration decisions of pastoralists. Furthermore, future research may also emphasize on how the resulting conflicts are to be resolved.

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1. Introduction

Since water means life, the importance of access to water may be obvious. Still in different parts of the world water scarcity and the competition for this natural resource is a major challenge (Mutiga et al., 2010). In the arid and semiarid (ASAL) areas of the world water scarcity and water stress is a serious issue. Whereas water stress is about the ratio of water use over the total amount of available water in an area, water scarcity is about the access to these water resources (UN, 2012) and can therefore be seen as a more comprehensive concept. Especially in dry seasons people in arid and semi-arid areas(ASAL) areas are facing problems. If water sources dwindle and are not likely to recover soon, people are forced to respond. One of the groups that suffer from these water issues are livestock keepers, nomadic pastoralists in search for water sources as well as pastures left for grazing. These pastures are rejuvenated after the return of the rains. In other places, fresh grasses are produced when a delta area is flooded again following the start of the new rainy season. If these seasons are delayed or below average in subsequent years, the drought might become too severe and the animals will perish. The north-eastern part of Kenya, is one of these semi-arid areas where access to water comes with challenges.

This research project focuses on the challenges pastoralist people in this semi-arid areas face and which strategies they use to deal with these challenges. Chapter I will start with an introduction to Kenya and the research area, which will form the background. Furthermore, the challenges will be presented and the research focus will be clarified. it by formulating the research objective and specific research questions. It will also provide an outline of this master thesis.

This research project took place was executed in collaboration with the Cocoon Initiative Kenya project (Conflict and Cooperation over Natural Resources), a research programme conducted in each of the five major river basins in Kenya, on the significance of natural resources, notable water and land in conflicts or enhancing cooperation. This programme is executed by the African Studies centre Leiden and the South eastern Kenya University in collaboration with two non-academic pasterns, which are Cordaid, Netherlands and World Initiative for Sustainable Pastoralism linked to International Union for Conservation of Nature (www.iucn.org, 2013; M. M. E. M Rutten, personal communication, June 2015).

1.1 Background

Kenya is an East African Country, that has declared their independence from Great Britain in 1963 (Boye and Kaarhus, 2011). The country has a surface area of 581.313 square kilometres (UN, 2014) and an estimated population of 44 million in 2013. The GDP per capita in Kenya was US$ 1,245.5 in 2013. Compared with the world average US$10,613.5 and with a Sub-Saharan Afrcan average of

US$1,770.6, Kenya has a relatively low GDP per capita. 29,5% of the total GDP was added by the agricultural sector, which includes livestock production (Worldbank, 2014).

Estimates are that 84% of Kenya can be classified as semi-arid or arid land. Only 19% of these dry lands have some potential for agriculture. As a result people occupying the ASALs need to look for other ways of living. In 31% of the semi-arid and arid areas, livestock keeping is possible and in the remaining 50% livestock keeping is only possible in the form of nomadic pastoralism (Muthee, 2006). The FAO (2005) states the average annual rainfall in Kenya is 630mm, but with a large variation. In northern Kenya, where most of the semi-arid and arid areas are located, the average is less than 200mm, while on the slopes on Mount Kenya the average annual rainfall is over 1800mm.

One of the counties within Kenya which for a large part is considered semi-arid or arid land is Isiolo county. Isiolo Count is shown in Figure 1. With an annual rainfall of 200 to 550mm, this county can be classified as 85-100% semi-arid or arid (Ruto, Ongwengi and Mugo, 2009). This drought causes problems between the different communities living in the area competing over the pastures available. The following article from the humanitarian news and analysis website IRIN, published on the 28th of December, 2011, illustrates the problems which are being faced in the area:

> *Fighting between communities over grazing land in northern Kenya's Isiolo region has led to at least 10 deaths and the displacement of some 2,000 people in the past three days, according to local leaders and residents. " The fighting, mainly between the members of the Turkana and Somali communities, with some Borana siding with the Somalis, has disrupted transport and trade networks and hampered access to farms and communal grazing areas....The area's most affected by the fighting are Burat, Mulango, Kilimani and Kampi ya Juu, all in Isiolo central division.*

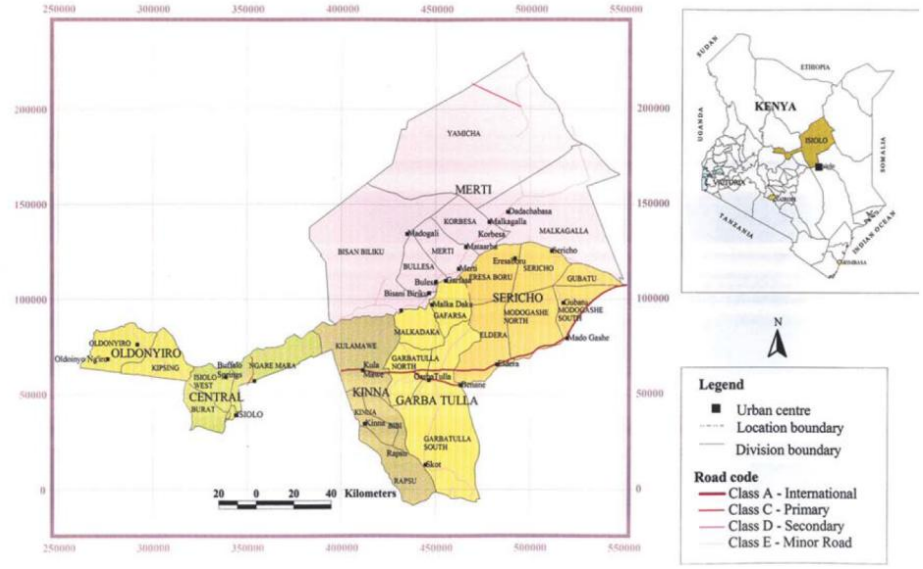


Figure 1: Location of Isiolo County within Kenya. (Source: Mati et al. (2006) who have adapted it from the Department of Resource Surveys and Remote Sensing (DRSRS 1993) and the Ministry of Planning and National Development, Nairobi).

For a large part Isiolo County lies within the Upper Ewaso Ng'iro North River Basin (figure 2), which stretches out to the Northwest of Mount Kenya and covers 15.200 km² (Gichuki, 2002).

Although the main Ewaso Ng'iro River flows from the Nyandarua range, most of the water supply comes from various small different tributaries originating from Mount Kenya (Ericksen et al., 2011). Mount Kenya, as one of the main water towers of Kenya, is therefore of major importance for the Upper Ewaso Ng'iro North Basin.

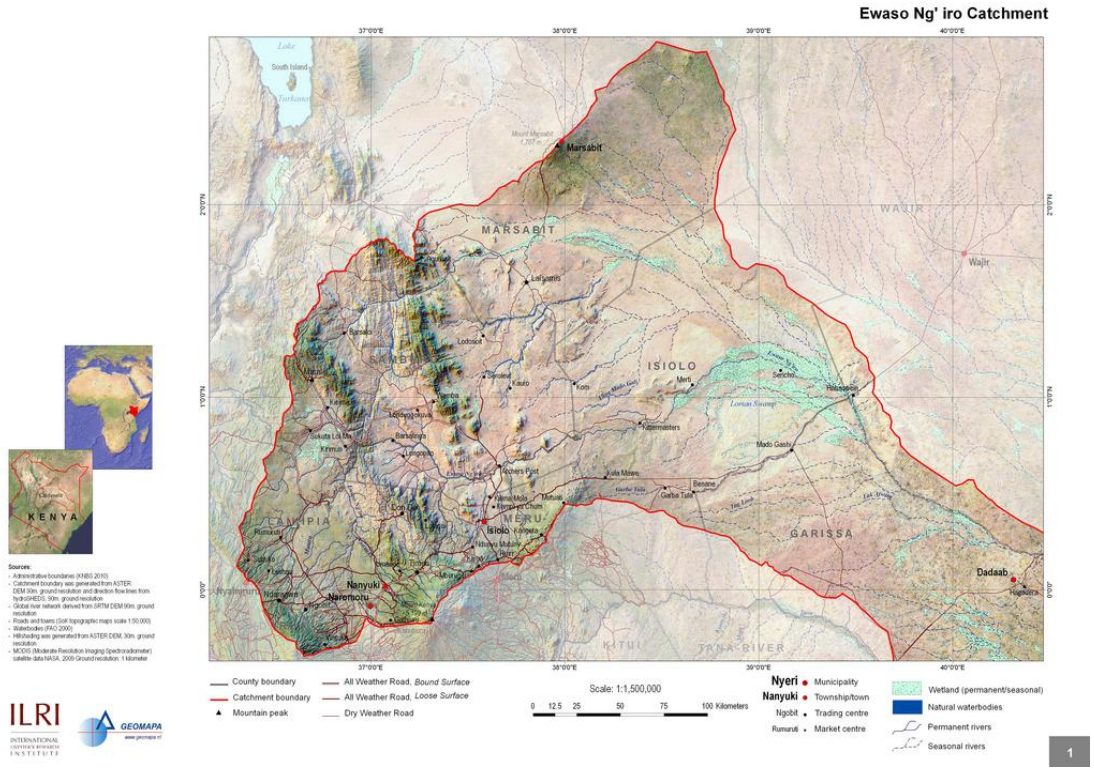


Figure 2: Location of The Upper Ewaso Ng'iro water catchment (Ericksen et al., 2011).

Because of the differences in elevation, a variety of climatic zones exists in the basin. This means there are spatial and temporal differences in rainfall and temperature patterns (Mutiga et al., 2010). Most of the rain is falling in the highlands in the upper mountain areas and therefore these areas have good vegetation and mostly good agricultural conditions. Figure 3 shows the average monthly aridity index of the Ewaso Ng'iro North Basin from January (left corner up) to December (right corner bottom), this also shows the differences between the humid high areas in the south (blue) and the more arid lower areas (brown).

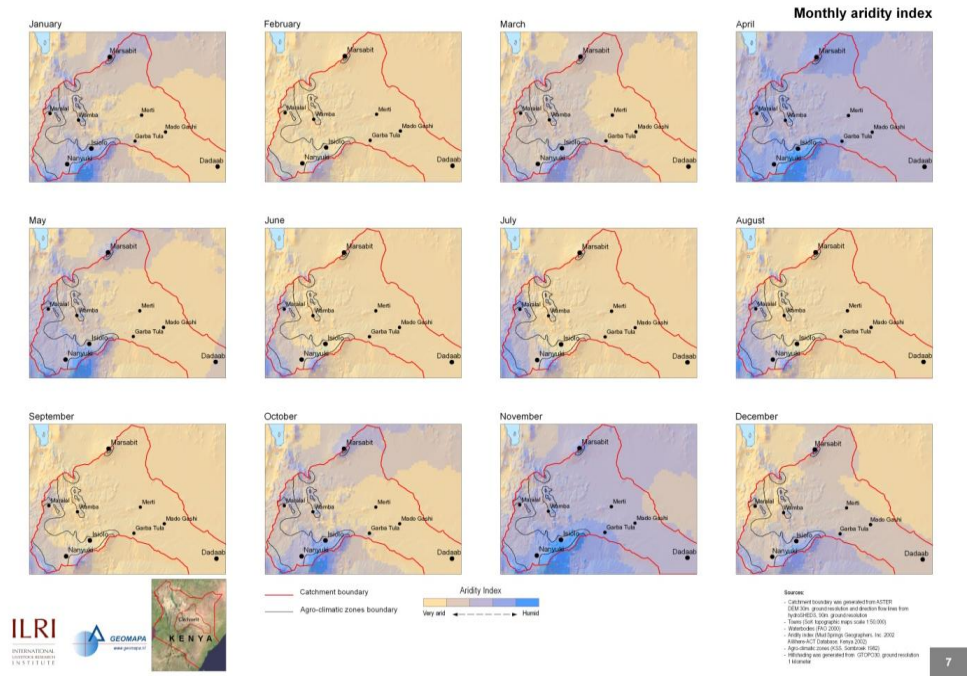


Figure 3: Monthly aridity index of the Ewaso Ng'iro North Basin (Ericksen et al., 2011).

Land use is changing in the Upper Ewaso Ng'iro river basin, but without much concern to the water conservation, which affects the lower stream zones. An example of a change of land use is given by Kiteme and Gikonyo (2002), who state that major land use changes have occurred in the foot zones of Mount Kenya whereby "large scale farms have been transformed in large-scale horticulture irrigation schemes oriented towards the international market." These effects of globalisation have a visible effect on the Upper Ewaso Ng'iro River Basin, which according to Kiteme and Gikonyo (2002) have changed into a complex multi-stakeholder society consisting out of an urban population in the various towns and trading centres, large-scale horticultural irrigators, small-scale horticultural farmers which produce for large-scale farmers, agro pastoral small, holders, large-scale ranchers, pastoralists and international tourists. Not only the society in the direct surroundings of the foot slope zones of Mount Kenya are affect but a far more larger area is being influenced by these changes. Kiteme and Gikonyo (2002) state this multi-stakeholder society is ranging from the foot

zones of Mount Kenya to the Laikipia Plateau and the Samburu Plains. The semi-arid county of Isiolo, that was introduced earlier in this section, lies in between these areas. In Chapter 4 a further description of Isiolo as research area will be given. Since Isiolo is a large county it was impossible to do a research in every corner of the county. So because of various arguments, which will be explained in chapter 3, a small part of the county is selected: the Isiolo Holding Ground. This semi-arid area is situated in the Western part of the County, bordering Laikipia Isiolo and Meru County. Again, an area is selected within the Isiolo Holding Ground. Taking into account the limited framework and besides, the complexity of the interaction between those communities and their environment, it is not possible to do research in all places of the Isiolo Holding Ground. The selected area might be a relatively small area within the county of Isiolo, it is still an interesting area, that is home to a large variety of communities. Besides, the findings of this research might be only valid for this area, they will still be of use when comparable studies are conducted in other semi-arid areas where various pastoralist communities adapt a form seasonal migration in their way of living.

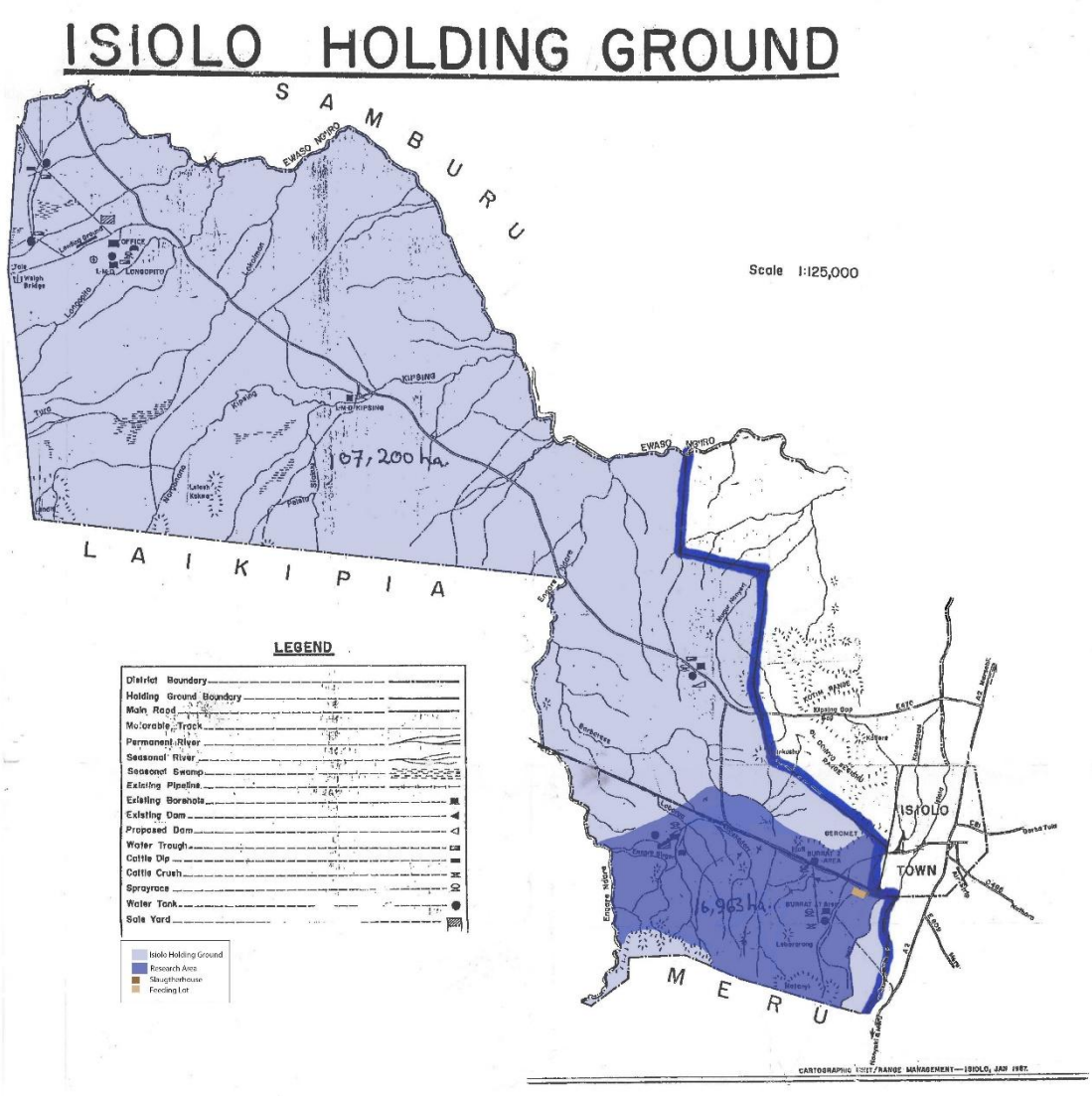


Figure 4: Isiolo Holding Ground (based on the map: Cartographic Unit/Range Management – Isiolo, 1987).

In Figure 4, the population growth in the different areas within the Ewaso Ng'rio River Basin is presented. The map shows that in parts of Laikipia and Isiolo the people living per square kilometre in the last five decades has increased. In the areas between Nanyuki (Laikipia) and Isiolo town, which is also the research area, a strong increase is clearly visible. Besides, the increase of the population density in upstream areas is important, because this has resulted in an increase of water usage by people in upstream areas.

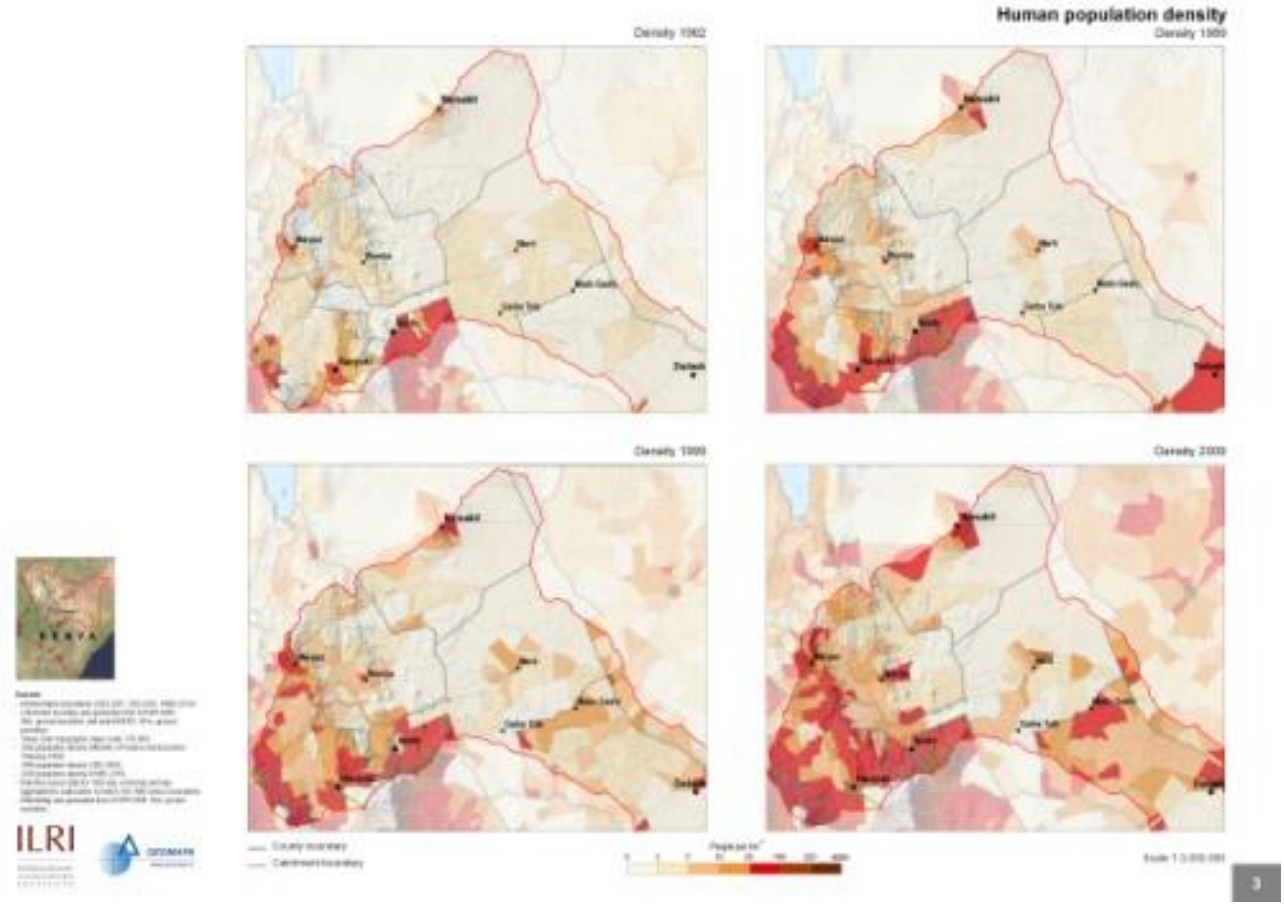


Figure 5: Population density in the Upper Ewaso Ng'iro River Basin (Ericksen et al., 2011).

The main problem in the area is the decreasing of the dry season flows, whereby pastoralists, livestock and wildlife are forced to move upstream in search for water (Mungai et al., 2004). However this research will show that in times of drought, other directions will be followed such as the national reserves Daraka (Meru County) or Shab (Isiolo county). This already points out the different interests of the various users of water as an important natural resource. In the downstream areas (semi-arid/arid) problems occur when the river flow declines, especially in the dry seasons. The different types of drought and the different kinds of challenges will be described in the theoretical framework.

Various groups in the Isiolo Holding Ground cope with the challenges that accompany water scarcity. It has been decided to focus mainly on the Ndorobos for the reason they stood out in the way they migrate. Furthermore, there were some practical reasons for choosing this particular group, which will be discussed in more detail in Chapter 3. This research will show differences between coping strategies of the Ndorobo people and of other communities. One of the strategies to cope with water scarcity could be migration to other areas, next to other (costly) options such as water lorrying (Scheffran et al, 2012). This study will focus mainly on the (agro) pastoralist communities in this semi-arid areas, but without neglecting the interaction with other communities within this multi-stakeholder society that live within the Upper Ewaso Ng'iro River Basin. This thesis searches for the reasons pastoralists decide to live a life in which seasonal migration (with their livestock) has a central place, instead of living a settled life. In between these two extremes, several ways of living are visible. The motive to choose a specific coping strategy has, at times, also to do with considerations concerning migration decisions. For example, the migration of the whole household might be applied or just the migration of a few household members. The main focus of this study is the migration, in search of water and pasture, of pastoralist communities, but in particular the community of the Ndorobo people. These communities have been followed from May till August. Among other places, they mostly occupy the area between Isiolo town and Laikipia county.

1.2 Research objective

The previous subsection has outlined the background of the key issues at stake in the Upper Ewaso Ng'iro North Basin. It is a region with a complex multi-stakeholder society. The Isiolo Holding Ground, which is a specific semi-arid area within the Ewaso Ng'iro North Basin has been selected as study area. Because of issues such as changing seasonal migration and water scarcity, the complexity of this situation is expanding. Because of the seasonal availability of grass and water, pastoralists are forced to move with their livestock in search for these resources. The following objective of this research is formulated:

The objective of this research is to gain more insight in what the various facets of water scarcity, in relation and in combination with each other, mean for the migration decisions of (agro) pastoralists and how it forms a potential trigger for drought related conflicts in the semi-arid Isiolo Holding Ground in Kenya.

This objective will be reached by conducting surveys and interviews in the Isiolo Holding Ground and by doing observations in this area. The academic relevance of this objective is found in the

contribution it makes to the knowledge about seasonal migration patterns and water scarcity in semi-arid areas in a changing environment and how it effects the way of living of (agro) pastoralists and may form a potential trigger for drought related conflicts. Although, this topic of the relation between natural resources and pastoralism has already been studied in many contexts and time periods, this research has a specific spatial focus with a particular research population which mainly consists out of Ndorobo people. Furthermore, its relevance can be found in the contribution to the Cocoon Initiative Kenya Programme. So this is not just an isolated research but it is part of a broader set of researches on the link between natural resources and conflict. Besides, this study involves the relation between migration and natural resources and conflict, which may give a new perspective on the impacts of scarce natural resources and related conflicts.

Next to the academic relevance, this research is also of social relevance. This study will lead to more insight in the impact of changing migration patterns due to environmental and social changes. This study will, for example, show that water scarcity is not a purely environmental issues, but is also influenced by social changes, such as an increasing population density. The relation of water scarcity to migration should therefore not only be approached from an environmental, but also from a social point of view. Furthermore, the social relevance can be found in the fact that the pastoralists in this specific area has been given a voice. This research does not only focus on meteorological and hydrological to determine water stress in the area, but combines these facts with the experiences and perceptions of the people who strongly depend on the condition of their environment. These experiences and perception could in turn be useful to policy makers who deal with water and land issues in semi-arid areas and whose objective is to represent the interests of the pastoralists communities living in those areas.

1.3 Research questions

In order to reach the stated research objective, the following central question has been formulated whereby a selection has been made to follow in particular, but not exclusively, a specific group of pastoralists, the Ndorobo who's home base is the Isiolo Holding Ground.

How do the various facets of water scarcity in the semi-arid Isiolo Holding Ground influence the seasonal migration of the (agro)pastoralist communities, and in particular the Ndorobo, that live in this area, and how might this form a potential trigger for drought related conflicts?

This central question is further subdivided in different sub questions illustrating in more depth the three central concepts: water scarcity, seasonal migration of (agro)pastoralists communities, and

drought related conflicts. Furthermore, the sub questions elaborate on how these different concepts can be linked to each other.

1. The sub questions that are posed to get a better understanding of water scarcity are:

- What is water scarcity and which indicators can be used to get a good understanding of the various facets of water scarcity?
- In which degree are these various facets of water scarcity present the semi-arid Isiolo Holding Ground?

2. Seasonal migration is a complex concept because it is not just about migration but the concept also indicates a kind of periodical aspect.. The sub questions that address the seasonal migration of (agro) pastoralists in this research are:

- What is seasonal migration, specifically in semi-arid areas?
- What are the reasons for (agro)pastoralists to migrate seasonally?
- Which patterns of seasonal migration can be distinguished in the Isiolo Holding Ground?

3. Furthermore, another few sub questions are formulated to get a better understanding on how the various facets of water scarcity influence seasonal migration of (agro) pastoralists.

- To what extend do the various facets of water scarcity influence the decision of (agro) pastoralists to migrate seasonally?
- How do these different facets of water scarcity interact, concerning their impact on seasonal migration?

4. Next, this research' interest is to elaborate on the various groups studied, in particular the Ndorobo, but also the Turkana, Somali, Borana, Samburu, Masai, Meru, who live in the same area. These groups all apply a variety of coping strategies. Therefore the final sub questions are:

- Which different (agro) pastoralists groups live in the semi-arid Isiolo Holding Ground?
- What are the differences between these pastoralist communities regarding to the way they deal with water scarcity and seasonal migration?

5. Finally, some sub questions are posed in order to answer how the concepts of water scarcity and seasonal migration are related to drought related conflict.

- How does water scarcity form a potential trigger for drought related conflicts?
- How does seasonal migration form a potential trigger for drought related conflicts?
- How does drought related conflict influence seasonal migration of (agro)pastoralists?

This list of sub questions will be answered throughout the thesis, starting from the theoretical framework.

1.4 Outline

In this first section, a description has been given of the background of the Isiolo Holding Ground as an semi-arid area within the Upper Ewaso Ng'iro North Basin. It addressed the key problems of pastoralist communities of this area concerning seasonal migration, water scarcity and drought related conflict. In order to answer the sub questions, Chapter 2 starts with a theoretical framework, discussing the three central concepts used in the research questions. In Chapter 3 the methodology used in this research will be specified. Subsequently, Chapter 4 will give an in-depth description of the socio-economic situation and the environmental condition of the Isiolo Holding Ground. Next, Chapter 5 will focus on water scarcity in the Isiolo Holding Ground. In Chapter 6 the seasonal migration of (agro) pastoralists will be analysed and will be related to water scarcity and drought related conflicts. Finally, in Chapter 7, conclusions will be drawn and recommendations will be made.

2 Theoretical framework

In the introduction, the challenges of the Isiolo Holding Ground as semi-arid area in the Upper Ewaso Ng'iro North River Basin were outlined and the research objective including the accompanying research questions were formulated. This chapter will discuss the theoretical framework on which this research is based. The main concepts are water scarcity, seasonal migration of (agro) pastoralists, and drought related conflicts. Those concepts can be positioned in a broader framework of the access to natural resources-conflict nexus. This framework will be introduced in the first section of this chapter. The other sections of this chapter will elaborate on the concepts water scarcity and migration.

2.1 Natural Resources – Conflict nexus.

Before explaining the issues of water scarcity and pastoralism, this section will focus on the nexus between natural resources and conflict and it will examine the pastoralists' access to natural resources. In figure 6 the Cocoon Initiative framework of the natural resources-conflict nexus, based on the impact assessment framework by Slootweg and Mollinga (2009), is shown. It underlines the importance of the linkages between the biophysical, the resources management and the societal subsystems. This framework is applicable in this research, since it conceptualizes potential conflicts that can be triggered by natural resources. This fits in the resource objective to study how natural resources and migration decisions can influence this potential conflict.

The framework shows that according to Slootweg and Mollinga (2009), the biophysical subsystem is a subsystem with specific geographical boundaries which provides five different ecosystem services, namely: provisioning, regulating, cultural, carrying, and supporting. The first four services that are used in the framework are described in the Millennium Ecosystem Assessment (2003) as follows:

> *Ecosystem services are the benefits people obtain from ecosystems. This includes provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits.*

According to Slootweg and Mollinga (2009) they miss an important category, namely the carrying services of the ecosystem. These carrying services are about the ecosystem providing space for

organisms. Humans distinguish themselves in the way they require space from the ecosystem because they construct roads and houses, they use rivers and they require space for tourist activities.

In Figure 6, the relationship between the variety of natural resources and the biophysical subsystem is drawn. This variety of natural resources was added by Rutten and Mwangi (2014) to the model framework. The variety of natural resources is of course related to the state of the biophysical subsystem. This relation is important in this research since the availability of pasture of the access to water depends on the ecosystem services of the biophysical subsystem.

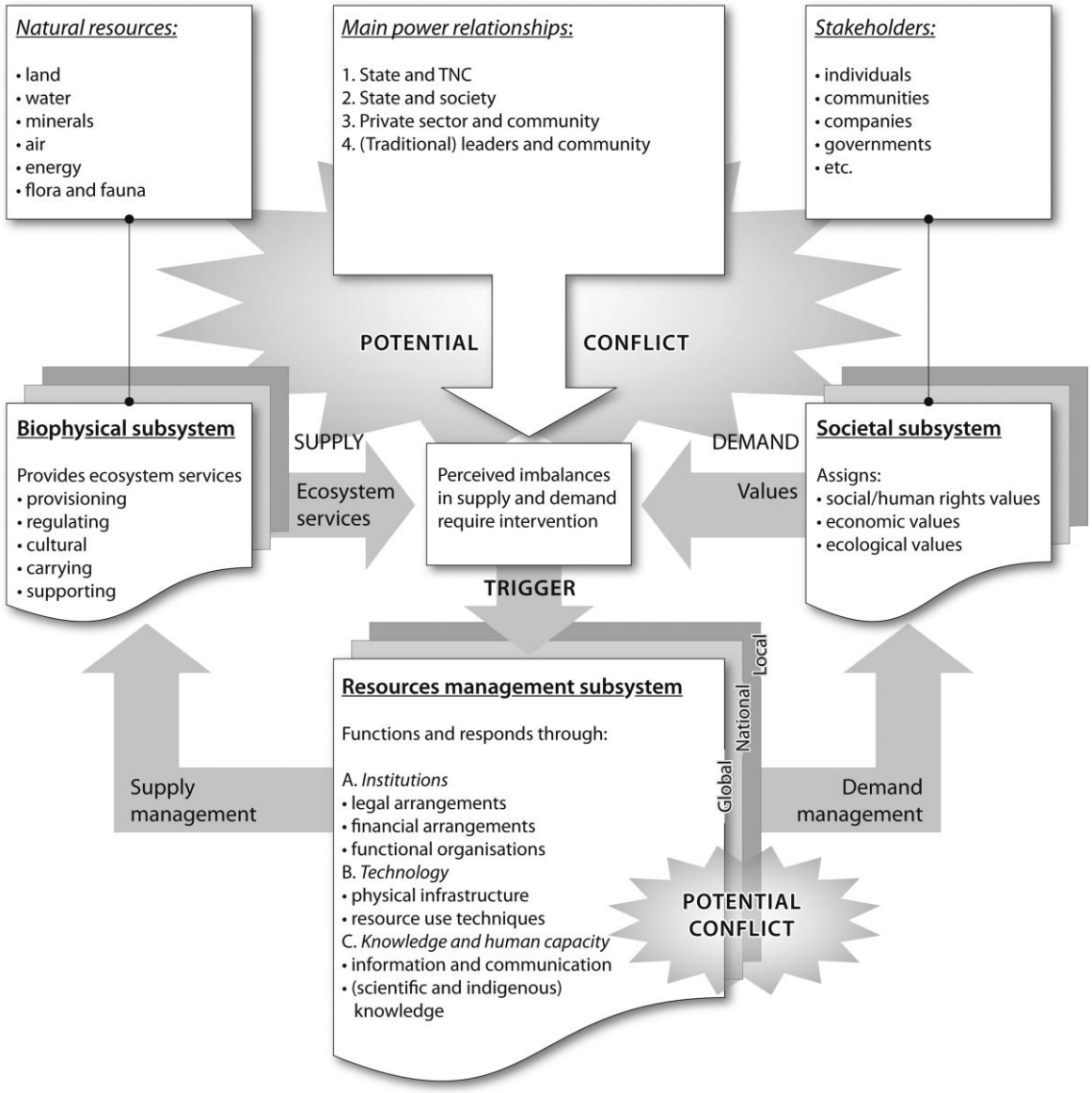


Figure 6: Natural Resources-Conflict Nexus (Rutten & Mwangi, 2014).

The next subsystem in the framework of Slootweg and Mollinga (2009) is the societal subsystem. Similar to the ecosystem services of the biophysical subsystem the societal subsystem is also based on the Millennium Ecosystem Assessment (2003). Since this framework is meant for an evaluation on

a global scale, Slootweg and Mollinga (2009) have adjusted it to make it more suitable for the evaluation of the local scale and the differences between cases. This societal subsystem assigns social/human rights values, economic values and ecological values. How these values are described varies per case since they depend on what importance stakeholders attach to these values. Social/human rights values are the quality of life in its broadest sense and can for example be expressed in health, safety or the level of food. Economic values can be divided in direct and indirect consumption from the ecosystem. Direct consumption is, for example, the fish from rivers. Indirect consumption is, for example, the water used for irrigation. This value is often expressed by assigning a monetary value to the economic activities or the household income as an expression of the financial condition of the population. The ecological values are the values of the biological diversity, which means potential future benefits, but also interaction of the ecosystem with other systems. As argued before, the different stakeholders exist in this societal subsystem and they all perceive and use these values differently. For example, if a water source is (over) used by a company, this might be in conflict with the human right of the inhabitants to have access to water. Rutten and Mwangi (2014) elaborate further on the importance of the variety of stakeholders and point out the main categories of stakeholders in their framework. Other information that was added by Rutten and Mwangi (2014) are the four main power relationships (based on Peter Veit, in Chaudry and Lynch, 2002) at stake in a certain location, which influence the potential conflict. Also, the three key geographical levels (from local to global) where resources are managed were added to the framework. According to (Hermans, 2011) it is still not clear how water stress and conflict are related to climate change and migration. He states it is often suggested water stress leads to more conflict, but on the other side, Witsenburg states (in Hermans, 2011), thatconflict is more likely to occur in areas where those resources are available. When livestock keepers start to move in times of drought and use similar routes and choose the same destinations where pasture and water is available, conflict may occur. However, this is not only a one-way relation between migration and conflict. Goldstone (2002) argues that on the other hand, violent conflict leads to a sharp rise in migration.

In the research, access to the natural resources water and pasture for pastoralists in semi-arid areas is of main importance. Therefore the following part of this theoretical chapter will mainly focus on these natural resources in semi-arid areas. Scoones (2004) states that the situations in these areas are characterised by complexity, non-linearity and non-equilibrium dynamics. Pastoralists have developed strategies over the ages to live with uncertainties, such as a great variety in the amount of precipitation. For a long time, development policies for these semi-arid areas were based on equilibrium thinking. These more conventional views from many planners, who saw development as managing, controlling, predicting and stabilising, changed to views that acknowledged the

uncertainty and the dynamics of the inhabitants of semi-arid areas. Possible responses of pastoralists to the uncertainty of climate change, could be the rethinking of their livelihood strategies by for example choosing to keep goats instead of cattle or making a change in the crops they cultivate. Scoones (2004) advocates the use of a more non-equilibrium approach, but he also sees the challenges this approach faces since planners and managers still try to eliminate the uncertainty in their policies.

The next sections zoom in on the two central concepts in this research, that can be placed in the more comprehensive Cocoon Initiative framework introduced in this section. Firstly, water scarcity will be explained as a concept. Water as a natural resource obviously fits in the biophysical subsystem since it is provided by this system. However it also fits within the other two subsystems (societal and resource management) because water is valued by different stakeholders and furthermore, management is needed when the values of different stakeholders do not go hand in hand. The subsequent section will focus on the concept seasonal migration. How seasonal migration fits in the Cocoon Initiative framework will be explained in section 2.2.

2.2 Water scarcity in ASAL areas

Water scarcity is one of the key concepts of this research and is an major issue in the highland-lowland system of the Ewaso Ng'iro North Basin (Mutiga et al., 2010), in which the Isiolo Holding Ground is situated. Water as natural resource fits easily in the framework of Cocoon, introduced in the previous section. This section first elaborates on various definitions of water scarcity and besides, various theories of water scarcity will be explored in order to get a better understanding of the concept. In the last part of this section the concept of water scarcity will be narrowed down to the water scarcity in semi-arid and to be able to apply this to the case of the Isiolo Holding Ground.

2.2.1 Defining water scarcity

Various definitions of water scarcity are given in literature. The UN (2012, p. 126) defines water scarcity as: *"the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully."* The UN (2012) distinguishes water scarcity from water stress. Whereas water stress is about the ratio of water use over the total amount of available water in an area, water scarcity is additionally about the access to these water resources. So although an area may experience low water stress, the water scarcity may be high if water resources are hard to access. Water stress is a more physical concept about the availability of water, while water scarcity is a relative concept about the access to water determined by human, institutional and

financial constraints. This scarcity may be the result of affluence, expectations and customary behaviour which together makes scarcity a social construct (UN, 2012). Physical scarcity and economic scarcity are often used as dimensions to distinguish various types of scarcity. Molden et al. (2007, p.62) define physical water scarcity as what occurs when "available water resources are insufficient to meet all demands, including minimum environmental flow requirements." This is more in line with what the UN defines as water stress, it is about the ratio of used available water resources. On the other hand economic scarcity according to Molden et al. (2007, p.62) "occurs when investments needed to keep up with growing water demand are constrained by financial, human, or institutional capacity." This is consistent with the view of the UN on water scarcity, because water might be available in nature but it cannot be reached or used for reasons such as pollution. Figure 7 shows that Kenya, as most countries in Sub-Sahara Africa, deals with economic water scarcity (Molen et al., 2007). However the map in Figure 7 is too large of scale to indicate if this is also true for the Ewaso Ng'iro North River Basin, and in particular for the Isiolo Holding Ground.

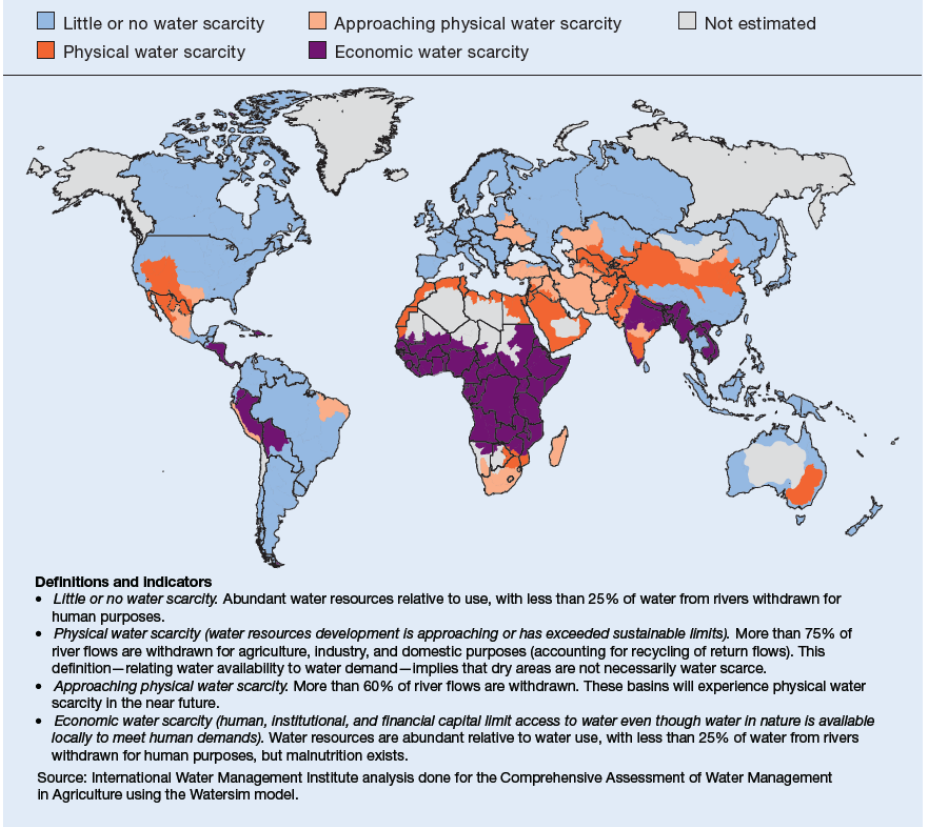


Figure 7: Water scarcity in the world (Molden et al, 2007).

2.2.2 Water Poverty Index

According to Rijsberman (2006) a more complex model is needed than the simple supply-demand models such as the last mentioned definitions. He mentions another model that is used to measure the water scarcity is developed by Sullivan et al. (2003). They developed the Water Poverty Index which uses a more holistic approach. This index used five dimensions: access to water; water quantity, quality and variability; water uses for domestic, food and productive purposes;
capacity for water management; and environmental aspects. To calculate the WPI ratings five various components are intergraded: *'Resources', 'Access', 'Capacity', 'Use' and 'Environment' (*Sullivan et al., 2003). This model tries to measure if individuals are water secure at household and community level. However, the simple models are likely to be used because they are better to be understood and use more simple indicators. The Water Poverty Index is more comprehensive, but is it also more difficult to understand (Rijsberman, 2006). In figure 8 the five components of the WPI are explained further as described by Sullivan et al. (2003) and Sullivan, Meigh & Lawrence (2006).

WPI component	Data used
Resources (R_i) - Provides some assessment of a qualitatively adjusted value of the per capita quantitative measure of ground and surface-water availability for region *i*	• Assessment of surface water and groundwater availability using hydrological and hydrogeological techniques • Quantitative and qualitative evaluation of the variability or reliability of resources • Quantitative and qualitative assessment of water quality
Access (A_i) - Indicates access people have to water for effective use for their survival in region *i*.	• Access to clean water as percent households having piped water supply • Reports of conflict over water use • Access to sanitation as percent of population • Percent water carried by women • Time spent in water collection, including waiting • Access to irrigation coverage adjusted by climate and cultural characteristics
Capacity (C_i) - Indicates level of human and financial capacity to manage the system for region $_i$.	• Wealth equivalent to ownership of durable items • Mortality rate for children under 5 years • Educational level • Membership in water users associations • Percent households reporting illness due to water supply • Percent households receiving a pension, remittances or wages
Use (U_i) - Indicated by level of water use by different sectors of the economy and the economic returns from same in region *I*	• Domestic water consumption rate • Agricultural water use, expressed as the proportion of irrigated land to total cultivated land • Livestock water use based on livestock holdings and standard water needs • Industrial water use (purposes other than domestic and agricultural)
Environment (E_i) – For lack of acceptable figures to represent environmental integrity or environmental water needs, these alternative proxy data were used.	• People's use of natural resources • Reports of crop loss during last 5 years • Percent households reporting erosion on their land

Figure 8: The various WPI components/dimensions are accompanied by various indicators (Sullivan, Meigh & Lawrence, 2006, p.416).

In Figure 9 it is shown the WPI of Kenya indicates Kenya has a 'severe' water scarcity. Figure 10 shows how the WPI of 47.3 from 2001 results from the various components. This illustrates how

Kenya (on national level) scores on multiple components: relatively low on resources but relatively high the water use.

Fig. 5. Water scarcity based on the Water Poverty Index at national scale. (*Source*: Sullivan et al., 2000).

Figure 9: National WPI ratings (Sullivan et al., in Rijsberman, 2006).

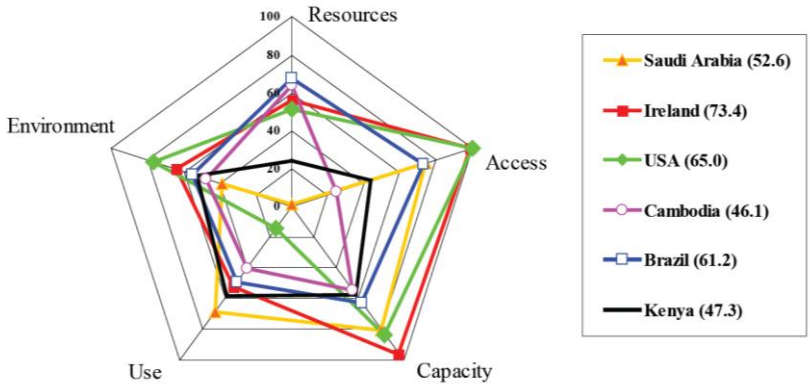


Figure 10: International WPI Values for 2001 (Sullivan, Meigh & Lawrence, 2006, p.419).

2.2.3 Refining the model

Since its introduction, suggestions for an improved method to measure the WPI have been made. For example, Garriga and Foguet (2010) acknowledge the usefulness of the WPI as indicator to assess water stress, water scarcity and linking physical estimates of water availability with socioeconomic drivers of poverty, but they argue this method has some methodological limitations and therefore the WPI should be refined. This criticism focuses on how available data is combined in the index and besides, on the statistical properties of the index. The first criticism focuses on the methodological limitation, created by the flexibility of indicators which can be chosen. Since one of the objectives of the WPI is to use existing data, some unavailable indicators may be replaced by others when calculating the WPI for a specific location. This happens at the expense of comparability because various indicators are used in various WPI ratings. Garriga and Foguet (2010) also refer to the criticism by other authors including the critique on the equal weighting of components used for the WPI. According to Sullivan et al. (2003) there is no reason for weighing the various components

because no component should be more important than another. However an equal weighing is justified neither and the weights given to the various components depend on individual judgement. How these various components are combined is essential for the WPI. Therefore transparent display of the weights assigned to the components is needed so there will be no misunderstanding of the WPI rating.

Another shortcoming is that a final value of a component may be the result of low scores of certain indicators that can be counterbalanced by high indicators (Nardo et al, 2005 in Garriga and Foguet (2010). This is the same for the final WPI score, the information given by the various components is more useful than the WPI itself. Therefore the WPI has also been criticised because the final WPI does not really add extra information compared to the various separate components.
Another statistical shortcoming of the WPI according to Jiménez et al (in Garriga and Foguet, 2010) is the high correlation with other indices such as the Gross Domestic Product and the Human Development Index which makes it less significant as policy tool.

This shows that although Rijsberman (2006) stated the WPI offers a more comprehensive index there are yet several shortcomings. Garriga and Foguet (2010) subsequently provide suggestions how to overcome these shortcomings. Concerning the weighting various components it is concluded that many different techniques exits, but that all methods will be subjective. That issue foremost explains the reason to use equal weighting. Which weighting system is used should be justified also when the choice is for an equal weighing.

Garriga and Foguet (2010) conclude that a weighted multiplicative function should be used for studies at local level, since it is the most suitable aggregation method for this scale. A weighted multiplicative function means a weighting is used (this could also be an equal weighting) and that the function is multiplicative, instead of additive. The initial WPI is using an additive function calculated by adding the various variables which may mean that poor scores for some indicators are counterbalanced by good scores of others. To overcome this problem it is better to replace this additive function with a multiplicative function so the low and high scores in the various components are more visible (Garriga & Foguet, 2010). According to these authors an additive function should only be applied if the components are independent variables, but since this is unrealistic a multiplicative function is preferable.

Garriga and Foguet (2010) come with a refined model which they used to calculated the WPI for Turkana County, Kenya. Their selection of indicators is based on Giné and Pérez-Foguet (in Garriga & Foguet, 2010). In Figure 11 an overview of the various indicators which they use for every component has been given. Still it is clearly visible they based their model on the method constructed by Sullivan, Meigh and Lawrence (2006). Both use the indicators quantity, quality, variability and reliability of

water resources to measure the component '*Resources'*. Garriga and Foguet (2010) already made a clear overview of levels and scores, which makes it a more applicable model.

Table 2. Variables Used, Levels, and Scores (Reprinted with Permission from Giné and Pérez-Foguet (2009))

WPI component	Indicator	Levels and scores			
		Fair (1)	Acceptable (0.66)	Poor (0.33)	Risky (0)
Resources	R1: water quantity sufficiency[b]	Always sufficient	For human and livestock	Only for human	Not sufficient for human
	R2: reliability of supply [time not operational (%)][b]	<5%	5–10%	10–25%	>25%
	R3: seasonal variability of water resources (months per year with water)[b]	11–12	9–10	7–8	<7
Access	A1: access to safe water[a]	Households with access to improved water supply (%)			
	A2: access to improved sanitation[a]	Households with access to improved sanitation (%)			
	A3: one way distance to water source (km)[a]	<1	1–2	2–5	>5
	A4: waiting time (min)[a]	<30	30–60	60–120	>120
	A5: cost of water (KSh per 20 l container)[a]	<1	<2	<5	>5
	A6: operational status of water source[b]	Water sources operational (%)			
Capacity	C1: management system[b]	Facilities managed at local level (%)			
	C2: ownership over water source[b]	Facilities owned at local level (%)			
	C3: water association registered[b]	Facilities managed by associations legally registered (%)			
	C4: records kept[b]	Water entities which keep records (minutes, correspondences …) (%)			
	C5: financial control[b]	Water entities with financial control system in place (%)			
	C6: funds audited[b]	Water entities whose funds are regularly audited (%)			
Use	U1: domestic water consumption rate (per capita)[a]	Ample (>40 lpd)	Basic (20–40 lpd)	Limited (10–20 lpd)	Scarce (<10 lpd)
	U2: conflict over water sources (human-human)[b]	Facilities in conflict (%)			
	U3: conflict over water sources (human-livestock)[b]	Facilities in conflict (%)			
	U4: use of local water treatment (boil water)[b]	Households who treat water for drinking (%)			
	U5: livestock water use (m^3pd)[b]	<50	50–100	100–200	>200
Environment	E1: Qualitative assessment of water quality[a]	Protected source	Open source but treated	Open source, local treatment	Open source, no treatment
	E2: protection of water sources[b]	Water facilities protected (fenced) (%)			
	E3: number of pollution sources (P.S.) around WP[b]	None	1 P.S.	2 P.S.	>2 P.S.
	E4: number of environmental impacts (E.I.) around WP[b]	None	1 E.I.	2 E.I.	>2 E.I.
	E5: conflict over water sources (human-wildlife)[b]	Facilities in conflict (%)			

[a]Data from RWSS service level.

[b]Data from water sources audit form.

Figure 11: Overview to measure the WPI (based on Sullivan, Meigh and Lawrence (2006) and Giné & Pérez-Foguet, in Garriga and Foguet (2010).

A higher contrast can be found at the component *'Access'*. First of all Garriga and Foguet left out the 'percent water carried by women' and access to 'irrigation'. Besides, they moved the indicator about conflict to the component *'Use'.* They have also changed the 'access to clean water as percentage households having piped water supply' into 'access to safe water'. They also added the 'actual distance to a water sources' and the removed the indicator about access to irrigation. Garriga and

Foguet (2010) also changed the indicators measuring the component '*Capacity'*. It seems Sullivan, Meigh and Lawrence (2006) focuses more on the capacity of households, while Garriga and Foguet (2010) are focusing on the capacity of the system. More similarities can be found for the component *'Use',* they both use indicators to measure the domestic and livestock water use. Garriga and Foguet (2010) seem to have dropped the agricultural and industrial water use. In the overview of Garriga and Foguet(2010) the indicator livestock water use is indicated in m3 per day. If livestock uses a lot of water this is seen as negative since it competes with the domestic water consumption rate. As already stated they also added indicators concerning conflict to this component. Besides, they have added an indicator about water treatment. The last component, *´Environment´* also differs, while Sullivan, Meigh and Lawrence (2006) mainly focus on the environment impacts on livelihoods, Garriga and Foguet(2010) are focusing on the impact on the environment, so also on water resources.

2.2.4 Measuring a WPI for the Isiolo Holding Ground

In the last subsection we have seen we have seen Sullivan et al. (2003) and Sullivan, Meigh and Lawrence (2006) list indicators to measure the various components of the WPI. When refining the WPI, Garriga and Foguet (2010) also made a selection of indicators and applied these on a case study in Turkana. This subsection will combine those two models and arguments will be given for the selection of indicators to measure the various components of WPI in this study.

As shown in figure 8 the indicators used by Sullivan et al. (2003) to measure the component *Resources* are: Physical availability of both surface- and groundwater, taking into account variability and quality as well as the total amount of water. As already argued, Garriga and Foguet (2010) did not suggest major changes, besides these indicators corresponds with the objective of this research which focuses on the seasonal differences of water availability in Isiolo Holding Ground as an area within the Upper Ewaso Ng'iro North Basin. Although the indicators are more or less the same, Garriga and Foguet (2010) added scores and levels to measure these, these will be taken over, and in some cases adjusted.

In this research the component *'Access'* will mainly focus on the access of pastoralists to water resources for both human use and economic use, i.e., water for livestock and in some cases agriculture. Other indicators used are, 'access to clean water as a percentage of households having a piped water supply' and access to improved sanitation. An important and obvious way to measure the access the water which was added by Garriga and Foguet(2010) is the distance of a household from a water sources. In addition to the distance in kilometres, the water coverage of the total of

water point in the area will be determined. Related to this indicator is the operational status of those water sources and the waiting time at these water sources. The indicators: 'the percentage of water carried by women', 'access to irrigation coverage adjusted by climate characteristics' and the 'costs of water left out', will be left out, because they are hard to measure or not of significant use. For the indicator about irrigation the choice has been made to combine it with an indicator for the component '*Use*'

In the last part it has been pointed out that the next component of the WPI, *'Capacity'*, is measured differently by Garriga and Foguet (2010) and by Sullivan, Meigh and Lawrence (2006). Sullivan, Meigh and Lawrence (2006) argue this component is about the capacity to manage the system for the region, which includes both a human and financial aspect. Since they focus more on household level instead of on the system in the region like Garriga and Foguet (2010) do, this component will be more based on the indicators given by Sullivan, Meigh and Lawrence (2006).

Lawrence, Meigh and Sullivan (2002) state the Human Development Index is a useful index to measure both financial and human capacity. It includes the GDP per capita and the Purchasing Power Parity(PPP) values, which are the more financial indicators. Besides, it includes the social indicators such as education and health factors. A argued by Garriga and Foguet (2010) the HDI correlates with the WPI and therefore the HDI will not be included. However, indicators such as life expectancy, education and the Gini-coefficient, which are also used to measure the HDI, will be included to measure '*Capacity'*. Nevertheless the HDI is a useful index to show and compare the area (Isiolo County) with other areas.

Sullivan, Meigh and Lawrence(2006) suggest to measure the financial aspect with the 'wealth equivalent to ownership of durable items' and with 'percent households receiving a pension, remittances or wages'. To which extend this indicator measure the wealth of pastoralists is questionable. Since most of the pastoralists' capital can be found in the property of livestock this might be a more significant indicator than the percent of households receiving a pension, remittances or wages. Combined with the wealth equivalent to ownership of durable items this will measure the financial capacity of pastoralists to in the area to manage the system. A list of durable items has been adopted from the Cocoon Survey and this list is a basis for indicating the financial capacity. To decide whether a herd is large enough it has been measured if the produced milk is sufficient for human consumption. Furthermore, the respondents have been asked if they do sell milk (which may increase their capacity). In order to determine how equal the wealth in the region is distributed the Gini coefficient will be added to this component. This is also suggested by Lawrence, Meigh and Sullivan (2002) when making an international comparison of the WPI. The other aspect of the component capacity, the human capital, can be measure with the indicators: 'Mortality rate for children under 5 years', 'education level', 'the membership in water users associations' and the

'percent households reporting illness due to water supply'. The mortality rate for children under 5 years, might be difficult to measure since it is a specific area without data on that scale,. For the other indicators: 'education level' and 'membership in water users associations' this is less difficult since these indicators can be measured through surveys conducted in the specific area. However, in an early stage of conducting fieldwork, it appeared the membership to this kind of association is low which led to the choice to replace this indicator by whether the population is familiar with the water user association which should be active in the area. The next indicator brought by Lawrence, Meigh and Sullivan (2002) is the percentage of households reporting illness due to water supply is a health factor to measure the human capital. Since this is indicator is also difficult to measure the choice has been made to choose another indicator (life expectancy at birth) to measure health factor of the human capital of capacity.

As shown in Figure 5 the component *'Use'*, is indicated by 'the level of water used by different sectors of the economy and the economic returns from same in Region *I'* (Sullivan, Meigh and Lawrence, 2006)." Industrial water use is not an important issue for the Isiolo Holding Ground where the pastoralists move around and will be left out of the analysis. Agricultural water use is important to some extend because in some regions of the area under review agriculture is possible. The use of water for agricultural reasons can be measured through the proportion of irrigated land to the total cultivated land. Because the main source of income in the research area is livestock keeping, the most important indicator for this component in this research is livestock water use, based on livestock holdings and standard water needs. The last indicator is meant to measure the domestic water consumption. According to Sullivan, Lawrence and Meigh(2006) this can be measured by estimating the use based on rural or urban classification. In this study this will mostly being done by asking the respondents which sources they use for their domestic water use and if this they availability of water is sufficient for domestic purposes. Garriga and Foguet (2010) suggest adding indicators to this component which measures conflict. This will be done for conflict between humans on water sources. Competence about water between livestock and humans will be left out of account, since the indicators domestic water use and livestock water use already measure whether livestock water use endanger the quantity left for domestic water use.

About the component *'Environment'* Sullivan, Meigh and Lawrence (2006) comment some problems occurred when they applied this component in their study due to the differences in rural and urban situations. Sullivan et al. (2003) state the component 'environment' is about "the evaluation of the environmental integrity related to water and of ecosystem goods and services from aquatic habitats in the area," in a semi-arid area as the Isiolo Holding ground where pastoralism is the most important way of living, this will be expressed in the evaluation of the quality and quantity of pastures. Since pastures in the environment are related to the water amount, this also reflects the

Water Poverty in a region. The Vegetation Condition Index is also a well suited index to evaluate the environmental integrity related to water. The index's name already implies, it evaluates the condition of natural vegetation and pasture in an area at a certain moment in time (National Drought Management Authority, 2015). Besides, the quality and quantity of pastures it will be taken into account whether there are grazing regulations in the area to sustain and preserve the pastures in certain areas. Another important way to elaborate on the relation between the environmental conditions and the pastoralism is an indicator which measures if pastoralists experienced livestock loss in the last five years. The last indicator which will be used to measure the human-wildlife conflict in the area.

This list of indicators should be make it possible to calculate a WPI for the Isiolo Holding Ground which helps to measure the water scarcity in the area. In this section is was argued some of the indicators will be excluded for the reason that it may be insignificant for this research or because of more practical reasons, for example, for the reason that measuring an indicator is too time consuming and it therefore does not fit in the time frame of this project. An important note that should be made as consequence of this is that the WPI that results out of the research is less applicable for other resources than for this research. However the WPI will still be useful if the adjustments made when creating the WPI for the Isiolo Holding Ground are considered when it is applied in another research. On the other hand some indicators were added to the model of Sullivan, Meigh and Lawrence (2006). The final list of components and indicators used to measure the WPI in Isiolo Holding ground can be found in Table 1 on the next page.

WPI Component	Indicator	Levels and scores			
		Fair(1)	Acceptable(0.66)	Poor(0.33)	Risky(0)
Resources	Water Quantity Sufficiency (rivers)				
	Water Quantity Sufficiency (other sources)				
	Water Quality				
	Percentage of water sources which is improved				
	Percentage of water sources tested safe				
	Reliability of supply (time not operational (%).				
	Seasonal variability of water resources (months per year with water)				
Access	Percentage of people having access to piped water supply				
	Access to improved sanitation				
	one way distance to water sources (km)				
	Operational status of water source.				
	Waiting time (min)				
	water coverage of water points				
Capacity	Wealth equivalent to ownership of durable items				
	Herd size (based on 'enough for milk consumption')				
	Sell Milk				
	Gini coefficient				
	Educational level				
	Membership in water users associations				
	Life expectancy at birth.				
Use	Domestic water consumption rate (per capita)				
	Livestock water use (m3 per day)				
	Agricultural water use, expressed as the proportion of irrigated land to total cultivated land.				
	Wildlife water use				
	Conflict over water sources (human-human)				
Environment	Availability of pastures in dry season				
	Availability of pastures in wet season				
	Quality of pastures				
	Reduction herd size				
	Grazing regulations (% of population experiencing grazing regulation)				

Table 1: Indicators used to measure the WPI in Isiolo Holding ground (based on Sullivan, Meigh and Lawrence (2006) and Giné & Pérez-Foguet, in Garriga and Foguet (2010).

Chapter 3 will give more information about how those various indicators will come together in a WPI. The selection of indicators for the WPI of this research is comprehensive, however the focus on pastoralist in this specific area in Isiolo, Kenya comes at cost of the comparability of the resulting WPI which, according to Garriga and Foguet(2010), is one of the limitations of the WPI.

To be able to place the WPI in context of the semi-arid Isiolo Holding Ground, the next subsection will focus on water scarcity and drought in ASAL areas.

2.2.5 Water scarcity and drought in ASAL areas

This subsection will serve to make sure the application of the theoretical framework on the situation in the Isiolo Holding Ground will happen more fluently. Kenya is classified as a semi-arid area, which already indicates the area has to deal somehow with drought and water scarcity. This might seem obvious, but there are various types of drought which can be distinguished. This section will elaborate on the various types droughts distinguished by Thornthwaite (1947) and by Wilhite and Glantz (1985) who both elaborate on different aspects to determine and distinguish the types of drought. The goal of this subsection is to be able to determine in Chapter 4 which type, or types, of drought the Isiolo Holding Ground deals with. Subsequently it forms a context in which the WPI for the Isiolo Holding Ground is measured in Chapter 5.

Three types of drought are categorised by Thornthwaite (1947). He distinguished permanent, seasonal and contingent droughts. The first type of drought is characteristic for the driest climates, the second can type be found in climates with clear wet and dry seasons and the final type of drought occurs in climates with irregular and variable rainfall. This contingent drought occurs mostly in humid and sub-humid climates and affects a relatively small area. Since this type of drought varies in intensity and time of occurrence this makes it hard to anticipate on and therefore this is the most vicious type of drought.

Another classification of drought is made by Wilhite and Glantz (1985). They distinguish meteorological, agricultural, hydrological and socio-economic drought, which are based on the source of water availability. This complements the classification of Thornthwaite (1947), which is aiming more at the time of occurrence of the drought. The definitions of Wilhite and Glantz are based on a number of authors and are still used today by institutions such as the Food and Agricultural Organisation of the United Nations (FAO) and National Drought Mitigation Centre. The first type of drought is meteorological drought, “Meteorological definitions of drought are the most prevalent. They often define drought solely on the basis of the degree of dryness and the duration of the dry period (Wilhite and Glantz (1985, p. 113).” An important note is that a definition of this type

of drought is region specific. This is also acknowledged by the FAO (n.d), who points out the example of the dry lands in Sub-Saharan Africa (including Kenya) where areas with a climate characterised by bimodal area should be defined differently than climates characterised by monomodal rainfall. Furthermore, they note it has been suggested to define meteorological drought in some dry land area as a rainfall failure of two successive years. The definition of the second type of drought Wilhite and Glantz (1985) give is Agricultural drought, "Agricultural drought definitions link various characteristics of meteorological drought to agricultural impacts (Wilhite and Glantz (1985, p. 114)." This should take into account the various types of crops and the conditions of a crop during several of crop development (Wilhite and Glantz, 1985). The following type of drought is hydrological drought, which is especially interesting when studying river basins, such as the Upper Ewaso Ng'iro River Basin. "Definitions of hydrologic drought are concerned with the effects of dry spells on surface or subsurface hydrology, rather than with the meteorological explanation of the event. (Wilhite and Glantz, 1985, p. 115). " Linsey et al (in Wilhite and Glantz, 1985) defines hydrological drought as a "period during which stream flows are inadequate to supply established uses under a given water management system." The FAO (n.d.) also defines hydrological drought as the lack of water due to a short supply of surface and sub-surface water. The final type of drought which defined is socio-economic drought, which is about the socio-economic impacts of drought. This type of drought can be the consequence of meteorological, hydrological as well as agricultural drought (Kifer and Steward, in Wilhite and Glantz, 1985). Furthermore, socio-economic drought can be related to the supply and demand of water as an economic good. This means drought can also appear if they supply remains constant, while the demand changes or increases.

Besides these types of drought elaborated on by Wilhite and Glantz (1985), the FAO (n.d.) also has a special focuses on pastoral drought. This type of drought can be compared with agricultural drought, but differs from this type of drought since it cannot completely be explained by the various characteristics of meteorological drought. They are pointing out the mismanagement of rangelands, as socio-economic cause, that can also lead to pastoral drought. An interesting point the FAO (n.d.) makes is that the pastoral livelihood in essence is characterised by this variety in rainfall and availability of pastures and the flexibility to move to various place to sustain their way of living. This means that pastoral drought is not likely to exist in areas where pastoralists are able to move away from those areas experiencing drought to areas where there is enough water and pasture.

Figure 12 is a model by the National Drought Mitigation Centre in the USA on how these four mentioned types of drought are related to each other. The model of this sequence of drought is based on Wilhite and Glantz (1985).

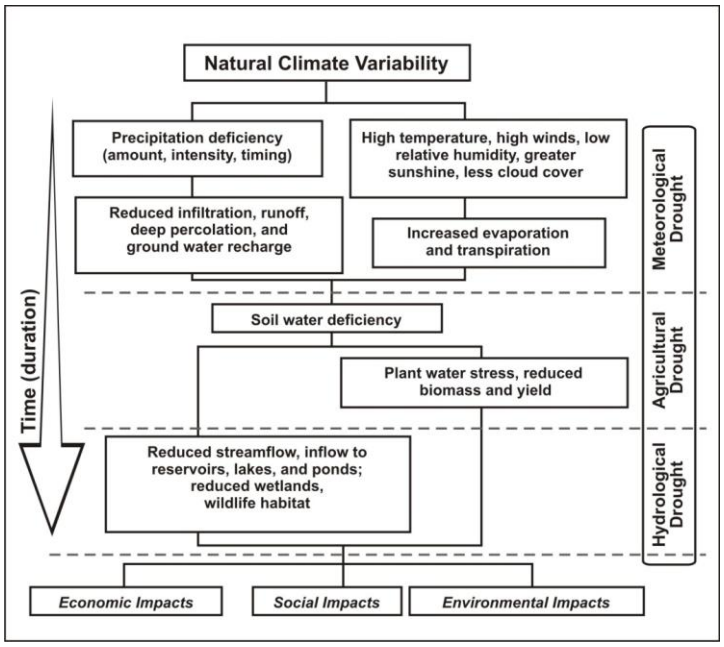


Figure 12:The sequence of drought (National Drought Mitigation Centre, University of Nebraska-Lincoln, U.S.A, n.d.).

This subsection focused on the various ways drought is categorised. Both Thornthwaite (1947) and Wilhite and Glantz (1985) came with categorisations which are useful in this research on water scarcity in the Isiolo Holding Ground. Whereas Thornthwaite (1947) focuses more on the time aspect of the occurrence of drought: permanent, seasonal and contingent, Wilhite and Glantz (1985) focused more on the availability of water. Even though these cited authors are not the most recent, the classification they made is still of use in current studies on drought and are useful as basis for the following chapters. The discussed types of drought will be applied on the Isiolo Holding Ground in Chapter 3, when the situation of the study area is outlined. When it becomes clear which types of drought the pastoralists in the Isiolo Holding ground are coping with in Chapter 4, Chapter 5 will focus on the water scarcity in the Isiolo Holding Ground. Before applying the discussed theory, the following subsection will focus on the concept of migration and its relationship with water scarcity.

2.3 Seasonal migration of pastoralists

Seasonal migration of pastoralists also fits within the Cocoon Initiative framework since it might be a response to the varying availability or scarcity of natural resources. Seasonal migration can in its turn also influence the demand of a societal subsystem, because it means people come into an area where possibly already are people valuing the natural resources, for example, other pastoralist groups using the pastures and water sources. This section starts with how pastoralism can be categorised in different 'types of pastoralists', with a focus on the seasonal aspect. Subsequently, the

next subsection explains which factors influence a pastoralist's decision to move from one place to another.

2.3.1 Defining pastoralism

Pastoralism can be categorised in different types, to get a better understanding of the differences among pastoralists. Nomadic pastoralism is a major land use in the arid and semi-arid rangelands of the world. Blench (2001) defines various categories of pastoralism but he does also acknowledge that his conceptualisation is just a simplification and that pastoralist are highly flexible and therefore not easy to be placed in a certain category. He distinguishes nomadism, transhumance and agropastoralism whereby nomadism has the highest, and agropastoralism the lowest, degree of mobility. The movement of nomads are "opportunistic and follow pasture resources in a pattern that varies from year to year (Blench, 2011, p.11)" Pastoralists who can be categorized as nomads are most likely exclusively livestock producers. Although they prefer using established routes, their movements are irregular since the availability of resources also varies.

Blench (2001) explains that contrary to nomadic pastoralism, transhumance is more regular between fixed points with more fixed routes and the movements depend on the seasonal availability of resources in those fixed points. One of the other characteristics of transhumant pastoralists is that they often have a permanent homestead in which the older members stay and often crops are grown, mostly for human consumption. Another characteristic of transhumant pastoralism is the splitting of herds as a strategy to provide milk to the homestead. Also work animals and weak animals are often left behind at the homestead.

The last category of pastoralism is agropastoralism which according to Blench(2001) may described as settled pastoralists who possess land rights which makes them invest more in agriculture and are able to grow enough crops to sustain their family. M. M. E. M Rutten (personal communication, December 2014) however emphasises the access to water is a far more important reason pastoralists invest in agriculture. Furthermore, Blench (2001) argues their herds are smaller than the former two forms of pastoralism. In contrast to the other forms of pastoralism they are not dependent on pastures away from their homestead, probably because the pastures nearby are enough to sustain a small herd. Blench (2001) also adds to this point that if the herd becomes too large the agropastoralist may choose to send a part of the herd away with a nomadic pastoralist. Another difference between this category and the former two is that agropastoralists invest more in their homestead and the infrastructure in the surroundings since they are more attached to one place.

As acknowledged by Blench (2001) this categorization is a simplification and not every pastoralist can be categorized as either a nomad, a transhumant or an agropastoralist. In contrast, it may have characteristics of various 'types' of pastoralism. A pastoralist may choose to split his herd and send his cattle to a certain area while in the meantime his goats and sheep stay in another area with another family member. They do not have fixed places where the go to at a specific moment in the year, since this all depend on the availability of pasture. In the meantime the members at home cultivate some crops to sustain the family. Splitting herds and cultivation by pastoralists families may be categorized as agropastoralists or transhumant agropastoralists by the definition of Blench (2001), but the irregular migration patterns are more characteristics for nomadic pastoralists.

Since this research focuses on seasonal migration of pastoralists, all respondents will be pastoralists. However, it will vary to what extend their livelihood will depend on livestock keeping. Some respondents will live a more settled live while others will be on the move more frequently. A further description of the pastoralists living in the Isiolo Holding Ground will be given in Chapter 4.

2.3.2 What determines the seasonal movement of pastoralists

This section will attempt to make clear which model can be used to explain migration decisions of pastoralists and how this model can be related to the indicators and components which determine the Water Poverty Index. An often used model to explain migration is the push-pull model. This neo classical model is mainly used to explain international (labour) migration (Castles and Miller, 2009), while this study mainly focuses on internal seasonal migration of pastoralists. Castles and Miller (2009) argue labour migration cannot only explained by economic reasoning but should also take political, social and cultural factors. Besides, an economic push pull model is too simplistic and static compared to the migration decisions. This should also account for pastoralists moving from one place to another with their livestock. Their movements cannot solemnly be explained by dry and wet seasons and their economic reason of which area will bring them most profit, but are also explained by for example: family, community dynamics and (sense of) security. Arango (2000) extended the existing push-pull model by including retain and repel factors, which could be categorised as non-migration factors. Despite the fact this model is mostly applied on international migration, we could argue a push pull retain repel model is possible to analyse the migration decisions of pastoralists.

Dyson-Hudson and Dyson-Hudson (1980) bring forward various factors which together might explain the movement of pastoralists. First of all, it is self-evident, but nonetheless important to understand pastoralists typically rely on animal husbandry for their economic activities. The arid and semi-arid environments they live in are characterized by variations in climatic conditions under which plant growth is seasonal, occurring only when temperature and rainfall allow it. Their strategy for

providing year-round food for their herd is to move their livestock to pasture rather than bring fodder to them (Dyson-Hudson and Dyson-Hudson, 1980). In dry season, pastoralists usually move their cattle to highlands or well watered areas (dry season pastures). When the rains begin in the rangelands, they move back to take advantage of the new and more abundant wet season pastures. Moving between rangelands and dry season grazing areas allows pastoralists to exploit resources in different agro-ecological conditions at different times to make up for fluctuations in production (Goodhue and McCarthy, 1999)

The movements of pastoralists may be affected by various categories of factors. Dyson-Hudson and Dyson-Hudson (1980) distinguish ecological, environmental (physical and social), political, economic and affective factors. First of all, a reason for pastoralists to move could be an ecological reason, which mainly means the exploitation of resources. If resources are available seasonally, this is major reason to move in order to be sure the livestock is fed regularly. This is closely related to water scarcity since these resources depend on the availability of water in an area. Other factors that influence this movement as well are the physical and social environment influences the movements. Dyson-Hudson and Dyson-Hudson (1980) mention, for example, insects and diseases as a problem in the physical environment which pastoralists want to avoid. Issues that pastoralists want to avoid in the social environment are, for example, the competition with other groups. Factors that can be categorized as political factors are: international boundaries, local governmental restrictions, and a desire to avoid taxation and conscription. Next, Dyson-Hudson and Dyson-Hudson (1980) name the economic factors, which are the "presence of markets and the willingness of sedentary agriculturalists to lease potential pasture land to nomadic populations." Affective and cognitive factors included "people's values and perceptions of themselves and of their spatial and temporal environment."

By including these various factors in explaining the movement of pastoralists a broad range of various movement patterns can come into being. Dyson-Hudson and Dyson-Hudson (1980) therefore state that ecological, political, economic, and affective factors together determine the movement of each pastoralist within a pastoral society and this subsequently leads to a broad variety in movements. So not only the movements of various pastoral groups differ, within these different groups the individual pastoralist may move differently than the other.

In addition, various other reasons can be added to these factors. For example, security can be included in the category of social environmental factors. Pastoralists may need to look for other pastures when their usual grazing area is inaccessible (Blench, 2001). The factors found in the study area of Isiolo will be assigned to the various categories distinguished by Dyson-Hudson and Dyson-Hudson (1980).

Central in this research is the influence of water scarcity on the migration decisions of (agro) pastoralists. In recent studies on the link between water scarcity and migration climate change is often included. Nevertheless, pastoralists are skilled in responding to water scarcity and this is not to be considered as a new phenomenon (Nori in Hermans, 2012). Furthermore, Nori (in Hermans 2012) argues the physical water scarcity, or water stress, is most of the time not a problem for pastoralists since they adapt to this by migration seasonally. However, as explained in 2.1.1 water scarcity also includes access to water and according to Nori (in Hermans, 2012) this is what forms the problem for pastoralists. So access is an important aspect of water scarcity if we are looking on how water scarcity influences migration decisions of pastoralists.

Returning to the migration model, we have now seen the importance of including various types of factors which determine the movement of pastoralists. The model which included push, pull, retain and repel factors, is well suited to adopt these factors, because the various factors can be categorised as one of these factors. We will better able to explain the migration decisions of pastoralists when not only including economic factors in this model, but also ecological, environmental (physical and social), political and affective factors as proposed by Dyson-Hudson and Dyson-Hudson(1980).

Since this study is focussing on seasonal migration of pastoralists, ecological and environmental migration factors will have a central place Besides ecological and economic factors, various other factors including the presence of health and education facilities, and the availability of security and family might attract (pull factors) someone to an area or makes them stay (retain factors) them in an area. On the other hand a lack of those factors might make them leave from an area (push factors) or might prevent they will choose to go to a certain area (repel factors). At the same time it could be stated these various mentioned migration factors are based on similar factors which determining the Water Poverty Index. For example, the arability of pastures, water and security do not only influence the components of the Water Poverty Index, it also influences whether pastoralists move to a certain place, or prefers to stay at their current location. This does not mean exactly the same variables are used, but it are comparable subjects. The major part of the final list of migration factors which is concluded in the survey can therefore be traced back to the subjects the WPI covers. However, two migration factors have been added to this list. Since the Isiolo Holding Ground is an area with a great variety of communities, ethnical and cultural motivations are taken into account as possible factors which might influence migration decisions.

In addition to these factors in the push, pull, retain, repel model, it is important to take into account the various compositions of the herd of each household. Migration decisions of pastoralists

depend on whether a household keeps cattle, camels or only goats and sheep. Goats and sheep are more drought resilient than cattle and can stay longer without water (Mati et al. 2006).

2.4 Conceptual framework

This chapter explained in detail the concepts which are used in this research. In this concluding subsection a conceptual framework will be shown in order to visualise the links between those concepts.

The objective of this research is to know the relative importance of water scarcity/WPI in determining the decisions (agro) pastoralists make concerning their movements. Since this research focuses on this relation it will have a central place in the conceptual model. However various other factors which contribute in the migration decision, categorised in push, pull, retain and repel factors, will be included.

In the conceptual model, which is shown in figure 13, the relationship between water scarcity and the migration decisions of (agro) pastoralists, is elaborated. The latter is the depended variable in this research and it is influenced by the independent factors determining the movements. Water scarcity is the central, but not the only variable influencing the migration decision of (agro) pastoralists. This migration decision is also influenced by 'Resource based conflict', which in turn is affected by the water scarcity. This means, 'Migration decisions of (agro) pastoralists) is not only a depended variable, but also an independent one. This relation fits with the research objective which besides the links between water scarcity and migration decisions also focuses on the effects of this dynamics on resource based conflict.

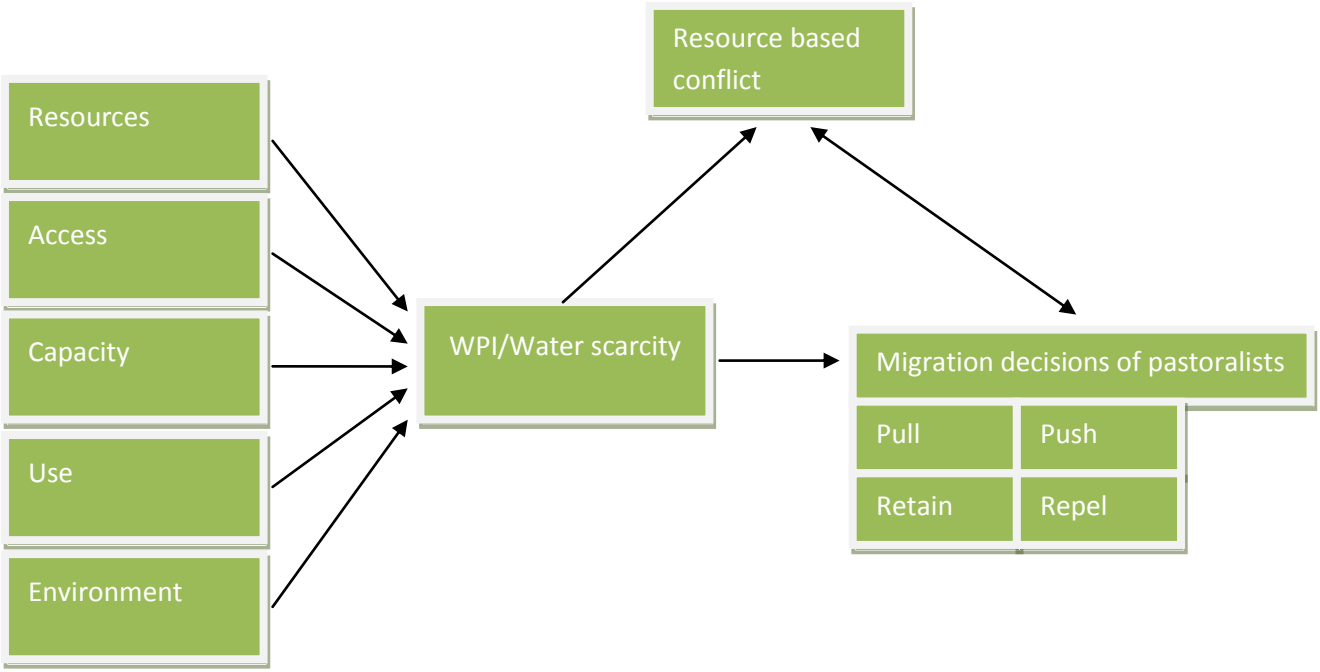


Figure 13: Conceptual framework.

3 Methodology

This chapter discusses the methodology used in this study. It was decided to apply a mix of qualitative and quantitative methods. The geographical focus of the research was the area West of Isiolo town, which falls within the Isiolo Holding Ground. The motivation to select this area will be elaborated upon in section 3. The sampling of the study population will be explained section 3.2. In section 3.3 the focus will be on how the data was collected and which implication this process has had on the results. Finally, section 3.4 explains the analyses of the data collected.

3.1 Research area

This research project focused on the area West of Isiolo town (see map in figure 14). The map in Figure 14 shows both the boundaries of the Isiolo Holding Ground and besides, the area within the Isiolo Holding Ground which has been allocated as the key research area of this study (marked in dark purple). The Isiolo Holding Ground is a huge area of 124,163 hectares in the East of Isiolo County, bordering the counties of Meru, Laikipia and Samburu. Many respondents refer to the Isiolo Holding Ground as 'the L.M.D' (Livestock Marketing Division). The L.M.D is a unit of the Ministry of Agriculture officially owns the area (Boye and Kaarhus, 2011) which is meant to function as a holding ground for livestock in transit. The area is home to a many communities who all live or move around within the Isiolo Holding Ground (Mainly Borana, Maasai, Meru, Ndorobo, Samburu, Somali and Turkana). A more detailed description of this area and its history will be given in Chapter 4.

There are various reasons which make the Isiolo Holding Ground an interesting location for this study. First of all it is an ASAL area where water scarcity is an issue and it is an area with complex dynamics and movements of pastoralists. Furthermore, it is an area with a large variety of communities who all make claims on the land on which they live or which they use to graze their livestock.

However, not each and every corner of the Isiolo Holding Ground has been visited during the research period as this was limited to three months only. Moreover, many pastoralists at the time had started to move out, to various locations within, but mainly outside, the Isiolo Holding Ground. Besides, travelling in the area is time consuming due to the lack of proper roads. At times it took almost two hours by motorbike having started from Isiolo Town to reach the respondents. The choice has been made to select an area within the Isiolo Holding Ground as the key research area, allowing for more respondents in a smaller area to be interviewed. At the start of the data collection this research area was somehow open since it all depended on the location of the pastoralist communities and the possibilities to reach those locations. Selecting an area within the Isiolo Holding

Ground limits the possibility of drawing generalised conclusion about the Isiolo Holding Ground. However, it is believed that findings from the selected research area are valuable and significant to get a better understanding of the relationship between increasing water scarcity and the migration decisions of (agro) pastoralists in semi-arid areas, which is the key objective of this study.

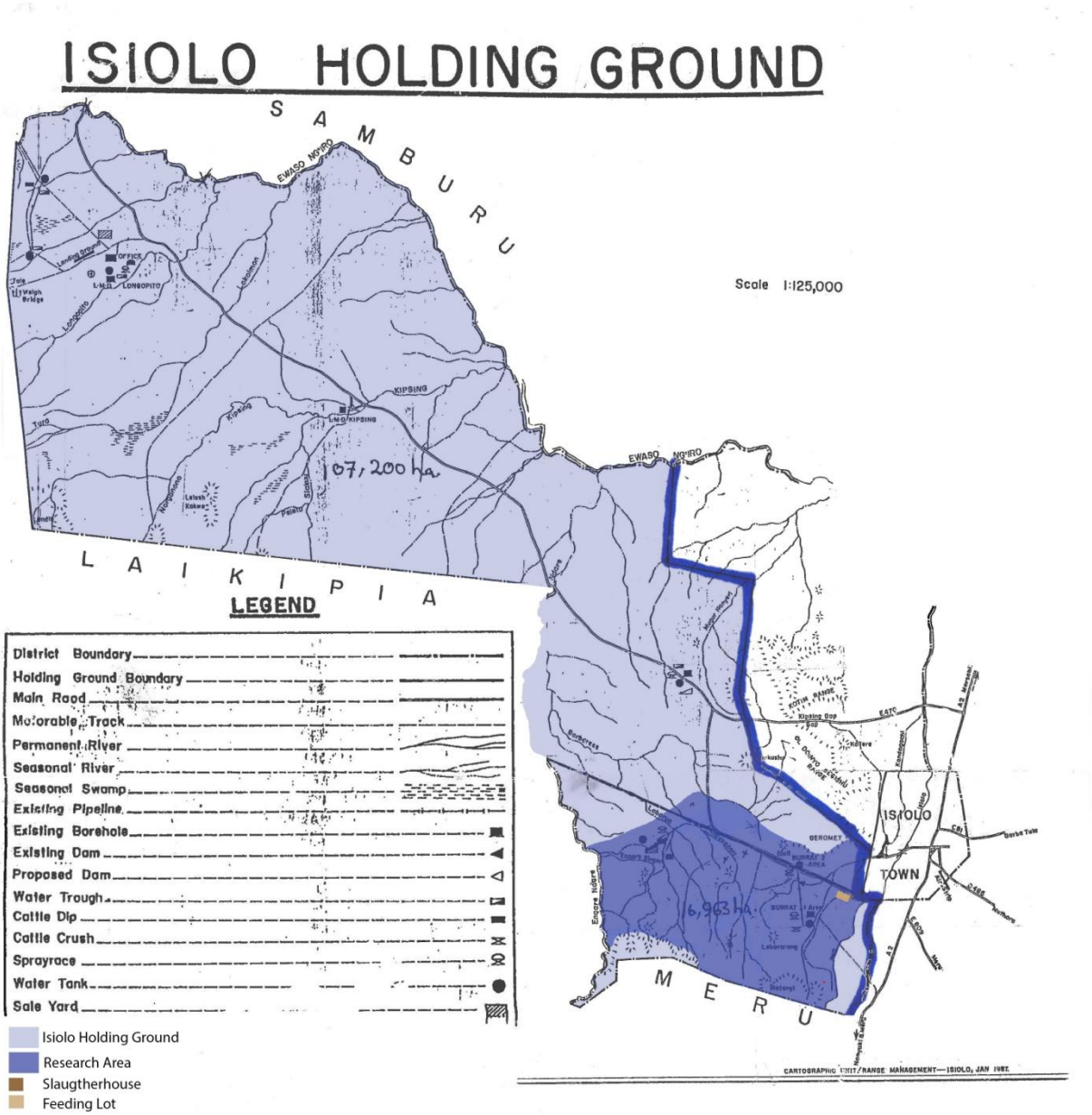


Figure 14: Isiolo Holding Ground and research area (based on a map Cartographic Unit/Range Management – Isiolo, 1987).

Within the research area a total of 81 respondents were interviewed. The red dots in Figure 15 indicate the interview locations with the respondents. These dots do not necessarily indicate the exact home area of the respondent, although for some this is the case. The mobility of the pastoralists and our ability to find them during the time of fieldwork resulted in the overview presented. Upon the start the first interviews took place close to the nearly finished slaughter house

(see map). From there, the various respondents were asked where other pastoralists could be found. This resulted in doing interviews in the areas of Burat1, Burat2, Mlango, Leparua, Il Ngwesi, Olchurai, Ngare Sirgon and Motonyi. This resulted in clusters in these specific locations where pastoralists were present. It should be clarified that Burat is a sub location in Isiolo West. However respondents specified their location further to villages and others, so Leparua, for example, is a village within the sub location Burat.

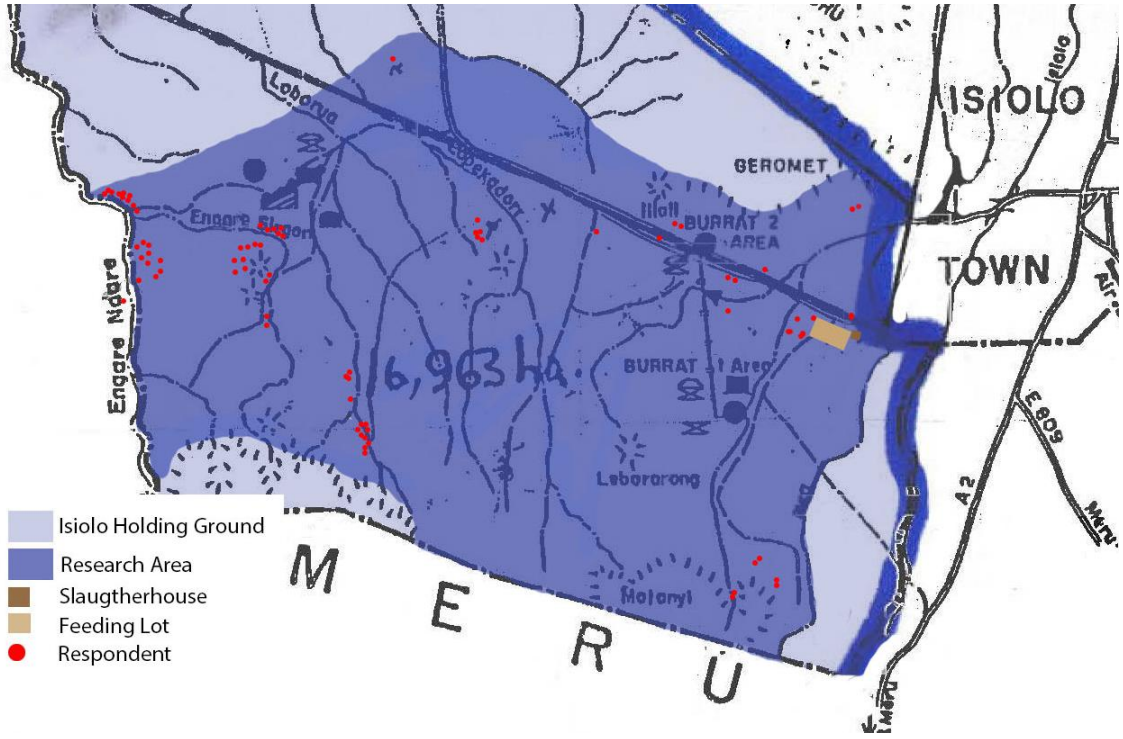


Figure 15: Respondents within the research area.

3.2 Sampling respondents

Interviewing nomadic pastoralists is always a challenge from the nature of their mobility. Moreover, labour demands especially during periods of drought are that during a day not many opportunities are available to have a lengthy time available to pose questions. For this reason the exact interview locations were not know before entering the field, we were depended on presence and availability of the pastoralist. This section will elaborate on how the study population was selected and for what reason.

In first days of doing fieldwork we walked and drove around looking for the sounds of livestock moving around. Almost every pastoralist who we came across was asked if they were willing to cooperate, and most of them were. Some of them told us they did not have the time to sit down with us because they were busy with their livestock. However, this strategy was far from perfect since some of the days we returned to Isiolo town without having spoken to any respondent. Right at the start of the field work it became clear the people who should form the study population were very dynamic at the time. When we entered the Isiolo Holding Ground around May there were a lot of pastoralists with their cattle residing, however a few days later most of them had left. There was no sign left of them and the place which was so full of life had now become deserted. So instead of just driving around to trying our luck to find any pastoralists, we asked people in the surroundings were we could find the pastoralists. From that moment the strategy has been used where respondents were asked after an interview if they knew where we could find more pastoralist households. Locations were named which overlapped with the places other respondents had pointed out. Subsequently we would in one of the following days visit these places and so step by step we were able to build our sample of pastoralist respondents. However, it is also necessary to mention we did not go to every place the pastoralists pointed out because some of these places were unreachable from Isiolo town because of distance or for security reasons. In June for example, we came across a lot of Ndorobos who moved in groups in north-eastern towards Shab. Despite the fact it could have been a significant contribution to this study to see how they moved towards Shab and how they interact with other communities on their way and in Shab, it was strongly discouraged to go there since tensions run high in the area when the various communities come together in one area.

Since various communities moved around in the Isiolo Holding Ground in search for pasture and water, some tensions could be felt. With most of these tensions we could deal because these did not run high, the only thing is that we needed to stay alert. Moreover, to be located in the middle of these pastoralists in search for pasture and water, and the related tensions, was interesting for this study. However, during some interviews in Burat1 and Burat2, I or my research assistants did not feel

completely comfortable doing interviews with some of the pastoralists. However, we also interviewed some (heavily) armed pastoralists carrying automatic weapons, which looked like AK47s. Some of these pastoralists did according to my research assistants not reveal to us the complete story and the information was therefore not always as useful as from other respondents. Besides, when we approached armed pastoralists they often did not want to cooperate because they were afraid we might pass this information to the authorities. This also has influenced the sampling of the pastoralists.

One of the communities in the Isiolo Holding Ground which was more cooperative was the Ndorobo community. This made it a more suitable focus group for this study, they took enough time to answer our questions and they seemed to like talking about their experience or telling anecdotes.

This method resulted in a total sample size of 81 respondents which were interviewed during three months. Most of them were Ndorobo (55). Some Maasai(4) where interviewed, but with a hindsight it could be possible that those people also were Ndorobo, since this is a sub community of the Maasai and they sometimes are inclined to say they are Maasai instead of naming their sub community. Other respondents belonged to the communities of: Turkana (7), Samburu (8), Somali (4), Borana (2), Meru (1) and Taita (1).

3.3 Data collection

From the start of this research project, the basis of the methods used for data collection was already clear. It started by studying literature it became clearer how pastoralists in the research area are living and how they move around. Subsequently, an idea came into being on which data was needed to reach the research objective. Since there was a need for specific data from the research area, fieldwork was inevitable. Preceding the fieldwork some useful discussions with Dr. Marani from the University of Nairobi took place. This resulted in better image of the pastoralists in the area and the survey was adjusts to fit in with the newly obtained information on the area. Moreover, a large part of the standard Cocoon Initiative survey has been used, which makes the collected data comparable with other Cocoon Initiative studies in Kenya.

The fieldwork took place from May until July and has been collected mostly through interviews and by doing observation. A part of those observations were participant observations, since on some of the mornings we walked along with the pastoralists when they moved from their Boma (homestead/livestock enclosure) to a river for example. As explained in the former section the study population among groups of pastoralists through the snowball method: asking pastoralists were other pastoralists about the presence of other pastoralists and where they could likely to be found. This, strategy worked out most efficient.

The majority of the data was collected through interviews with various pastoralists. A combination of qualitative and quantitative methodology was used to reach the research objective. This is also reflected in the interview guide made for this research which is a mix of closed-ended question and open-ended questions. The interview guide can be found in the Appendix. For a large part this interview guide is based on the Cocoon Initiative basic survey format, with the intention that the collected data contributes to a larger dataset on Natural resources and conflicts in Kenya. The Cocoon Initiative survey has a basic set of questions which are posed in different locations all over Kenya and a second section that has locations and topic specific questions. To answer the location specific research questions various questions were added to make the survey complete. Besides, these closed-ended questions, open-ended questions were added so that pastoralists could tell their story on certain topics concerning water scarcity, their movements, conflicts and others, which gives the interview guide also a qualitative character.

In general the data collection by doing interviews went without problems. However, some limitation of this study should be made clear. First of all there was a language barrier and even though the translators were incredibly helpful, it is inevitable some information was lost during the translation. Furthermore, the study was limited to some areas because of security reasons and besides the interviewing time was restricted from sunrise till around noon. After noon the pastoralists were either busy with their livestock, or they went almost unreachable places, to let their livestock graze.

Another limitation of the study is that in some cases it was not clear whether the pastoralists gave all the information they have got and whether this information was correct. This was illustrated by an interview with an English speaking, and apparently well-educated pastoralist. He told that when you interview a (Turkana or Maasai) pastoralist as an outsider, this would be rather difficult, since they believe that if you getting out information it might kill them. Another interesting finding was when we came across a young Samburu pastoralists who ran away to warn homestead when we approached, they even left behind their herd for a moment.

In the surveys most question could be answered by a Likert scale from score 1 to 5. For example, the respondents are asked to indicate if there is enough water available for human consumption. If they think there is sufficient water they might answer by indicating a 5, when they feel it is really not enough they might chose to answer with a 1. It might also occur respondents choose a 3 when they think it is in between or if the water availability varies through the periods of the year.

Observations took place alongside the interviews. In the end, when analysing the data, it should be taken into account that this is just one specific period of a certain year. During data collection we

experienced almost no precipitation. This will have likely influenced the answers as these were given by pastoralists in search of water and pasture. Most of the time, respondents pointed out the availability of water and pasture (which depends on the amount of water) as most important resources to sustain their way of living. Observations took place mostly in the same locations as the interviews. At the river near the slaughterhouse, where pastoralists were watering their animals, observations were done. Another important observation took place at one of the boreholes which had stopped working. This resulted in some interesting data on how pastoralists respond to these unpredictable events. As already explained, the questions posed in the survey were the result of including the basic set of Cocoon Initiative questions, studying the literature and doing an interview with Dr. Marani. During the fieldwork some new questions arose and therefore it was decided to interview experts in Isiolo Town. This helped clarify certain events observed during the field and answers which were often given by the pastoralists. So besides the observations and surveys, some interviews were conducted and some discussions took place with a number of key informants such as Dr. Marani, from the University of Nairobi, Mr. Muggi, from the Livestock Department Isiolo, Mr. Haji, chair of the Isiolo Holding Ground User Association, Mr Karunda Kongo from the National Environment Management Authority (NEMA) and Mr. Lordman from the National Drought Management Authority (NDMA). Next to the interviews with experts in Isiolo Town to clarify results from the field, an in-depth interview was conducted with a pastoralist who knew the English language very well. The information this pastoralist had, was very useful since the stories of pastoralists interviewed so far could be placed in context.

As explained in the theoretical framework the migration of pastoralists is influenced by various factors and data has been collected on these various factors. The combination of closed-ended and open-ended questions allowed the collection of some interesting data and stories. This survey set-up allowed the respondents to tell the stories which were on their mind when questions were asked about certain topics.

Seasonal differences should be taken into account since the data was collected in a period without much precipitation.

3.4 Data analysis

The type of data resulted from this research is both qualitative and quantitative. This means a part of the data will be analysed by using IBM SPSS Statistics software. The qualitative data will be analysed by comparing various answers of each respondent and link these to the studied literature. When analysing the data, a special focus is on the construction of the Water Poverty Index (WPI).

The collected data measured water scarcity and therefore the different questions in the interview resulted in the construction of a Water Poverty Index (WPI) of the locations in the Isiolo Holding Ground. Measuring this was done by using existing data of the different dimensions, but also by using the formulated questions in the survey. This resulted the indicators were both measured by quantitative and qualitative data.

As argued in Chapter 2, the use of a multiplicative function to measure the WPI is favourable. Although Garriga and Foguet (2010) also suggest a weighting of the components, this is still arbitrary and therefore may give biased information. Besides, the resulting WPI will be easier to understand if equal weighting is used and therefore the choice has been made to use equal weighs for the different components.

Sullivan, Meigh and Lawrence (2006) resent the WPI as an index which tells something about the water scarcity in a certain area. In figure 10, for example, the WPI for different countries was given and conclusion may be drawn from this index on national level. It might be more valuable if this index is given on a more local scale and from the perspective of various groups of people. Especially so, since water scarcity is something which not only depends on the amount of water available but also on how people use water and the perceived scarcity.

Garriga and Foguet (2010) argue it should be explored whether the variables at index and sub-index level are well balanced by performing a Principal Component Analysis (PCA). The goal of the PCA is to reduce the variables so that fewer uncorrelated variables remain. When the weightings are assigned, the WPI can be calculated by using a multiplicative function. Van der Vyver (2013) states the following formula should used when aggregating a WPI with a multiplicative function.

$$WPI = \sqrt[n]{\prod x_i^{w_i}}$$

Figure 16: The weighted multiplicative function used to measure the WPI (Van der Vyver, 2013).

First a weighting has to be given to each sub index. This will be calculated by executing a Principal Component Analysis (PCA). Explain further. No significant correlations when executing a PCA, except for the sub index '*Resources'*, which means no significant correlated variables are present for the other sub-indices. Besides, since only 7% of the correlation between all variables is higher than 0.3, it is better not to carry on with a PCA for all the variables of the Index (Pallant, 2007). At the same time this means no variables can be excluded because of correlation between the variables. This means all variables will be included and equal weights will be assigned to them. The weighting of every variable is shown between brackets after every variable in the table.

The next step is to see if it is possible to do a PCA on the sub index level to see which weighting should be assigned to each sub index. To perform such a PCA the various variables of a sub index will be merged into one new variable. Since no weighting has been allocated to the various variables, this step will be easy to perform. When adding the scores of the various sub indices and a PCA is executed, the same happened as for the separate variables, there are again too few correlations above the 0.3. Therefore equal weights will be assigned to the various sub indices.

		Levels and scores			
WPI Component	**Indicator**	Fair(1)	Acceptable(0.66)	Poor(0.33)	Risky(0)
Resources	Water Quantity Sufficiency (other water sources) (0.143)				
	Water Quantity respondents (rivers) (0.143)				
	Water Quality (according to respondents) (0.143)				
	Percentage of water sources which is improved(0.143)				
	Percentage of water sources tested safe(0.143)				
	Reliability of supply (% of water points not operational for less than 7 days(0.143)				
	Seasonal variability of water resources (months per year with water) (0.143)				
	Total				
Access	Percentage of people having access to piped water supply (0.167)				
	Access to improved sanitation (0.167)				
	one way distance to water sources (km) (0.167)				
	Operational status of water source. (0.167)				
	Waiting time (min) (0.167)				
	water coverage of water points (0.167)				
	Total				
Capacity	Wealth equivalent to ownership of durable (0.143)				
	Herd size (based on 'enough for milk consumption') (0.143)				
	Sell Milk (0.143)				
	Gini coefficient (0.143)				
	Educational level (0.143)				
	Familiarity with water users associations (0.143)				
	Life expectancy at birth. (0.143)				
	Total				
Use	Domestic water consumption rate (per capita) (0.2)				
	Livestock water use (m3 per day) (0.2)				
	Agricultural water use, expressed as the proportion of irrigated land to total cultivated land. (0.2)				
	Wildlife (0.2)				
	Conflict over water sources (human-human) (0.2)				
	Total				

Environment	Availability of pastures in wet season (0.167)	
	Availability of pastures in dry season (0.167)	
	Quality of pastures (good and bad grass) (0.167)	
	Reduction herd size (0.167)	
	Grazing regulations (% of population experiencing grazing regulation) (0.167)	
	Conflict natural resources sources (Human- wildlife) (0.167)	
	Total	

Table 2: Indicators used to measure the WPI in Isiolo Holding ground (based on Sullivan, Meigh and Lawrence (2006) and Giné & Pérez-Foguet, in Garriga and Foguet (2010).

4 Isiolo Holding Ground

This chapter will describe in further detail the characteristics of our study area which is the Isiolo Holding Ground, located in Isiolo County. Section 4.1 will start by describing the function of the Holding Ground. Subsequently section 4.2 will provide information of the various communities that occupy the area. Attention will be paid to various land claims existing over this area, because this also affects which resources the various communities will use. This might affect migration decisions, but also the tensions between communities when they enter an area which is claimed by another. Section 4.3 will focus in particular on the Ndorobo community living within and/or using the Isiolo Holding Ground. Section 4.4 describes the area from an economic perspective (i.e. importance of livestock in economic sense). Since pastoralists and their movements depend on the environment, the last section, section 4.5, will describe the environmental characteristics and changes. This chapter derives most information from literature, bus also presents data collected through fieldwork interviews. That information, foremost, provides understanding of how the respondents perceive the changes.

4.1 Functioning of the Holding Ground

The Isiolo Holding Ground is named by many respondents as the L.M.D (Livestock Marketing Division), which is a unit under the Ministry of Agriculture that used to be the organisation managing the area. This land is reallocated after independence, in order to function as a holding ground for livestock in transit, which supported pastoralists to sell their animals. Muthee (2006) states this organized livestock marketing exists in Kenya since 1952 when the African Livestock Marketing Organisation (ALMO) came into being. Its functions was to organize, sponsor and encourage maximum sales opportunities of livestock produced by African pastoralists. At the same time this organisation tried to reduce the overstocking by increasing the outlets where pastoralists could sell their livestock. The ALMO was renamed as Livestock Marketing Division (LMD) in 1968 which marketing activities continued until 1982. It was during this period the LMD developed various holding grounds (including the one in Isiolo), disease free zones and stock routes (Muthee, 2006). According to H. Haji (personal communication, July 2014), chair of the Isiolo Holding Ground Users Association, the LMD in Isiolo was functioning well between 1968 and 1984 because both private and company ranches received support through donations, so that livestock production could function well. Since the donations to the ranches (both private and company) stopped due to corruption of politicians the functioning of the LMD collapsed. Without those donors marketing support was unavailable to help pastoralists in those ranches selling the animals, besides, livestock diseases increased. Because ranches could not sell the animals, pastoralists lost their income. At that time the

LMD abandoned the area. Then in the 1980s the Structural Adjustment Programme (SAP) changed the role of the LMD (Aklilu, 2002). The area attracted traders and it worked out well for the first years, but since weapons entered the area, conflicts were triggered which scarred off the traders. They left the area and currently the Isiolo Holding Ground User Association gives services to the pastoralists during the dry spell and offer grass and water for animals within the area.

4.2 The communities in the Isiolo Holding Ground

According to the 2009 census the total population of Isiolo County is 69,573 people. Figure 17 shows the Isiolo County age pyramid with a wide base and a narrow top. When looking more specifically to the Isiolo Holding Ground, we are also able to determine the population living in the Isiolo Holding Ground. In Burat, a sub location of Isiolo County where most of the fieldwork was conducted, a total of 8,590 people live within the Burat, of which 4,580 male and 4,010 female. A part of Isiolo West sub location also belongs to the Isiolo Holding Ground, the total population of this sub location is 4,262, consisting out of 2,162 male and 2,100 female. In Oldonyiro and Kipsing, the western part of the Isiolo Holding Ground, a total of 15,388 people live. This part however was not included in the research area. It is difficult to state whether these numbers are that accurate, reliable and meaningful, since we are dealing with an area where the in and out migration of pastoralists is a common phenomenon.

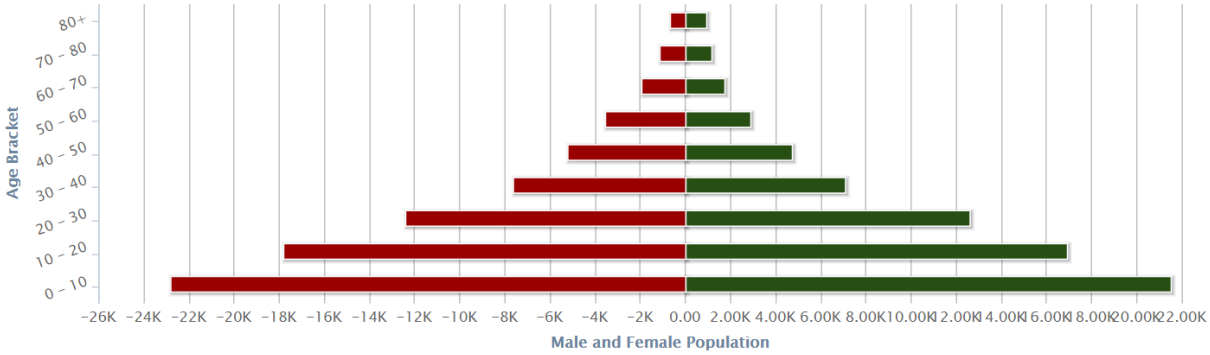


Figure 17: Age pyramid, based on the 2009 census (Open data, Government of Kenya).

As already pointed out in chapter 3, various communities were interviewed in the Isiolo Holding Ground. This section will first examine the various views on who owns and claims the land. Hjort (1979) for the 1970s stated the land ownership in the district of Isiolo has been classified as County Council Trust land. According to Boye (2007, p.5) this means that: "The county council is the trustee of the land categorized as Trust Land. It also collect land rents, and allocates land in collaboration with Ministry of Land and Provincial Administration According to Boye and Kaarhus (2011) around 2010 about 70% of the land in Isiolo County is trust land, 20% of the land is government land which

includes the national parks and game reserves and military barracks. The remaining 10% is private land which can primarily be found in Isiolo Town. In the Trust Land Act (Cap 288) of 1963 it is established that the Trust land in Isiolo is held in trust by local authorities for the people using the land in Isiolo (Boye and Kaarhus, 2011). The problem of this Trust land according to Boye and Kaarhus (2011, p.106) is that: "The Trust Land Act has also been perceived as ambiguous, as it did not clearly define who actually controls the land. The County Council is responsible for the local people's rights and interests, but at the same time there is an abuse of trust in the context of this Trust Land Act (Boye and Kaarhus, 2011). This abuse was already illustrated by the case in LMD of Isiolo where corruption resulted in the departure of donors and eventually in the abandonment of the LMD. Another problem Boye and Kaarhus (2011) point out is that "land is predominantly unsurveyed and unregistered, and people occupy and use land by reference to customary rights, mostly without title deeds." This accounts for the lands which are classified by the government as being of low potential. In contrast, areas with more potential agricultural value customary land rights were converted into individual registered land. However, it is too simplistic to think assigning title deeds is the solution for the problem around the various existing land claims. There are various counter-arguments which question the assumption that individual property rights is beneficial for the inhabitants of the land. One of the problems of assigning title deeds is pointed out by Payne (in Davis, 2006). He argues that people who are able to get formal property rights will benefit a lot, but there is also a group that is not able to get these property rights, which will create more inequality among the inhabitants. According to Borwein (2013) the idea that private property rights will in any case lead to economic development should be questioned since empirical research has shown assigning individual property rights might lead to land degradation, increasing poverty, wealth inequality and it also might threaten the capacity of pastoralists to earn a living through livestock production. In the context of this study the negative effects on pastoralists is of course an important conclusion drawn by Borwein (2013). So the problem Boye and Kaarhus (2011) point out might be relevant, it should be questioned whether their suggestion to solve it by registering and will turn out well.

With the change of constitution in 2010 changes concerning categorising land were introduced. From that moment the three categories of land that can be distinguished in Kenya are: public, community and private land. Community land involves "land which is held in trust by county governments (Boye and Kaarhus, 2011). " Other major changes which are being emphasized by Boye and Kaarhus (2011) are the repeal of the Trust Land Act (which will be replaced by a new Community Land Act in 2015) and the special attention which is needed to correct historical injustices and pastoral land issues. Land issues and historical injustices can be traced back to colonial times it seems that this is one of the causes of the violence in Isiolo County in 2011 between communities who claim to be victims of the historical injustices described in the new constitution.

Even though the Isiolo Holding Ground is perceived by many respondents as trust land, it appears the research area (as shown in chapter 3) is not community land held in trust by the County government. Furthermore, another part of the Isiolo Holding Ground had never been trust land at all. This is explained by D. Muggi, (personal communication, June 2014 and January 2015) from the Livestock Department in Isiolo who states the south eastern part of the Isiolo Holding Ground (17,000 ha) was already a quarantine area in 1922, before independence. Because it was gazetted before independence and also before the establishment of the Isiolo County Council this land has never been trust land. The first mentioned part which was trust land in the past was converted to state land. This is confirmed the defenders in a case whereby Maasai claimed land in Leparua. "The defendant's case was that the land was not being held in trust of the Maasai community and the area was in fact a government quarantine area since 1922." (High court at Meru, 1996).

The other, and the larger part (107,200 ha) of the holding ground was trust land in the past when it was owned by the Isiolo County Council. When the Ministry of Livestock became the owner of this area the status of the land changed from trust land to state land. According to H. Haji (personal communication, July 2014) (chair of the Isiolo Holding Ground Users Association) the government took over in 1968. As visualised in figure 15 and 17 in chapter 3, this study was almost exclusively conducted in the south eastern part (17,000ha) of the Holding Ground which has never been trust land, but is government land.

The Ministry of Livestock still holds a formal title deed on the Isiolo Holding Ground. However, land is still being claimed by different communities. Customary rights often determine which land is occupied by whom. When the LMD unit left the Isiolo Holding Ground, communities such as the Turkana and Samburu who do not originate from the area moved here. But the Ministry of Livestock asked these groups to leave (Boye & Kaarhus, 2011). Other communities also use the land. Some of these groups we interviewed are Ndorobos, Maasai, Somali, Borana, Meru and Taita. Boye and Kaarhus (2011) made an overview of the five ethnic groups that according to them share the Isiolo District, these are: Borana, Somali, Samburu, Turkana, Meru. The Ndorobos are not included in this overview, the Ndorobo respondents mostly live at the Isiolo side of the border, but they also made use of the Il Ngwesi group ranch at the Laikipian side. They occupy areas in Isiolo County, but perhaps they do not claim the land they occupy in the same way as the other communities do. A closer look at the land claims of those various communities in Isiolo County is needed to understand the dynamics and tensions that exist in the area.

	Land claims and perceived rights to land	Sources of legitimation for claims
Borana	• Rightful ownership of land in the whole district • Exclusive claims to grazing land and water points in the Waso area • Rights to land management in the district	• Pre-colonial occupancy of the area • Customary rights confirmed by colonial government • Colonial policy of tribal separation and confinement within defined boundaries • Traditional Borana tenure rules governing land and resources • Trust Land Act
Somali	• Access and user rights to key resources (land, pasture and water for herds) • Exclusive ownership rights in Isiolo Central Division	• Customary rights to negotiate access and use of resources • Agreement between colonial government and ex-soldiers on land rights in Isiolo Central Division/Town • Constitutional right of Kenyans to settle and own land anywhere in the country
Samburu	• Rightful ownership (or co-ownership) of land with Borana in Isiolo District • Indigenous rights in Isiolo Central Division • Access and user rights to key resources (land, pasture and water for herds)	• Being the indigenous people of Isiolo during pre-colonial times • Samburu place names in the district, indicating the Samburu were the original inhabitants
Turkana	• Rightful claims to land to settle and keep herds in parts of Isiolo District	• Presence in the district since early colonial times • Constitutional right of Kenyans to settle and own land anywhere in the country
Meru	• Rightful ownership to part of Isiolo Central Division • Individual titles to land in Isiolo Town	• Colonial district boundaries • Land allocation by post-colonial government • Constitutional right of Kenyans to settle and own land anywhere in the country • Registered Land Act

Figure 18: An overview on the land claims in Isiolo District by various Ethnic groups (Boye and Kaarhus, 2011).

The first distinction Boye and Kaarhus (2011) make is the distinction between the Meru and the other four communities, since the Meru are by tradition more sedentary farmers. This does not mean the other pastoralist communities are not involved in other activities than livestock keeping. Boye and Kaarhus (2011) present Borana claims that they used to live in parts of Isiolo County until the start of the 20th century, when they were forced out by Somali attacks. Furthermore, the Borana obtained exclusive grazing rights from the British in the division of Merti and Garba Tula, within Isiolo County. Currently they also live in the divisions of Kinna and Sericho. To prevent conflicts between Borana and Somali a boundary was established between Isiolo and Wajir and Garissa, where in the latter two regions foremost Somali live. In the West and South another boundary must ascertain the Borana did not expand into Samburu and Meru County (Hogg in Boye and Kaarhus, 2011). On the

other hand Boye and Kaarhus (2011) explain how Samburu people also see themselves as the ones originally occupying Isiolo County in the pre-colonial time. Now they have an own County north of Isiolo and they also occupy the Oldonyiro Division in Isiolo County. According to them they were forced to move out of Isiolo by the colonial government and Turkana and Somali now live in the place where they used to live, with still the same Samburu names for those places. On the other hand Herti and Isaak Somali respondents in Boye and Kaarhus (2011) claim the area in and around Isiolo Town in Isiolo Central Division, which now lies within the LMD, was assigned to them by the colonial government after they participated in the First World War. According to them they were the exclusive owners of the area and the other communities who wanted to enter Isiolo Town needed a permit. With the establishment of Isiolo town, which mainly consisted out of Herti and Isaak Somali, Samburu where pushed further away out of that area. Hjort (1978) writes these two subgroups of Somali in northern Kenya are mostly urban, however other subgroups of Somali which are pastoral exist. Hjort (1978) also describes how problems occurred for the Somali during the demarcation of the plots in 1930 when they discovered Isiolo Town was not located within the boundaries of Isiolo District, but in Meru District. Because of this, the process of assigning land rights halted but the Somali kept living and grazing their livestock in Isiolo Town and its surroundings. Living in Isiolo without land rights caused feelings of insecurity and unrest among them.

Also Turkana came to Isiolo, some of them bought to Isiolo by Somali to work for them as herders, others by the district commissioner to work as labourers in the 1940s (Boye and Kaarhus, 2011). Eventually they settled in Isiolo County, but according to the informants of Boye and Kaarhus (2011) the colonial government tried to remove them. This stopped, after independence the Turkana still lost grazing land around Isiolo Town due to difficulties in post-colonial times. A major change for the area around Isiolo Town after independence was the moment the land, that had been assigned to Isaak and Herti Somali by the British Government, now became the LMD, a livestock holding ground for all communities.

In 1963, following on the independence, the Shifta war began, Boye and Kaarhus (2011) refer to the description of Dahl (1979) who elaborates on the causes and consequences of this war. Somali wanted the region to join Somali, but it was decided otherwise. A conflict between Somali and Borana guerrillas and the government arose and state of emergency was declared, some of the Borana found affiliation with the Somali fighters due to the common religion, myths of common descent and links with Somali pastoralists. Hjort (1979) also underline the fact that the Borana which joined the Shifta were mainly Muslim Borana. However not all Borana identified with the Somalis, Hjort (1979) also states Borana felt exploited by the Somali who moved out of the conflict zone with their livestock and crossed the border to Somalia. They left the Borana and their livestock behind in the war region which resulted in the destruction of their livestock. As a result of the conflict and two

drought years many Borana pastoralists were forced to change their way of living and moved to Isiolo Town. When the Somali returned after the war in 1969 they found a lot of land left empty by the Borana which the Somali could take control over (Dahl, 1979). According to a Borana informant of Boye and Kaarhus (2011) Somali tried to displace the Borana completely. According to this informant, the violent conflicts between Borana and Somali in the years after the Shifta war were about land, and not about pasture and water. Boye and Kaarhus (2011) elaborate further on this statement, they continue by giving he point of view of a Somali who feel they were victims by the government because they could not join greater Somali and because they lost their land with the introduction of the LMD. Another problem for the Somali was that when the evacuated Isiolo Town the Meru took over their trading business. As argued above, the Meru claimed land in Isiolo Town, which was originally under Meru administration. Borana did see them as migrants because they did not inhabit Isiolo before and only took advantage of the conflict situation. On the other hand the Meru, who are used to have title deeds, find difficulties since it is hard for them to get those in Isiolo, since Borana have the authority (Boye and Kaarhus, 2011). After the Shifta war the Turkana who looked after the livestock of the Somali refused to return the animals, which were entrusted to them by their employers. The Turkana did so for the reason that they never had been paid for their work as herder. As a result the Turkana took over the wealth of the once rich Somali who employed Turkana, the hierarchy changed (Hjort, 1979). According to Boye and Kaarhus (2011) the Turkana people in Isiolo also highly valued the constitutional right of any Kenyan Citizen to settle in any locality of their choice in the country.

Another problem around title deeds in Isiolo Town occurred when in 1992 the allocation of land as private land turned out to be an allocation of the plots to non-residents, whereby residents were forced to leave.

4.3 Ndorobos

The largest group of respondents in this study are the Ndorobos, the following part will elaborate on this group based on literature and what is found during fieldwork.

First of all the term Ndorobo, and the origin of this naming, should be explained in more detail. The name ‘Ndorobo’ or ‘Dorobo (as the British called them)’ was actually introduced by the British. Maa-speakers used the term ‘il-torrobo’ for the hunters and gatherers, what happened subsequently is that the British perceived this naming as an ethnical label which they applied to all hunters and gatherers in the Kenyan highlands. To the Maa-speakers hunters and gatherers have a lower status than pastoralists and by naming a group il-torrobo, or Ndorobo, makes them inferior (Cronk, 2002). Different authors which are referred to by Cronk (2002) state Maa-speakers characterise these groups with negative concepts as: offensiveness, meanness, poverty, cowardice,

womanhood, degradation, imperfection, degeneration, contamination, envy, selfishness (Galaty, Holis and Spencer in Cronk, 2002).

As a result of the ethnic label people put which had nothing in common, except from the fact they were gatherers and hunters and they stood close to the Maasai (Cronk, 2002). So when the people in this study are named Ndorobo, without being specific, it is still not clear what kind of community it is. Cronk (2002) describes how the British struggled with this 'ethnic community' which was scattered around the country with not even a common language.

The Ndorobo respondents in this study, which are Maa-speakers, can be traced back to the 'ilng'wesi' which moved to the North-West and South East direction of the Mukogodo area in the 1930s (Cronk, 2002). This means the Ndorobo referred to in this study, are Ilng'wesi Ndorobos. Nowadays many of the 'Ilng'wesi live in the Il'Ngwesi Group Ranch (figure 19). Cronk (1989) describes how the Ilng'wesi moved in and out of Mukogodo and how the British influenced these movements. They were forced into the Mukogodo area when the British allocated the highlands around Mt. Kenya to the white settlers. Cronk (2002) even states the ilng'wesi were deported by the British to Meru in 1925. Many of them returned to Mukogodo after the deportation and they obtained permission to live in Mukogodo again in 1937.

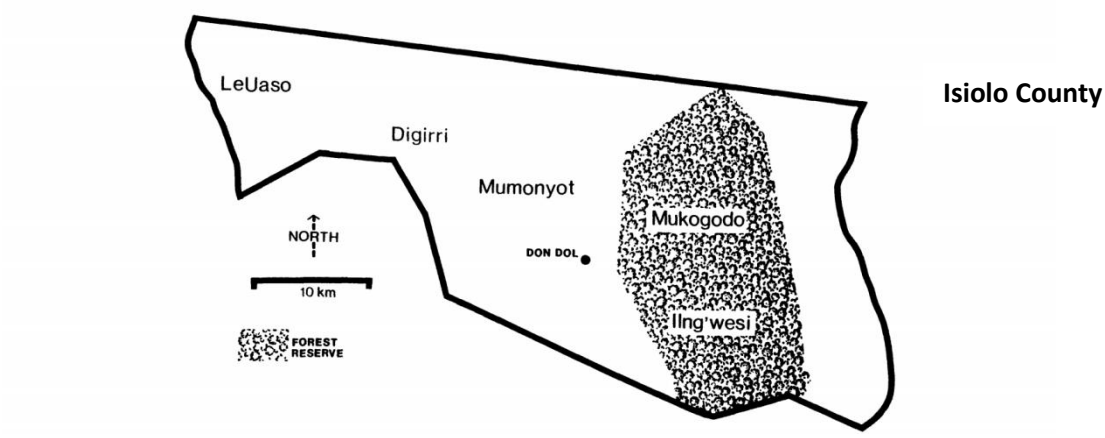


Figure 19: The Mukogodo Division which borders Isiolo (The Holding Ground) at the north and east side (Cronk, 1989).

A response to those forced movements out of Mukogodo was to use intermarriages with the Mukogodo to return to the area when they were being deported. Besides, the new ties in the area ensured their livestock was safe during their absence.

Already at the start of the 20th century hunting and gathering was not the main occupation of the Ing'wesi Ndorobos anymore, instead many of them became livestock keepers (Cronk, 1989). This makes the term 'Ndorobo', derived from il-torrobo, out dated, however people still refer to them as Ndorobos, and they do themselves as well. Although, some of them call themselves Maasai in first

instance, but when they were asked if this means they are also Ndorobo as sub community of the Maasai, they confirm this. An interesting statement Cronk (2002) makes is that "It is clear from the colonial records that Mukogodo and their neighbours (Il Ngwesi is one of them) were well aware of the instrumental qualities of ethnic labels." The British protected these groups since they were seen as inferior by the 'proper' Maasai. Therefore they even used the 'hated' term Dorobo to name themselves when they appeared before the Kenya Land Commission (KLC) and said in their testimonies: "We are of pure Dorobo extraction. We are not Masai or Meru (KLC in Cronk, 2002)." This illustrates they wanted to be called Dorobo because it had certain benefits, however the British still deported non-Mukogodo from their area, even after the testimonies whereby representatives of ilng 'wesi stated they were Dorobo. This makes clear how they identified themselves as Dorobo as attempt to manipulate the British. At the same time the groups named il-torrobo wanted to lose this stigma and wanted to be accepted by other Maa-speakers as 'real' Maasai.

In Figure 19, is shown Il Ngwesi is located on the other side of the border with Laikipia, this means the place itself is not located within the Isiolo Holding Ground. However, almost every respondents interviewed near Il Ngwesi was actually located within the Isiolo Holding Ground, so at the East side of the river. However, when the respondents were asked at which location we were they told Il Ngwesi. For this reason some respondents in the Isiolo Holding Ground identified the interview location as Il Ngwesi. Other places where many Ndorobos were being interviewed were located in Engare Sirgon, Leparua and Orchurai. In Table 3, it is shown that 16.4% of the Ndorobo respondents that stated the interview took place in Il Ngwesi were actually in Burat2. It is difficult to sate with 100% confidence that the Ndorobos in those various places are all il'ngewsi Maasai, however they at least seem to see them as their community and all see the Il'ngwesi as their area, a place of the Ndorobo people. Most interviews with Ndorobo people were done in Engare Sirgon and Leparua.

Location of the interview with the Ndorobo community	Percentage
Engare Sirgon	29.1
Leparua	23.6
Il Ngwesi	16.4
Orchurai	16.4
Other locations	14.5

Table 3: Based on conducted surveys during fieldwork in 2014.

In addition to interview locations, the Ndorobo respondents have been asked where there main location of residence is. In Table 4 the most often mentioned locations are listed. This overlaps partly

with the interview locations of the Ndorobo respondents. This is explained by the fact not all respondents were interviewed at their home location, but appeared to live in one of the listed places.

Main location of residence of the Ndorobo Community	Percentage
Engare Sirgon	29.6
Leparua	29.6
Il Ngwesi	14.9
Orchurai	11.1
Other locations	14.8

Table 4: Based on conducted surveys during fieldwork in 2014.

4.4 Economic description

The previous section presented the communities who occupy the Isiolo Holding Ground. This section will elaborate on the economic activities of these groups. As this study focuses on livestock keepers and their movements it seems self-evident that the main source of income of the major part of the selected respondents (97, 5%) is livestock keeping. For 37.1% of the pastoralists farming is an additional source of income. According to most respondents (41.8%) the land they use for grazing is located in a group ranch, in some cases use is also made of government or trust land for grazing. One might expect that the Ndorobos, who are concentrated around the Il Ngwesi Group Ranch, which they see as their area, will state they mainly use pasture in a Group Ranch. However, the part of Ndorobos who use pasture in a group ranch is 32.2% only, which is below the average of 41.8%. The explanation for this might be the fact Ndorobos see the Il Ngwesi Group Ranch as a company ranch because of the lodge which is located in the ranch. 37.9% of the Ndorobos said they use a company ranch to let their livestock graze, this is higher than the average of 27.8%. During the interviews people who use the pastures in Il'Ngwesi Group Ranch told that the people of that company define the grazing regulations in that area. D. Muggi (personal communication, June 2014) states the Ndorobos in Leparua have characteristics of agropastoralists. They for example cultivate Napier grass, which is used as fodder for their livestock. This illustrates they are not really pure pastoralists, but closer to agro-pastoralists.

The data resulting from the interviews with Ndorobo respondents will be compared with the, non-Ndorobo respondents, however it should be kept in mind this is a simplification of the diversity of communities categorised as 'non-Ndorobo'.

As for the major part of the respondents in the Isiolo Holding Ground, the main occupation of the Ndorobo respondents is livestock keeping. Besides livestock keeping, 38.3% also indicate farming as a source of income and some of them also have blue or with collar jobs. Compared to the average, the percentage of the Ndorobos who use farm as extra source of income is high in Leparua, 75% mentioned farming as another source of income. This might be explained by the way the Ndorobos are 'settled' in Leparua. Most of them have (a part) of the household fixed in that place and the ones who do not migrate might be occupied with farming in Leparua. Besides, Leparua is located near a river and also a borehole is available, which makes it a more potential area for agriculture.

The Kenyan Central Bureau of Statistics has in fact listed 87% of the households in Isiolo District as being "landless" (Syagga 2006: 319, in Boye and Kaarhus, 2011). Fieldwork shows that 89% of respondents form the Isiolo Holding Ground claim to have a residential plot. For the Ndorobo people this is even 94, 5%, while for the non-Ndorobo respondents this is only 77.8%. However, this does not necessarily mean they actually possess title deeds. Maybe they consider it as their residential plot, without owning it officially.

Besides the residential plot, a part of the respondents also states the own a commercial plot. Figure 21 shows less than half (44%) of the respondents states they own a commercial plot. From the non- Ndorobo respondents however, 56% own a commercial plot, while from the Ndorobo respondents only 37% has a commercial plot.

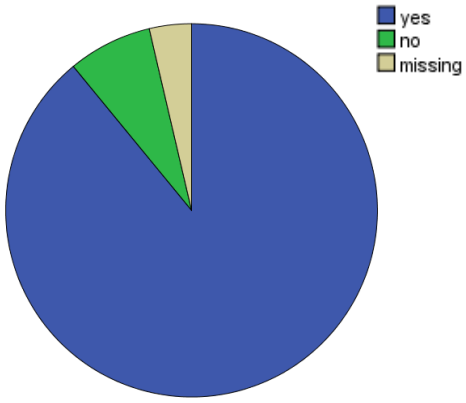


Figure 20: Percentage of the respondents that owns a residential plot(Based on conducted surveys during fieldwork in 2014).

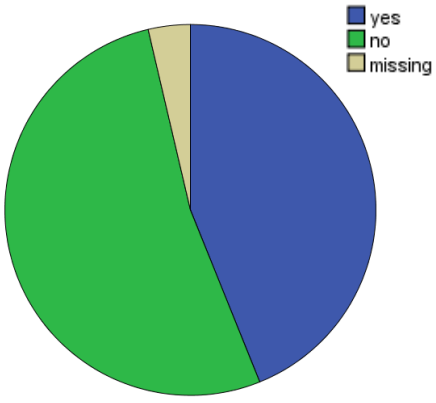


Figure 21: Percentage of the respondents that owns a commercial plot(Based on conducted surveys during fieldwork in 2014).

4.5 Environment

The previous section in this chapter focussed on the social, economic and political facets of the Isiolo Holding Ground. Another essential facet that should be examined is the environmental facet. For pastoralists in semi-arid areas this facet is of great importance. The first sub section discusses the climate in the Isiolo Holding Ground and the accompanied land cover in the area. Following to this subsection, the other two sub section will go further into detail on the aspect of water, by describing the precipitation and the hydrology of the area. In this section the classifications of Thorntwaite (1947) and Wilhite and Glantz (1985) will be used to determine which type of drought is present in the Isiolo Holding Ground.

4.5.1 Climate and land use

In general the climate in the Isiolo Holding Ground can be classified as an Aw climate on the scale of Köppen. This is visible in the map in Figure 22, which shows the approximate location of the Isiolo Holding Ground (indicated with IHS) in an area with an Aw climate. This means the climate in Kenya can be described as tropical (A) and savannah (w), which means that in the driest month the precipitation is less than 100mm minus the 'Mean Annual Precipitation'/25. Besides, the temperature of the coolest month in a savannah climate does not falls below 18 degrees Celsius (Pee, Finlayson and McMahon, 2007).

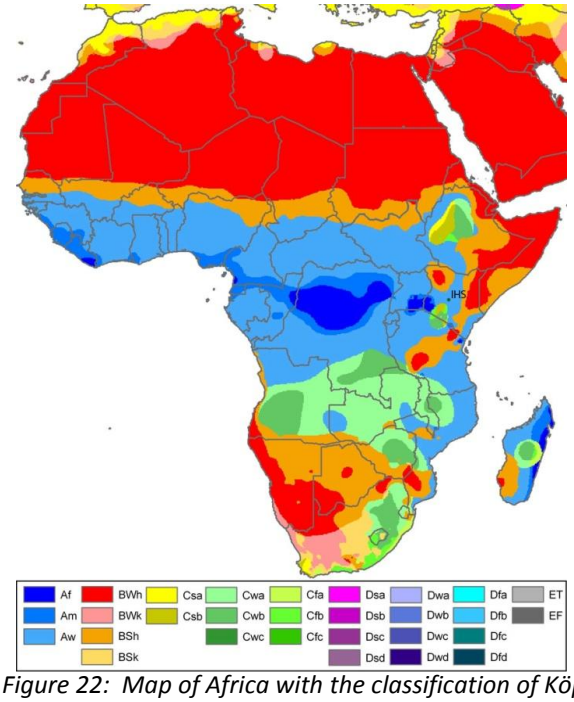


Figure 22: Map of Africa with the classification of Köppen. (Peel, Finlayson and McMahon, 2007)

This type of climate also determines the land cover in the area. Figure 23 shows a part of a land cover map of the Upper Ewaso Ng'iro river basin. It clearly shows that vegetation present in the Isiolo Holding Ground is mainly shrub savannah. Besides, some Bush land can be found around mountains of Ol Lengishu Forest and Kotim Range Forest, North-West of Isiolo Town.

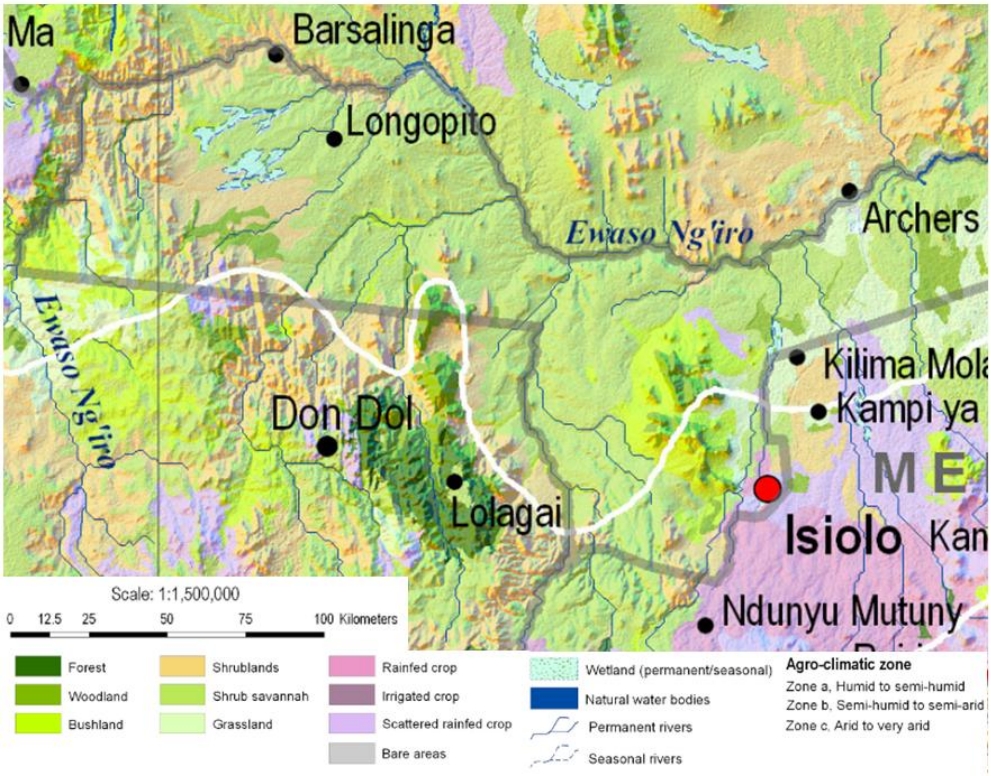


Figure 23: Land cover in the Isiolo Holding Ground (Ericksen et al., 2011).

4.5.2 Precipitation

As briefly stated in the introduction the Isiolo Holding Ground can be categorised as semi-arid, with seasonal rains. Following the classification of Thornthwaite (1947), this means we should exclude permanent drought as an overall potential characteristic for the area since short and long rains are present in the Isiolo Holding Ground. The two types of drought that could apply are seasonal and contingent drought. First of all, it can be argued the drought periods in the Isiolo Holding Ground are seasonal since periods of rain and drought alternate during the year. Figure 24 clearly demonstrates two different periods of rainfall (bimodal rainfall) which indicates a clear wet and dry seasons. The long rains normally occur from March till May and the short rains endure from October till December (Ericksen et al., 2011).

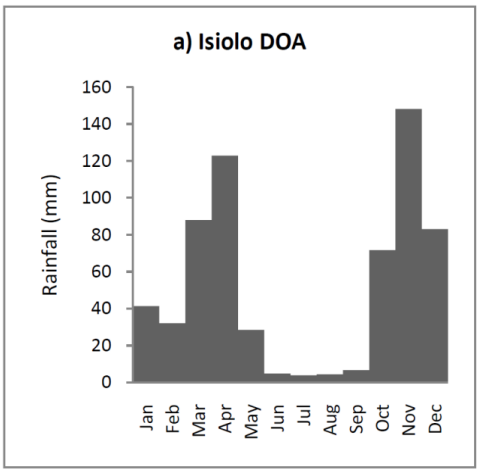


Figure 24: Long-term average monthly rainfall(Ericksen et al,(2011).

The seasonality of rainfall is also demonstrated in Figure 25, which shows various maps with the amount of the monthly rainfall, this figure not only tells us the variation between seasons but also the great variety between the locations within the river basin.

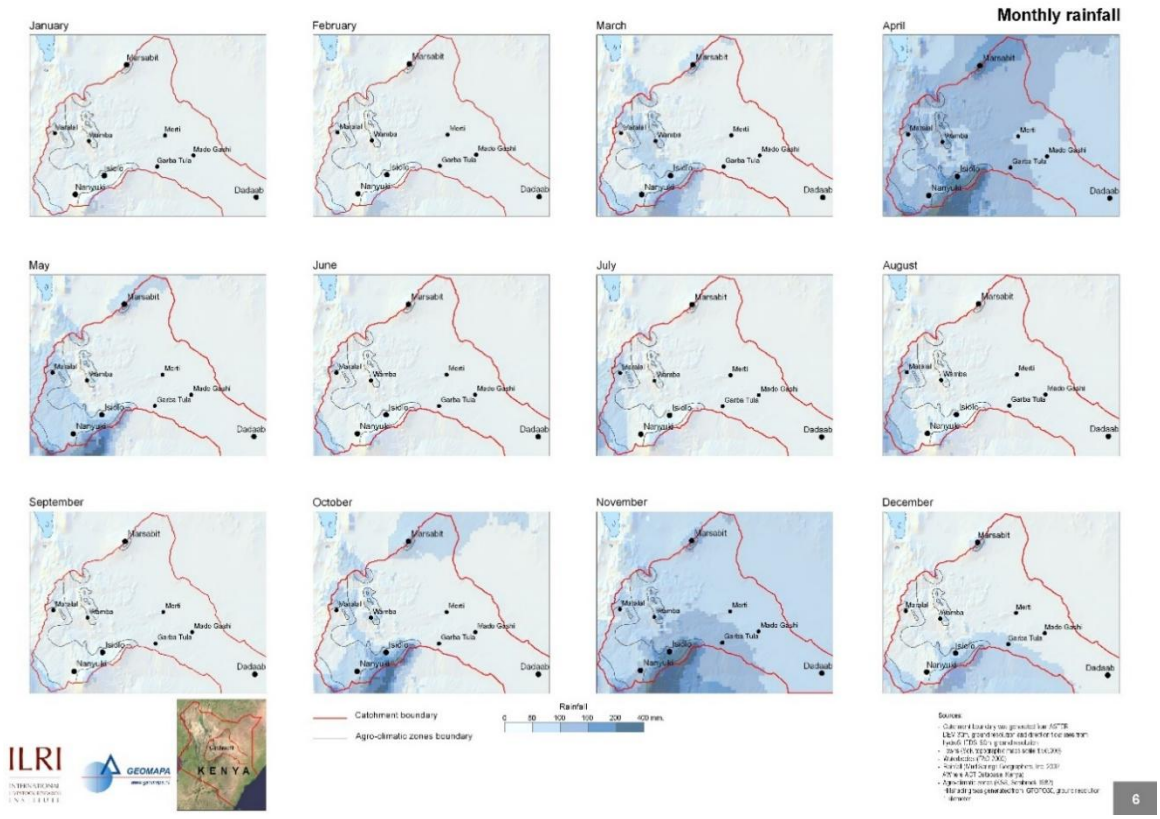


Figure 25: Average monthly rainfall in the Ewaso Ng'iro River Basin (Ericksen et al., 2011).

Even though the seasonality of the climate seems clear, it can also be argued that the Isiolo Holding Ground has to deal with contingent drought. In some years the short or long rains fail to occur in its normal quantity. It is hard to anticipate one these unexpected droughts. At the end of 2014 for example, when the short rains occur, the Isiolo Holding Ground received only 25 to 50% of the mean amount of rain for this period. Figure 26 shows in the far south west corner only five to 25% of the normal amount of rainfall for the short rains (Kenya Food Security Steering Group, 2014).

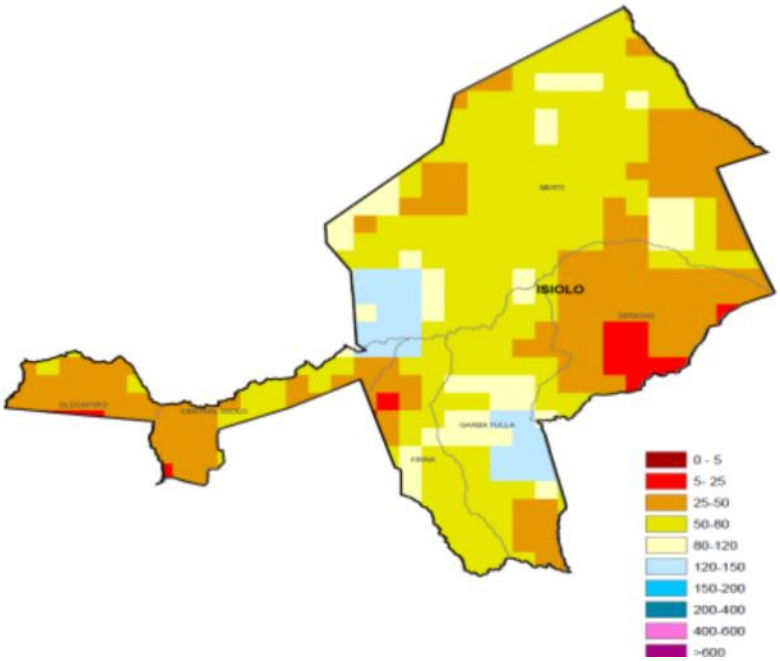


Figure 26 Percentage of the normal amount of short rains (KFSSG, 2014a).

When looking at the long and short rains of the various years in the following figure 27 a great variability is visible. In 1997 for example, during the El Niño phenomenon, the short rains peaked in November and the short rains in April. This might appear as a positive outcome in that year, however, that amount of rain means there is a high risk of floods. Ojwang, Agatsiva and Situma (2010) reported floods in the neighbouring county Laikipia and the Kenya Daily Nation reported about deadly casualties in Isiolo town (Reliefweb, 1997).

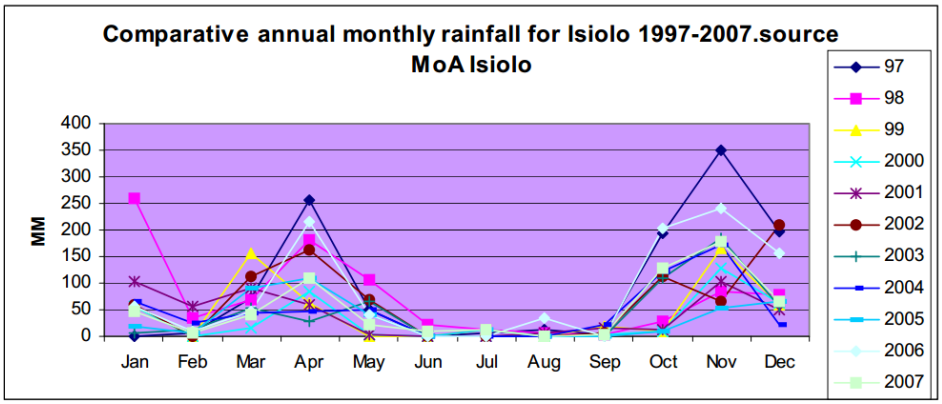


Figure 27: The comparative annual monthly rainfall for Isiolo for the years 1997-2007 (ADB & GoK, 2008).

We might conclude that since this 'seasonal climate' is accompanied with a great variability and unpredictability, the drought which occurs in the Isiolo Holding Ground should also be approached as contingent droughts. These two types of drought are not mutually exclusive which is also argued by Thornthwaite (1947) who states contingent drought may occur in the areas of seasonal droughts.

The year 2014, during which fieldwork was conducted, was a dry year. As shown in figure 28 the long rains started already in March, which is early. However the NDMA (2014) states that the rains ceased after 2 days and did not improve the environmental conditions in Isiolo County. During the full period of field work only one day some precipitation occurred. This was however, very little and is not included in figure 28. At the end of 2014, the short rains failed completely. The report of the NDMA (2013) also shows below average short rains for 2013. 2014 being a dry year as compared to the long term mean probably impacted upon the answers given by the respondents in the Isiolo Holding Ground.

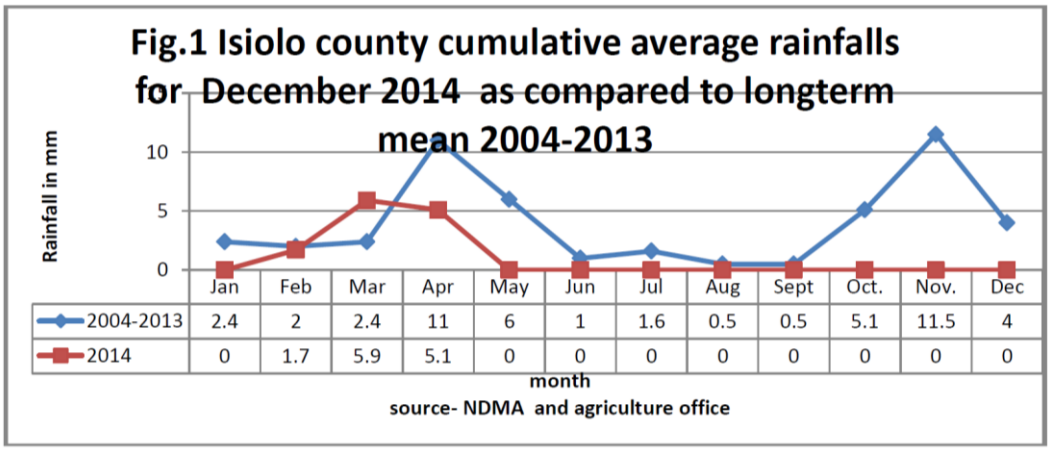


Figure 28: Average rainfalls 2014 compared to mean 2004-2013 (NDMA, EWS, 2014).

Besides the categorisation of Thornthwaite (1947), the four categories of drought distinguished by Wilhite and Glantz (1985) gives us also extra insight in the type of drought that can be found in the Isiolo Holding Ground. First of all the distinction between meteorological and hydrological drought is made. As explained in chapter 2, meteorological drought is mainly dryness of an area. One of the suggestions pointed out by the FAO (n.d) was to define a drought in dry lands as a meteorological drought if rainfall failed in two successive years. In a report by the United Nations Environment Programme (UNEP) and Government of Kenya (GoK) on the drought in Kenya in 2000, for example, it was stated that the "failure of the long rains in March 2000 was the fifth successive dry spells over a period of two years (UNEP & GoK, 2000, p. 11)." With reference to several rainfall graphs and maps shown in this section it can be argued there is a lot of variability in meteorological drought. As Figure 26 (KFSSG, 2014a) and Figure 27 showed, years of severe drought as well as years of extreme rainfall exist.

4.5.3 Hydrology

Besides Meteorological drought, Wilhite and Glantz (1985) distinguish hydrological drought. Since the study area is located within a river basin, hydrological data is essential. In Figure 29 the rivers which run through the Isiolo Holding Ground are visualised. In Chapter 5 it will become clear there are more pans or dams than the ones visualised in Figure 29. What is important at this point is to understand the hydrology of the area. An interesting point is, Mati et al. (2006) state the Ewaso Ng'iro is the only permanent river in the region. However, during field observation also other rivers seemed to have a permanent character. Besides, those permanent rivers, various Laghas (ephemeral streams) were visible in the area.

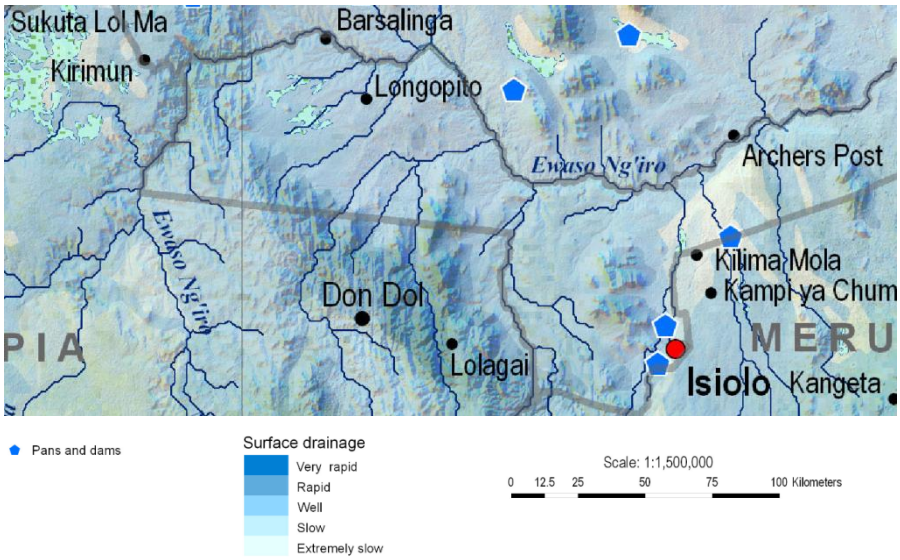


Figure 29: Rivers in the Isiolo Holding Ground. Excision from (Ericksen et al., 2011).

Between 1960 and 2010 the average volume of water of the Ewaso Ng'iro River that passes Archers Post, at the border with Samburu County, (situated North of Isiolo Town, as indicated on the map in Figure 29) is 0.67 km³ per year. Figure 30 shows the average monthly discharge of the river, based on monthly records between 1960 and 2010. Interestingly, the river is also characterised by a clear seasonal pattern following the periods of short and long rains).

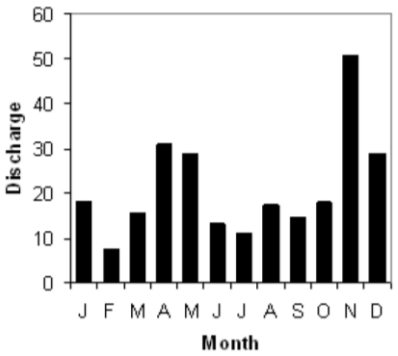


Figure 30: Average monthly discharge (m3.sec-1) of the Ewaso Ng'iro at Archer's Post (Ericksen et al., 2011).

Ericksen et al. (2011) compared the average monthly discharge of the river between 1970-2010, with the discharge of 1960-1979. They concluded that the discharge at Archers Post dropped from 24.1m³/s to 18.8m³/s due to abstractions upstream. As a result low water levels have become more common and have also resulted in a greater variability of the flow. This is also illustrated in Figure 31, before 1980 discharges below 1m³/s were uncommon, but ever since this has happened far more frequently.

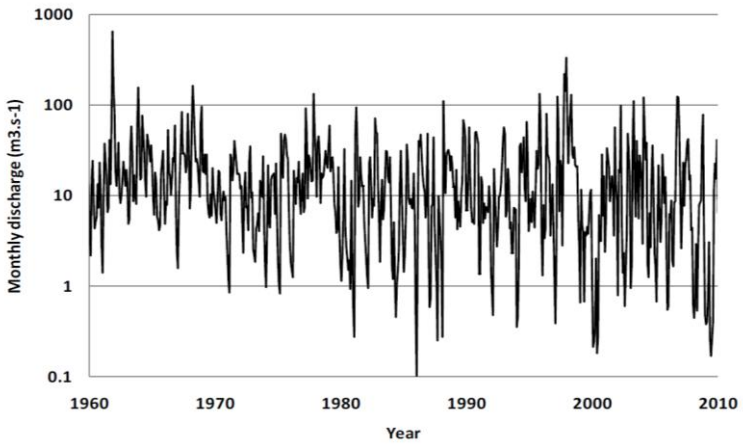


Figure 31:Variation in monthly discharge of the Ewaso Ng´iro at Archer´s Post 1960-2010 (Ericksen et al., 2011).

The effects of dry spells on the hydrology are clearly visible when looking at the variety in discharge of the Ewaso Ng'iro river. At times, the river flow is inadequate to supply established uses under a given water management system. The river simply runs dry in the lower parts around Merti and Habeswein (Ericksen et al, 2011). Therefore, it could be argued the area also deals with hydrological drought. However, the dry spells should be approached as a combination of both meteorological and hydrological drought. If rainfall fails a period of drought can be defined as meteorological drought. During these dry spells abstractions of rivers increases. As a result people, in particular those living further downstream, will experience hydrological drought since the discharge becomes inadequate to supply those areas. That abstractions increase in dry periods is justified by Ericksen et al. (2011) in Figure 32, which shows the permitted abstractions are higher during the years of drought (2000, 2001, 2008 and 2009) and lower in the years of rain (1998 and 2007). These permitted abstractions could be used for a variety of economic activities such as agriculture and pastoralism, but also for human consumption.

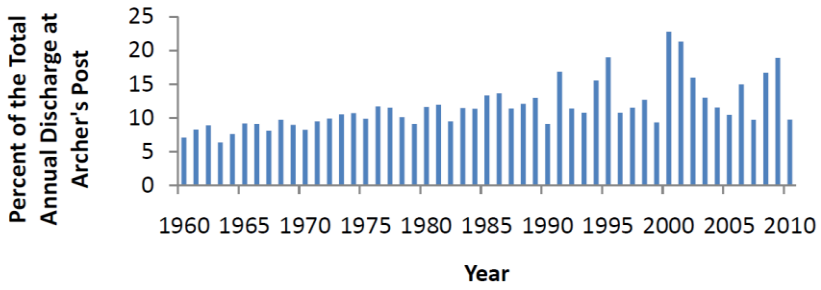


Figure 32: Permitted abstractions as a percentage of the total annual discharge at Archer's Post (Ericksen et al., 2011).

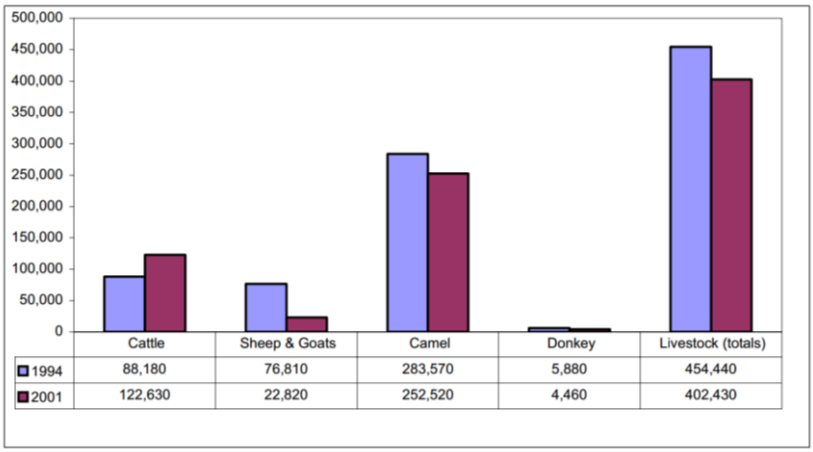
4.5.4 Socio-Economic, Agricultural and Pastoral drought.

The increasing demand in combination with a supply that does not increase, can eventually also leads to socio-economic drought. Figure 32 shows the increase of demand of water from the river when there is a lack of rainfall. On top of that, the demand might also increase if populations or the number of large scale agricultural enterprises grows. Abstractions for irrigation in Laikipia have an impact on the discharge of the river downstream. It can be concluded that the decline of the river flow (which lead to hydrological drought) has not exclusively natural causes and, therefore, this can partly also be categorised as socio-economic drought. An interesting point is that the demand upstream does not necessarily lead to socio-economic drought in the upstream areas itself, but that it might lead to socio-economic drought in the lowland areas where the supply of river water decreases.

Besides hydrological and meteorological drought, Wilhite and Glantz (1985) distinguish the category of agricultural drought, complemented by the FAO (n.d.) with pastoral drought. Since the sample population of this study consists of (agro) pastoralists, there is no need to go further into the agricultural drought in the Isiolo Holding Ground. Instead, it is more useful to see if pastoral drought occurs in the Isiolo Holding Ground. It could also be argued the Isiolo Holding Ground deals with pastoral drought. When it functioned well, the LMD used to buy the weak animals from the pastoralists, but with the corruption and mismanagement in the LMD the socio-economic impact of droughts increased.

As already stated in Chapter 2 pastoral drought will not really occur if pastoralists are able to move from dry places to places with enough rainfall. This has also been shown by the argumentation of Dyson-Hudson and Dyson-Hudson (1999) which stated that the way of living of pastoralists is flexible and well adapted to those unpredictable and variable climates. Still pastoralists are experiencing difficulties when they, for example, for a long time relied on the security the LMD provided and later ceased to exist. A severe drought such as the one in 2000 has devastating consequences for the livestock, and thus on the livelihood of pastoralists. Figure 33 shows how the

number of livestock decreased due to the drought in 2000, the total number of livestock in Isiolo decreased 11.4%.



	Cattle	Sheep & Goats	Camel	Donkey	Livestock (totals)
1994	88,180	76,810	283,570	5,880	454,440
2001	122,630	22,820	252,520	4,460	402,430

Figure 33: Livestock population in Isiolo in 1994 and 2001. (UNEP & GoK, 2000).

This subsection discussed the various types of drought the Isiolo Holding Ground has to deal with. When using the classification of Thorntwaite (1947), the droughts occurring can be categorised as seasonal and contingent. It took more effort to determine the types of drought according to the classification of Wilhite and Glantz (1985). It can be stated the drought in the Isiolo Holding ground is a combination of meteorological hydrological, socio-economic, and pastoral drought.

It also can be concluded the various types in this classification cannot be approached in isolation from each other. For example, pastoral drought cannot be approached in isolation of meteorological and hydrological drought, instead it brings in the socio-economic aspects which impacts the outcome of a dry spell is experienced. We have seen the functioning of the management in the area affects how a drought is experienced, whether it is metrological or hydrological.

This chapter elaborated on a variety of aspects of the Isiolo Holding Ground. It started by a brief outline of the history of the Isiolo Holding Ground and it has shown the complexity of its history and the various communities who make use of the area and claim land in Isiolo County. In particular it has focused on the Ndorobo community in the Isiolo Holding Ground. The Isiolo Holding Ground has also been described from an economic perspective. This chapter concluded with a section on the (combination) of droughts categories which occur in the Isiolo Holding ground. Chapter 5 will completely focus on water scarcity in the area.

5 Water scarcity in the Isiolo Holding Ground

In chapter 4, it became clear that the climate in Isiolo Holding Ground is characterised by bimodal rainfall and contingent and seasonal drought. Earlier, in Chapter 2, the method to measure water scarcity has been set. The Water Poverty Index (WPI) has been introduced by Sullivan et al. (2003) and has been developed further by Garriga and Foguet (2010). Based on the model developed by these authors a model to measure the WPI in the Isiolo Holding Ground has been introduced in Chapter 2. In each section, starting from section 5.1, the five sub indices of the WPI: '*Resources', 'Access', 'Capacity', 'Use' and 'Environment'* will be measured. This results in a WPI for all studied communities and location in the Isiolo Holding Ground, however, it is mainly based on the Ndorobo community, since this community is most represented in the dataset. . The purpose of this chapter is to determine the degree of impact on the migration we should remember pasture is the key resource for pastoralists and that water has to be available in the vicinity of that key resource. Water (scarcity) is related to pasture, and it should always be approached in the availability of pasture.

5.1 WPI: Resources

The first sub index to measure is *'Resources', w*hich consists of seven indicators. This section will elaborate on these indicators to determine a score that will be measured of the presented data resulting from both conducted fieldwork and secondary data.

5.1.1 The availability and quality of water

The first set of indicators used to measure the component '*Resources*' are the availability of and quality of water as experienced by the respondents in the Isiolo Holding Ground. Both indicators were included in the surveys and were divided in water meant for human consumption and for economic purposes, in most cases the economic purpose is livestock keeping. The river is the most important source for watering livestock for 88.2% of the respondents. For human consumption it stands at 63.8%. The other key resource used for human consumption is a pipeline water tap, this goes for 23.4% of the respondents.

Most striking is that most respondents state they do not experience a lack of water. Instead, the majority of the respondents say they have more than enough water available for their human consumption and economic activities. Out of all respondents, 50.6% gave 'the availability of water for human consumption' a score of 5, which means they find it 'sufficient', for economic purposes, 48.7% gave a score of 5 as well. For human consumption the mean score is 4.30, so between

'somewhat sufficient' and 'sufficient'. For water for economic purposes this mean is 4.24, which does not differentiate much from the availability for human consumption.

Besides the availability, the quality of the water for human consumption is perceived as good, with a mean of 3.95 for household consumption. Economic purposes, with a high mean score of 4.50 is perceived as very good. Despite this high mean, not all respondent think the quality of water is good, 20% experiences the water quality for human consumption as neither good, nor bad. From the respondents, 9.3% thinks the water is of a bad quality for various reasons. Some state the water is of bad quality due to diseases, other state the bad quality is the result of livestock using the same water or because irrigation pumps are polluting the water. One of the respondents (Respondent 44) states the problem is that there is no alternative for the polluted river water. This is also supported by the fact that most of the households only use the river for both human consumption and livestock keeping. What is interesting is that not all people point out the problem of diseases, since most of them use the same rivers in the area. This could mean those people are not aware of those diseases or does not perceive it a negative issue.

Most of the respondents stated that the availability of water for both human consumption and economic purposes remained the same over the last 10 years (a score of 3). For livestock purposes we can see a light decrease of water availability (2.96), but this does not differentiate much from water for human consumption. Most respondents indicated the trend with a score of 3, some of them referred to the water being seasonal. Although the majority of respondents says the availability of water is enough, or good, half of the respondents still gives reasons for water scarcity they experience. Perhaps they do not experience drought at this particular moment, but the answers they give also suggest they are experiencing drought throughout the year, and they give reasons for the water scarcity. They indicate they experience drought because of the seasonality, but also because of an increase of the livestock population and the increase of water use in upstream areas and due to less rainfall

From the fieldwork notes it appears as if water is one of the main reasons to migrate. At the same time we have seen that the survey respondents mostly stated that water is available in sufficient to good quantities and the quality is good. This might be explained by the fact that pastoralists aim to apply a highly flexible herd management. If fodder and water is non-available, pastoralists will move to the location where it is still available. This corresponds with the idea that pastoral drought would not exist if pastoralists are free to move to places without drought. Therefore it could be a logical explanation water scarcity for pastoralists is not caused by the lack of resources, since they will adapt to the variety in the availability of water. On the other hand, agriculturalists

which are more permanently settled in a specific location will have more problems when resources become scarce in that place.

Despite the fact the river is the most important water source for the major part of the respondents, other water sources such as boreholes and piped water scheme should be taken into account as well. The Northern Water Service Board (NWSB) published a report based on the Water Point Mapping project (led by the Ministry of Environment, Water and Natural Resources (MEWNR), SNV-Netherlands and TWAWEZA) (NWSB, 2013). The indicators which are not featured in the survey are based on this secondary data. The NWSB (2013) reported on whether the water availability from these sources is enough for both households and livestock production. Only 27.5% confirmed it was enough for human consumption and livestock. This seems contradictory with the outcome of this study, but it is not necessarily in contrast since the data from the NWSB did not include water from the rivers. Therefore, the difference could be explained by the fact the river is most important for the respondents and they perceive the availability from this source as sufficient. Besides, the fact that the respondents barely use water from a borehole might be related to the fact that water at boreholes is insufficient. If they leave the boreholes out of account and only use river water, this could explain their statements about the sufficiency of water resources,

Besides, the NWSB also collected data on the water quality from the various water points. 77% of the water points in the Isiolo Holding Ground are improved sources. Furthermore, almost half of the water sources are tested as unsafe. This is not about the perception of the users, but the result from tests on the quality of the water. The map in Figure 34 visualised the quality of the improved water sources in Isiolo County, only the ones located in the Isiolo Holding Ground have been taken into account in this analysis and the analysis that will be described further in this section.

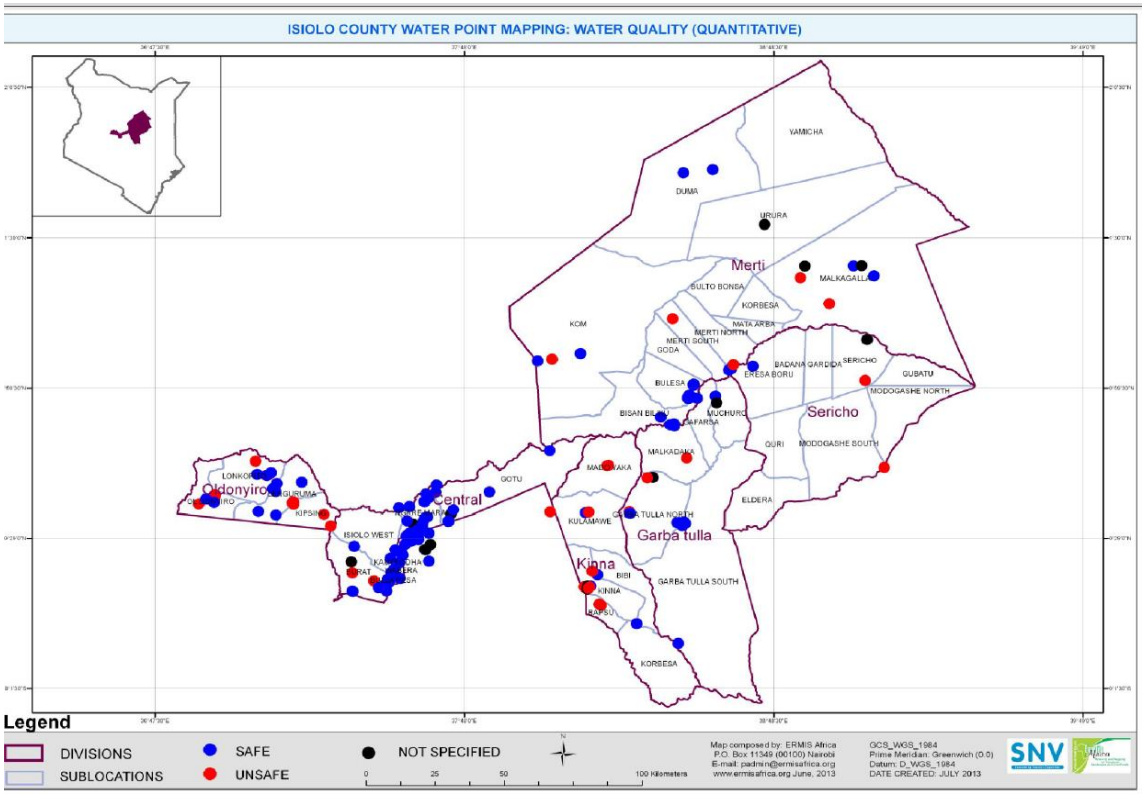


Figure 34: The quantitative water quality of improved Water Points in the Isiolo County (NWSB, 2013).

5.1.2 The reliability and seasonal variability of water supply

Another indicator is the reliability of water source and can be measured by analysing the time it is not operational. According to the NWSB (2013) a water source is considered reliable when its downtime is less than seven days a month. Figure 38 shows the reliability of water points as collected by the NSWB in the Isiolo Holding Ground. The percentage of people claiming good availability is more or less as big as those claiming it is insufficient. When translating this to the indicator of Garriga and Foguet (2010) about the reliability of the water points, 57% of the water points have a downtime of less than 7 days a month.

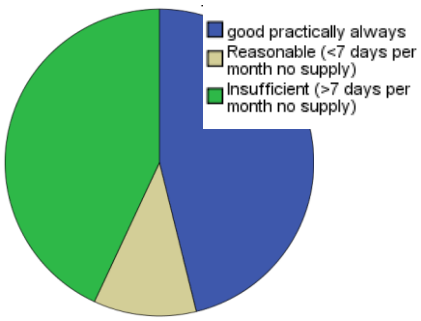


Figure 35: The reliability of Water Points (NWSB,.2013).

Besides the reliability, the seasonal variability of water resources has been measured by the NSWB (2013). However, the seasonal function does not necessarily mean a water point is not functioning at all, as it has already been argued the opening or closing of boreholes can also be used as strategy to guide pastoralists and preserve grasses in a certain area. For the Isiolo Holding Ground User Association this is an important instrument and they will only

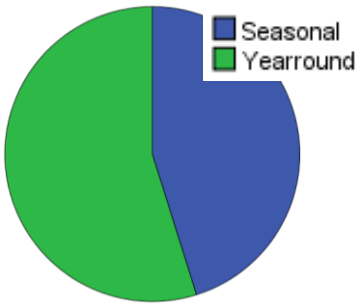


Figure 36: The seasonal variability of Water Points (NWSB, 2013).

close a borehole when they know there is enough water available at another water source, so here the question arises if this is a fair criterion for a well-functioning water point. In the Isiolo Holding Ground 55% of the water points provide water year round. Since it is not known how many months they provide water and half of the water points are providing water year round the indicator 'seasonal variability' will be classified as 'acceptable'.

So, when the collected data from the field study the water quantity and quality in the Isiolo Holding Ground was analysed, the results were positive. However, when these results were combined with data from the NWSB (2013) this opinion should be nuanced a bit. In contrast with the respondents, the data from the NSWB points out the water quantity in the area is insufficient and besides, a large part of the water points is unsafe. Table 5 shows the scores on the various indicators for the component resources. The total score for this sub index is 0.61 with various scores varying from fair to risky.

WPI for sub index 'Resources'					
		Levels and scores			
WPI Component	Indicator	Fair	Acceptable	Poor	Risky
Resources	Water Quantity Sufficiency (other water sources)	Always sufficient	For human and livestock	Only for Human	**Not sufficient for human**
	Water Quantity respondents (rivers)	**X**			
	Water Quality (according to respondents)		**X**		
	Percentage of water sources which is improved			0.77	
	Percentage of water sources tested safe			0.55	
	Reliability of supply (% of water points not operational for less than 7 days)			0.57	
	Seasonal variability of water resources (months per year with water)	11-12	**9-10**	7-8	<7
	Total	0.61			

Table 5: Based on data from the NSWB (2013) and on conducted surveys during fieldwork in 2014.

5.2 Access

The second component of the WPI is *'Access',* the indicators which measure this component, include the access to water for human and for economic use and also the distance they need to cover to reach a water source. Besides, the operational status of the water points and the waiting time at a water point will be taken into account. Other access related indicators are the access to improved sanitation and the percentage of the households who have access to piped water supply.

5.2.1 Access to improved sanitation

The situation of sanitation is characterised by spatial inequality between urban and rural areas within Isiolo County. The map in Figure 37 shows that in Burat 63% of the population has unimproved sanitation, in Oldonyrio this is even 98%. This means 82% of the population in the Isiolo Holding Ground is using unimproved sanitation. When comparing this to the average in rural Kenya (47%) or county(60%) level the percentage of people using unimproved sanitation (the bush) are significantly higher, especially in Oldonyrio (KNBS & SID, 2013). So the percentage of household with access to improved sanitation is 17%.

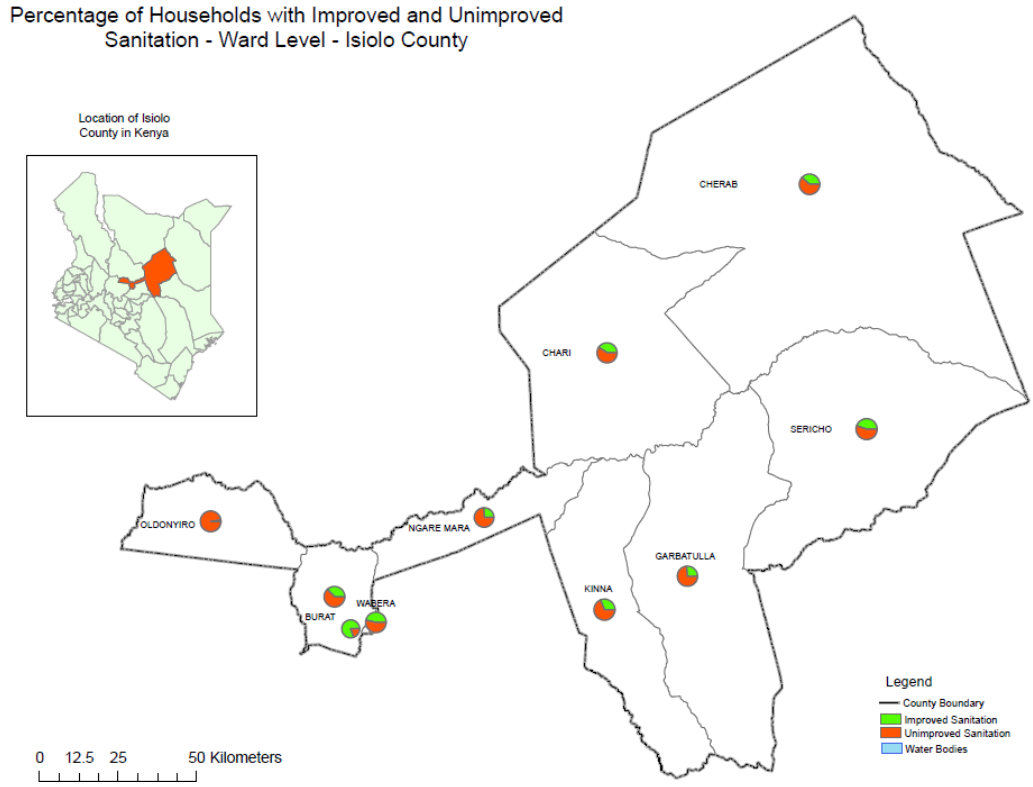


Figure 37: Percentage of households with improved sanitation in Isiolo County (KNBS & SID, 2013).

5.2.2 Piped water supply and distance to water sources

25 % of the respondents in the study area make use of piped water and the majority of them live in Leparua. 85% of the respondents who are using piped water state the quality of water for human consumption is very good. Another 15% indicates the quality as good. In Leparua, there is a water

tank which is owned by the neighbouring Lewa Conservancy. The water is originating from a spring which streams into a water tank and subsequently transported further through a pipeline to the end users. Because of this pipeline, a large part of the respondents from Leparua (25%) state to use this water source. Besides, the water in the cattle trough in Leparua is originating from the same tank.

The component '*Resources*' has shown that river is the most important water source for the majority of the respondents. None of the respondents claimed that access to water is blocked, when they want to make use of a water source. But the component '*Access*' also takes into account the distance needed to cover to reach the water sources. The survey established that that the mean distance to the river is 1.4 km. The maps in Figure 38 might explain why the majority of the people in the Isiolo Holding Ground mostly use the river for both human consumption of water and for economic purposes. They show that for most respondents the permanent rivers are closer than the boreholes, wells or springs.

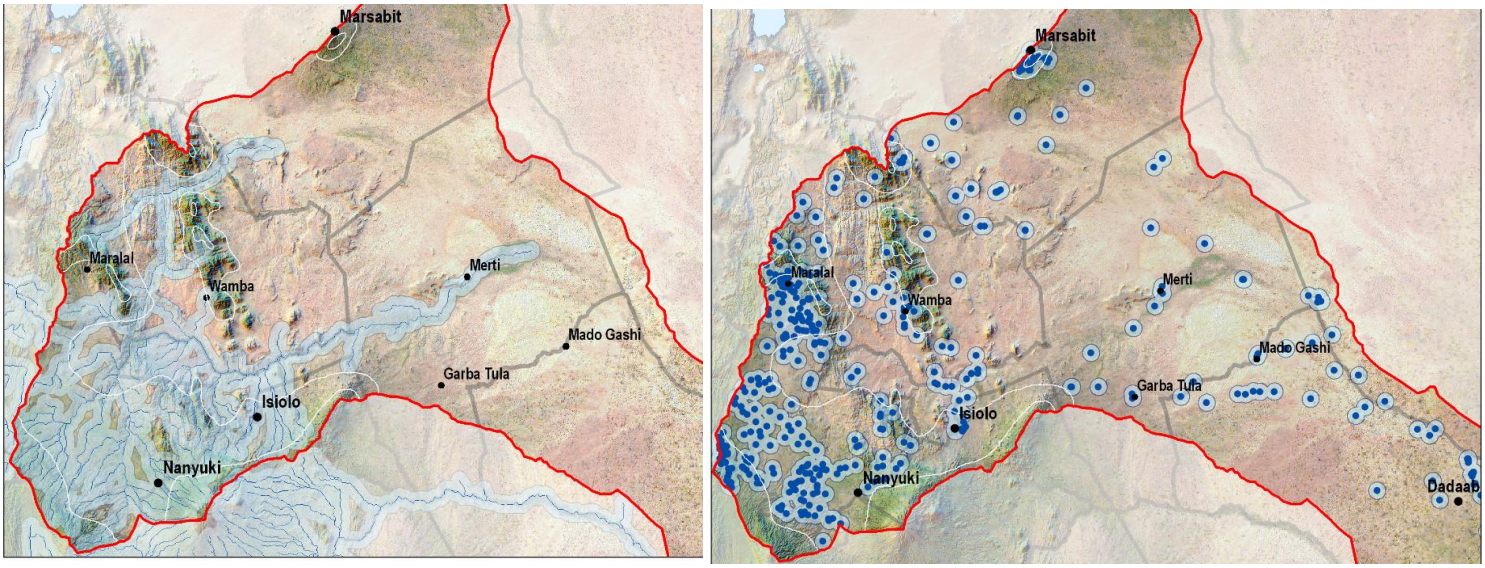


Figure 38: Left: 5 km distance from permanent rivers. Right: 5 km distance from boreholes, wells and springs (Ericksen et al., 2011).

The information collected during fieldwork revealed that for the households interviewed, the average distance to a water source is 1.9km, which is relatively low for Isiolo County. Mati et al. (2006) states that during dry seasons, only 7% of Isiolo County have access within a radius of 5 km. The short distance to the water source respondents indicated can possibly be explained by the fact that most respondents in the Isiolo Holding Ground were located close to a river. With a mean of 1.0 km the Ndorobo people in Leparua and Ngare Sirgon in particular were, relatively close to a water source, compared to the other communities interviewed (with an average distance of 2.4 km). As a consequence this influences the access facet of water scarcity. Figure 38 shows that we can state that the Isiolo Holding Ground is well covered with permanent rivers. When going further East, or

downstream, the Ewaso Ng'iro River is the only permanent river available and access to water is therefore much more complicated.

5.2.3 Operational status of water source

Another indicator used to measure the access to water resources is the operational status of the water sources. Figure 39 illustrates the water sources and piped schemes available in the Isiolo County according to the NWSB (2013). The map clearly shows, compared to the rest of Isiolo County, the Isiolo Holding Ground has a relatively high number of boreholes. This might indicate a good access to water. However, there are various issues which could question this apparent favourable situation.

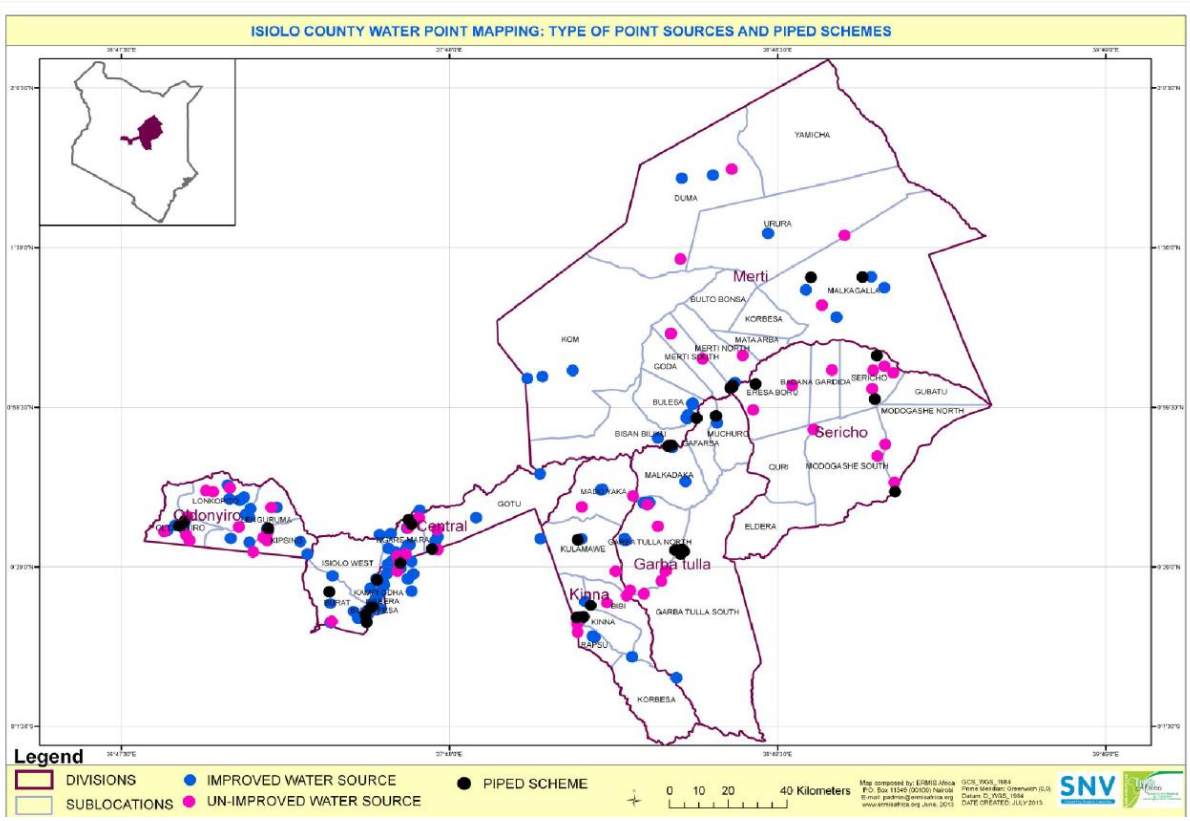


Figure 39: Distribution of mapped water sources in Isiolo County (NWSB, 2013).

First of all only 50% of the water sources in the Isiolo Holding Ground is functional and in use. The other half is either not functional at all, or functional and in bad shape or not in use. Besides, there are some indications that the functioning and managing of the water sources is not always flawless. This problem can be illustrated by the issues with the BuratII borehole (also called the Biliqo borehole). On the 11th of June 2014 we visited the borehole and found it was not running. The day before the people employed to maintain it, had run away with the money and some fuel meant for the pump. They had received the payments from the pastoralists who make use of the borehole. Normally they bring this money to the office in town so that the boreholes can be maintained.

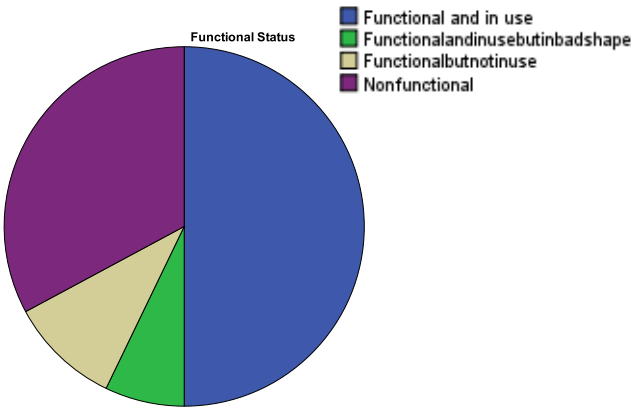


Figure 40: Functional status of the Water sources in the Isiolo Holding Ground (NSWB, 2013).

According to the data from the Water Point Mapping Project which were the report of the NWSB (2013) is partly based on, the Biliqo borehole in Burat has been coping with problems from the day it was meant to start running. It was vandalised when it was still very new. The data claims that the borehole has not been functioning since its construction in 2011. In 2014, when fieldwork was conducted for this study, the borehole was functioning, though except for those days when the employees stole the money and left. This case shows the consequence when a water source is not lost, but it also illustrates the flexibility of the pastoralists. The Samburu pastoralists were lucky that the BuratII/Biligo borehole was reopened and taken over by the Isiolo Holding Ground User Association on 12 June. Furthermore, it shows that, although the statistics in this study indicates rivers are more important water sources for the pastoralists, there also pastoralists who rely on a borehole such as the one in BuratII.

Mr. Haji who is working for the Isiolo Holding Ground Users Association describes the importance of good management practices of the boreholes since they have an important regulatory function. By opening or closing a borehole the association is able to direct the pastoralists to certain areas. If they close a borehole pastoralist will move away and the grass in that area will be preserved for the dry season. Normally they open the boreholes from June until September and from January until March, which are the dry season periods. This means that pastoralists cannot access the boreholes in the wet season. Providing water and regulating grazing are thus the main functions of the Isiolo Holding Ground Users Association. According to Haji a challenge they face is that they are not able to control all grazing areas, they can only regulate the grazing around boreholes.

According to the NWSB (2013) the pressure is between 601 and 800 people per water point in Burat. Burat has a total population of 8,590 people and a population density of 24.9 per km^2. By comparison, Isiolo West, with a population of 4,262 and a density of 10.7 per km^2 has to deal with a higher pressure on the water sources because of the low number of functional water sources in Isiolo West. Only five water sources are functioning well and in use. This explains the relatively high pressure on the water sources in Isiolo West, which is visualised in the map in Figure 41. The population data is based on the Census of 2009, but drawing conclusions based on this population data should happen carefully and with some nuances. It should be questioned whether to what extent this data is really representative for the actual population density during times of drought. In other words the people counted in 2009 in these areas might indeed reside here but during other periods of the year the area might be flooded with immigrant pastoralists.

Moreover, one need to realize that for those boreholes that are in operation some are functioning but are either in bad shape or not in use by the pastoralists. Besides, the functioning of the water points the NWSB (2013) also reported on the waiting time at those water points. The waiting time is not so much depended on the human population but on livestock numbers. At 54.3% of the water points this is more than 60 minutes. According to Garriga and Foguet (2010) this should be scored as 'poor'.

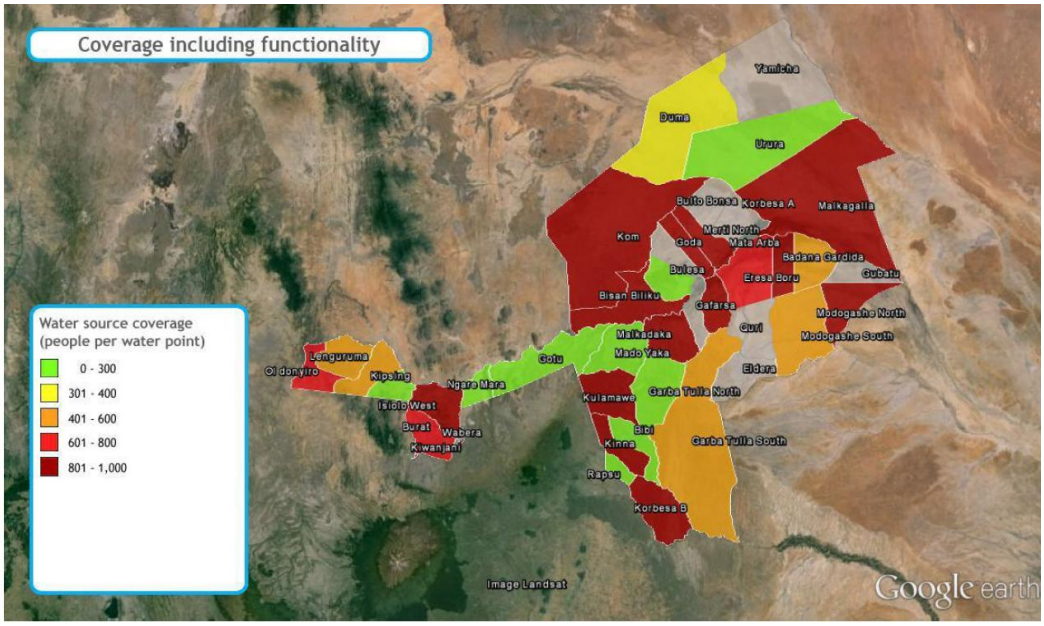


Figure 3.1.4Sub-location water point coverage (including functionality)

Note: The areas coloured grey represents sub-locations that have coverage of more than 1000 persons per functional improved water point which falls outside the ranges programmed into the water point mapper.

Figure 41: People per water point per sub location (NSWB, 2013).

5.2.4 Water coverage of water points

The NWBS (2013) used the criteria of Water Aid to measure the Water source coverage by dividing the total population (Population Census 2009) of a sub location by the total number of people served by the water sources in that area which were functioning well. So this indicator included the population in the area with the indicators already measured earlier. The water source coverage is measured by four different criteria, which are also included in measuring the WPI. It combines the functionally, reliability, seasonal variability and waiting time. The NWBS states that, unfortunately there data concerning the number of people served a water source was not that accurate since it was based on the respondents from their survey and not in documentations from the boreholes.

The table in Table 6 shows the results when the criteria are applied on the various sub locations of the Isiolo Holding Ground. The water coverage in Isiolo West is high, this is explained by the fact that despite the relatively low number of water sources, a high number of people are served by the water sources. Besides, the part of water points which are functional and in use in Isiolo West is higher than in other sub locations (71.4%). Striking is the fact that the data of the NWSB (2013) for Lenguruma and Lonkopito shows no people are served by the water sources in those sub locations. Whether this is an error in the data or this is actually is the status of the water sources, is unclear. The table in Table 7 shows a similar table as the one in Table 6. The only difference is the condition which was made on the year-round availability is left out, for the reason this is used as strategy to guide pastoralists away from areas which should be preserved for dry periods. This leads to an adjusted water coverage for the Isiolo Holding Ground with an average water coverage of 10%.

Water coverage in the Isiolo Holding Ground (Including criteria Year-round availability)			
Sub Location	**Total population**	**People served by water source**	**Water coverage (%)**
Burat	8590	1050	12,22
Isiolo West	4262	1490	34,96
Kipsing	3407	40	1,17
Lenguruma	2153	0	0,00
Lonkopito	2856	0	0,00
Oldonyiro	6972	200	2,87

Table 6: Based on NSWB (2013).

Water coverage in the Isiolo Holding Ground (excluding criteria Year-round availability)			
Sub Location	**Total population**	**People served by water source**	**Water coverage (%)**
Burat	8590	1050	12,22
Isiolo West	4262	1490	34,96
Kipsing	3407	160	4,70
Lenguruma	2153	52	2,42
Lonkopito	2856	70	2,45
Oldonyiro	6972	200	2,87

Table 7: Based on NSWB (2013).

This data from the NSWB(2013) which is used to measure the water coverage in the various sub locations of the Isiolo Holding Ground, does not include the river as water source. Again, it is important to note the river is a more important source according to the collected data in the Isiolo Holding Ground. The results shown in Table 6 and 7 suggest that, a large majority of the population in the Isiolo Holding Ground do not have access to water. Although it is important to consider the access to well functional water sources, the access to a water sources in general might be sufficient because the well accessible rivers. This means that both the water coverage (of well functional water sources) and the access to river should be taken into account in determine the score for the WPI component *'Access'.* As a result table 8 shows the scores for the various indicators for the sub index *´Access'* and the total score of 0.34. The table shows that, except for the 'one way distance to water sources', all scores are scored below 0.5, in the category poor or risky.

WPI for sub index 'Access'					
		Levels and scores			
WPI Component	Indicator	Fair	Acceptable	Poor	Risky
Access	Percentage of people having access to piped water supply			0.25	
	Access to improved sanitation			0.17	
	one way distance to water sources (km)	<1	**1-2**	2-5	>5
	Operational status of water source.			0.5	
	Waiting time (min)	<30	30-60	**60-120**	>120
	water coverage of water points			0.1	
	Total	0.34			

Table 8: Based on data from the NSWB (2013) and on conducted surveys during fieldwork in 2014.

5.3 Capacity

According to Sullivan, Meigh and Lawrence (2006), the component *'Capacity'* indicates the 'level of human and financial capacity to manage the system for region i,' which in this case is the Isiolo Holding Ground. Even though, it has been argued the HDI will not be included as indicator for the sub index '*Capacity',* it still might tell us something about the capacity of the Isiolo Holding Ground. Figure 42 shows Isiolo County has a relatively high HDI compared to the other counties and to the national average. To get a more specific image about the *'Capacity'* in the Isiolo Holding Ground, the following sections will elaborate on both the financial and human capacity. At the same time, these sections elaborate on general characteristics. It has been chosen to introduce these comprehensively in this part instead of in Chapter 1, for the reason it fits in the structure of analysing the various WPI components.

District	Type	HDI 1999	HDI 2003	HDI 2005	HPI 2005
Turkana	Arid	0.2455	0.198	0.172	36.2
Wajir	Arid	0.2593	0.346	0.256	n/a
Garissa	Arid	0.3427	0.441	0.267	n/a
Tana River	Arid	0.3780	0.382	0.307	36.1
Mandera	Arid	0.3246	0.427	0.310	n/a
West Pokot	Semi-arid	0.3350	0.241	0.334	n/a
Samburu	Arid	0.2982	0.256	0.347	41.8
Kajiado	Semi-arid	n/a	0.468	0.348	38.6
Marsabit	Arid	0.2890	0.195	0.411	42.3
Narok	Semi-arid	0.4462	n/a	0.502	40.1
Isiolo	Arid	0.4245	0.522	0.580	36.6
Transmara	Semi-arid	n/a	n/a	0.582	39.8
Laikipia	Semi-arid	0.5415	0.536	0.585	n/a
Moyale	Arid	n/a	n/a	0.674	n/a
Baringo	Arid	0.5062	0.508	n/a	n/a
National average		**0.5035**	**0.550**	**0.532**	**42.3**

Figure 42: Human Development Indices and Human Poverty Indices for pastoralists areas in Kenya (Humanitarian Policy Group, 2010).

5.3.1 Wealth equivalent to ownership of durable items

The indicator 'Wealth equivalent to ownership of durable items', measures the financial capacity of a household. In chapter 4 the ownership of commercial and residential plots was already given. This chapter will start by discussing the ownership of durable items in more detail. During the field work, the respondents were asked about assets ownership, so whether they have a: brick house, iron sheet roofing, car, motorbike, bicycle donkey cart, TV, Radio, mobile telephone, biogas, solar energy, electricity line and bank account. If a household owns all of the 13 items a score of 13 will be assigned. On the other hand if a household owns none of these items a score of 0 will be assigned. For the sample population 3.1 is the mean score. This means the average household own 24%, or 3 out of 13 of these durable items. The majority of the respondents own a mobile phone (81.7%), a house with iron sheet roofing (58.3%) and a radio (57.3%). The fact 58.3% of the respondents has iron sheet roofing, means that the other 41.7% uses either grass or other material as roofing. Besides the data collected during fieldwork, data is also available from a report published by the KNBS and SID (2013) which presents information on, for example, the building material which is used for their houses. This report shows that the main roofing material in Burat is iron sheet (62, 3 per cent). This corresponds with the collected data; 25% of the population in Burat is using grass as roofing material. When these percentages are compared to county level, this is almost the same. But when the part of the population which has iron sheet roofing is compared to the national level of 73.5%, this is lower in Burat. On the other hand the part using grass as roofing is higher than the national level of 13.3%.

5.3.2 Herd size and milk production

The next indicator, which also indicates the financial capacity of households to manage their economy, is the number of animals. This is probably more important than the ownership of durable items, but also related to it.

The importance of livestock is illustrated by one of the respondent's states the goats he owns are the bank he has and he has not a 'real' ban account. When studying pastoralists, the kind of property that really matters is livestock. When observing the data collected during field work there are significant differences between the numbers of animals the respondents possess, it ranges from a minimum of 7 and a maximum of 1,420. However, the main occupation of the person with only 7 animals is farming. When excluding this respondent, the pastoralists with the lowest number of animals is a Turkana living in Maili Tano who says he owns 24 animals. He stated that keepings animals is his main source of income and farming is another source of income. However, farming is only another source of income if there is enough rain so he is able to produce enough for commercial purposes. The average total herd size of the respondents in the Isiolo Holding Ground is 189, but with a high standard deviation which indicates the high variation in herd size. If we look at the various categories of animals the average number of cattle is 52 for goats and sheep 129 and for camels only 1. This large difference in the number of animals is not the only what matters, probably more important is the composition of the herd. The pastoralist with a herd size of 1,420 states the number of cattle he owns is 150. In contrast a pastoralists with a total herd size of 500 animals, owns 300 cattle, which is the largest amount of all respondents.

The composition of the herd matters because this impacts the experience of water scarcity and, what is maybe more important for this study, migration decisions. Sheep, goats and camels are more resilient to drought than cattle, so it could be stated that a pastoralist who owns a herd only existing out of cattle will experience water scarcity differently than a herd consisting out of sheep, goats or camels.

Although difference can be found between the communities concerning the type of animals they keep, these difference are not significant. It can be stated that Ndorobos in the Isiolo Holding Ground generally do not keep camels (50 out of the 55 Ndorobo respondents do not keep camels). And, for example, camel milk is traditionally produced by groups such as the Somali, Turkana, Gabra and Rendille, in Isiolo Turkana communities also keep camels (Musinga, Kimenye and Kivolonzi, 2008). According to D. Muggi (personal communication, June 2014), some communities do not keep camels because of tradition. As a consequence drought strikes camels keepers differently than the ones who do not keep camels, because camels keep producing milk, while cattle and goats do not. Still, in this study no significant difference can be found between the numbers of those types which are kept.

Pastoralists with different herd sizes apply various strategies when concerning the location of their herd. The respondents with most animals often split their herd into various herds. Pastoralists, such as the one who owns 300 cattle, employ people to look after their cattle. They do not actually walk along with them the whole time, but they need to check on the animals which are dived into

different herd with different family members or employees, in particular when they are migrating. Chapter 6 will discuss these various strategies applied by pastoralists in more detail.

An important note is that during the interviews not all respondents seemed to tell the whole truth about the number of animals they possess. In some cases the total number of animals mentioned was not equal to the sum of the various animals. Perhaps they do not want to reveal all their property in a survey, which is understandable for a pastoralists whose property mainly exist out of livestock.

The livestock belonging to the households in the Isiolo holding Ground does not immediately reveal if it is sufficient to make a living. To measure the capacity of the livestock the respondents have been asked if the milk production is sufficient for household consumption. On a scale from not sufficient at all to extremely sufficient, the majority of the households state the milk production is somewhat sufficient (average score of 3.05, or 0.61 when it is converted to a score from 0 to 1). A related question was asked about whether the respondents sell their milk. Again, this is also related to the different seasons. Most respondents (80%) answered that they did not, which means this does not enlarges their financial capacity.

This shows the capacity of their herd is somewhat sufficient, but not sufficient enough that they are able to sell milk left over. No significant differences are found between Ndorobos and the other communities in the Isiolo Holding Ground.

5.3.3 Gini coefficient

An index which is part of the Human Development Index, is the Gini Coefficient. In Figure 43 a map of Isiolo County is shown with the various Wards. A Gini coefficient closer to 1 means the income inequality is higher than when the score is closer to 0. Burat has a Gini Coefficient between 0.24 and 0.35, the average of 0.295 will be used as a score for this indicator. The mean Gini Coefficient of Isiolo County is 0.431, which means Burat is a bit less unequal than average (KNBS & SID, 2013). Compared to Kenya, with a Gini Coefficient of 0.445, both Burat and Isiolo County income more equal distributed. At the same time the poverty rate of Isiolo County is 72.6%, while the national poverty rate is 47.2& (Commission on Allocation, 2011).

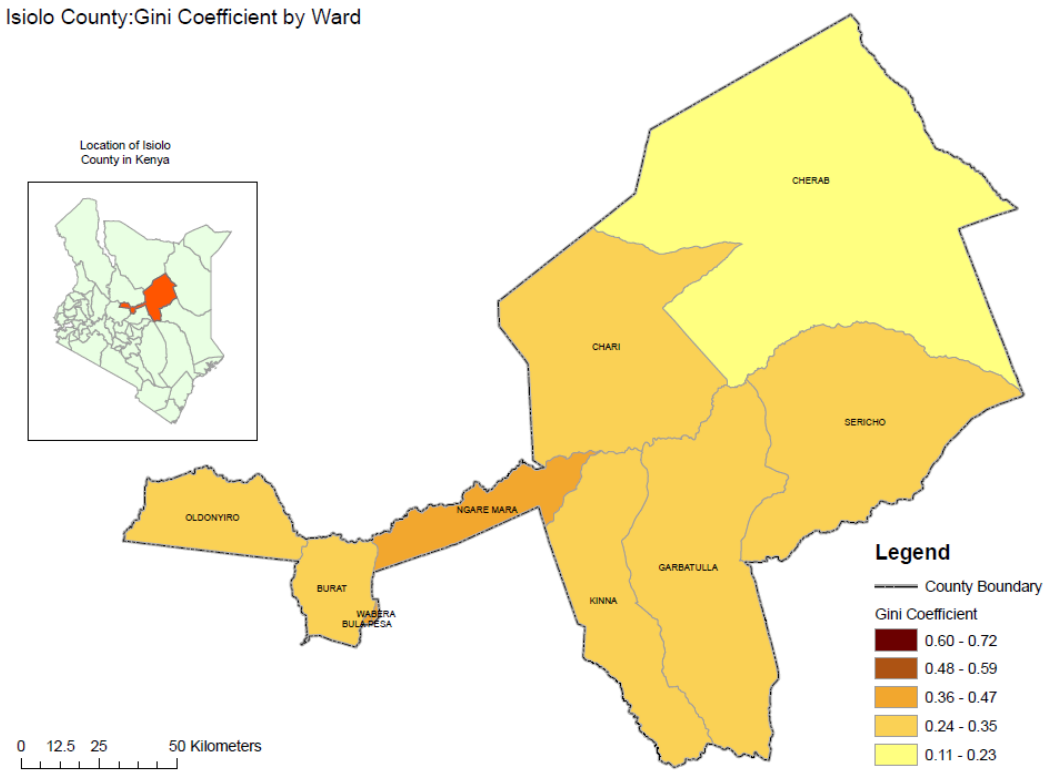


Figure 43: Gini coefficients in Isiolo County (KNBS and SID, 2013).

5.3.4 Educational level

Besides financial capacity, the human capacity is important for measuring the component *'Capacity'* of the WPI. 69.2% of the respondents never received any education. 30.6% went to primary or secondary school, but only 15.3% finished primary school. For both Ndorobos and other communities the percentage that did not go to school is the same. The percentage of Ndorobos that finished primary school (15.3%) is a bit higher than for other communities (7.7%). None of the respondents made it to college or university, only one respondents finished secondary school. The primary school endures 8 years, while secondary school endures 4 year. If we assign scores from the lowest education level (score zero) to the highest education level (score 12), it is possible to calculate a mean score for the education level in the Isiolo Holding Ground and for the various communities. The Isiolo Holding Ground has a mean score of 1.95 out of 12, which obviously might be explained by the fact that a majority did not receive any education. Some difference can be found between the education received by Ndorobos and the other communities. The Ndorobos have a mean score of 2.23, while the other communities have a score of 1.38, but this is not a significant difference. Besides this data which resulted from the surveys, the KNBS and SID (2013) also present data on education in their report.

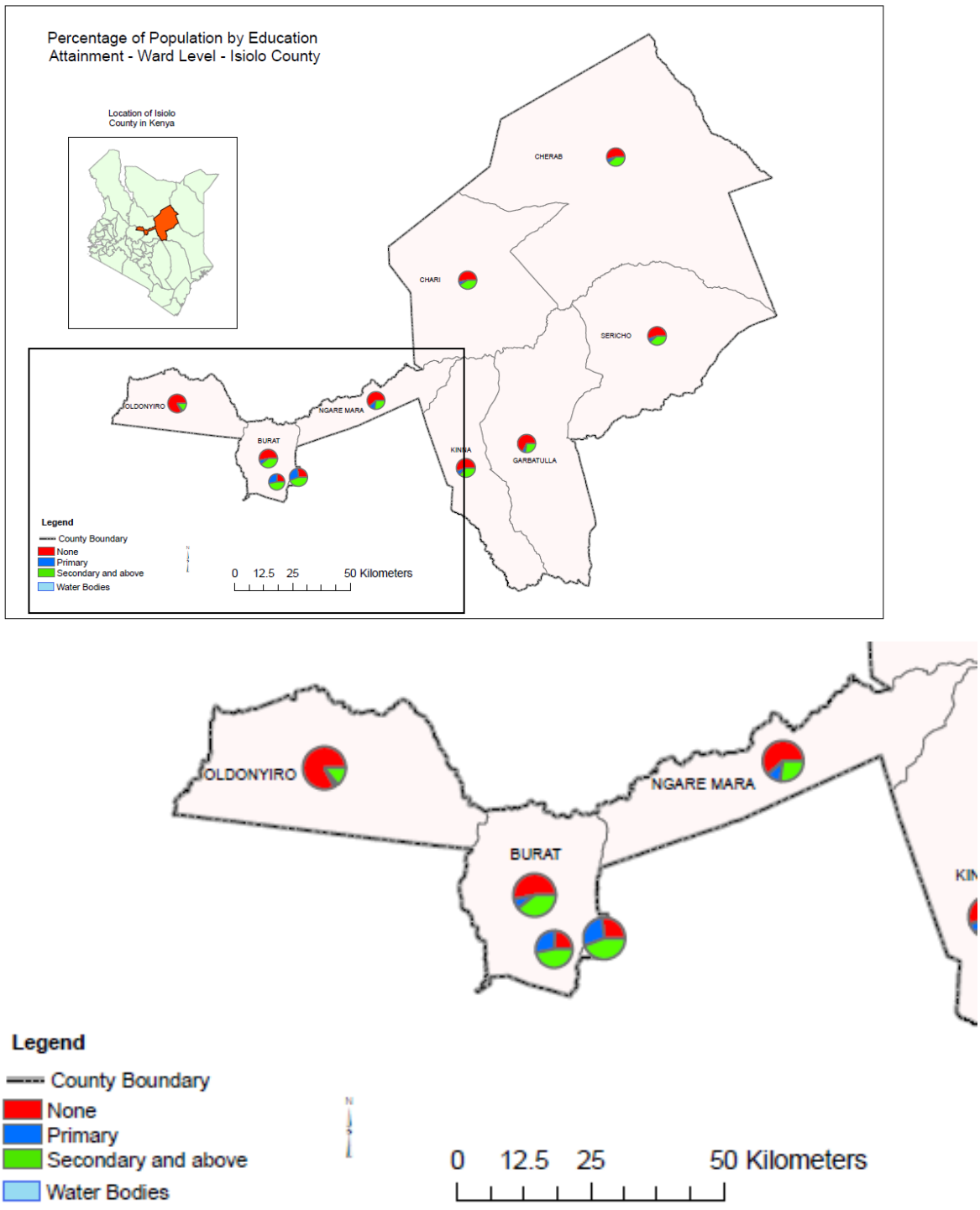


Figure 44: Isiolo County-Percentage of Population by Education attainment by Ward (KNBS and SID, 2013).

The map in Figure 44 also visualises that in the area of Burat, where most interviews were conducted, the majority did not receive any education. Oldonyiro, in the western part of the Isiolo Holding Ground, has relatively low numbers of people enrolled in primary or secondary school. This also shows the spatial inequality between urban and rural areas within Isiolo County. The Isiolo Holding Ground is rural and scores lower on education as part of the human capacity.

According to the Kenyan National Bureau of Statistics (KNBS) and the Society for International Development (SID) (2013), Isiolo is the most unequal county when looking at education. 51% of the county population does not receive education, while 49% does receive some. The high percentage on both sides indicates the gap between those groups and therefore there is a highly unequal situation. The Isiolo Holding Ground has a higher percentage (69% versus 51%) of people who did not receive any education than the average in Isiolo.

5.3.5 Familiarity with water users associations

Another indicator to measure the human capacity is by examining the familiarity with water users associations in the area. Water user associations in Kenya are called Water Resource Users Associations (WRUAs). These came in to being in the late 1990s to manage water related problems such as water abstraction among the different users. The function of the WRUA is to regulate this abstraction in order to ensure to all stakeholders access to water of sufficient quantity and quality Kiteme and Gikonyo, 2002). In Figure 45 areas are shown that fall under the jurisdiction of two WRUAS. The WRUA which has been outlined on the West side is the Ngare Nything WRUA, and the one on the East side the Ngare Ndare WRUA. The Ngare Nyting/Sirgon results from springs on the slopes of Mount Kenya (Ngare Nything Water Resource Users Association, 2009) and the Ngare Ndare from a spring in the Ngare Ndare forest.

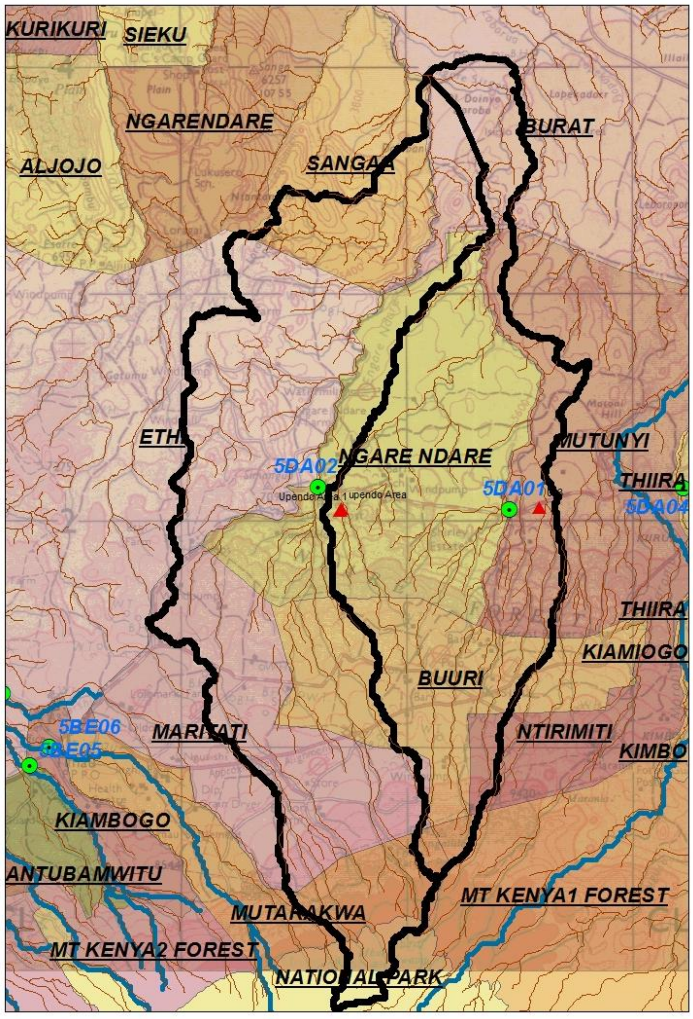


Figure 45: Ngare Ndare and Ngare Nything WRUAs (Unknown source).

Of all respondents only one indicates he had been active in a WRUA in the past. This person had acted as the vice-chair of the WRUA in NgareNdare, which is according to him not very active at the moment. That might also explain the rather low score among the respondents concerning the visibility of the WRUA. Some 65% of the respondents are not familiar at all with the WRUA, let alone

being a member of the association. From the 35% which is familiar with the WRUA, some of them are negative about it. A positive significant relation with can be found through a Chi-square test between whether a respondent is a Ndorobo and the familiarity with the WRUA operating in the area. According to the criteria of Cohen (1988, in Pallant, 2007) the relation between those variables is of medium effect. No significant relation could be found between the familiarity with WRUA and education.

5.3.6 Life expectancy at birth

In 2012, the life expectancy at birth in Kenya was 61 years. Compared to the global population's life expectancy at birth of 70 years this is a low expectancy. In Figure 46 is visualised that in the year 2010, the life expectancy at birth in Isiolo was just above the national average. Unfortunately no data could be found on the life expectancy at birth in Isiolo in 2012, which means data from 2010 will be used. The life expectancy index which results from the life expectancy of 56 years in Isiolo 2010, is (57-25)/(85/25) = 0.53

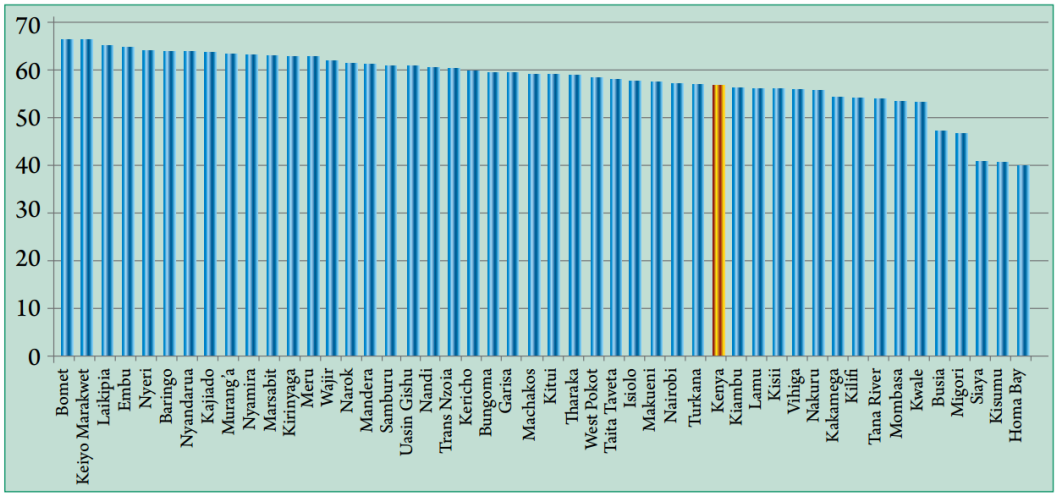


Figure 46: Life expectancy at birth in Kenya by county (Kippra, 2013).

Combining these various indicators results in a total score for the sub index 'Capacity'. Some of the data was only available on county level, which might have a negative effect on the outcome. Still this data is a valuable contribution, especially since there is also emphasis on indicators based on surveys in the study area. The total score for this sub index is 0.23, which from a scale from 0 to 1 can be categorised as a risky score. The overview of this component can be found on in table 9 on the next page. Every indicators of this component is scored as either poor or risky.

WPI for sub index 'Capacity'					
		Levels and scores			
WPI Component	**Indicator**	**Fair**	**Acceptable**	**Poor**	**Risky**
Capacity	Wealth equivalent to ownership of durable items			0.24	
	Herd size (based on 'enough for milk consumption')			**X**	
	Sell Milk (%)			0.27	
	Gini-coefficient			0.295	
	Educational level				**X**
	Membership in water users associations				**X**
	Life expectancy at birth.			0.53	
	Total	0.27			

Table 9: Based on data from the NSWB (2013) and conducted surveys during fieldwork in 2014.

5.4 Use

The fourth sub index of the WPI for a region is the component *'Use'.* This component is indicated by the level of water use by different sectors which contribute to the economy. The sectors which are distinguished are livestock production, agriculture, households and wildlife. The Water Resource Management Authority (WARMA), which is covers the various WRUAs in a water sub catchment, presents data on the water supply and demand in the region and therefore is a good basis for this component.

5.4.1 Domestic water demand: Urban and Rural

First of all WARMA (2013) a makes a distinction between urban and rural water demand. The urban water demand for domestic use comes from three towns in the region: Isiolo Town, Oldonyiro and Kipsing. Together, the demand a total of 4,577 m3 a day. The WARMA measured the rural water demand for domestic use for Isiolo (which included Central, West and East division), which was 466 m3 a day and an increase is expected in the years to come. But because Isiolo East, which includes Ngare Mara, is not part of the Isiolo Holding ground a closer look to the specific locations is necessary. Burat, which lies both in Central and West, is the only area that can be counted as a rural area. In Isiolo Central no rural population can be found according to the report. In Burat the population is 8,590 and the water demand is 381 m3 a day. In Oldonyiro the rural population is 5,009 and the water demand a day is 222 m3. For the Isiolo Holding Ground the total rural water demand is 603 m3 a day. Since the supply is sufficient to meet this demand, the domestic water rate could be categorised as fair.

5.4.2 Livestock water demand

The next sector which is demanding water is livestock production. Since livestock production is the major contribution to the livelihood of pastoralists this category is an important indicator to measure for the economic return of this water use. The water demand in Isiolo is 2,571 m3 a day, this number includes the area of Isiolo East which is not part of the Isiolo Holding Ground. When excluding Isiolo East and Ngare Mara and including Oldonyiro (858m3 a day) the total water demand for livestock is estimated to be 2,827 m3 a day. When comparing this with the water supply for livestock production, there is still a surplus.

5.4.3 Agricultural water Demand

Since most livelihoods in the Isiolo Holding Ground are mainly based on livestock keeping, agricultural water use is of less importance. Still this water demand should be taken into account.

The map in figure 47 shows the total area assigned to agriculture. It is very limited and concentrated around Isiolo Town. The map in figure 47 does not show any irrigated area but some irrigation did take place though in the Isiolo Holding Ground. During fieldwork irrigation was found in the area of Leparua and Engare Sirgon.

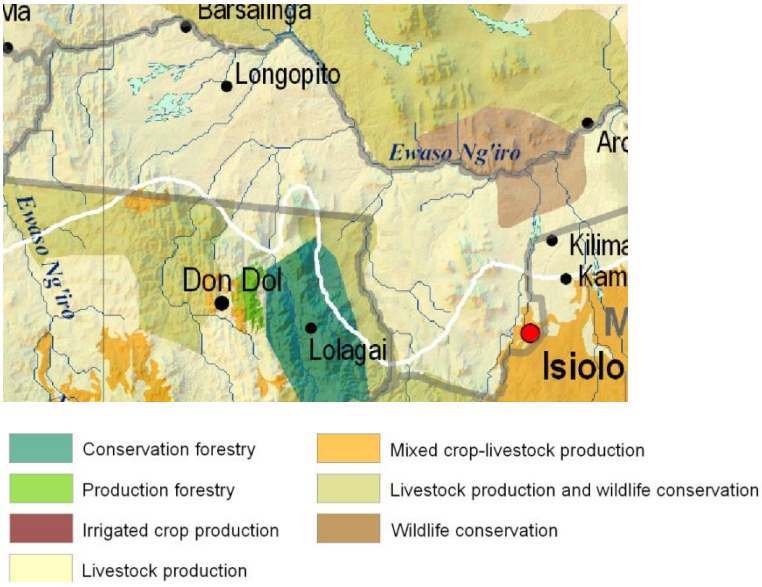


Figure 47: Land use in the Isiolo Holding Ground, excision of a map from Ericksen et al. (2011).

Also WARMA (2013) reports that in Burat a total area of 287ha has being irrigated and 100 ha for Oldonyiro. This is 57% of the total irrigable area in those two areas and the estimated water demand was 19,059 m3 per day.

5.4.4 Wildlife

The final category of water users in the area is wildlife. In Isiolo, wildlife is demanding 682 m3 a day, based on the wildlife in the conservations. But since the Isiolo Holding Ground mainly has to deal with the Lewa Game Reserve, bordering Leparua, this is the most important water user for the research area. This conservation demand 235m3 a day. When comparing the water demand for wildlife in Isiolo County with the water supply available, there is still a surplus. However, this surplus will decrease in the years to come (WARMA, 2013).

Table 10 shows an overview of all estimated water demands from the various sectors. While livestock is the most important economic sector in the Isiolo Holding Ground, it uses six times less water than irrigate the 387 ha of agricultural land.

Sector	Water demand in m3 a day
Domestic (Urban)	4577
Domestic (Rural)	603
Livestock	2827
Irrigation	19059
Industrial	0
Wildlife	253
Total	**27319**

Table 10: Total water demand in the Isiolo Holding Ground (WARMA, 2013).

5.4.5 Human-Human conflict

The final indicator measures whether there is conflict between groups of people when using water. 42.7% states there is no conflict and 42.7% experiences some conflict when using water. The reaming 2.7% states there is frequent conflict on this subject. Since the part of the population who state there is no conflict is 42.7%, a score of 0,427 will be assigned to this indicator on a scale where a score of 1 would represent no experienced conflict on water, and a score of 0 would mean everyone in the research area would experience conflict.

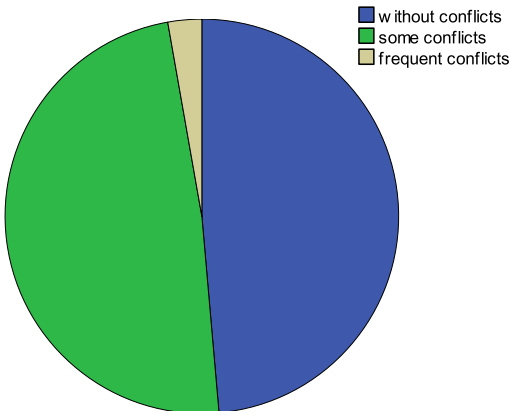


Figure 48: Human-Human conflicts when using water (Based on conducted surveys during fieldwork in 2014).

This sub section showed agriculture uses a lot of water for irrigation, compared to livestock. This while livestock production is the main source of income to many people inhabiting the Isiolo Holding Ground. The overview of this component can be found on in table 11 on the next page. It shows the only fair and acceptable scores have been assigned to the indicators on this component.

WPI for sub index 'Use'					
		Levels and scores			
WPI Component	**Indicator**	**Fair**	**Acceptable**	**Poor**	**Risky**
Use	Domestic water consumption rate (per capita)	X			
	Livestock water use (m3 per day)		**X**		
	Agricultural water use, expressed as the proportion of irrigated land to total cultivated land.			0.25	
	Wildlife water use		**X**		
	Conflict over water sources (human-human)			0.472	
	Total	0.61			

Table 11: Based on data from the NSWB (2013) and on conducted surveys during fieldwork in 2014.

5.5 Environment

This last section will elaborate on the component '*Environment'*. The most important environmental indicators for the WPI in pastoralist areas are the quality quantity of pastures and water. Since the quality and quantity of water has been sufficiently examined, this will be left out here. The quantity and quality of pastures, on the other hand, will need a closer evaluation, just as the grazing regulations and livestock loss as environmental indicators.

5.5.1 Quantity and quality of pastures

As argued in the theoretical framework, the quantity and quality of pastures is important since pastoralists rely on the pastures as natural resources. The quantity is measured by asking the respondents whether the availability of pastures are enough in their area. The availability of pastures varies per season, so a distinction is made between the availability of pastures in dry and wet season. A clear majority of respondents (83.5%) stated that the availability of grazing is sufficient in wet season. At the same time 75% of the respondents stated that the availability of pastures during dry season is insufficient. When the respondents was asked about the trend and a majority of this group(82%) states there is always a lack of pastures in dry seasons since it is seasonal. Table 12 also shows this seasonality with opposite scores for the availability of pasture during dry and wet seasons.

The Availability of pastures in wet and dry seasons	
Available pasture in dry season is	Percentage of respondents
Sufficient	0
Somewhat Sufficient	1.3
neither insufficient nor sufficient	11.4
somewhat insufficient	74.7
insufficient	12.7
Available pasture in wet season is	**Percentage of respondents**
Sufficient	83.5
Somewhat Sufficient	8.9
neither insufficient nor sufficient	3.8
somewhat insufficient	3.8
insufficient	0

Table 12: Based on conducted surveys during fieldwork in 2014.

Besides, the availability of pastures, the respondents were asked how they valued the quality of the pastures. Specific question were posed about the presence of good and bad grasses in their area and what the trend was for both types. More than half of the pastoralists in the study area stated they did not know how to differentiate good and bad grasses and therefore indicated the trend as constant for the last ten years. Other respondents, who recognised good and bad grass, also indicate this trend as constant. They indicate it as constant because they did not really experience a change through time, but they told the presence of both types of grass varies from place to place. Others told goats and cows know the difference between those grasses. Since more or less half of the respondents state the trend stayed the same, but a large part of them could not tell the difference, this indicator will be scored as 'poor' and not as reasonable. According to M. M. E. M Rutten (personal communication, April 2015) this is conspicuous since pastoralists often are able to differentiate various types of grasses and can determine whether these are good or bad ones. According to Rutten a possible explanation might be Ndorobos are not pure pastoralists, but also live on other agriculture for example. Simon (personal communication, July 2014) thinks al pastoralists know, but some might be not aware of those different grasses. However, Simon also states that despite this lack of knowledge, they have learned by experience.

To make a better evaluation of the environmental integrity related to water, the Vegetation Condition Index(VCI) is also used to measure the condition of pastures and natural vegetation. While the quantity and quality of pastures was examined by surveys, the VCI is being found in reports for the National Drought Management Authority (2015). Although this VCI is not for Isiolo County as a

whole, but is restricted to Isiolo North, it included a wide area outside the study area. Still it will be a useful contribution to the component *'Environment'.* Figure 49 shows us the VCI index from March 2001 to February 2015. This matrix confirms the answers of the respondents by showing a great variability within the various years (seasonality) and a great variability between the years. Normally the VCI ranges between the values 35 and 50, when a value comes below this value there is drought. In 2014, when the fieldwork was conducted, VCI indicated a normal situation in just two months. The other months had a VCI that indicated either moderate or severe drought. From 2001 till 2004 no severe droughts occurred when using the VCI, which means that no drought was visible when observing the condition of pastures and natural vegetation in this period. On the other hand, in the years such as 2009 and 2011, most months were characterised by severe or extreme drought.

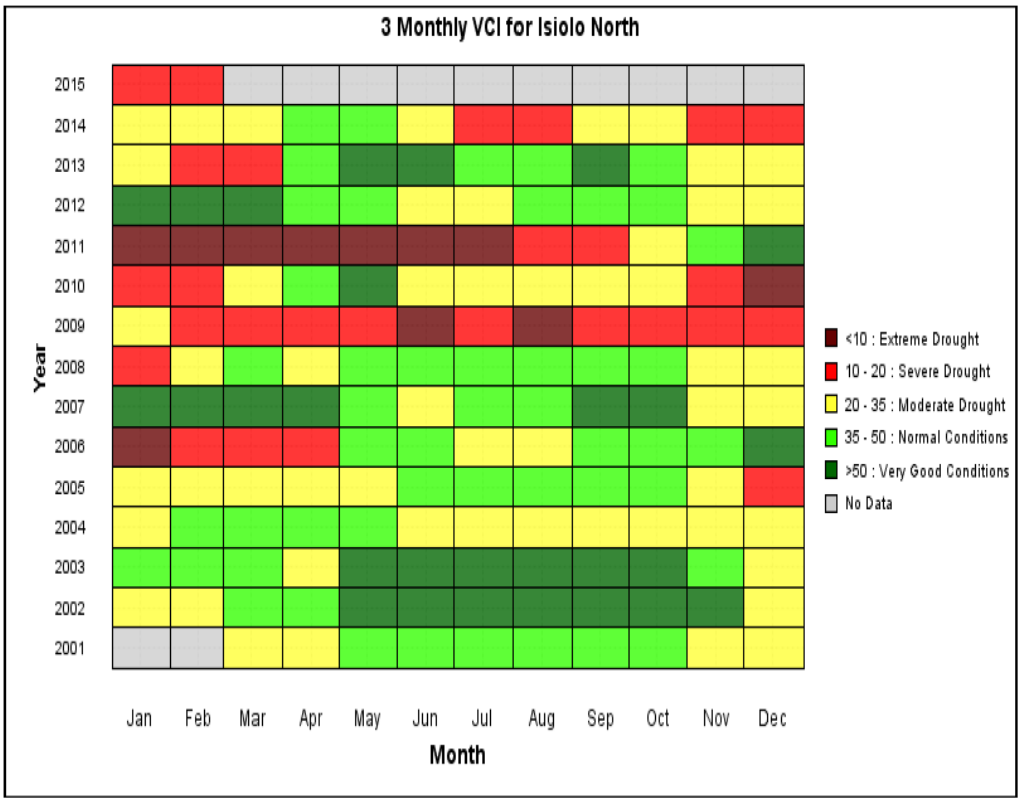


Figure 49: VCI Matrix for Isiolo North Constituency (National Drought Management Authority, 2015).

5.5.2 Livestock losses.

Another indicator which is used to measure the status of the environment is the percentage of the population who state they had more animals than they currently own. More than half of the respondents (51.2%) states their herd reduced in size because of drought. Other causes mentioned are diseases, cattle rustling, wildlife attacks, flooding and selling of the animals. A reduction because of diseases and sale might be related to drought. One might expect that selling of animals is a strategy to cope with drought periods, but also other reasons to sell animals have been found. Three

Ndorobo respondents, for example, told that they reduced not only because of drought, but also because they sold livestock so their children had the possibility to go to school. From all respondents, 58% point out the year 2009 as the moment when their herd reduced in size, in a lot of cases the herd size decreased by more than a half. This illustrates the vulnerability of pastoralists in semi-arid areas.

5.5.3 Regulations on grazing

The next indicator used to measure the component *'Environment '* is 'Regulations on grazing', which is a way to preserve pastures. 85% of the study population states grazing is regulated in the areas which they use to let their animals graze. 70% of the total population states the grazing is regulated by the elders of the community. This is common in pastoral societies. Barrow et al (2007, p.2) state: "In terms of grazing management, informal rules ensure that herds avoid grazing areas that are already in use, maintain an appropriate distance from other herds, and avoid grazing areas recently vacated. Such practices are critical for the rest and recovery of pastures." Beyene (2006) argues these well-established regulations, set by local institutions, are coming under increased pressure because of environmental change. Still, they state that informal institutions enable herders to manage grazing resources when the government does not have much influence in regulating these resources. But if local institutions fail to manage these resources, state support is inevitable. However, if state support is needed, a major criterion is that this support is cooperative with the existing structure of the local institutions. The Isiolo Holding Ground User Associations sees grazing guard as a possible solution to prevent grazing the preserved grazing areas in the Isiolo Holding Ground, but they do not have the capacity to employee these guards (H. Haji, personal communication, July 2014). So for now, they can only influence the grazing around boreholes by opening or closing those.

Grazing regulations are commonly perceived as a positive situation. However, it might negatively affect the access to grazing ground which in turn might force pastoralists to move to other less preferable places. According to M. M. E. M Rutten (personal communication, April 2015) this could be form a relative shortage of (access) to resources, even though there is no absolute lack of resources. This means that the flexibility and ability of pastoralists to maintain the access to resources is challenged.

5.5.4 Human-Wildlife conflict

The last indicator for this component is about how often the population is affected by wildlife in the area. Wildlife may attack humans or their livestock, or destroy the crops in the field. 80% of the population experienced conflicts over natural resources with wildlife. According to 50% of the population the trend of human-wildlife conflict is stable the last 10 years, 25% believes the situation

has improved, some of them argue this is due to fencing. Respondents also indicate there is a seasonal difference, in dry season less wildlife can be found compared to the wet season. This conflict affects the people in the area, but since these conflicts are mainly about attacks on humans and the destruction of crops, and not about conflict on water, this indicator will be scored as 'poor'.

The scores of the various indicators of the component '*Environment*' are listed in Table 13. The seasonality of the availability of pastures is clearly visible. Grazing regulations are present according to more than 75% of the population. Indicators of this component with a low score are the quality of pastures, the reduction of herd size and human-wildlife conflict over natural resources.

WPI for sub index 'Environment'					
		Levels and scores			
WPI Component	**Indicator**	**Fair**	**Acceptable**	**Poor**	**Risky**
Environment	Availability of pastures in wet season	**X**			
	Availability of pastures in dry season				**X**
	Quality of pastures			X	
	Reduction herd size			**X**	
	Grazing regulations (% of population experiencing grazing regulation)	**>75**	75-50	50-25	<25
	Conflict natural resources sources (Human- wildlife)			**X**	
	Total		0.50		

Table 13: Based on data from the NSWB (2013) and on conducted surveys during fieldwork in 2014.

5.6 Calculating the WPI for the Isiolo Holding Ground.

To conclude this chapter, the WPI for Isiolo Holding Ground will be calculated by aggregating the five sub-indices. As already justified in chapter 3 an equal weighting is in this case the best suited weighting of sub-indices. Garriga and Foguet (2010) state the best way to aggregated with a multiplicative function.

$$WPI = \sqrt[n]{\prod x_i^{w_i}}$$

Figure 50: The weighted multiplicative function used to measure the WPI (Van der Vyver, 2013.)

When we input the five values of the sub-indices of the Water poverty index, the WPI can be calculated. The formula shows we should first calculated the product of the five components. In our

case the weighting (w_i) is not necessary. When the product has been calculated a fifth root algorithm of the product will be shifted.

The Water Poverty Index for the Isiolo Holding Ground					
		Levels and scores			
WPI Component	Indicator	Fair(1)	Acceptable(0.66)	Poor(0.33)	Risky(0)
Resources	Water Quantity Sufficiency (other water sources)				**X**
	Water Quantity respondents (rivers)	**X**			
	Water Quality (according to respondents)		**X**		
	Percentage of water sources which is improved		0.77		
	Percentage of water sources tested safe		0.55		
	Reliability of supply (% of water points not operational for less than 7 days		0.57		
	Seasonal variability of water resources (months per year with water	11-12	**9-10**	7-8	<7
	Total		0.61		
Access	Percentage of people having access to piped water supply		0.25		
	Access to improved sanitation		0.17		
	one way distance to water sources (km)	<1	**1-2**	2-5	>5
	Operational status of water source		0.50		
	Waiting time (min)	<30	30-60	**60-120**	>120
	water coverage of water point		0.10		
	Total		0.34		
Capacity	Wealth equivalent to ownership of durable		0.24		
	Herd size based on 'enough for milk consumption'		0.61		
	Sell Milk		0.20		
	Gini-coefficient		0.295		
	Educational level				**X**
	Familiarity with water users associations				**X**
	Life expectancy at birth		0.53		
	Total		0.27		
Use	Domestic water consumption rate (per capita)	X			
	Livestock water use (m3 per day)		**X**		
	Agricultural water use, expressed as the proportion of irrigated land to total cultivated land.		0.25		
	Wildlife (m3 per day)		X		
	Conflict over water sources (human-human)		0.472		
	Total		0.61		
Environment	Availability of pastures in wet season	**X**			
	Availability of pastures in dry season				**X**
	Quality of pastures (good and bad grass)			X?	
	Reduction herd size			**X**	
	Grazing regulations (% of population experiencing grazing regulation)	**>75**	75-50	50-25	<25
	Conflict natural resources sources (Human- wildlife)			**X**	
Total		0.46			
WPI of the Isiolo Holding Ground		**0.44**			

Table 14: Based on data from the NSWB (2013) and on conducted surveys during fieldwork in 2014.

As a result, the formula resulted in a Water Poverty Index for the Isiolo Holding Ground of 0.44. A high score has been assigned to *'Resources'* and *'Use'*. This high score for 'Resources', which indicates a good availability and quality of water, might be explained by the flexible herd management of pastoralists which enables them to find enough water resources. However, pastures, which are part of the component '*Environment',* have been assigned a lower score. A possible explanation could be that finding pastures is more difficult and might therefore acquire a higher flexibility than finding the resource water. The lowest score has been found on Capacity and the highest scores have been found on Resources and Use. The resulting WPI shows the impact of drought. Due to the low score of '*Capacity*' and '*Access*' it will be more difficult for pastoralists to deal with these circumstances. Figure 51 shows a pentagram with the five components of the Water Poverty Index. It clearly shows the differences between the various components.

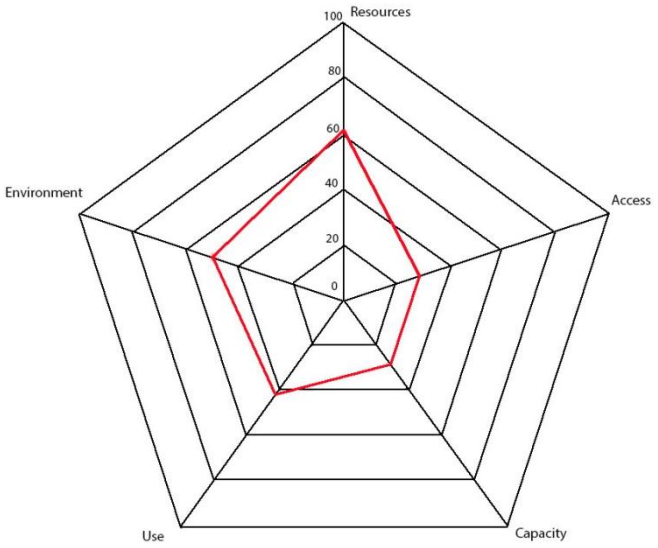


Figure 51: WPI for the Isiolo Holding Ground on the five components (Based on data from the NSWB (2013) and on conducted surveys during fieldwork in 2014. The use of the pentagram is based on Sullivan et al 2003).

6 Migration

This chapter will elaborate on various aspects related to migration of the various communities, but with a particular focus on the Ndorobo community. It starts with a global description of migration patterns of the pastoralists in the Isiolo Holding Ground. It describes the frequency of migration and the trend of this frequency. Subsequently, section 6.2 describes how the migration decisions can be categorised within the push-pull-retain-repel model on the basis of the categories given by Dyson-Hudson and Dyson-Hudson (1980). In addition, section 6.3 will go further into detail on the relation between the factor water and the migration decisions. Section 6.4 will elaborate on the obstacles pastoralists face on their route to a new location. Section 6.5 shows the various strategies pastoralists in the Isiolo Holding Ground use to move from one place to another. Section 6.6, which is the final section, will discuss how this migration is related to drought related conflict.

6.1 Migration of pastoralists in the Isiolo Holding Ground

When fieldwork was conducted and pastoralists were interviewed, one of the criteria was that at least one of the household members is migrating with their livestock. Besides, it has been tried to exclusively conduct interviews with the head of the household. As a result of these criteria, pastoralists are interviewed either at their main location of residence, or while they were on the move with their livestock. Since many settlements which were visited during the fieldwork were Ndorobo settlements, it is likely they consider this as their area. This also accounts for other communities in the Isiolo Holding Ground, however these places were not visited during the fieldwork because of various reasons given in Chapter 3. This also affects the analysis of the migration patterns, since it is likely the Ndorobo community will experience the place as their home area. This might be different for communities who were on the move in the area and stayed in temporary settlements.

In addition to the question about whether members of the household were migrating from time to time, the survey paid attention to the frequency of migration. More than half of the respondents stated they migrate at least four times a year. Besides, more than three-quarters of the respondents states the frequency of migrating has increased in the last 10 years. Even though an increasing trend has been indicated, it should also be nuanced by the fact that it seemed that many respondents found it hard to compare their current situation with the situation of 10 years ago. The pastoralists, who state there is an increasing trend, give various reasons for this increase. Some pastoralists state they have to migrate more often because of drought, or the longer periods of droughts. Others state there is an increase of herds in the area, whereby some of them explicitly noticed it were in particular the herds of the other communities. Either the herds increased, or it was

because other communities migrated to the area. Figure 52, which was also shown in the introduction, shows the population density in the area increased. However, this map does not exclusively show the increasing density of pastoralists which would support the argument of the pastoralists. The maps shows the total population density which also includes the agricultural and pastoralists population. Furthermore, the map does not show the seasonal variations of this density, which would be an interesting when analysing the movement of pastoralists .

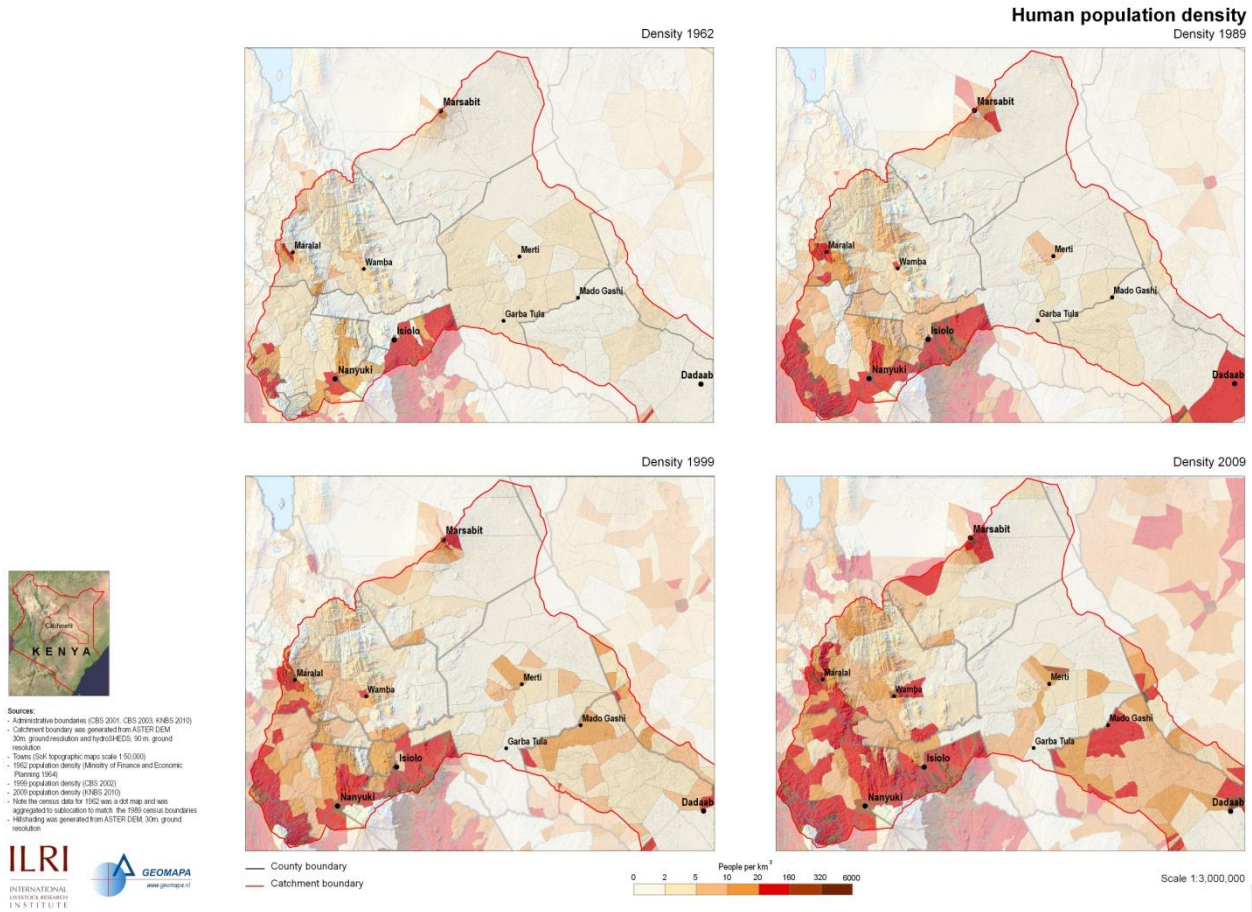


Figure 52: Population density in the Upper Ewaso Ng'iro River Basin (Ericksen et al., 2011).

Of all respondents, 15% stated there was a decrease of the frequency they had to migrate. Arguments which were given for this experienced trend were the improved grazing regulations for example. Some pastoralists even state the drought has become less the last years, which might have to do with the severe droughts in, for example, 2009 After this drought, the situation became more relaxed. Another respondent argues he does not migrate that much anymore since migration inevitably will lead to more diseases.

The respondents have also been asked whether they have thought about settling, instead of moving around with their livestock. Various answers were given to the question, a majority of 49.2%

indicated this question with 'sometimes'. Only 21.6% of the respondents thinks often or constantly about settling. Respondents stated they wanted to settle, but at the same time stated this was not possible since they depend on their livestock. Settling seemed impossible to many of the respondents, therefore this question is statistically maybe not that meaningful. However, it illustrates how difficult it is for pastoralists to change to a sedentary lifestyle. The same kind of answer is given to the question about whether they migrate voluntarily. A majority of the respondents state they migrate voluntarily, they are not forced by anyone and it is their own choice to do so. However, this should be questioned since it could be stated they have no other choice since they are forced to migrate, because of ecological (availability of water an pasture) and social environmental (conflict) factors.

6.2 Locations through time

To get a better understanding of the movements of the pastoralists in the Isiolo Holding Ground, the previous locations of the respondents, was analysed. First we should notice that a lot of respondents found it hard to recall there exact locations at a certain point in time. For this reason the response to this answer ranges between 30 and 70 respondents for the various months in the period from August 2013 till July 2014. Besides, the interviews were conducted from May till July, so not every respondent had the opportunity to indicate his location for June or July 2014.

As explained in Chapter 2, the location of pastoralist depends on the composition of their herd. Due to this variety in herd compositions, migration patterns are more complex and divers. Mati et al. (2006) state goats and sheep are more drought resilient than cattle and can stay without water for a longer period. Therefore, they can stay longer at the main location of residence during drought periods. Besides, goats and sheep are often kept at home because of the milk production (M.E. M.M Rutten, personal communication, June 2014). Their cattle, and in some cases their camel, can cover much larger distances and their locations have been explicitly asked when the head of the household was located at his main location of residence. Dividing herd also occurs due to the fact cattle and sheep are grazers and goats and camels are browsers and different fodder is required. During fieldwork the goats and sheep could often be found in household's main location of residence for this reason. The household members who do not migrate, look after the goats and sheep. During fieldwork it appeared these were In most cases women, children or elderly. This does not mean that pastoralists do not migrate with their goats and sheep at all, it is just happening less frequently in cases when drought is more severe.

When analysing the locations where the respondents have stayed with their cattle or camels, it becomes clear that some places are only visited in certain periods during the year, while in other

places there is at least one of the respondents present in every month of the year. What stands out in the graph in Figure 53, is an increase of the number of respondents who's cattle were located in Shab in June and July (2014).But also in Il Ngwesi, which is near the group ranch, and in various conservancies outside the Isiolo Holding Ground in the neighbouring counties Samburu and Laikipia. In July, 36% of the respondents, which were al Ndorobos, were located in Shab. All the pastoralists who moved to those places are Ndorobo respondents. This is probably explained by the fact that during the month of July almost exclusively Ndorobos were interviewed. So it does not mean exclusively Ndorobo respondents move to those places. Instead, pastoralists stated that, for example, Shab is a place where a lot of communities move to and tensions are running high. This cases does not stand alone. Tensions also ran high in the study area, more specific, in the Il Ngwesi Conservancy, when various communities moved in with their livestock. The consequences of this movements will be explained in more detail in section 6.6.

In July there was a decrease of respondents whose cattle stayed in the other locations included in the graph. These locations are mainly the places where Ndorobo pastoralists are settled. The rest of the year the number of respondents whose cattle were located in those locations was more or less stable. This is also shown by Figure 53. A migration strategy which is used by pastoralists is they split their herds and move them to different locations. It happens that a pastoralist moves a part of his cattle to Lewa Conservancy, while others migrate to Shab for example. Section 6.5 will discuss the migration strategies of pastoralists in more detail.

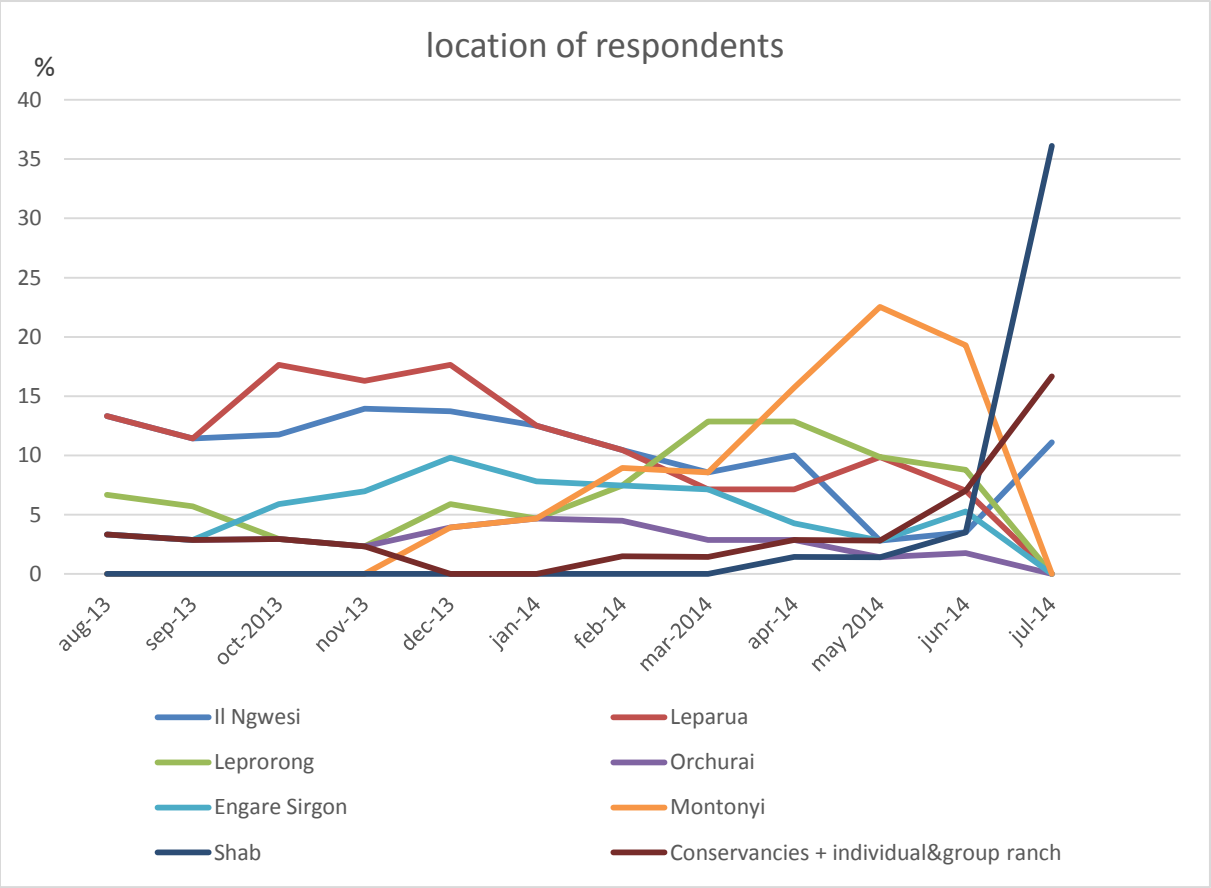


Figure 53: Location of the respondents between August 2013 and July 2014 (Based on conducted surveys during fieldwork in 2014).

Since the survey only takes into account the locations since August 2013, the locations before that period are not asked by default. However, some respondents clearly recalled the locations they were in previous years and mentioned they did not migrate that often before a certain year. Other outcomes were that 14.5% of the respondents did not migrate for a year and have started migrating more frequently in 2014. This indicates these pastoralists prefer to stay in one place whenever possible, but have no choice but to migrate when pasture runs out during drought. Figure 53 already showed where pastoralists stay throughout the year and how crowded these places are. When categorising all 68 locations on the basis of whether these locations are in or outside the Isiolo, Holding Ground a new graph is drawn in Figure 54.

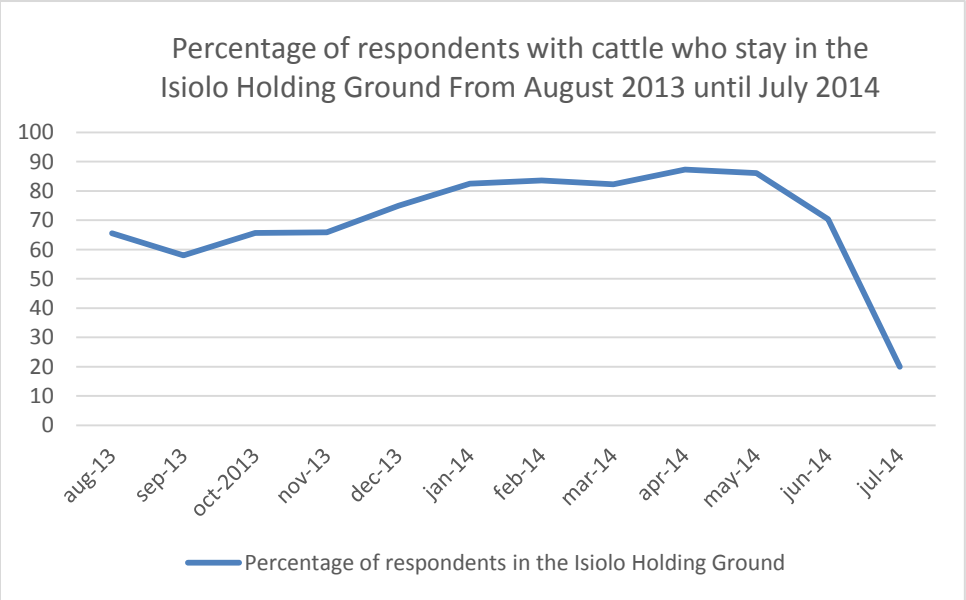


Figure 54: Percentage of respondents with cattle who stayed in the Isiolo Holding Ground between August 2013 and July 2014 (Based on conducted surveys during fieldwork in 2014).

The resulting graph in Figure 54 clearly shows a decreasing trend from May onward, which means pastoralists are moving out of the Isiolo Holding Ground with their cattle. Again, most of the respondents were Ndorobo respondents, besides, the main residence of a majority is in the Isiolo Holding Ground. The decreasing trend corresponds with the observation during this study. In July 2014, a majority of the households have their cattle located outside the Isiolo Holding Ground. As stated above, pastoralists have chosen to move their cattle to (far away) places such as Shab or conservancies. In April and May the highest percentage of the respondents was located within the Isiolo Holding Ground. This might be related to the long rains (March-May) so pastoralists are able to find well suited areas closer to their homestead. This seasonal movement also results in the recovery of dry season grazing areas, such as Shab, in the periods when there is enough pasture available in the home areas of pastoralists. It would be preferable if pastoralists comply to this movements, however, different communities and individuals make various decisions on when to move out, which might result in conflict. An example of such a conflict will be given in section 6.6. Eventhough the graph in Figure 54 gives an interesting view, we should keep in mind the Isiolo Holding Ground expands a large and varied area and the study area is in one of the corners close to other counties.

6.3 Push, pull, retain and repel factors.

This section will examine the influence of various factors on the migration decision making of pastoralists and the relation to water scarcity. Sub section 6.3.1 will start with analysing the factors on the basis of the categories of migration factors given by Dyson-Hudson and Dyson-Hudson (1980)

and the push, pull, keep and repel model, as introduced in Chapter 2. Besides, in sub section 6.3.2, the importance of the migration factors will be related to the various WPI components.

6.3.1 Factors influencing the movements of pastoralists

In Chapter 2, it has been argued ecological factors can explain a large part of the migration decisions. The survey also showed the ecological factors were mentioned as most important migration factors by pastoralists in the Isiolo Holding Ground. This means pasture and water are important push, pull, retain and repel factors. In addition, the social environmental factor 'security' appeared to be one of the most important factors. When the influence of pasture, water and security is compared with each other, pasture and water are experienced as more important than security. This means that if water and pasture is available in another place (and not in their current location), likely it will be decided, to go that area, despite the fact security is not guaranteed. However, for most of the respondents insecurity is an important repel factor, which means they will avoid places which are insecure. For example, one of the respondents who lives not far from the slaughter house, leaves the area when there is insecurity and he returns when there is security again. This shows 'seasonal' migration, which is mainly explained by ecological factors, also impacts the social environment, which in turn influences migration decisions of pastoralists. Another respondent illustrates the importance of security as pull factor, by stating that he is prepared to go as far as Nairobi for security. In July, some Somali pastoralists were interviewed who were still staying in Burat. This was conspicuous, since the number of pastoralists present in the area has strongly decreased at that time. Other pastoralists moved out because there was nothing but bad grass in Burat. The Somali pastoralists were asked why they did not go to Shab for example. The Somali respondent answered he could not go to Shab, because he fears the insecurity in that place. He preferred to stay in this place, even though he had to look for good pasture in far places. In contrast to most respondents, another respondent states security is not a repel factor to him if at the place of destination water and pasture is enough. In that case they do not care about security, they will just migrate to that place. When analysing the differences between the communities, it appeared security is a significantly more important migration factor to Ndorobos compared to other communities. This does not mean they face more insecurity than others, it only makes clear Ndorobos are more concerned about this issue. This finds expression in the fact they move in groups. During fieldwork observations it has been found other communities members, which are armed in some cases, move in small groups.

Returning to the main migration factors, water and pasture, it has become clear from the survey data the availability of pasture is slightly more important than water. This is also supported by the fact

that watering of animals does not always happen on a daily basis. Opiyo, Mureithi and Ngugi (2011), who researched how the availability of water impacted upon the overall use of resources by pastoralists in Kitui and Mwingi districts, found that the watering frequency of livestock depended on the kind of animal, the specific group op pastoralists and the season. “In dry seasons, livestock are not necessarily watered daily, the Somali, Orma and Kamba water their cattle once every 2-3 days, sheep and goats every three and two days respectively, and camels every 3-5 days. (Opiyo, Mureithi and Ngugi, 2011 p.48),” Mati et al. (2006, p. 17), who conducted research in Isiolo District, even claims that watering of livestock happens less frequent; “cattle are normally on a watering frequency of 2 to 3 days, small stock up to 5 days and camels up to 15 days. ” When relating the watering frequency to the migration factors of pastoralists, we could state that a pastoralist household can stay in a place where pasture is available, but still have to move one in the two days or more to water their animals in other places. This was also visible during the fieldwork in Burat, near the KMC slaughter house. In May, when the pastures in the area were near to finish, people still came to that place to water their animals at the river running beyond the slaughter house. The use of watering intervals is a coping strategy during dry periods (NDMA, 2014).

Besides the ecological and (social) environmental factors, there is a need to distinguish political, economic and affective factors. However, a low score was found for a possible political motivation to migrate. Some pastoralists stated they did not feel any affiliation with politics or with the set rules.

The respondents have been asked whether there are economic factors that are taken into account. In case a respondent did not know how to answer, they were asked whether the presence of a market was of any importance to them. This has been done for the reason that a market might be important since that is the place where they can sell and buy animals or buy supplies to meet their needs. According to one of the respondents, this is a pull factor to him, but he also argues a market will mean that many communities will go to that place. Furthermore, likely a community will be settled in that place with ‘shambas’ (cultivated plots), which makes it hard to let their herd graze in that place. As a consequence they cannot migrate to a place to near to the market. Another economic factor which affects their mobility is the (lack of) means to move to a certain location. Simon (personal communication, July 2014) explains when a pastoralists decide to move to a conservancy, costs are involved such as medication for the livestock and labour to look after the livestock. This is only profitable when the herd is large enough. Many pastoralists might therefore prefer cheaper options such as Shab. Many people move to this place. despite the challenge present in those places, such as insecurity. This shows pastoralists cannot always select the most preferable option because of limiting financial factors.

The other factors which are distinguished are the affective and cognitive factors. One might state these values and perceptions depend on education for example. Simon (personal communication, July 2014) states for example, people will migrate less if they receive more education. However, no correlation has being found between those two variables in this study. The reasoning for migration might also be affected by the group one belongs to. Migration decisions might be influenced by a cultural or ethnical motivation by taken into account the presence of other communities or the absence of their own community. However, the survey data showed many respondents state they do not care about the differences concerning the various ethnic communities. Still some respondents state this issue does influence their migration decisions. They state, for example, they cannot go to a place where no one else of their community is present. Someone stated he needs people from his community in case he gets ill for example. Other respondents however aired that they do not care much about their community not being present, as long if it is safe in that place they can stay with other communities.

6.3.2 Water scarcity and seasonal migration

Since the main focus of this study lays on the relation between water scarcity and migration decisions, this sub section will discuss this link in more detail. The migration factors can be traced back to various components of the WPI. Water, for example, is well represented in the component '*Resources'* and pasture in the component *'Environment'*. The availability of pasture and water is influenced by the seasonality, but of course also by the variables included in the component *'Access'.* So even though the WPI component '*Resources',* scored relative high, if the access to these resources is insufficient, pastoralists will still need to migrate. Furthermore, the component *'Environment'*, scored lower than the component *'Resources'*. On top of this, pastures are a slightly more important migration factor than water for pastoralists in the Isiolo Holding Ground. A lower score on the WPI implies a greater impact on migration in the area, since It has a higher degree of scarcity.

Security is included in the WPI component '*Use'*, but only by one indicator. This indicator scored between 'acceptable' and 'poor'. As argued in this sub section, security is an important migration factor as well. A low score has been assigned to the WPI component *'Capacity',* which refers to the capacity to deal with water scarcity. At the same time a limited capacity may indirectly influence migration patterns, since they might not have the financial means to choose a certain option, or not the human capacity to make the most efficient choice.

The availability and quality of pasture is an essential resource for pastoralists and an important facet of the WPI. The study area has already been described as an area characterised by bimodal rainfall. This section will therefore analyse in which periods through the year pastoralists are located at their

main location of residence, and when they leave their home location in search for water and pastures. Data resulting from the interviews showed several respondents emphasized the importance of use the grazing land in and around their home places in times of rain. Although this can be interpret as an ecological factor which affects migration decisions, social values are involved in this process as well. Not only for the reason dry season grazing lands need time to recover, but also because conflict is less likely to occur when everyone uses the grazing lands around their home place. It illustrates how pastoralists strive for a situation without conflict and insecurity. Besides preventing conflict, pastoralists might also just prefer to stay at their home location when this is possible. This argument is supported by the fact that a majority of pastoralist state they want to settle in one place with their cattle. However, this is difficult in times of drought. For the Ndorobo community it means a part of the household is located at a more or less permanent place, surrounded by other households of their community. Another part of the household moves around with the cattle and do not return to their home place every day. Whether they can stay at their home location with their cattle depends on whether pasture is available close to their home location. This relationship between rainfall and the location of the pastoralists is visualised in Figure 55. It shows the percentage of respondents which was located at their home location from August 2013 till July 2014. The figure also visualises data on the precipitation in Isiolo County in those months, measured by the NDMA (2013 and 2014). No specific data for the Isiolo Holding Ground on rainfall in this period could be found. For this reason data is used on County level. When analysing this data, it appears that, there were six months without any rain in this period. During the periods of the short (October-December) and the long rains (March-May), some rainfall was measured.

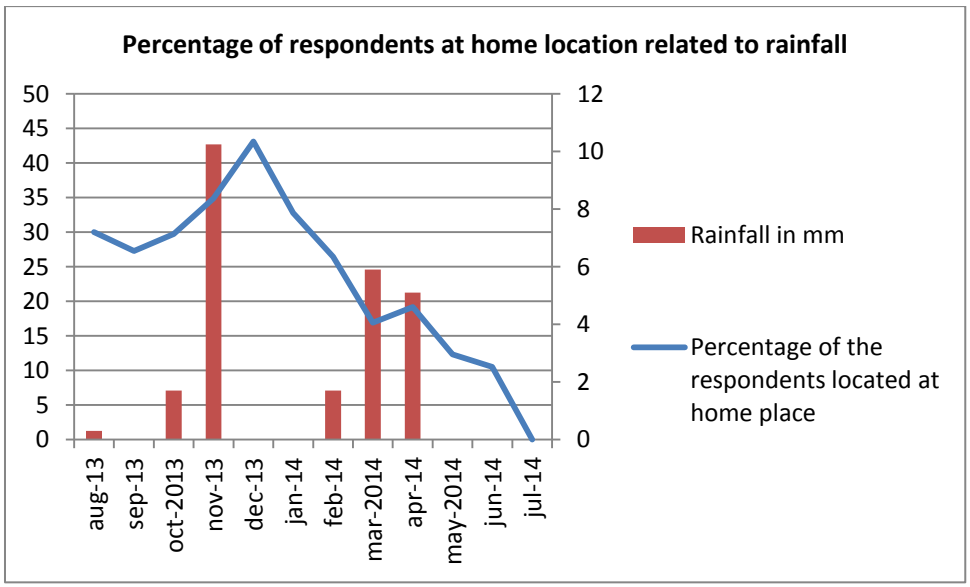


Figure 55: Percentage of respondent at their home location, compared with the rainfall (NDMA 2013, 2014, combined with data based on conducted surveys during fieldwork in 2014).

Figure 55 clearly shows the percentage of respondents being at home was highest in November and December, after the rains in October and November. After this period of rain, pastoralist again left their home places with their herds. In April, during the period of the long rains, the percentage of pastoralists being at their home location is increasing again, indicated by a small peak in the graph. In May 2014, a month without precipitation, the pastoralists again moved away from their home locations. It is not clear why the percentage is that high in the months August and September 2013, when the rainfall is minimal. As already stated in this chapter the measurements for the months October 2013 and July 2014 and are less reliable, since the number of respondents for those months are minimal.

Rainfall, however, is not the only water related factor influencing migration. In chapter 5 it has been made clear how the Isiolo Holding Ground Users Association implements a strategy by opening or closing boreholes. Besides this is an indicator measuring the component *'Resources'*, it also influences the access of water sources. Normally the Isiolo Holding Ground Users Association opens the boreholes from June until September and from January until March. When they open a borehole in dry seasons it makes it more attractive to a pastoralist to stay close to the borehole. According to the Isiolo Holding Ground User Association this impacts movements of pastoralists. However, this could be nuanced because, the fieldwork data showed the main source for the pastoralists remains the river. Another effect of this strategy, which is not of less importance, is that pastures around the borehole are not used during rainy seasons and thus preserved for the dry periods. Still, one could state the pastoralists will stay around when the borehole is closed, because of the availability of good pastures around the borehole in rainy seasons. Besides, the Isiolo Holding Ground Users Association does not have the power to regulate the grazing itself. Therefore it is not excludable that pastoralists still use those pastures in rainy seasons.

For the pastoralists who rely on a well-functioning borehole, the importance of that water source is not being underestimated. The event at the Burat II borehole which was mentioned in Chapter 5 shows what happens when there is a sudden change of circumstances. At that time, the Samburu pastoralists depend on the singular water source in that place for both livestock and human consumption. They were attracted to that place by the availability of water and the bit of pasture which was left. When the borehole stopped running, this motivation to stay in that place disappeared. The Samburu community gathered and discussed about what to do with this problem. One of the outcomes of the meeting was that they agreed to pay a visit to the office of the Isiolo Holding Ground in Isiolo Town to see whether the borehole was to be reopened. In case this was not going to happen, it was clear to them they were forced to migrate to another place. One of the

potential places they could migrate to was Lepororong, approximately 10 kilometres from their current location near the BuratII borehole. At that time, pasture and water was the only thing they were demanding. They sent people to survey the place to if pasture and water were available. They came back to decide whether to migrate with the herd or to look for another place. According to the pastoralists, Mr. Haji, the chair of the Isiolo Holding Ground Users Association, suggested them to go to Mlango, a place not that far from the Burat II borehole. In Mlango water is available, because the borehole is open. However, they could not consider that place since there was no grass available and besides, there were many other people in that area. Ngare Ndare, a previous location they migrated to, had the same problem. The Samburu pastoralists had come to this place because some pasture was still left. Pending on whether the borehole would be reopened, they left very early the next day to water the livestock in various places, including the Mlango borehole. This illustrates they still hoped for a solution and they preferred staying in that place, waiting patiently for a day, so they did not have to face the issues that come along with again migrating to another place. As became clear in chapter 5, the Samburu pastoralists were lucky the Burat II borehole could be reopened the same day. This example shows us how a non-Ndorobo community responds to such an event when water becomes scarce and how a community responds by discussing what to do next. This does not mean Ndorobos will act in a other manner, still they might react in another way since they have more or less permanent settlements in the area.

6.4 Strategies

To this point, this chapter has discussed the various factors influencing migration decisions and how these are related to water scarcity. When pastoralists have decided to migrate, they will determine the route to use. They either use shortcuts or move along the main 'government' roads. A majority states to go straight by using shortcuts. The fact they move straight from one place to another does not mean they also ignore the water sources, they diverge from their straight route to make use of those sources. This is also illustrated by the answers given when asking the pastoralists about if water sources influence their migration routes. More than 90% of the respondents consider water when they are migrating from one place to another. It appeared most pastoralists have to use the road in Laikipia, since fencing prevents them to cross through land. In Isiolo this is different because pastoralists can use various routes through the open land.

When further analysing the answers given by the respondents, it appears some of the respondents mention that they first survey the destination they have in mind. Of all respondents, 42.7%, states the place is first surveyed by members of their community. Some of them specify this by stating the elders of the community are the ones who go to the place of destination first.

Afterwards, they return to report about the place. In some cases, they first speak to the chief and elders in that area to ask their permission, so that they will allow them to graze in their area. One respondent told that when they go to another county, such as Laikipia, they also need to go to the District commissioner, which nowadays is called the County Commissioner, for a permit. Striking is the differences between Ndorobos and the other communities in the Isiolo Holding Ground concerning this matter. 55.8% of the Ndorobos mention they survey the place beforehand, while the average of the other communities is only 13%. An ANOVA test shows us the difference between those groups is significant. This shows the differences between how Ndorobos and other communities on how they deal with this aspect of migration. Again it is important to notice this does not necessarily mean that the other communities do not survey the place at all, but we can state that those respondents did not mention this as an important facet of their migration decisions.

Another difference that is found between Ndorobos and other communities is that Ndorobos used to move in larger groups. In May, we found a large group of Ndorobos in Montonyi, who were all preparing to go to Shab. Respondents in that area stated it is safer for them to move as a group. Furthermore, they do not bear arms themselves, but they organised security by asking rangers (with 2 or 3 vehicles) from Leparua and Il Ngwesi Conservancy to travel with them (Simon, personal communication July 2014). During fieldwork observations this is only ascertained for the Ndorobo community and not for the other communities visited in the Isiolo Holding Ground.

In Chapter 4, it was stated the Ndorobo community in Leparua is cultivating Napier grass to feed their livestock. This show the Ndorobo community can be identified as a more agro pastoralist community. Producing fodder could be a strategy to prevent the need to migrate in order to feed the livestock. As a result, conflicts are avoided with other communities which all want to make use of certain grazing areas.

When the respondents were asked about the locations throughout the year they gave various locations for their cattle and for their goats and sheep. This means that the livestock that belongs to a household is divided among several members of the family, or in some cases employees or second degree relatives or stock friends who take care of the herd. As stated in section 6.3.2 not every pastoralists is able to move to various locations with their cattle since costs are involved to make this possible.

6.5 Obstacles on the route

When pastoralists determined a route to their destination, they come across various obstacles along the chosen migration route. Among the mentioned obstacles which will be discussed in this section are: wildlife, diseases (concerning both people and livestock), shambas and cattle raiding. On the

other hand, a group of 28% states they do not face any obstacles when migrating from one place to another. Out of this group that do not experience any obstacles, 5.3% states they first survey the route to use. Other mentioned obstacles which will not be described in this section are: insecurity and conflict because of other communities, resistance from other communities when they want to pass their area and theft of livestock. Figure 56 shows an overview of the most frequent mentioned obstacles.

Wildlife is the most pointed out obstacle during migration. This could be an elephant which is blocking their way, so that they are forced to move around them. Others point out that lions, leopards and hyenas might attack their livestock. Another danger on the route are diseases, these are diseases affecting livestock. 23.7% of the respondents experience this as an obstacle during migration.

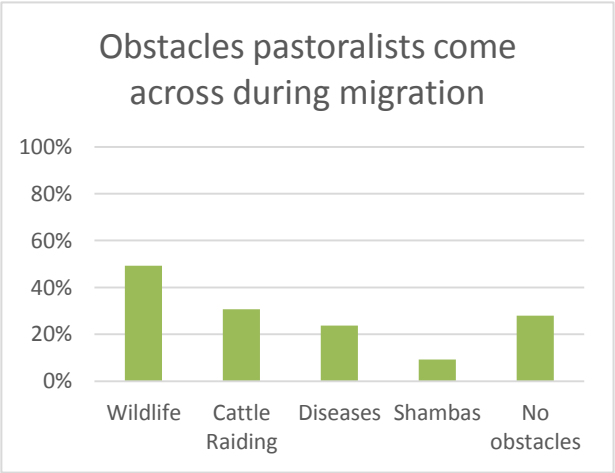


Figure 56: Obstacles during migration (Based on conducted surveys during fieldwork in 2014).

For 8.5% of pastoralists, shambas are an obstacle, due to the fact they need to move around the agricultural plot, or pay the owner to cross it. Some respondents told that, it sometimes is hard to pass these shambas without destruction because it happens routes are to narrow and they cannot prevent that animals will enter and feed on the crops. Simon (personal communication, July 2014) explained this is especially relevant for other counties than Isiolo, such as Laikipia. In these counties they cannot move as freely as they can in the Isiolo Holding Ground, because of title deeds and a different land use. Respondents tell they need to follow the road when they migrate to Laikipia. It might be questioned whether this should be labelled as obstacle or not. Contrary to, for example, diseases or wildlife attacks, they can still move safely to their destination. On the other hand, it might be seen as an obstacle since they might need to adjust their route.

Another frequently mentioned obstacle is cattle rustling. In total, 30.7% of the respondents state the raiding of livestock is an obstacle during migration. The impact of this obstacle is illustrated by an example given by one of the respondents. He knew a herder whose herd reduced from 400 to 200 animals after a cattle raid in 2009. Several respondents state they do not pass a place, if other communities are in conflict with each other.

6.6 Drought related conflicts

This section will discuss the relation between water scarcity and conflict in more detail. This section will also show that drought related conflicts are not necessarily expressed during dry periods, but can also break when the wet season has started. This relationship can be placed within the Cocoon Framework, since the main focus of this framework lies on the relation between natural resources and conflict. As stated in section 6.4, 30.7% of the respondents experiences cattle raiding as an obstacle during migration. This section will discuss the relationship between this specific type of conflict and water scarcity in more detail.

Witsenburg and Adano (2009) argue that water scarcity, the shortage of pastures and the search for these resources are likely to lead to tension between various groups. Especially, when these resources are shared. Witsenburg and Adano (2009), who did a case study in Marsabit state that in contrast to many other types of conflicts in semi-arid areas, cattle raiding is more violent during wet seasons than during drought. This is a logical consequence since livestock is weak during drought and cannot be trekked away, so it is more preferable to steal animals after a drought when they are stronger. They also argue conflicts around natural resources increase in time of abundance. However, there is some disagreement in literature about this. In contrast to Witsenburg and Adano (2009), Gaitho (2014) showed conflicts over natural resources are more violent during dry season when communities move to the same dry season grazing land in for example conservancies. Conflicts as a result of scarce natural resources which have to be shared seems more logical.

One can still state cattle raiding is a consequence of dry periods. Huho, Ngarira and Ogindo (2009) state cattle rustling is a way to replace their lost livestock during drought and that the increased drought frequency in the low corridor of northern Kenya has resulted in more frequent cattle raiding activities. As example he notices some respondents from the Isiolo Holding Ground told they were left with no cattle in 2009. The survey conducted for this study also showed 2009 was a dry year and the herds pastoralists reduced.

Drought is not the only cause for cattle raiding. Witsenburg and Adano (2009) give various possible explanations for cattle raiding, which are not all necessary connected to wet or dry season periods. They state cattle rustling also has to do with traditional ceremonies for example. Kaimba, Njehia and Guliye (2011) state traditionally the acquisition of livestock involved only small scale violence and the deadly casualties were rare. However, since the proliferation of small arms and the commercialization of cattle rustling, cattle rustling occur more often with large-scale violence between neighbouring communities. Kaimba, Njehia and Guliye (2011, p.3) state the commercialization of cattle rustling is a phenomenon, where: “wealthy businessmen, politicians, traders or local people pursuing economic objectives finance raids among the pastoral communities.”

This is confirmed by a recent event in Isiolo County whereby a group of professionals funded cattle rustling among pastoralists and then sold the animals (Wachira, 2015). Besides the arguments which emphasize the lack of resources as a consequence for the tensions between pastoralists in semi-arid areas, Boye and Kaarhus (2011) state these clashes also represents conflicts over land.

As a consequence of this cattle raiding, pastoralists arm themselves for protection against these hostile groups. This was also visible during the observations in the Isiolo Holding Ground. Various armed pastoralists were interviewed while they were in their bomas or on the move with their herd. Striking is the fact that no armed Ndorobo respondents were found, they state that when they were migrating they organised protection together with the help of ranchers located near the settlements of the Ndorobo community.

Besides cattle raiding as consequence of drought, there are other conflict related consequences as well. During the fieldwork near Il Ngwesi conservancy in July, we met ranchers who told us about the insecure situation on that moment. They told us that Samburu entered Il Ngwesi conservancy while there is still enough grass at the place where they stay. They did not have permission to enter the conservancy, but used force to answer the conservancy which lead to insecurity. According to the Daily Nation newspaper, the same happened in June 2015. Herder from Isiolo invaded the conservancy with hundreds of animals. As a result Ten herders have been killed during this clash (Gitonga, 2015).

According to Gaitho (2014) 39.8% of the respondent in his study, which was conducted in Il Ngwesi and Lekuruki group ranches, stated security improved because of the presence of armed scouts which were introduced with the Community based eco-tourism in those ranches. Harrison (2001) stated there used to be a lot of insecurity in the area before tourism came. People used to live in fear of loss of land and livestock, they were forced to move away in times when Somali pastoralists invaded the area. Now the problem of insecurity was decreasing, due to the tourism sector and the related guards.

Gaitho (2014) argues that despite the improved security, the conservancies become an area of conflict in times of drought. Conflicts are triggered when neighbouring communities. In particular, the Samburu and Somali pastoralists from the north, invaded the area in times of drought. In the conservancies pastures are preserved and are therefore invaded by these communities who look for pasture and water for their livestock.

As section 6.3 showed, security is an important factor influencing the migration decision. This means the previous mentioned type of conflicts in semi-arid areas, influences migration decisions. Kaimba, Njehia and Guliye (2011) found a significant relation between cattle rustling and the decision to migrate. Pastoralists decide to migrate to safer areas to avoid they lose livestock to cattle rustlers.

The relation between conflicts and migration is not a one way relation. Migration might subsequently result in a new conflict when various communities pass each other. The survey data, showed that the Isiolo Holding Ground also face the problem of cattle rustling during migration. Furthermore, conflict may arise when pastoralists move to the same locations as other herders. This can be illustrate with the example of Shab, were most Ndorobos moved to in June and July 2014. These are possible ways of how drought related conflict affects migration, but also how drought related migration also affects drought related conflicts.

Finally, the effectiveness of various institutions in resolving the conflicts in the Isiolo Holding Ground will be discussed. According to the respondents, Traditional Peace Committees, in most cases the elders of a community, are most effective. NGOs, WRUAs and Religious organisations are experienced as less effective. The Government scores just below average on the scale from very effective to not effective at all. Interesting are the significant difference between Ndorobos and other communities on whether an institution is perceived as ineffective.

An independent samples t-test significant showed a significant difference between how the effectiveness of NGOs, religious organisations and Traditional Peace Committees are experienced by the two groups. The effectiveness of Traditional Peace Committees is perceived significantly higher by the Ndorobos. While the other communities assigned a higher effectiveness to NGOs and to Religious organisation compared to the Ndorobos. In this study, no explanation has been found for these differences between various communities. Besides, a detailed analysis of these differences would go beyond the objective of this study. However, future studies might focus on the community specific experiences concerning the effectiveness and, subsequently, on how this information can be used to resolve conflicts.

This chapter discussed various aspects of migration in the Isiolo Holding Ground. It started by outlining the frequency pastoralists are migrating and to which places they go during the year. It can be concluded pastoralists are migrating more frequently as compared with ten years ago, with as main reason increasing drought. This is confirmed by the rainfall data as presented in Chapter 4 in Figure 27. This Figure shows the precipitation is characterised by variability and unpredictability. As explained in Chapter 4, drought in the Isiolo Holding Ground could therefore be categorised as contingent drought. During drought periods, pastoralists from the Isiolo Holding Ground move to conservancies and to Shab. Meanwhile, pastoralists move back to their home location in times of rain, when pastures are available close to their homes. It has been found the availability of pasture, water and security are the most important push, pull, retain and repel factors for the pastoralists. These fits within the ecological and social environmental categories as suggested by Dyson-Hudson

and Dyson-Hudson (1980). Besides, it has been argued how these migration factors are related to the water scarcity, measured by the Water Poverty Index.

When it has been decided where they will go, different strategies concerning migration are used. A significant difference has been found between Ndorobos and other communities. In general pastoralists from the Ndorobo community first survey the place and the route, while other communities seemed not to attach that much importance to first survey the destination and route. Besides, it has been explained to which obstacles pastoralists come across on the route such as, wildlife, cattle raiding and diseases. Then, this chapter described how the pastoralists use different strategies. The last part of this chapter elaborated on how drought related conflicts fits in the relation between water scarcity and migration. It has been concluded that drought related conflicts such as cattle rustling does not only affects migration, but also the other way around. Drought related migration might impact conflicts and insecurity because different communities start moving and pass each other and each other's areas.

7 Conclusion

This concluding chapter contains the drawing of conclusions, which will be discussed in section 7.1. This first section is structured by the sub questions that were posed in this research. Furthermore, in section 7.2 of this chapter, the research process will be reflected, and recommendations for future research and local policy makers will be given.

7.1 Conclusions

The objective set for this study was to gain more insight in what the various facets of water scarcity, in relation and in combination with each other, mean for the migration decisions of (agro) pastoralists and how it forms a potential trigger for drought related conflicts in the semi-arid Isiolo Holding Ground in Kenya. The three central concepts: water scarcity, seasonal migration of (agro) pastoralist communities, and drought related conflicts were discussed through sub questions posed, to get a better understanding of these concepts, and how these can be linked to each other.

The concept of water scarcity is covered comprehensively in this study. In the theoretical framework various definitions were given of water scarcity. It has been argued that water scarcity cannot be measured by simple supply-demand models, as most definitions suggest. Instead, a more complex model is necessary as Rijsberman (2006) proposes. His suggestion to use the Water Poverty Index by Sullivan et al. (2003) has been adopted in this study since it is a more comprehensive model. To calculate the WPI ratings, five various components are intergraded '*Resources', 'Access', 'Capacity', 'Use' and 'Environment*' (Sullivan et al.,2003). A great advantage of the WPI compared to other models is this more comprehensive approach.

Before this model could be applied to the situation in the Isiolo Holding Ground, some adjustments were made in consequence of critical comments found in literature on the model of Sullivan et al. (2003). Garriga and Foguet (2010), for example, focused on the methodological limitations of the model. In the methodology chapter, a way of measuring the WPI in the Isiolo Holding Ground was constructed. After executing a Principal Component Analysis, it has been decided to assign equal weightings to the various components and to the indicators belonging to these components. Together, this theoretical framework and the accompanying methodology, formed the foundation for analysing the degree of water scarcity in the semi-arid Isiolo Holding Ground.

Before the various WPI components were analysed in the Isiolo Holding Ground, the environmental characteristics of the Isiolo Holding Ground have been discussed in chapter 4. On the scale of Köppen, the climate in the area can be categorised as an Aw climate, which stands for a

tropical (A) and savannah (w). In addition, it has been concluded not one single type of drought can be distinguished in this area. According to the classification of Thornthwaite (1947) the Isiolo Holding Ground is an area with both seasonal and contingent drought. In addition, when using the classification of Wilhite and Glantz (1985), the drought in the area is a combination of meteorological, hydrological, socio-economic, and pastoral drought. Those types of drought, which occur in the area, cannot be approached in isolation from each other. Socio-economic drought may occur when management is failing during dry spell, whether this is due to meteorological or hydrological drought. Related is the pastoral drought, which cannot solemnly be explained by meteorological aspects, but also takes into account socio-economic aspects. We have seen the functioning of the management in the area affects how a drought is experienced. It has also been argued pastoral drought is unlikely to exist if pastoralists are able to move away from dry places and towards places where pasture and water are available.

Subsequently, Chapter 5 measured the various facets of water scarcity in the Isiolo Holding Ground by using the constructed WPI. The lowest score has been found on *'Capacity'* and the highest scores have been found on '*Resources'* and *'Use*'. When the component '*Resources'* was measured, it appeared that the majority of the pastoralists interviewed stated that the availability and quality of the resource water is good, but, drought occurs seasonally. Besides, drought occurs because of an increase of the livestock population, the increase of water use in upstream areas and less rainfall. The high score of this component might be explained be the highly flexible herd management of pastoralists. If the key resources pasture and water are non-available, pastoralists will move to locations where it is still available. Therefore it could be a logical explanation that water scarcity, for pastoralists, is not caused by the lack of resources, since they adapt to the variety in the availability of water. However, the resource pasture is part of the component '*Environment',* which was assigned a lower score than *'Resources'.* Finding pastures might therefore acquire a higher flexibility than finding the resource water. As the component '*Resources',* '*Use*', also scores high compared to the other components. This is explained by the fact that the people in the Isiolo Holding Ground do not demand more water than supplied (WARMA, 2013). For the component '*Environment*', the presence of grazing regulations had a positive contribution to the WPI. On the other hand, the negative impact of drought on the herd size and human-wildlife conflicts, showed the impact of environmental factors on the WPI. Besides, the seasonal climate and the availability of pastures in dry season negatively impact the environmental facet of WPI. On the other hand, the availability of pastures in wet season periods affects the score of this component positively. The components that impact the WPI most negatively were *'Access'* and *'Capacity'.* All indicators but one, within the component '*Access*', were scored as poor or risky. The only indicator that positively influenced the component *'Access',* is the distance pastoralists state to cover in order to reach a water source. A low score was

assigned due to a low percentage of the pastoralists in the Isiolo Holding Ground which has access to piped water supply. Moreover, half of the existing water sources are not operational, the waiting time is high and the water coverage of these sources is low. Combined with the minimal percentage of people who have access to improved sanitation, the lowest score has been assigned to this component. A relatively low score for each indicator explains the low score for the component *'Capacity'*. The wealth equivalent of durable items is low. Besides, it appeared most respondents experienced the milk production of their herd as sufficient. However, only 20% of them sell milk. Furthermore, the area deals with inequality, indicated by a low Gini-coefficient. The low score on '*Capacity*' is also to blame on the low education level in the Isiolo Holding Ground. Moreover, the indicator that is more directly related to the capacity to deal with water issues, namely the membership of people in water user association, is extremely low.

The resulting WPI shows the impact of drought and how the various facets of water scarcity are interlinked. Despite the fact that water resources are available in the Isiolo Holding Ground, the low score of '*Capacity'* and '*Access'* negatively impacts the WPI. These facets make it more difficult for pastoralists to deal with droughts in the semi-arid Isiolo Holding Ground.

The second concept elaborated on in this study, is the seasonal migration of (agro) pastoralists. In semi-arid areas as the Isiolo Holding Ground, it is almost impossible to use livestock production as a way of living, without migration. The pastoralist in the Isiolo Holding Ground made clear that even if they want to live a settled live, this is not possible in combination with being a livestock keeper. This is also shown by the Water Poverty Index that explains the seasonal differences of the components *'Resources'* and *'Environment'.* This means that being a livestock keeper in the Isiolo Holding Ground almost necessarily goes hand in hand with being a pastoralist. What may occur is that someone states he is a livestock keeper, but he himself does not migrate since he has either family members or employees who look after his herd. As accounted for the concept of water scarcity, various definitions exist to explain this specific type of migration. In this study it has been argued to use the categorisation of Dyson-Hudson and Dyson-Hudson (1980) as foundation for the factors influencing migration decisions. They state that the movements of pastoralists may be affected by ecological, environmental (physical and social), political, economic and affective factors. These have been reclassified in push, pull, retain, and repel factors. This leads to a distinction of a variety of movements since every individual pastoralist makes various choices within the context of a group. So not only the movements of various pastoral groups differ, within these different groups the individual pastoralist may move differently from one another. The three key factors that make a livestock keeper decide to migrate are: pasture, water and security. Migration patterns also depend on the composition of a pastoralists' herd. Cattle are, for example, less resilient than goats and sheep

and therefore will need to be moved to other places earlier than goats or sheep. This often results in dividing the herd and migration to different places with these herds. Also, herds are split because goats and sheep eat different types of grass. Furthermore, there is an increasing variety of migration patterns due to differences in herd size. Rich pastoralists with large herd choose to split their herds and let their employees look after their livestock.

The main focus of this study is to relate water scarcity to migration, where water scarcity is measured through the WPI. It is possible to relate the observed migration patterns to the WPI, because it includes many factors that also appear to form important migration factors. Chapter 6 showed that migration of the (agro) pastoralists in the Isiolo Holding Ground is clearly characterised by seasonality. The same counts for the calculated WPI, which takes into account the seasonal variability of the availability of resources. Pasture and water scarcity are the main reason. This means that the degree water scarcity in an area may lead to migration of pastoralists. In Chapter 6 it was concluded that pasture is the key factor in the decision making of livestock keepers in the Isiolo Holding Ground. However, the availability of pasture and water are not to be studied in isolation from each other. The WPI is a well-suited index to emphasize the importance of water and pasture. A low score has been found on the component *'Environment'* which included the availability, quality and seasonality of the pastures. Since it has been argued throughout this thesis this resource is essential to pastoralists, the impact on migration is therefore self-evident. A higher score was assigned to the WPI component '*Resources'*. However, the availability and quantity of the resource water was negatively impacted by the access to this resource. Pastoralists might therefore still be forced to migrate to another location if the access to a resource is blocked.

A clear pattern is found between the precipitation and the migration of pastoralists. This precipitation is essential for the availability of pastures. A lack of rainfall therefore, has been described by the pastoralists as a main reason for drought. It may be concluded that rainfall influences whether a pastoralist remains at his home stead, or he decides to move to other places. It seems their principle to return to their home place with their livestock to prevent conflict, if rains and pastures are available in their own place.

Besides the key factors pasture and water, it has been shown that migration patterns are affected by the factor 'security'. It can be concluded that this is an important repel factor to the pastoralists. They will avoid places where there is insecurity and will prefer to move to other locations. It has been shown pastoralists visit various places during the year and certain places are common destinations in times of drought or in times of rain. The Ndorobos for example, stay closer to home in wet seasons and a majority stays at their main location of residence with their family. During drought they are forced to move outside the Isiolo Holding Ground to neighbouring counties

or to conservancies. While this is mainly based on the availability of pasture and water, security also influenced the way pastoralists migrate from one place to another. Furthermore, this security aspect might also display seasonality, since this mainly occurs when they need to move away from their homestead. In places where pastoralists move to during dry periods, such as Shab, tensions often run high, since all communities want to make use of the resources in the area.

It appeared, pastoralists in the Isiolo Holding Ground were not aware whether, political, cultural or ethnical motivations influence the migration patterns. Especially the political motivation was treated as unimportant.

Every community perceives water scarcity and migration differently and deals with it in its own way. Compared to the other communities, the Ndorobos have most characteristics of (agro) pastoralists. This is expressed in their settlements around small rivers, their agricultural plots and the fodder they produce on these plots. The fodder they produce, might prevent the need to migrate more frequently. As a result, conflicts are avoided with other communities that all want to make use of certain grazing areas. The other communities that have been included in this study are: Turkana, Samburu, Somali, Borana, Meru and Taita. In contrast to the other communities, Ndorobos state that surveying their potential destination and the route towards this destination is an important facet of their migration strategy. The Ndorobo people prefer moving in a group, assisted by armed rangers from conservancies to protect them from other communities. Contrary to the Ndorobos, other communities bear arms to protect themselves. This also shows how they deal with water scarcity. Furthermore, water scarcity is perceived differently due to the different composition of herds. Ndorobos generally do not keep camels, which make them less drought resilient. On the other hand, it has been found in the study area, that the Ndorobos are settled closer to the river. Consequently, this will impact how the WPI components '*Resource*' and *'Access'* are experienced.

Finally, the link between water scarcity, seasonal migration and conflict was analysed. Before the relation between water scarcity and conflict was analysed, a broader framework of the Cocoon Initiative was introduced in the Theoretical Framework. This framework underlines the importance of the linkages between the biophysical, the resources management and the societal subsystems. The biophysical subsystem is a subsystem with specific geographical boundaries that provides five different ecosystem services, namely: provisioning, regulating, cultural, carrying, and supporting (Slootweg and Mollinga, 2009). The relevance of this framework is found in the fact that it can be used to place the relation between water scarcity and conflict in a wider context. In Chapter 6 it appeared various types of drought related conflict are present in the Isiolo Holding Ground. It has

been argued that water scarcity and the search for resources are likely to lead to tensions, especially when resources are shared between groups.

Firstly, drought can lead to cattle raiding, which is a problem for the pastoralists. Cattle-raiding is a consequence of drought, but does not necessarily occur during a dry period. After a drought, cattle-raiding is a way to replace the livestock that perished during drought (Witsenburg and Adano, 2009). However, drought is not the only cause for cattle raiding. It can also be explained by traditional ceremonies that involve small-scale violence, but rarely with deadly casualties. However, it has been argued that this violence has increased over time. Pastoralists now arm themselves for protection against these hostile groups.

Other drought related conflicts occur when different groups want to use the same resources. The example has been mentioned of Il Ngwesi, where Samburu pastoralists invaded the conservancy that lead to insecurity. One might argue that due to the introduction of these Community based eco-tourism ranches and their accompanying guards, security has increased. However, conservancies are a place where pastures are preserved. This attracts pastoralists from other places in dry seasons, which leads to more insecurity.

This already implicates that migration on its turn, can lead to drought related conflicts. This relation is also underpinned by the tensions in Shab, another place were pastoralists move to during dry periods. Migration might subsequently result in new conflicts when various communities get in each other's way. During migration, cattle rustling forms a main obstacle when pastoralists want to reach their destination. These are different ways of how drought related conflict affects migration, but also how drought related migration affects conflicts.

Drought related issues are a problem for pastoralists in the Isiolo Holding Ground. It makes them feel insecure and it impacts their mobility. The pastoralists believe that elders, in Traditional Peace Committees, are most effective in resolving these issues and conflicts. On the other hand, NGOs, WRUAs and Religious organisation are the least effective. Also the effectiveness of the government only appeared to be average.

7.2 Reflections and Recommendations

This section of the conclusion will reflect and discuss the process and findings of this study. It can be concluded that the study reached its objective to gain more insight in what the various facets of water scarcity, in relation and in combination with each other, mean for the migration decisions of (agro) pastoralists and how it forms a potential trigger for drought related conflicts in the semi-arid Isiolo Holding Ground in Kenya. Answering the various sub questions, which focused on the three main concepts and the relations between these concepts, started already from the first days after

the objective of this research became clear. This does not mean the objective or sub questions were not adjusted during the study. Conducting research through fieldwork in an area one is not familiar with, makes it difficult to determine a research objective that perfectly corresponds with the situation in the study area.

Some limitations concerning the conducted fieldwork and its implications should be mentioned. It should be taken into account that, due to a limited time framework, the fieldwork was conducted in a specific period of a certain year. As explained, there is a great variety between the periods of the year due to the seasonal climate, and furthermore, differences have been found between the years. Other limitations were already mentioned in Chapter 3. During fieldwork, the language barrier formed a limiting factor. This also goes for the suspicion of some pastoralists, which made them decide to refuse us to come closer, or in other cases not to tell the truth.

One the basis of the findings in the research as well as the limitations, some recommendations are proposed for further research. The mentioned Water Resource Users Associations (WRUAs), which were introduced to manage water related problems, might have a significant impact on the actual and experienced water scarcity, but also on the migration decisions of pastoralists. Since no WRUAs were (experienced as) active in the research area, this factor could not be included as migration factor. Besides the academic relevance of this proposed recommendation, it may help policy makers to better manage problems concerning water scarcity that pastoralists face. Related to this, further research should focus on how drought related conflicts could be resolved by local policies. This study has shown that pastoralists experience Traditional Peace Committees as most effective. Besides, differences have been found between how communities experience this effectiveness. At the same time, pastoralists have stated they do not engage in politics. According to the pastoralists, the government is not that effective in resolving conflicts. For these reasons, future research might focus on how local politics could become meaningful to pastoralists, by cooperating with them and considering their customary laws in order to prevent and resolve conflicts in an effective way.

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Appendix

Questionnaire: Ewaso Ng'iro North Basin

Name of interviewer:_____Nr. Questionnaire:_____ Date: __- __- 2014
Location of the Interview:_____

A: PERSONAL CHARACTERISTRICS OF RESPONDENT

1. Name of respondent:_____
2. Head of the household? (Y/N)_____
3. Sex: m/f 4. Age: ___

5. Marital status:
(1=single; 2=married monogamous; 3=married polygamous; 4=divorced/ separated; 5=widowed)

6. Ethnic group/ Community:_____

7a. Main location of residence:_____ 7b. since:_____

8 Previous main locations of residence of the last 10 years:
_____from____till____
(if the respondent migrates often during the year:
_____from____till____
*Ask for the change in **main locations (regions)** where the*
_____from____till____
respondent moved around
_____from____till____
(if not applicable, code NA)
_____from____till____

_____from____till____

_____from____till____

_____from____till____

_____from____till____

9 Highest education level:_____
(0=none; 1_=primary school; 2_=secondary school; 3_ =college; 4_=university; 5= (Koranic school)
(indicate the last class as well, e.g 14 = primary school, standard four), 23 = secondary school form three).

10a. Does the household has a (answer with Y/N):

1) brick house _____
2) iron sheet roofing, _____
3) car, _____
4) motorbike_____
5) bicycle_____
6) donkeycart_____
7) TV_____
8) Radio_____
9) mobile telephone_____
10) biogas_____
11) solar energy_____
12) electricity line _____
13) bank account _____

10b. Does the household have a commercial plot? (Y/N) ____ If yes: Number_____
Where_____

10c. Does the household have a residential plot? (Y/N) _____ If yes: Number _____

B: HOUSEHOLDCHARACTERISTICS AND AVAILABILITY OF NATURAL RESOURCES

11. Household composition

	male	female

Number of children (0-4 years)		
Number of children (5-19 years)		
Number of adults (20-59)		
Number of adults (60+)		

12. Main household occupation/ main source of income:__
(1)=livestock keeping;(2)=farming; (3)=fishing; (4)=hunting/ gather.(5)=shop keeping; (6)=trading (agr);
(7)=trading (non-agr); (8)=white collar job; (9)=blue collar job (10)other: specify_____)

13. Other sources of income next to main occupation (more than one answer possible):__
(1)=livestock keeping; (2)=farming; (3)=fishing; (4)=hunting/gathering;(5)=shop keeping; (6)=trading (agr);
(7)=trading (non-agr);(8)=white collar job; (9)=blue collar job (10)other:_____)

14. Number of animals belonging to the household:

	Number
Cattle	
Goats/ Sheep	
Camels	
Chicken	
Others/Specify: 1. 2.	

15. Is this number of animals sufficient for the household's milk consumption need?
Not at all 0 0 0 0 0 Very much so

16. If yes: do you sell milk? (Y/N/NA)_____

17. If no: did you ever have a sufficiently large herd? Yes, ____Years ago. No NA

PASTURE (for households normally involved in herding animals (if not applicable use code NA)
18. Is the pasture in use by the household an:
1) Individual ranch 2) group ranch 3) company ranch 4) trust land
5) Else_____

19. Which areas do you use to graze your animals?
1) Near homestead 2) else_____ 0_____ km

20. Is there enough grazing land available for your household in the dry season?
Strongly disagree 0 0 0 0 0 strongly agree

21. Is there enough grazing land available for your household in the wet season?
Strongly disagree 0 0 0 0 0 strongly agree

22. If negative: since which year does the household lack sufficient grazing pastures? NA
YEAR____

23a. Does a 'grazing regulation' exist in the area(s) which you use to let our animals graze? (Y/N/ Don't know)
_____

23b. If yes: Which institution/person/group regulates this grazing? _____
_____
_____

24. How would you indicate the trend of **good grasses** available in recent years compared to the last 10 years
Strongly decreased 0 0 0 0 0 strongly increased

25. How would you indicate the trend of **bad grasses** available in recent years compared to the last 10 years
Strongly decreased 0 0 0 0 0 strongly increased

26. If quality of pasture is decreasing please indicate reasons for this negative trend. (If not, code NA):___
_____

	Strongly Disagree				Strongly agree
1. more animals (overgrazing – erosion)	0	0	0	0	0
2. less animals (under grazing –shrub/bush)	0	0	0	0	0
3. (bad)invading plant species (*mathenge*)	0	0	0	0	0
4. salty water flooding	0	0	0	0	0
5. salinization of groundwater	0	0	0	0	0
6. more shambas encroaching on pastures	0	0	0	0	0
7. more wildlife competing over grass	0	0	0	0	0
8. new (fenced) activities, e.g. *jatropha*	0	0	0	0	0
9 Lack of finances to buy/lease pasture	0	0	0	0	0
10. less flooding of river /drying of water sources	0	0	0	0	0
11. less rainfall	0	0	0	0	0
12. longer dry seasons	0	0	0	0	0
13. higher temperatures	0	0	0	0	0
14. urbanisation	0	0	0	0	0
15. _____	0	0	0	0	0

ARABLE LAND (SHAMBAS) (If applicable, if not: code NA an continue with question 30)
27.Which areas does your hh use to cultivate? – near homestead 0 / else: _____ 0

28. Is there enough good arable land available for your household?
Not at all 0 0 0 0 0 Very much so

29. If less good arable land available in this region what are the reasons for this trend: _____
_____
_____

WATER RESOURCES

30. Does your household use water from :	Always	After Rains Only	Stress Period Only	Dis-Tance	Ownership	Livestock Use (Give Order Importance) NA	Human Consumption (Order) NA	Used For Cultivation (Order) NA
1. shallow well	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____
2. borehole	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____
3.water pan/hole	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____
4. dam	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____
5. roofcatchmentwaterjar	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____
6. pipeline watertap	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____
7. river	y /n	y /n	y /n	Km__	-	_____	_____	_____
8. _____	y / n	y / n	y / n	Km__	ind/gr/gov	_____	_____	_____

31a. Is there enough water available for your **household (human) consumption**?
Strongly disagree 0 0 0 0 0 strongly agree

31b Trend of the last 10 years
Strongly decreased 0 0 0 0 0 strongly increased

31c. If the answer is negative: What is the reason for the water scarcity? *(or: NA)* _____
_____
_____

32a is there enough water available for your hh's **economic activities** ? (agriculture/livestock)
Strongly disagree 0 0 0 0 0 strongly agree

32b Trend of the last 10 years

Strongly decreased 0 0 0 0 0 strongly increased

32c If the answer is negative: What is the reason for the water scarcity? *(or: NA)*_____

_____

33a How is the quality of the water for human consumption?

Very Bad 0 0 0 0 0 Very Good

33b How is the quality of the water for economic purposes?

Very Bad 0 0 0 0 0 Very Good

34. Are you familiar with the WRUAs which is operating in this area? (Y/N)_____

WILDLIFE

35a Quantity of wildlife in the area

Very low 0 0 0 0 0 Very high

35b What is the trend of the quantity of the last 10 years?

Strongly decreased 0 0 0 0 0 Strongly increased

36 Does your household use wildlife (products e.g., feathers) for:

a. Home consumption 1) yes 2) No

b. Commercial purpose 1) yes 2) No

C: MIGRATION

37a Does your household move to different locations from time to time:
1) yes
2) No (go to question 39)
3) No, but used to do so

37b How often do you migrate?
1) Less than once in the 2 year
2) 1 time in the 2 year
3) 1 time a year
4)2 times a year
5) 3 times a year
6) 4 times a year
7) More than 4 times a year

37c Does this migration/movement happen on a voluntary basis?

Completely involuntary 0 0 0 0 0 Completely voluntary

37d When 1 of the first 3 dots is answered: What is the reason this does not happen voluntary? (*or NA*)

_____

_____

38a Explain the trend of the frequency that you migrate(last 10 years):

Strongly decreased 0 0 0 0 0 strongly increased

38b What is the reason for this increase/decrease?

_____

_____

39 What are the factors (<u>characteristics of your residence!)</u> that make you **want to leave** to another place (push factors)?

1. The economic situation of your current place

Not at all 0 0 0 0 0 Very much

2. Social contacts

Not at all 0 0 0 0 0 Very much

3. Availability of water at current place

Not at all 0 0 0 0 0 Very much

4. Availability of pasture at current place

Not at all 0 0 0 0 0 Very much

5. Security at current place
Not at all 0 0 0 0 0 Very much

6. Availability of health facilities
Not at all 0 0 0 0 0 Very much

7. Function Water regulations(by WRUAs)*
Not at all 0 0 0 0 0 Very much

8. Political motivation**
Not at all 0 0 0 0 0 Very much

9. Ethnical motivation***
Not at all 0 0 0 0 0 Very much

10. Cultural motivation****
` Not at all 0 0 0 0 0 Very much

11. Other_____
Not at all 0 0 0 0 0 Very much

12. Other_____
Not at all 0 0 0 0 0 Very much

* If function Water regulation is important, specify why:_____
_____

**If Political motivation is important, specify why:_____
_____

***If ethnical motivation is important, specify why:_____
_____

**** If cultural motivation is important, specify why:_____
_____

40. What are the factors that make **another place more attractive than your current place**? (pull factors)

1. The economic situation of that place
Not at all 0 0 0 0 0 Very much

2. Social contacts
Not at all 0 0 0 0 0 Very much

3. Availability of water at current place
Not at all 0 0 0 0 0 Very much

4. Availability of pasture at current place
Not at all 0 0 0 0 0 Very much

5. Security at current place
Not at all 0 0 0 0 0 Very much

6. Availability of health facilities
Not at all 0 0 0 0 0 Very much

7. Function Water regulations (by WRUAs)*
Not at all 0 0 0 0 0 Very much

8. Political motivation**
Not at all 0 0 0 0 0 Very much

9. Ethnical motivation***?
Not at all 0 0 0 0 0 Very much

10. Cultural motivation****
Not at all 0 0 0 0 0 Very much

11. Other_____
Not at all 0 0 0 0 0 Very much

12. Other_____
Not at all 0 0 0 0 0 Very much

* If function Water regulation is important, specify why:_____
_____

**If Political motivation is important, specify why:_____

***If ethnical motivation is important, specify why:_____

**** If cultural motivation is important, specify why:_____

41. *What are the factors that make you stay at your current place (also when someone does migrate)? (keep factors)*

1. The economic situation of your current location

Not at all	0	0	0	0	0	Very much

2. Social contacts

Not at all	0	0	0	0	0	Very much

3. Availability of water at current place

Not at all	0	0	0	0	0	Very much

4. Availability of pasture at current place

Not at all	0	0	0	0	0	Very much

5. Security at current place

Not at all	0	0	0	0	0	Very much

6. Availability of health facilities

Not at all	0	0	0	0	0	Very much

7. Function Water regulations (by WRUAs)*

Not at all	0	0	0	0	0	Very much

8. Political motivation**

Not at all	0	0	0	0	0	Very much

9. Ethnical motivation***?

Not at all	0	0	0	0	0	Very much

10. Cultural motivation****

Not at all	0	0	0	0	0	Very much

11. Other_____

Not at all	0	0	0	0	0	Very much

12. Other_____

Not at all	0	0	0	0	0	Very much

* If function Water regulation is important, specify why:_____

**If Political motivation is important, specify why:_____

***If ethnical motivation is important, specify why:_____

**** If cultural motivation is important, specify why:_____

42: What are the factors that makes you decide **not to migrate** to a certain place? (in other words: what are the characteristics of a place that make you decide to go to another place, or choose not to migrate at all? (Repel factors)

1a. The economic situation of the location (*or in other words: if the economic situation in a place is bad, will this make you decide **not to migrate to this place**?)*

Not at all	0	0	0	0	0	Very much

1b. Lack of means to migrate (lack of money)

Not at all	0	0	0	0	0	Very much

2. Lack of social contacts

Not at all	0	0	0	0	0	Very much

3. Lack of water

Not at all	0	0	0	0	0	Very much

4. Lack of pasture

Not at all	0	0	0	0	0	Very much

5. Insecurity

Not at all	0	0	0	0	0	Very much

6. Lack of health facilities

Not at all	0	0	0	0	0	Very much

7. Function Water regulations(by WRUAs)*

Not at all	0	0	0	0	0	Very much

8. Political aspects**

Not at all	0	0	0	0	0	Very much

9. Ethnical motivation***?

Not at all	0	0	0	0	0	Very much

10. Cultural aspects****

Not at all	0	0	0	0	0	Very much

11. Other_____

Not at all	0	0	0	0	0	Very much

12. Other_____

Not at all	0	0	0	0	0	Very much

* If function Water regulation is important, specify why:_____

**If Political motivation is important, specify why:_____

***If ethnical motivation is important, specify why:_____

**** If cultural motivation is important, specify why:_____

43. Could you please draw on the map how you migrate in a year time (starting from?) (if not applicable, NA)

44. How do you choose the migration routes you use? (if not, NA)_____

45a Have these routes been changed the last 10 years? (Y/N) NA

45b What are the reasons that these routes have changed/stayed the same? (if not applicable, NA)_____

46 How do the different types of water resources (q30) influence your migration routes? (if not applicable, NA)

47 Which obstacles does your household come across when trying to move from one to another place? (order of importance: 1 is most important)

Obstacle:_____

Obstacle:_____

Obstacle:_____

48a. How often do you cross land that is used by agriculturalist when you are moving around?

Never 0 0 0 0 0 Always

48b. Explain trend (last 10 years):
Strongly decreased 0 0 0 0 0 strongly increased

48c. What are the reasons for this increase or decrease?_____
_____
_____
_____

49a. Does the existence of WRUAs affect the decision of which migration routes to use? (Y/N) (*unfamiliar with WRUA: code NA*)
49b. Explain why it does or it does not have influence._____

50. Have you ever thought about settling at a permanent place instead of moving from one place to another?
Never 0 0 0 0 0 Very often

When asking agriculturalists (if applicable, otherwise code NA and continue with question 53).
51. If settled after being a pastoralist: What were the reasons for you to settle in this area and change to a sedentary lifestyle? (if applicable)

52a. Number of pastoralists crossing this location?
Very Low 0 0 0 0 0 Very high

52b. What is the trend of the last 10 year?:
Strongly decreased 0 0 0 0 0 strongly increased

52c. What are the reasons for this increase or decrease?_____
_____
_____

D: CONFLICTS/COMPETITION OVER NATURAL RESOURCES

53 Which statement would characterize the use of natural resources in this **REGION** best: In this region the people use the natural resources available:

1 WATER: Without conflicts 0 / some conflicts 0 / frequent conflicts 0
2 LAND (SHAMBA): Without conflicts 0 / some conflicts 0 / frequent conflicts 0
3 LAND (Pasture): Without conflicts 0 / some conflicts 0 / frequent conflicts 0
4 WILDLIFE Without conflicts 0 / some conflicts 0 / frequent conflicts 0
5 OTHER _____ Without conflicts 0 / some conflicts 0 / frequent conflicts 0

E: CONFLICTS OVER NATURAL RESOURCES EXPERIENCED BY THE HOUSEHOLD MEMBERSTHEMSELVES!!!

54 Please specify the most severe conflicts experienced by your households in the following periods. Please mention the kind of conflict, natural resource involved, the cause, the other party involved besides the household, the intensity, the outcome for the household) (e.g. Human-wildlife: all maize (1 acre) eaten by baboons, somehow positive outcome for hh because of compensation by KWS).
54a The last month:

54b The last year (excl last month):

54c The last 10 years (excl last year)

54d Ever (excl last 10 years)

55 Which of these conflicts have been on the INCREASE/DECREASE in recent years? USE ++/+/±/-/- -

Conflict over	Increase/Decrease	Parties involved
Water		

land cultivation		
land grazing (pasture)		
Forest/wood		
Wildlife		
Other/ specify:		

F: CO-OPERATION/RECONCILIATION

56 Which institutions have been (in) effective in resolving conflicts?

If effective: choose the kind of conflicts in which it has proved to be effective (more answers possible): 1=Intra-group, 2=Inter-group, 3= Group –government, 4=Group-private business 5= Human- wildlife. If an institution is unknown, choose: DN.

Institutions	**Very Ineffective**			**Very Effective**		**Resolving Kind of conflicts**
1. Traditional peace committee	0	0	0	0	0	
2. WRUAs	0	0	0	0	0	
3. Government (e.g. police)	0	0	0	0	0	
4. Religious organizations	0	0	0	0	0	
5. NGOs (local/international)	0	0	0	0	0	
6. Others	0	0	0	0	0	

57. Questions/Comments/ Important elements I have forgotten?_____

_____

_____