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DEPARTMENT OF DEVELOPMENT STUDIES

**Turkana Pastoralists and Adaptation to Climate Change**

Pastevci kmene Turkana a adaptace na klimatickou změnu

(Bachelor thesis)

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At 1.22pm the Bassonarok appeared, an enormous lake of blue water dotted with some islands. The northern shores cannot be seen. At its southern end it must be about 20 km wide. As far as the eye can see are barren volcanic shores. I give it the name of Lake Rudolf. Daudu Muhiman stayed behind, maybe died? One elephant.

Count Samuel Teleki, March 5<sup>th</sup>, 1888

## **Acknowledgement**

I would like to thank to Mgr. Zdeněk Opršal, Ph.D. for the supervision of this thesis, for his patient guidance and valuable recommendations.

**Declaration of authorship**

I do solemnly declare that I have authored this bachelor thesis *Turkana Pastoralists and Adaptation to Climate Change* and that I have correctly acknowledged all bibliographic references and quotations.

In Olomouc (date):

Signature: .....

## ABSTRACT

This bachelor thesis is concerned with the Turkana people of northern Kenya and their adaptation strategies. The aim of this thesis is to assess the difficulties resulting from the ongoing climate change and evaluate the strategies the Turkana people adopt to cope with them. To be able to make this assessment this thesis looks at the history of the tribe and their traditional lifestyle that allowed these people to survive in the harsh environment in the past. The focus of this thesis is on pastoralism, which is the main adaptation strategy undertaken. Then it outlines the manifestation of the ongoing climate change in the Turkana region and the challenges it poses for the Turkana people. This thesis describe the adaptation strategies the people undertake to deal with these challenges and it evaluates the implications for the future of the Turkana tribe. It concludes that pastoralism, adapted to the new circumstances brought mainly by climate change, is still a viable strategy for the survival of the Turkana people in the region.

**Key words:** Turkana, climate change, adaptation strategy, pastoralism

## ABSTRAKT

Tato bakalářská práce se zabývá kmenem Turkana v severní Keni a jeho adaptačními strategiemi. Cílem této práce je popsat problémy způsobené současnou změnou klimatu a zhodnotit strategie, které lidé kmene Turkana využívají, aby se s těmito problémy vyrovnali. Abych byla schopna provést toto zhodnocení, nejprve popisuji historii a tradiční způsob života tohoto kmene, který mu v minulosti umožnil přežít v nehostinných podmínkách severní Keni. Tato práce se soustředí na pastevectví jako na hlavní adaptační strategii. Dále v této práci nastíním projevy současné změny klimatu v regionu Turkana a výzvy, které s sebou tyto změny přinášejí. Tato práce se zaměřuje na adaptační strategie, které kmen Turkana využívá, aby byl i nadále schopen přežít v této oblasti a hodnotí možný vývoj situace tohoto kmene. Ve své práci docházím k závěru, že pastevectví, pokud bude adaptováno na nové podmínky, je i nadále dobrou strategií pro přežití kmene Turkana v této oblasti.

**Klíčová slova:** Turkana, změna klimatu, adaptační strategie, pastevectví

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All the photos were taken by David Modrý in the Turkana District.

# 1 Introduction

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The Turkana region, located in northern Kenya, offers to its inhabitants conditions difficult for survival. Currently, the climate around Lake Turkana, world's largest desert lake, is harsh, with high temperatures and low, seasonal rainfall. This inhospitable environment is nowadays very difficult for the Turkana people to survive in. And yet, it is the cradle of human kind. It was on the shores of this lake that some of the evidence of the early human evolution was found. This tells us that the environment around the lake did not always look like this. The climate of the area is extremely dynamic, with the lake itself changing in size considerably. Up to 6,500 years ago, it even had a connection with Nile (Avery, 2013). Afterwards a more arid period begun, the rainfall declined and the water levels dropped. To survive in the area as hostile as it is today, the Turkana people had to adapt. And they were very successful. The main strategy to cope with the environment was pastoralism which became an integral aspect of their traditional lifestyle. Pastoralism allowed the Turkana people to undertake more measures to live in the Turkana district around the lake, such as variability of livestock species, variability of staples and the nomadic movement of herds. Thanks to these arrangements, they were able to survive in this region and they are commonly used as a model for human adaptation in classic anthropology.

However, ongoing climate change is affecting the area around Lake Turkana and the pastoralists of the Turkana tribe have to adopt various strategies to mitigate the impact of these changes. The adaptive measures adopted in the past are not enough to cope with these changes and the Turkana pastoralists have to look for other means to keep their livelihoods in the inhospitable region.

The aim of my thesis is to assess the difficulties resulting from climate change and evaluate the strategies the Turkana people adopt. It is also going to look at the implications for the future of the tribe.

The research questions I am going to answer in my thesis are the following:

- How did the traditional lifestyle of the Turkana tribe looked in the past?
- What are the characteristics of the climate around Lake Turkana?
- What are the manifestations of current climate change around Lake Turkana?
- How does climate change influence the Turkana people?
- Which strategies do the Turkana people adopt to mitigate the impact of climate change?
- What can be the expected outcome of this situation?
- What are the implications for the future of the Turkana tribe?

To achieve the aim of my thesis I am going to examine published resources about the life of the Turkana tribe with emphasis on their traditional lifestyle described in a complex study by Little & Leslie (1999). I am going to compare the results of this study, which was conducted in the 1980s, with more recent studies dealing with the current lifestyle and problems of the Turkana tribe. I am also going to evaluate predictive data related to the climate in the area to describe the future changes the Turkana pastoralists have to face.

## 2 History of the Turkana tribe

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### 2.1 THE TURKANA TRIBE BEFORE THE PRESENCE OF EUROPEANS

To better understand the current situation and the problems the Turkana people have to face, it is crucial to look at their origins and history. The Turkana tribe belongs to the group of Nilotic-speaking people. The Nilotic-speaking people are commonly separated into three groups: Highland (Southern Nilotes, Plains (Eastern) Nilotes and River-Lake (Western) Nilotes. Together with other tribes, for example the Maasai or Samburu, the Turkana are part of the Plains Nilotes. The Nilotic-speakers came to the area of the Rift Valley, in the south of Ethiopia, around four to six thousand years ago. This was the time of the first contact with the Cushitic-speaking people, who were already living in that area. Through this contact, Nilotes, the newcomers, influenced the culture of Cushitic-speaking people as they brought their traditions with them. The most influential of these traditions were probably the age-grouping system and the emphasis on intensive cattle husbandry, which continue to be a prominent markers of both the Nilotic and Cushitic cultures until the present day (Fedders & Salvadori, 1979). An advantage of the Nilotic people in the dry region was the acquisition of zebu cattle because it was more resilient to the harsh environmental conditions (Dyson-Hudson, 1999). The cultural dominance of the Nilotes ended around 2000 BC when the Cushitic-speaking people started to expand. The time of their arrival to the region of Northern Kenya is unclear. The first group of Nilotes, the Highland Nilotes, migrated to present-day northern Kenya around one to two thousand years ago and it was there that the division into the before mentioned three branches took place (Fedders & Salvadori, 1979). However, not all the sources agree on this timing. Dyson-Hudson (1999) claims that the Turkana came to the region only 500 years ago from the present-day Sudan. These discrepancies show that the information on the history of these people is insufficient and should be a subject to further research.

At the beginning of the 18<sup>th</sup> century, the Turkana people expanded south and took over the plains west of Lake Turkana. The tribes living in the area prior to their arrival (for example the Siger people, Samburu and Rendille) were either displaced or assimilated. At this time, the Turkana people already gained control over most of the current Turkana District. Throughout the 18<sup>th</sup> and 19<sup>th</sup> century, the Turkana people continued their raids of the neighboring tribes with the aim of gaining either new territories or more livestock. In the 1870s the Turkana people adopted more camels into their herds as they captured great number of them from the neighboring tribes. At the end of the 19<sup>th</sup> century, the Turkana were on the top of their territorial expansion and were powerful and wealthy people (Dyson-Hudson, 1999). It was the time when the European travelers started to explore the area. Hungarian Count Samuel Teleki was the

first European to discover and describe Lake Turkana and the surrounding area. These European explorers found the Turkana people to be very proud, hostile and aggressive people. The first contact set the mood of the future Turkana-European relationship.

## **2.2 TURKANA UNDER THE BRITISH PROTECTORATE**

At the beginning of the 20<sup>th</sup> century, the administrative borders in the Turkana region were unclear. Three powers claimed the area: Uganda, the British East Africa Protectorate and Abyssinia, present day Ethiopia. Abyssinia wanted to expand its territory southwards and have influence in the region, which was rich in ivory. British wanted to expand their territory northwards, up to the north of Lake Turkana. On the other hand, neither the Governor of Uganda, nor the Governor of the British East Africa Protectorate wanted to bear the responsibility for administration of the Turkana region, which was yet to be explored, with no maps available to the administrators. The Turkana were caught between these nations, who were competing for their territory. The border between Abyssinia and the British East African Protectorate was finally established in 1908. However, even after this date, Abyssinia continued to have bigger influence than the British in the region and it even appointed a governor of north Turkanaland until 1918, more than ten years after they officially lost control over the territory. This was made possible by the unwillingness of the Governors of the British Protectorates to spend money on securing of a non-profitable, desert territory. Abyssinia continued to provide guns for the Turkana and encourage them to pillage and poach. While the region was destabilized, it was easier for the Abyssinians to hunt there for elephants, whose ivory was very profitable trade article. The British administration, who had no real power in the region couldn't prevent these raids (Pavitt, 1997).

Finally it was the British who decided to end the lawlessness in the Turkana district, because they were worried about the safety of the white settlers in East Africa Protectorate and they saw the raids that took place for centuries as provocations (Dyson-Hudson, 1999). In Kenya, Turkana were the only tribe to resist the British rule. The British tried to punish them and force them into obedience by expropriating their livestock under the Collective Punishment Ordinance, but the effect of their actions was exactly the opposite of what they intended. It created even more stubborn opposition to the British rule and desire of revenge instead of willingness to submission. One of the reasons for the lack of success of these operations was the British lack of understanding of the local culture and the relationships between the tribes. One of the mistakes the British made was that for executing the punitive operations, they recruited members of the tribes who were enemies to the Turkana. Through this action, in the eyes of the Turkana tribe, they became allies of the Turkana enemies, conspired against the Turkana with the only aim: to steal their valued livestock. Since this livestock was the most

valuable possession and a sign of power, the Turkana wouldn't give it away and they were ready to fight back. The weaker tribes, who used to be raided by the Turkana, sided with the British as they hoped they will gain some advantage against the stronger Turkana (Pavitt, 1997). These tribes, who were cooperating with the British, also helped to shape their opinion on the Turkana people. As their enemies, they saw Turkana to be aggressors and usurpers and transferred this opinion on to the British administrators (Dyson-Hudson, 1999). This connection of tribal enemies with the British, together with the loss of livestock, led to the disruption of the local power and it escalated the tribal conflicts in the region instead of settling them down, as the British intended (Pavitt, 1997).

Another point in the history of the Turkana people, when the British rule made a mistake and impacted this tribe in a negative way, was the disarming of the Turkana people that took place in the 1920s. The British administration of the Turkana region felt that the guns, possessed by Turkana in big quantities thanks to the Abyssinian support, were an obstacle to establishing the rule of law in the northern Kenya. Turkana were disarmed by force, which meant a big advantage for the traditional enemies of the tribe. Following the disarmament, Pokot and Dassenach, who didn't have a shortage of arms, started to loot the Turkana herds, which were now without protection. They saw it as an opportunity for revenge for the times when Turkana were the strongest tribe in the region. Now it was the Dassenach who were supported by Abyssinia as a destabilizing factor in the region. The British authorities, which were residing in Nairobi, did nothing for the protection of the citizens of their "protectorate" (Pavitt, 1997). It was a hard time for the Turkana tribe, their men being killed by enemies and their livestock, the principal means of subsistence, was stolen. According to Pavitt (1997), many of today's problems that the Turkana have to face, stem from these early misfortunes and colonial mistakes. All together, the British effort to bring the Turkana under control were quite unscrupulous and it is estimated that the direct and indirect casualties of these actions were 14 % of the population (Dyson-Hudson, 1999).

### **2.3 ISOLATION OF THE TURKANA REGION**

During the British rule, the Turkana region, as part of the Northern Frontier District, was isolated from the rest of the Kenyan territory. The Closed Districts Ordinance, which came into force in 1902, restricted the movement of Africans in and out of the region (Weiss, 2004). There were four guidelines, developed by the British during their early administration of the Turkana region. Firstly, the Turkana region was to be administrated only on a maintenance basis which meant no investments for the region. Secondly, the presence of outsiders was to be strictly controlled. Thirdly, those nomadic people were allowed to follow their own customs under the guidance of their own chiefs. Lastly, the government interference was to be kept to

an absolute minimum (Dyson-Hudson, 1999). It is evident from these guidelines that the British saw the negative impact of their involvement in the region and wanted to change the way the Turkana region was administered. These policies gave the Turkana people a certain level of independence and a leeway to go on with their traditional way of life. On the other hand, those policies that were followed throughout the colonial period and even later, created a deep and long-lasting isolation of the region. This isolation had a negative effect on the development of the area (Weiss, 2004). The Turkana region was less developed than the rest of the country, lagging in education as well as medical facilities. Not even the missionaries were allowed entrance to the area until shortly before the independence of Kenya. And even then, they could dwell in the region only under the condition they agreed to provide medical and educational facilities (Dyson-Hudson, 1999). The British administration was taking advantage of the remoteness and underdevelopment of the region and used it for example for keeping the detainees of the Mau Mau uprising (Pavitt, 1997). Nowadays, the Turkana County is one of the poorest areas of the country with the poverty level of 74%. For comparison, the average poverty level in the rest of the country is 46% (Omolo, 2011).

### 3 Traditional Turkana lifestyle

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The lifestyle of the Turkana people changed throughout the history of the tribe. Thanks to the remoteness of the area they inhabit and due to attitude of the British administration, the Turkana people were able to keep many of their traditions up to the present day. To understand their current lifestyle, it is important to look at the way the Turkana people lived in the past. The description of the Turkana lifestyle in this chapter is based mainly on Little & Leslie (1999) who are drawing the information from the South Turkana Ecosystem Project study, conducted mainly in the 1980s.

The harsh environment of the Turkana region has the most prominent role in shaping the life of the Turkana people. Living under the conditions of low level and low predictability of precipitation, high insolation and low availability of plant food digestible by humans requires complex strategies to cope with these hurdles (Little et al., 1999). Pastoralism, which combines several of those strategies, is the most important feature of the Turkana culture. The everyday life of the Turkana people revolves around their animals, which are the principal means of subsistence for them. These animals are also the measurement of wealth and social status and play the main role during most of the cultural rituals. The oral tradition of the Turkana tribe attributes even the reason for their arrival to the area of northern Kenya and breaking away from the Jie people to cattle. A story says that the reason for their relocation to northern Kenya was that they followed a wayward ox (Fedders & Salvadori, 1979). Little et al. (1999) claim that it is mainly the flexibility and powerful adaptive capacity that makes it possible for the Turkana to survive in such inhospitable and highly dynamic environment.



*The Turkana people have a very close relationship with their animals (Photo: D. Modry)*

### 3.1 VARIABILITY OF LIVESTOCK SPECIES

One of the strategies, making it possible for the Turkana people to survive in the harsh conditions of the arid Turkana land, is variability of species of livestock and of the products this livestock provides. The Turkana keep several species of livestock. Cattle, camels, goats, sheep and donkey each exploit a different niche and thus allow the people to use up all the benefits their hostile environment offers. Keeping these five different species also reduces the risk of loss of animals be it due to drought, disease or raiding. Each of these species has its unique role in supporting the Turkana people in their everyday struggle. Camels have high milk productivity and can survive even the droughts that are common in the region. The disadvantage of camels is their slow reproduction. The cattle can produce as much milk as the camels, plays a special role during the ceremonies and it is considered a gauge of wealth. On the other hand, it has very high mortality during the droughts and cannot be milked at all when the conditions are not favorable. The goats are almost as resilient to the droughts as camels, they are able to reproduce very quickly, so the herd recovers soon after the drought. On the other hand, they need to drink often, produce only small amount of milk and cannot travel as far as the other species. The sheep are not very drought-resilient, nor do they produce big quantities of milk. They are valued for their fat tail, which is especially beneficial for people who suffer injuries. Even though the donkeys cannot be milked, they are used for carrying water, moving camps and in the emergency cases, when other food is not available, they can be eaten as well (Leslie & Dyson-Hudson, 1999).



*Turkana elder grazing his herd of goats near Lake Turkana (Photo: D. Modrý)*

These species are complementary in terms of resistance to drought, resistance to diseases, their need concerning water and forage and in terms of production. That is the reason for most of the families to keep all of these species even though the composition of herds varies in representation. The composition of herds depends on the preferences and abilities of its owner, as some herders understand certain species of animals better and thus are more successful in grazing them. It also depends on the labor available to the owner, because

during the drought the herd has to be separated into smaller units, each of which needs someone to take care of it. This practice will be discussed later in more detail. The change in environmental conditions also influence the composition of the herds, as the favorable conditions for different species vary and thus it is profitable to alter the number of animals throughout the year.

### **3.2 VARIABILITY OF STAPLES**

To make their diet more variable, the Turkana use all the available animal products: meat and milk as well as blood. Women milk the animals every day. Each woman is allocated a certain stock of animals and can use its milk to feed her children. Blood can be drawn from all healthy animals who are not pregnant or milked and is consumed mainly by the men who are taking care of guarding and grazing the livestock. The meat is usually consumed immediately, when there is an abundance, the owner shares with other who are later, when they have surplus, expected to share meat in return. The relative representation of these three staples in the diet varies depending on the food availability. During the droughts, the meat becomes the main staple, after the dry season it is the milk of animals with calves and later the blood of animals that are not milked. The choice between these three staples is an important strategy that leaves at least some possibility of survival during the fluctuation of climate (Leslie & Dyson-Hudson, 1999).

### **3.3 THE NOMADIC MOVEMENT OF HERDS**

Another strategy is the nomadic movement of herds. This movement enables the herders to cope with the low density and unpredictability of pasture and to avoid environmental risks. The herds can be split up by the species, as different species prefer certain type of vegetation or environment and faces different hazards. The herds can be also split up by production status, while women tend the animals that are milk and men graze and guard the animals that are not milked. The movement of the herds is the principal force behind the movement of the Turkana people. In general, each family tends their own livestock. It is divided between the main settlement (*awi*) and satellite camps (*abor*). Each individual decides their migration route themselves, there are no prescriptions or common rules to this movement (McCabe, Dyson-Hudson & Wienpahl, 1999). According to McCabe, Dyson-Hudson & Wienpahl (1999) up to 60 % of the reasons to move the *awi* are environmental, such as lack of water or forage for the animals. 20 % of the reasons are social, such as attacks from Pokot or bandits. However, even if the main reason to move is environmental, the herds still take into account social factors, such as the location of *awis* of their friends and other family members.

Usually, the movement of the herds follows an annual pattern. This annual cycle starts with the rainy season (between April and July) in the sandy plains in the north, called the *Toma*. At this time the water is easily available and there is enough forage to feed the animals. This time of the year allows several settlements (*awi*) to come together and engage in social events as this period doesn't require much labor. With the beginning of dry season, the herds start to migrate southwards and the cattle is often separated from the rest of the animals and sent to graze in the highlands. More into the dry season, the tribe divides into separate *awis* again. The milking and non-milking animals are separated and while the milking animals stay with the *awi* and most of its population, the non-milking animals follow their own migratory route. When all the herds are separated into smaller units, there is an order in which they should pass through the pastures. The cattle comes first to ensure there will be enough forage for this most valuable livestock and it is followed by small stock. At the peak of the dry season, the animals are concentrated along the southern border of the Turkana territory. This area is not safe due to proximity of the Pokot tribe so the herders try to spend as little time in the area as possible, even though the pasture is rich in this region. When the rainy season starts the herds turn their movement to the east and as soon as the forage in the north of the territory is sufficient, they return to the *Toma*, where their annual cycle of migration begins. On this annual journey the Turkana people and their herds cover the distance of 50 to 100 km during the good years and 100 to 200 km during the dry years.

This is a common route of migration, but there are several factors that may lead to herd owners to alternative routes. It can be either extreme drought, when the *Toma* cannot be used at all, it can be a fear of the Pokot raids that force the Turkana to avoid the southern part of their territory altogether. These routes are also disrupted by the humanitarian aid, as during the drought of 1991, when the famine relief camps were one of the most important determinants for the migratory routes of that year. However, there are also significant differences between the herders. Their choice of the route is influenced by the size of their herd, their family situation (how much labor do they have available) and also on their personal preferences as to the species of animals they keep (McCabe, Dyson-Hudson & Wienpahl, 1999). These personal preferences and the lack of tribal organization of the migration cause the individual responses to the same environmental factors to be quite different, as each herder adopts a different strategy.

## 4 Climate around Lake Turkana

As mentioned above, the climate in the Turkana area is very hostile. To better understand the way of life and the adaptations strategies that people in this area have to undertake in order to survive in this harsh environment, one has to look at the climate in more detail.

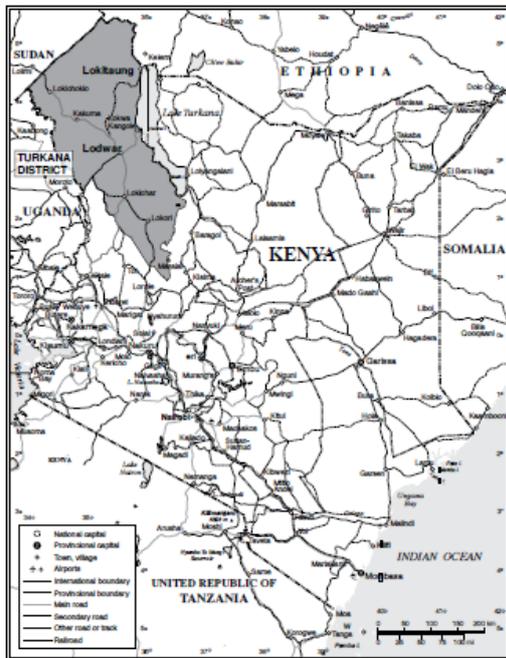


Figure 1: Location of the Turkana District (Omolo, 2011)

This area, mostly inhabited by the Turkana tribe, the Turkana County (also called Turkanaland), is located in the north-western corner of Kenya (Figure 1). The Turkana people who still practice pastoralism live in the area of approximately 9000 km<sup>2</sup> (Little & Leslie, 1999). According to the government of Kenya (2011), in 2009 the population of this area was 855,399.

### 4.1 THE DEVELOPMENT OF CLIMATE IN THE TURKANA REGION

In order to understand current climate change, it is necessary to examine the climate in the past. The climate around Lake Turkana was changing considerably throughout the history. In Pliocene, between 5.33 and 2.58 million years ago, which was the time of the evolution of the first humans, climate change took place in Africa which is believed to have an impact on the human evolution. During Pliocene, the climate shifted from relatively warm to a generally colder climate in Pleistocene. In Africa during early Pliocene, the conditions were warm and humid. During later Pliocene, they became cooler, drier and more seasonal, with savannas and deserts spreading. During this time, the environment of the Turkana basin changed considerably. There was a significant shift from forests and woodlands towards savannas. The

climate gradually changed into more arid and the seasonality increased (Fernández & Vrba, 2005).

The changes in the climate can also be observed on the changing water levels of the Turkana Lake. Up to 6,500 years ago, there was a connection between the lake and the Nile River. Later, according to Avery (2013), came another major climatic transition which again caused the region to become even more arid, the water levels in the lake dropped and the connection with the Nile was lost. This is the time when the climate around Lake Turkana started to look similar to what can be observed today.

## 4.2 THE CURRENT CLIMATE

According to Little et al. (1999), the Turkana region is located in a semi-arid, arid and very arid ecoclimatic zones. The government of Kenya classifies this region as one of the arid counties of the country (Republic of Kenya, 2011). It is one of the driest areas of Kenya. The temperatures in the region are very high and the average rainfall ranges between 100 mm/year in the very arid zone to 600 mm/year in the semi-arid zone. The amount of rainfall varies considerable between years, but the temperature is quite predictable. The monthly mean temperature ranges between 29 °C and 31 °C, the minimum value being around 22 °C and the maximum value can reach up to 40 °C. Since the temperatures stay the same throughout the year, it is the rainfall that creates the seasonality. In the Turkana region, there are two rainy seasons each year: the so called long rains, peaking usually in April and the so called short rains that peak usually in November (Figure 2). Most of the annual precipitation in the region falls during the period of long rains (Little et al., 1999). In the dry parts of the region, the rainfall is even more unpredictable and variable than in the wetter parts, which further increases the difficulty to adapt for these conditions. The southern part of the Turkana region gets more rainfall, that's why the nomads migrate towards the south in the peak of dry season.

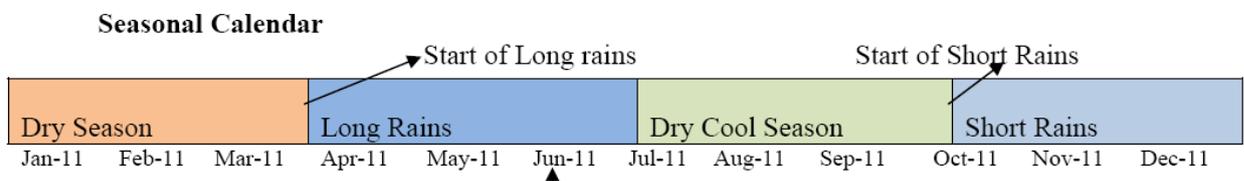


Figure 2: Seasonal calendar of the Turkana region (Riverra-Ferre & López-i-Gelats, 2012)

There are two important rivers flowing through the Turkana region. The Turkwel River which has higher flow rates to the west and the Kerio River to the east. They both originate in the humid highland regions outside the Turkana region, as they flow through the dry area their flow rate decreases and they both empty into Lake Turkana. These rivers may dry up during the dry season, but there are always pools of water on the river beds. Water can be also

gained by digging wells in the sandy river beds. Even though the Kerio River is smaller, it is more easily accessible for the Turkana as accessing the Turkwel River poses threat from the neighboring Pokot tribe and tse tse flies that can infect the livestock with sleeping sickness (Little et al., 1999).

### 4.3 MANIFESTATIONS OF CLIMATE CHANGE

Climate change in the region manifests in various ways and it's hard to predict its development in the future. One of the manifestations of current climate change in Kenya is the overall increase in temperature. Between 1960 and 2003 the average annual temperature increased by 1 °C. The most substantial warming is taking place in the period of long rains, between March and May. The days are getting hotter and between 1960 and 2003 the number of hot days increased by 15%. The hot days are also more common during the period of long rains. Since the year 2000, Kenya has experienced extreme droughts and floods every year (Thornton, 2010). On figure 2 we can see the mean high and low temperatures in Lodwar, the capital of the Turkana District. It shows the projections for temperatures between 2009 and 2090. According to these projections, both the high and low temperatures are clearly increasing in the future (Figure 3).

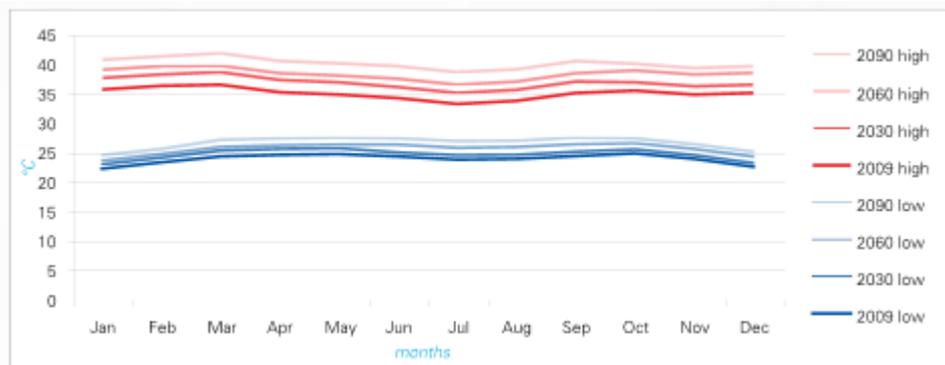


Figure 3: Mean high and low temperatures in Lodwar (Thornton, 2010)

Climate change also brings with it the decrease of rainfall and extreme droughts that are occurring more often than before. The climate projections show that Lodwar, and with it the whole Turkana District, is going to have one of the most variable rainfall patterns in the whole of Kenya (Thornton, 2010). According to this study, the total amount of rainfall may increase in the future, but its distribution is going to cause even more severe droughts and floods. We can observe this fluctuation in figure 3 below. For example in the year 2060, the projection shows the peak of the rainfall to be higher than in 2009, while the minimum is much lower than the situation in 2009 (Figure 4).

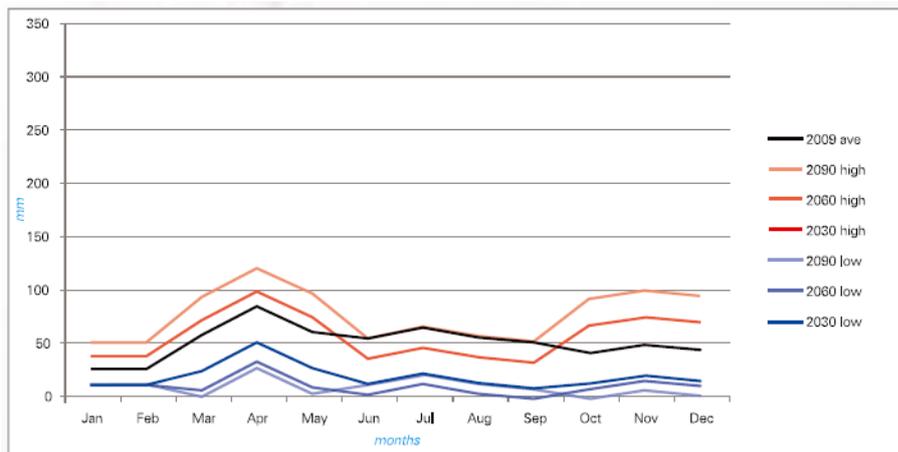


Figure 4: Mean high and low precipitation in Lodwar (Thornton, 2010)

From these projections we can see that the climate is changing and we can expect even more dramatical changes in the future. The climate is going to be more unstable and the extreme weather event, such as droughts and floods are going to be more common. The consequences of the frequent droughts and floods for the Turkana pastoralists are going to be examined in more detail in the next chapter.

#### 4.4 ENVIRONMENTAL FLUCTUATIONS

The ideal pattern of rainfall described earlier doesn't occur every year, as there are substantial year to year differences. In the past, several drought periods occurred, where the rainfall did not reach even the 100 mm/year. According to Little et al. (1999), these year of sub-normal rainfall occur at roughly three to five year intervals. According to Ellis (as cited in Little et al., 1999, p. 48), there are three temporal cycles of drought: the seasonal level, which creates two short droughts every year, the three-to-five-year interval mentioned by Little et al. (1999), and there are also multi-year trends, that last for several decades. However, even these patterns are disputable. Most of the sources agree on the three temporal cycles, there is less agreement on how long these cycles are. For example the study conducted by Notenbaert et al. (2007) identifies ten-year cycles of droughts.

Thanks to the nomadic grazing of livestock, the five different species of animals the Turkana keep and their ability to utilize various animal products, the Turkana are able to effectively cope with the seasonal droughts. The three-to-five-years droughts pose bigger problems and can result in substantial losses of livestock and lead to famine. The impacts of those multi-year cycles are yet largely unknown, but they are likely to cause changes in the composition of herds and means of subsistence (Little et al., 1999). How variable is the climate in the region can be illustrated by the study conducted by Little et al. (1999) when some of their respondents

pointed out that cultivation was possible in the past in some places that couldn't be cultivated in the present. The growing period usually lasts less than 60 days and thus makes cultivation impossible (Notenbaert et al., 2007). It is hard to predict the rainfall due to several factors such as the substantial diversity of relief in the rift valley system, the aridity of the region and the variability of the monsoon rains in this part of East Africa (Little et al., 1999).

## 5 Consequences of climate change for the Turkana people

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As described above, the environment in which the Turkana people have to survive is very hostile and the Turkana have to employ several strategies to cope with the hardships. Climate change that takes place in the area makes their survival even more challenging and they have to devise new means to deal with them.

### 5.1 HAZARDS RELATED TO CLIMATE CHANGE

Climate change poses a serious threat to pastoralism as a source of livelihood because it causes changes in the seasonality and weather patterns, making the climate more intense (Turkana County Climate Change Hearing, 2012). In their study, Riverra-Ferre & López-i-Gelats (2012) identify two main hazards resulting from climate change in the Turkana region: drought and extreme heat and occasional floods. These opposing factors both have very damaging consequences for the traditional pastoralists.

The drought and extreme heat result in many related problems. One of those problems is desertification which is caused both by natural and human factors (Turkana County Climate Change Hearing, 2012). Desertification causes further problems effecting the daily lives of the Turkana pastoralists. As the desert progresses, there is a shortage of the pastureland and it becomes harder for the pastoralists to find forage for their animals. As a result, the men often have to leave their families in search of better pasture, the families have to be split and the women, children and elders are left on their own which makes them more vulnerable. The pasture shortages also result in the increase of conflicts over the scarce resource among communities. One example of such conflict are the livestock raids (Riverra-Ferre & López-i-Gelats, 2012). Raids are one of the traditional ways how to expand the grazing land, gaining access to water sources and restocking (Oba, 1992). Counter-rides are the most common answer which creates a vicious circle of conflicts that are escalating during the times of climate stress. These conflicts create further stress on the availability of pastures and often the pastoralists cannot take their herds to the insecure areas because they are afraid of raids. This results in some productive areas being abandoned, while other areas have to be over-used in order to secure enough forage for the animals (Oba, 1992).

Another related environmental problem is the deforestation, which results in soil erosion and loss of trees that were used as forage (Riverra-Ferre & López-i-Gelats, 2012). The deforestation also causes a micro-climate change creates favorable conditions for breeding of the anopheles mosquito which may carry malaria. In this way, the deforestation also

contributes to the rising prevalence of malaria in the area (IPCC, 2007). Climate change also causes changes in vegetation, some of the plants that were available before entirely disappeared or are more difficult to find. This is a threat to the traditional knowledge as some of the herbs were used as natural treatment (Riverra-Ferre & López-i-Gelats, 2012). One such example is the 'Mbako' bark which used to be used as a traditional treatment of malaria. It is becoming less available and thus the pastoralists have to spend more money on the 'modern medicine' which causes debt (Charapa Consult, 2012). However, the decrease and change in vegetation does not impact only the medicinal plants. According to Galvin & Little (1999), in the past the Turkana used to collect more than 30 species of wild plants as a source of food. The non-availability of those plants decreases the variability of the regular Turkana diet.

Another direct consequence of climate change is the lower availability of water both for livestock and communities. Due to the decrease of the availability of water, more animals are accumulated around the watering points which causes increase in the prevalence of diseases. The difficulty of finding water, loss of traditional plants and natural habitat does not pose a problem only for the pastoralists, but for the wild animals as well. The Turkana people used to hunt some of these wild animals and their disappearance means that one of the sources of food, which used to be more diversified, is not available anymore. Even though the Turkana people do not hunt regularly and the wild game is not a large percentage of their calorie intake, it contributes to the diverse diet. It is usually the young boys that hunt small animals with bows and arrows and the men who may hunt larger animals, such as gazelles, while herding (Galvin & Little, 1999). As the habitat of those animals shrinks, it becomes almost impossible for the Turkana herders to supplement their diet with meat of wild animals. Another negative effect of climate change is the decreased productivity of the livestock (Riverra-Ferre & López-i-Gelats, 2012).

Climate change also brings along conditions favorable for the human pathogens. In practice this means the increase in the diseases caused by those pathogens, such as malaria. Climate change may have effect on both the distribution and seasonal transmission of malaria. Due to climate change, the temperatures are rising which changes the distribution of malaria, both in latitude and altitude. For example the highland areas which were malaria-free in the past are now experiencing malaria epidemics (Joto Africa, 2010). According to Joto Africa (2010), the temperature in Kenya's highlands increased by 0.5 °C in the past 50 years, which doubled the number of malaria-carrying anopheles mosquitos. They claim that the prevalence of malaria in the highlands of Kenya increased by 300%. However, pathogens such as malaria do not affect only the humans and they increase the prevalence of livestock diseases as well (Riverra-Ferre & López-i-Gelats, 2012). Climate change can also increase the prevalence of diseases transmitted between the people and their livestock (Joto Africa, 2010).

Paradoxically, the floods have consequences that are in many ways similar to the consequences of droughts. They cause a damage to pastures and thus reduce the availability of pasture lands. The floods also create good conditions for many of the human and animal pathogens and contribute to the extension of diseases (Riverra-Ferre & López-i-Gelats, 2012). Higher rainfall and floods create larger breeding areas for mosquitos and thus increase the prevalence of malaria. During the floods, communities living in the flooded areas are often displaced and they bear greater risk of acquiring waterborne diseases, as they live in temporary accommodation with only basic facilities (Joto Africa, 2010).

## **5.2 SOCIO-ECONOMIC FACTORS INTENSIFYING THE EFFECTS OF CLIMATE CHANGE**

It is not climate change alone that poses a threat to the Turkana people. There are several socio-economic factors that intensify the effects of climate change and makes the adaptation harder to carry through. According to Riverra-Ferre & López-i-Gelats (2012), those socio-economic factors can be divided into two main groups: rising population and competition for the use of rangelands, top-down planning and neglect of traditional institutions and customary practices and increasing integration within the market economy.

One of the factors intensifying the impacts of climate change is the rising population and competition for the use of rangelands. In 2009, the population in the Turkana District was more than 850,000 people (Republic of Kenya, 2011). According to Riverra-Ferre & López-i-Gelats (2012), the population of pastoralist in Kenya has tripled over the last 40 years. This remarkable demographic growth causes a competition for the use of rangelands. As the population increased, people are looking for new ways to sustain their livelihoods. This causes stress on the rangelands, as the people are searching for alternative uses of this land, mainly close to the available water sources. Some of these uses are rain-fed agriculture, charcoal burning, oil extraction infrastructures, construction of roads, creation of national parks and urbanization. The communal ownership is being replaced by private ownership. Rangeland privatization takes place mainly in the areas with better availability of water (Riverra-Ferre & López-i-Gelats, 2012). The former rangelands are used as farms or consumed by the expansion of urban areas. Especially around the Turkwel and Kerio rivers, cropping system is expanding, causing rangeland fragmentation (Watson & Binsbergen, 2008). This privatization and fragmentation poses limitations for the mobility of herds as some crucial areas, such as seasonal pastureland, are not available to the pastoralists any more. As people compete for the available land, conflicts arise and this is another cause of restrictions for the mobility of herds (Riverra-Ferre & López-i-Gelats, 2012). Restriction of the mobility of the herds is a serious problem for the pastoralists as it is a way to ensure enough forage for their animals

throughout the year, especially during the periods of drought. This situation increases the vulnerability of the pastoral communities and their dependence on humanitarian aid.

Another socio-economic factor intensifying the impacts of climate change is the top-down approach of the government and their neglect of the traditional practices that the tribes use to sustain their livelihoods. Pastoral communities in Eastern Africa are in general characterized by minimal government investment in infrastructure and basic services. In the Turkana District in particular, the government is promoting the settlement of pastoral communities. Some of the measures undertaken in order to achieve this goal are the imposing of state borders that are intended to prevent the free movement of the nomads, compulsory immobile schooling and agricultural practices that should reduce the food insecurity (Riverra-Ferre & López-i-Gelats, 2012).

Authors of the latter study argue that the integration within market economy is another negative factor intensifying the effects of climate change. As the pastoral communities become integrated within the market economy, their perception of livestock changes. They no longer view it as a mobile reserve or value that can be used during drought and times of difficulty but as a source of income because their meat can be sold. With this new approach they become more vulnerable to the external forces, particularly to the international food prices.

## 6 Adaptation strategies of the Turkana people

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In the past, the Turkana pastoralists had to develop many adaptation strategies in order to survive on the harsh and inhospitable environment of northern Kenya, such as those described in chapter 3. Climate change and the socio-economic effects that further intensify its negative effects are bringing new challenges to these pastoralists. In response, they have to adopt new strategies to cope with these rapid changes.

Riverra-Ferre & López-i-Gelats (2012) classify those adaptation strategies according to two criteria. Based on the initiator of the adaptation, they divide them between autonomous and planned. Herd mobility is an example of an autonomous adaptation because it was initiated by the pastoralists themselves while maintenance, rehabilitation and construction of water infrastructure is planned, because it was initiated by various NGOs and the Kenyan government. Based on the time scope of the adaptation they divide them between anticipatory and reactive. Shift from pastoralism to agropastoralism with cash crops can be classified as an anticipatory adaptation because it should reduce the dependence on traditional diet while herding with guns is an example of reactive adaptation strategy because it is a result of the growing insecurity.

### 6.1 DIVERSIFICATION OF LIVELIHOODS

The diversification of livelihoods is one of the strategies to cope with the current change. In the past, the Turkana people adopted pastoralism as one of the strategies to deal with the hardships of their environment. However, as this environment is changing, pastoralism is no longer sufficient to sustain their livelihoods. This forces the pastoralists to undertake different activities. Watson & Binsbergen (2008) defines this pastoral diversification as the pursuit of any non-pastoral income-earning activity in both urban and rural environments. The aim of most of these activities is to earn cash. Some of the pastoralists are trying to engage in small trade even though the positive effect of engagement in market economy is debatable. There is little evidence of the pastoralists being engaged in provision of services (Watson & Binsbergen, 2008).

One of the possible areas of diversification is the sedentary agriculture, which takes place in the areas with enough available water sources, particularly along the Turkwel and Kerio River. As the area is very dry, all the crops have to be irrigated. Around the Turkwel River, the farmers already grow crops such as maize, sorghum, sukuma, oranges, mangoes, bananas and vegetables. The most important crops are maize and sorghum which account for 80% of the overall production. The farmers are required to pay an annual fee for being able to join the

Irrigation Scheme (Watson & Binsbergen, 2008). According to a study conducted by Watson & Binsbergen (2008), most of the products from this kind of agriculture are not marketed outside the Irrigation Scheme and if some market transactions happen between the members, they are usually in the form of barter. However, there are many contradictory opinions on the sustainability of agriculture, some view it as a viable strategy, others as an unsustainable practice (Watson & Binsbergen, 2008). Some of the problems connected with irrigation agriculture in this area are the lack of fertilizers and pesticides. The lack of fertilizers causes the soil degradation and thus the loss of fertility. Due to the lack of pesticides makes it hard to protect the crops against pests and diseases. The farmers themselves saw the main constraint in the lack of appropriate machinery as they say that the land is too hard to be plowed with oxen. Another problem identified by the farmers is the lack of labor because the young men nowadays attend school more often, leaving the rest of the family with less available working force (Watson & Binsbergen, 2008).

Another form of livelihood diversification is fishing in Lake Turkana. This type of activity is usually undertaken by young and middle-aged man because it is a fairly dangerous business. In the past, even women used to fish, especially in the Ferguson Gulf. Nowadays, however, as the fishermen need to go further to the lake, it is more dangerous and it very rare for women to do so. The reason for engaging in fishing is usually the loss of livestock due to a drought or the farmers take it as a supplement to their family's livestock keeping. The fish are typically caught from a boat which is one of the constraints of entering the fishing business as the men need funds to rent, built or buy a boat. Around 60% of the fishermen on the lake still uses the traditional raft boats (Avery, 2013). The two main species of fish caught in the Turkana Lake are Tilapia and Nile Perch (Watson & Binsbergen, 2008). According to Avery (2013), the fishing around the lake is becoming more popular among the Turkana pastoralists since the 1960s. Before that, Lake Turkana was unique among the African lakes because it lacked indigenous fisherman population. In 2010, the study done by Mbogo (cited in Avery, 2013) reported 8,160 fishermen around Lake Turkana with their number still increasing. One of the challenges for fishing on Lake Turkana is the declining water level, which has been quite dramatic in recent years. The whole of Ferguson Gulf, which was one of the areas most abundant in fish, has dried up (Watson & Binsbergen, 2008). The number of fish in the lake is directly related to the water levels. The peak production rates take place during the peak of the water level while during the low water level, the population on fish is decreasing (Kolding, 1992, cited in Avery, 2013). The present decreasing of water levels in the lake can thus be considered a cause of the decline in fish production and may be an obstacle for the Turkana pastoralist in diversification of their livelihoods.



*Turkana fisherman on his traditional raft boat (Photo: D. Modry)*

There are two main reasons for the decline of Lake Turkana's water level: the recent lack of rainfall, causing severe and frequent droughts which is often attributed to climate change. The water levels are not influenced only by the changes in rainfall directly above the lake, but also in the drainage areas of its tributaries, Turkwel and Kerio Rivers. The second reason is the damming of the Omo River in Ethiopia (Watson & Binsbergen, 2008). The Gilbel Gibe III Dam on the lower Omo River in Ethiopia is under construction since 2006. It is a concrete dam with a hydropower plant and after its completion it should double the energy supply of Ethiopia. Its construction is accompanied with many controversies as the impacts of the completion of Gibe III Dam are not clear. The Omo River is the main source of water for Lake Turkana, up to 90% of its inflow comes from this river. When the dam is finished, some 67% of Lake Turkana inflow is going to pass through it. Winding down of the Omo River poses a serious threat to the whole lake. When they start filling the dam, the flow rate of the river is going to decrease and the water level in Lake Turkana could drop by almost two meters compared to the natural water levels. Shrinking of the lake would have serious consequences for the fish population of the lake and thus for the fishermen living around it. Another substantial constraint for further development of fishing around the lake is the lack of transport infrastructure. The transport infrastructure is absent, the markets are distant and there are no storage facilities. The fisherman have to rely on sun-drying and salting of the fish they catch, which reduces the number of potential customers (Avery, 2013).

According to Mwangi (2005, cited in Watson & Binsbergen, 2008), another viable commercial activity is honey production. This is possible along the Turkwel and Kerio Rivers and in higher altitudes along the Ugandan border. In the past, only small number of people in these areas kept bees and those that kept them used the honey mainly for their own consumption. However, nowadays many people in these areas engages in beekeeping and even the overall population notably increased. The main reason for producing honey are its medicinal properties and also the possibility to earn cash by its sale. In the areas suitable for beekeeping, some of the beekeepers have up to 40 beehives. An advantage of beekeeping is the ease to enter the business as it does not require any special tools and even the special clothes to protect themselves can be rented from some of the Catholic Missions. Traditionally, it was only man who kept bees, but in present there are even women groups producing honey. The manufacturing of beehives is also a significant business as there are individuals in the villages that have the necessary skills and tools for the building of the beehives. The beekeepers themselves see the honey production as a stable source of income that enables them to survive even during the droughts that would have devastating impact on the livestock keepers (Watson & Binsbergen, 2008).

To diversify their activities, some people also engage in small-scale business enterprises. This is an area also available to women. In fact, most of the small-scale businesses are dominated by women. They form groups in order to help each other start and be less vulnerable. One example of such group can be The Napuskine Women's Group in Lodwar. This group uses the merry go around system to generate capital for its members to buy the stock for sale. The member fees are collected twice a month and given to a member to buy stock for sale. After some time, some of the members are able to save money to buy the stock themselves, without relying on the group finances. One of the barriers that prevents some people from entering small-scale business enterprise is the initial capital. Pastoralists who wish to join the group have to pay an initial fee and also at the beginning they are missing basic business skills which makes the entrance into this area challenging (Watson & Binsbergen, 2008).

There are other possible areas of livelihood diversification that are sometimes exploited by the Turkana pastoralists. We can name basket-making and handicraft which supports a number of producers, transporters and traders. According to Watson & Binsbergen (2008) this is an important source of income especially along the dry-river valleys and around Lake Turkana. The basket-making is a sector also available to women which have fewer opportunities than men. While the women produce baskets, other woven good and handicraft, men engage in the production of wooden carved products. More possibilities for diversification include aloe production, gum arabic production, ecotourism, charcoal production, collection and sale of wild fruits or processing and selling of hides and skins. The pastoralists can also engage in

the sales of fresh milk, dried milk and dried meats. Poultry and egg production is also a possible form of diversification, but in the past it was not successful. Due to the poor diet and extreme conditions, the productivity and quality of poultry and eggs was very low. It was too expensive to buy the special chicken food and the poultry-keepers did not have sufficient knowledge about the appropriate care. These reasons, together with the high prevalence of chicken diseases caused the poultry production in the Turkana region to perish (Watson & Binsbergen, 2008).

In the study conducted by Watson & Binsbergen (2008) they identify only four of the possible areas of livelihood diversification as more stable than pastoralism. Those areas are honey production, irrigated agriculture, fishing and small-scale businesses. The most significant weaknesses of these areas of livelihood diversification mentioned by the study are poor marketing and low levels of added value. Another potential weakness is the fragility of natural ecosystems, especially in the case of fishing on Lake Turkana.

## **6.2 LIVESTOCK CORRIDORS**

Movement of the herds is one of the key adaptation strategies of the Turkana Pastoralists. As the season changes, they migrate with their herds in search for better pasture. This strategy allows the herd owners to feed their animals during the whole year, even during the periods of droughts. Due to climate change and the resulting droughts and floods, there is less pasture for the animals. The desertification of the savannah also cause pasture shortages. (Riverra-Ferre & López-i-Gelats, 2012). In the past, the herds of Turkana pastoralists had quite broad grazing area and their owners were free to decide where to graze their animals. The recent increase of private land ownership, spread of irrigated agriculture and alternative uses of the land pose serious restrictions to the movement of herds. In order for these people to be able to continue with their nomadic lifestyle, and thus cope with the harsh environment they live in, they need to keep the possibility of exploiting the different pasture areas. In their study, Riverra-Ferre & López-i-Gelats (2012) suggest that the rights of pastoralists to use the pasture land should be secured through the livestock corridors.

These livestock corridors are already being established in other African countries where both pastoralism and agriculture are important means of subsistence, for example in Benin (Brottem, 2007). These corridors are in place so the pastoralists can reach their usual grazing areas without restrictions and without destroying the crops. In Benin, those corridors are managed by locally elected officials and other stakeholders. The ownership of the land did not officially change but these corridors are considered to be a common property and perpetrators can be fined. In this case, the initiative to establish the livestock corridors came directly from the pastoralists themselves. These corridors increase the productivity of livestock thanks to

better access to suitable pasture land and watering points (Brottem, 2007). The situation in Kenya is in some ways similar to the problem the pastoralists faced in Benin. Due to the spread of agriculture, they lost the access to their traditional grazing grounds. For this reason, the solution applied in Benin might be successful even in the case of Turkana pastoralists. According to Brottem (2007) the livestock corridors also have positive impact on the biodiversity as there are usually more plant species as on the cultivated land. They can also act as passageways or even permanent habitats for pollinators and seed dispersers which have their unique role in the ecosystem.

### **6.3 MODIFYING LIVESTOCK DIVERSITY**

One of the results of climate change in the Turkana region is the increasing temperature and more extreme droughts. In the past, the Turkana pastoralists kept diverse herds, including several species of animal to allow benefit from all the niches of the environment at all times. As the climate and the conditions in the region change, it forces the pastoralist to change the composition of their herds. Riverra-Ferre & López-i-Gelats (2012) claim, that further diversification and change in the number and representation of species is a viable strategy to cope with current climate change. They suggest to change to composition of herds towards more drought-resistant species, such as camels and goats. They also propose that the change towards smaller animals would be a way to conserve water resources. A study done by Juma (2009) was looking at the impacts of the drought face in 2005-2006 on some of the Turkana villages. Their results show, that during the drought no camel mortality was reported, while the mortality of other species was substantial. For example the mortality of donkeys was more than 50% in both of the observed villages. This finding supports the claim that the shift towards more drought-resistant species would be a viable strategy. According to official figures, in 2005 the representation of camels in the Turkana herds was only 5%. Interestingly, the usual herd contains only 6% of cattle, which is considered the most valuable (Watson & Binsbergen, 2008). This can be an indicator of either the expensiveness of livestock, or their higher demands for water. A common herd contains about 58% of goats which have lower demand for water, being a smaller-size species (Watson & Binsbergen, 2008).

## 7 Implications for the future of the Turkana tribe

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Climate change, resulting problems and possible adaptation strategies are going to play an important role in the future of the whole Turkana tribe. The people will have to choose between adapting their way of pastoralism to the new circumstances and finding alternative ways of livelihood. Most of the resources in the Turkana region are scarce and the possibilities for alternative livelihoods are limited. Agropastoralism, as one of the possibilities, is constrained by the availability of water sources as the agriculture in the Turkanaland is possible only in irrigated fields. Climate change is expected to bring even lower amount of rainfall than in the present, which together with rising temperatures poses a serious challenge to any agricultural activity. Fishing seems to be another possibility, however, it should not be relied on too heavily as the future of Lake Turkana seems to be at risk due to the construction of Gibe III Dam. Fishing is also limited by the lack of infrastructure that would allow the fishermen to transport their catch.

As the alternative ways of livelihood are limited, pastoralism seems to be a viable option even in the uncertain future. Due to climate change and the intensifying socio-economic factors, some of the adaptation strategies adopted by the Turkana people in the past are either not sufficient or no longer possible. The nomadic movement of herds is constrained by the privatization of land and alternative uses of the former pastures. At certain times, the drought is so extreme that the even the variability of livestock species is not sufficient and all the species are at risk. However, all these difficulties can be overcome by new adaptation strategies such as livestock corridors or modification of the composition of herds. It is evident from observation of the history of the tribe and of the development of their traditional lifestyle, the Turkana people have an incredible ability to adapt. Thanks to this high adaptive capacity the pastoralist will be able to devise new strategies and this traditional lifestyle in a modified form. However, to be able to do so, they will have to overcome the socio-economic constraints.

According to Riverra-Ferre & López-i-Gelats (2012), the government and international institutions should play their role in this process of further adaptation. The pastoral communities were in the past characterized by minimal government investment and lack of interest. In order for the pastoralist to be able to maintain their lifestyle at least in some form, the governmental support is important. However, it is the form of this support that is going to be decisive. Deeper understanding of the traditional Turkana lifestyle is necessary in order for these measures to help rather than harm the pastoralists. The modern institutions need to be adapted to the pastoralist way of life and mobile livelihoods. Some measures that can be undertaken by the government include support of mobile health care services and mobile schooling or implementation of microfinance and loan services. Another example can be the

extension of Pastoralist Field Schools, which is a form of community managed education. Through this platform the pastoralists can exchange the knowledge among themselves, as well as discuss their social, economic and ecological issues. These schools allow the participants to gain better management skills and better understanding of their own traditional resource use practices.

The support of pastoralism and mobile livelihoods is in opposition to what the government of Kenya is doing today. The government is promoting the settlement of pastoral communities in the Turkana region by the institutions it imposes and by its policy measures (Riverra-Ferre & López-i-Gelats, 2012). But this settlement brings along several problems. A resulting environmental problem is severe land degradation, a consequence of the concentration of both human and animal population. Another phenomenon resulting from the settlement of pastoral communities is deforestation which is a consequence of cutting down trees for burning charcoal (Okoti & Ekaya, 2010). The traditional nomadic lifestyle had practical advantages for the health of the nomads. In a study conducted by Barkey et al. (2001), the settled Turkana men are more likely to suffer from infectious diseases, in particular from cough, eye infections and chest infections. The higher prevalence of these diseases is caused by the change of the composition of everyday diet, higher exposure to pathogens resulting from the increases population density and environmental pollution. The change in physical activity patterns and psychosocial stress also contribute to this phenomenon. If the former pastoralists settle, they will not be able to maintain the strategies they developed in the past to deal with the harsh environment and they will no longer be able to survive in the area.

Due to these problems of settlement of pastoralist communities and the lack of other means of subsistence, pastoralism still keeps its importance for the Turkana people. It is the task for the government to ensure that their institutions and policies help the pastoralists with the uneasy task of devising new adaptive strategies.

## 8 Conclusion

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When the Turkana people came to the area of northern Kenya, they were able to survive thanks to their lifestyle and its most important aspect, pastoralism. They were able to adapt to the harsh environment and thrive. They kept several different species of livestock and thus were able to exploit all the niches during all the seasons. Their diet was highly variable as they consumed all the animal products, such as milk, blood and meat. The Turkana people were nomads and migrated with their herds through their territory in order to be able to find forage for their animals all year round.

The current climate around Lake Turkana dates back to later Pliocene. At that time it became more arid, the seasonality increased and the savanna spread. Today, it is an arid area and the climate is characterized by high temperatures and little rainfall that creates the main seasonality. The climate can also be characterized by natural climate fluctuations between the rainy seasons and dry season which are difficult to predict. However, current climate change is shifting the pattern and making the climate even more variable and unpredictable. The average annual temperature in the Turkana region is increasing and even though the overall amount of rain is not decreasing dramatically, its distribution is changing considerably, creating periods of extreme droughts and floods.

These changes in climate pose another challenge to pastoralism as they make the climate even more intense. They threaten to overwhelm the adaptive capacity of the Turkana pastoralists as they are disrupting their traditional livelihoods. Desertification causes shortage of pastureland and it is harder for the herders to find forage for their animals. This results not only in the decreased productivity of livestock but also in the increased number of conflicts between the tribes and even between the pastoralists of the same tribe. Through the shrinking of habitats, climate change decreases the number of animal and plant species that used to be dietary supplement for the Turkana pastoralists. The prevalence of both human and livestock diseases is increasing as the deforestation and floods create an ideal environment for disease-carrying vectors. Lower availability of water sources is bringing more people and animals together and the probability of getting infected by those diseases is increasing for both humans and their livestock. In addition to these threats caused by the climate, there are also several socio-economic factors that intensify the effect of climate change and impede the adaptive capacity of the pastoralist. Rising population and competition for the pastureland, the governmental approach and the spread of market economy can all be examples of such factors.

To cope with those challenges, the Turkana people have to find new adaptation strategies. Those strategies are initiated by the pastoralists themselves or by various NGOs or Kenyan government. Some of those strategies are meant to mitigate the expected impacts of climate change and some of them are adopted in reaction to the problems already taking place. In times when there are so many challenges to pastoralism, diversification of livelihoods is one of the possible adaptation strategies. The pastoralist are getting involved in irrigated agriculture along the rivers, fishing on Lake Turkana, honey production, small-scale business enterprises and other activities, such as basket-making, handicraft or aloe production. Other adaptation strategies are aiming to adapt the pastoralism to these new conditions. Establishment of livestock corridors should allow the pastoralists to use the maximum of pastureland to ensure enough forage for their animals. Changing the representation of animal species in the herds to species that are more drought-resilient and less water-demanding is another way to preserve traditional pastoralism.

There are many problems constraining the pastoralists from diversifying their livelihoods. Lack of water sources, lack of infrastructure and the uncertain future of Lake Turkana are just a few of these problems. For this reason, pastoralism continues to be a viable strategy to survive in the area. Even though it will be necessary to alter some of the traditional pastoral practices, such as the migration routes or the composition of the herds, due to their incredible adaptive capacity the Turkana pastoralists should be able to do adapt to these new conditions. However, they will not be able to do so if they are further constrained by socio-economic factors, such as privatization of the pastureland and alternative uses of this land. Government should play a role in this process of adaptation and create policies and institutions that will help the pastoralists with these adaptations rather than prevent them from maintaining their traditional lifestyle.

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