



Candlelight for Health, Education & Environment

The Impact of Climate Change on Pastoralism in Salahley and Bali-gubadle Districts, Somaliland





**HEINRICH
BÖLL
STIFTUNG**
EAST & HORN
OF AFRICA



The Impact of Climate Change on Pastoralism in Salahley and Bali-gubadle Districts, Somaliland

Heinrich Böll Stiftung
Regional Office for East and Horn of Africa
Forest Road
P.O. Box 10799-00100, GPO, Nairobi, Kenya
Tel: +254-20-2680745, 2613992, 2613997
Email: nairobi@hbfa.com
Web: www.boell.or.ke

Heinrich Böll Stiftung
Schumannstr. 8
D-10117 Berlin, Germany
Tel: +49-30-28534-0
Email: info@boell.de
Web: www.boell.de

ISBN 9966-7172-3-4

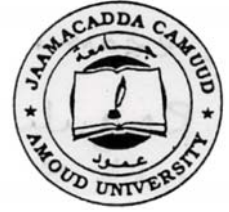
© 2010 Heinrich Böll Stiftung, East and Horn of Africa

All rights reserved. No part of this book may be reproduced without written permission from the publisher, except for brief quotation in books and critical reviews. For information and permissions, write to Heinrich Böll Stiftung.

Opinions expressed are the responsibility of the individual authors and do not necessarily constitute the official position of Heinrich Böll Stiftung.



■■■ HEINRICH BÖLL STIFTUNG
EAST & HORN OF AFRICA



The Impact of Climate Change on Pastoralism in Salahley and Bali-gubadle Districts, Somaliland

Authors:

Ingrid Hartmann, Ahmed J. Sugulle, Ahmed I. Awale

Contributors:

Prof. Abokor Sh. Abdi Mohamed, Mohamed Heban Awale, Asha Mohamed Samale, Abshir Migane Khaire, Elmi Ibrahim Wais and Ahmed Ismail Farah.



November 2009

Authors:

Ingrid Hartmann, Ahmed J. Sugulle, Ahmed I. Awale

Contributors:

Prof. Abokor Sh. Abdi Mohamed, Mohamed Heban Awale, Asha Mohamed Samale, Abshir Migane Khaire, Elmi Ibrahim Wais and Ahmed Ismail Farah.

Editor

Patrick T. Balla

Disclaimer

This document has been produced with the financial assistance of the European Union and Heinrich Boll Foundation; the Contents of this document are the sole responsibility of Candlelight for Health, Education & Environment and can under no circumstances be regarded as reflecting the position of the EU and HBF.

© 2010 Candlelight



Acknowledgement

I would like to acknowledge individuals and institutions that made their contributions to this study. In particular, I thank Ahmed Jama Sugulle, the Project Manager, CLHE/HBF/EC project for coordinating the study. I acknowledge the following members of Amoud University, Department of Agriculture and Environment, for actively participating in the study: Dr. Ingrid Hartmann, Prof. Abokor Sh. Abdi Mohamed, Mohamed Heban Awale, Asha Mohamed Samale, Abshir Migane Khaire, Elmi Ibrahim Wais and Ahmed Ismail Farah. This exercise benefited a lot from their expertise and knowledge.

The communities of Salaxley and Balli Gubadle districts, particularly the elders and women groups are duly acknowledged for their hospitality and for providing information. Special thanks go to Mr. Ali Awil, the Regional Governor of Balli Gubadle; Mr. Jama Hussein, Mayor of Balli Gubadle and; Mr. Abdirashid Mo'allin, Mayor of Salahley. In addition, I thank the logistics and finance departments of Candlelight for their excellent and timely arrangement of transport and resources needed for the assignment.

Finally, I thank the European Union (EU) and Heinrich Boell Foundation (HBF) for funding this case study.

Ahmed Ibrahim Awale

Executive Director

Candlelight for Health, Education & Environment

Executive Summary

Pastoralism is a traditional land management and production system which mimics wildlife in its basic principles. Through its dynamic, flexible and complex structures it has proved to be mostly adapted to the erratic climate and changing natural conditions of dry lands by providing and conserving a large array of ecosystem services in semi-arid to arid areas.

During the last decades it has been increasingly recognized that pastoralism is essential for the sustainable management and ecological health of dry lands, but also highly sensitive to increasing environmental degradation and global warming. It is threatened by several factors like the sedentarisation policies, intensive agriculture, ecological degradation and low social status accorded to pastoralists among many others. Pastoralism can be assumed to be mostly capable of dealing with climate change by making best use of patchy vegetation, erratic rainfalls and coping with increasing droughts. However, climate change itself affects pastoralism and all ecosystem services it provides.

Pastoralism in its role to deal with climate change and climate change as a factor which has negative impact on pastoralism is the subject of this report. This report analyses how climate change impacts the ecosystem services pastoralism provide and the socio-economic and environmental strategies employed in the coping strategies. It is an attempt to document the impact of climate change on pastoral livelihoods in the two districts of Salaxley and Balli-Gubadle in Somaliland. The study relied more on primary data collected through participatory tools such as Participatory Rural Appraisal (PRA), and Focused Group Discussions (FGD) as well as review of documented information.

The findings of the study indicate several impacts that the climate change process has had on the pastoralism in Salahley and Baligubadle districts. There is a growing concern among community members that there are changes in the weather pattern in comparison to the past, for example changes in temperature and rainfall levels. As a result, the traditional weather forecasting has changed to an extent that the predictions are not valid anymore. The community perceives change in the mating calendar of sheep as well as mating behaviour and time of wildlife. Climate change and the combined effects of soil erosion and reduced vegetation cover/deforestation is also leading to biodiversity loss with its longer consequences of loss of indigenous knowledge and information systems on pastoral production and natural resource management, ethno-veterinary knowledge, weather forecasting etc.

The combined effect of land degradation and extreme weather conditions has caused food insecurity among the pastoral communities in the study area. Livelihoods have suffered very much from consecutive droughts and most people do not see any future in pastoralism. There is increasing disruptions to families as well as increasing poverty. The declining number of livestock during droughts also affects the number of marriages.

The study reveals the decline of biomass of the vegetation as well as species loss in the last few decades. Extreme weather conditions in the form of storms, icy rains and flash floods have been experienced. Respondents mentioned that there is an average increase in temperatures resulting in heat stress on animals. The prolonged droughts, increased wind speeds and temperatures are some of the most prominent stress agents that impact on plant dynamics. The disappearances of rangeland species have given room to bush encroachment and invasive species. Consecutive droughts have led to chronic water scarcity across the area, leading to acute water crises.

Though indirectly, climate change is perceived to have led to the erosion of traditional institutions and the overall disorientation of environmental governance, leading to environmental degradation and increased conflicts, especially on land. As competition for resources increase, equally conflicts arise between and among herders, charcoal producers and wildlife. Climate change has

also exacerbated human-animal conflicts. The scarcity of wild foods and pasture is driving these animals to adopt aggressive grazing and food collection habits which bring them into conflict with humans.

As a result of climate change, pastoralists' way of life is undergoing great transformation and the trend is moving towards higher vulnerability, loss of solidarity mechanisms for coping with droughts, destitution and dropping off from pastoral life. Pastoral production system depends on the availability of natural resources which are sensitive to climate change. What complicates their situation is that pastoralists do not have a diversified pool of resources to draw from, which makes them more vulnerable. Due to the prevailing vulnerability of pastoralists as well as uncertainties over the pastoral productivity, many households have diversified their means of livelihoods to cope with climate change. Commercialization of milk is now common and many pastoralists have switched to charcoal production to compensate for economic losses from pastoralism, but are aware that this will also not be sustainable in the long run. An increasing number of pastoralists who lost their animals are leaving livestock production altogether, making their way to major urban centers, particularly Hargeisa town. The pattern of land use is undergoing a great transformation, particularly in the hilly areas towards south of Hargeysa. More and more ex-pastoral households are settled and establishing rain-fed farms. Some individuals have resorted to fencing communal land (enclosures) for their own exclusive use to ensure continuous access to grazing land as well as farming.

The study recommends a number of policy options and strategies towards climate change. It also proposes need for policy advocacy at national and international levels on climate change issues as well as increasing water use efficiency and productivity; soil conservation and flood reduction; sustainable agriculture; promoting economic diversification and alternative livelihoods. There is also the need for research and development of innovative solutions to the challenges affecting pastoralism.

LISTS OF ACRONYMS AND ABBREVIATIONS

CDM	Clean Development Mechanism
CLHE	Candlelight for Health, Education & Environment
DDP	Dry lands Development Paradigm
EC	European Commission
HBF	Heinrich Boell Foundation
INGOs	International non-governmental organizations
LNGOs	Local non-governmental organizations
ITCZ	Inter Tropical Convergence Zone
IWMI	International Water Management Institute
LADA	Land Degradation Assessment in the drylands
LDCs	Least Developed Countries
LUCC	Land Use and Land Cover Change
LUCF	Land Use Change and Forestry
NDVI	Normalized Differenced Vegetation Index
NOAA	National Oceanic and Atmospheric Administration
PEI	United Nations Poverty Environment Initiative (UNPEI)
REDD	Reduced Emissions from Deforestation and Degradation
PRA	Participatory Rural Appraisal
SWALIM	Somalia Water and Land Information Management
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

List of Tables

Table 1: Rainfall pattern of Salahley and Baligubadle in 1980-2009	22
Table 2: Major droughts in the living memory occurred once in every decade	24
Table 3: A typical traditional women's daily schedule	32
Table 4: Livelihood 'normal' threshold herd size in accordance with the target groups	33
Table 5: Charcoal producing households in Salahley and Baligubadle districts of Somaliland	37

List of Figures

Figure 1: Map of Somaliland	14
Figure 2: Animal carcasses at Qool-caday plain	18
Figure 3: The traditional sheep calendar prior to 1975	21
Figure 4: S. Gazelle (Cawl) grazing at Pleiades to decide its mating date	24
Figure 5: Reduced litter production, and erosion rills filled with sand near Bali-gubadle	27
Figure 6: Sand dune formation between Hargeysa and Salaxley	28

Table of Contents

(i) ACKNOWLEDGEMENT	4
(ii) EXECUTIVE SUMMARY	5
(iii) LISTS OF ACRONYMS AND ABBREVIATIONS	7
(iv) LIST OF TABLES	8
(v) LIST OF FIGURES	8
1.0 INTRODUCTION	11
1.1 BACKGROUND TO THE STUDY	11
1.2 OBJECTIVES OF THE STUDY	11
1.3 SCOPE, APPROACH AND METHODOLOGY	12
2.0 DESCRIPTION OF THE AREA OF STUDY	13
2.1 GEOGRAPHICAL COVERAGE	13
2.2 POPULATION	14
2.3 CLIMATE, VEGETATION AND WILDLIFE	14
2.4 SOCIO-ECONOMIC PROFILE	16
3.0 CLIMATE CHANGE AND ITS IMPACTS	18
3.1 COMMUNITY PERCEPTIONS OF CLIMATE CHANGE	18
3.1.1 Changes in weather pattern	18
3.1.2 Change in Mating Calendar of Sheep	20
3.2 CHANGE IN DROUGHT PATTERNS	23
3.3 CHANGES IN WIND SPEED AND DIRECTION	25
3.4 CLIMATE CHANGE AND DESERTIFICATION	26
3.5 DEGRADATION OF VEGETATION: CLIMATE CHANGE OR OVERGRAZING?	27
3.6 CHANGE IN WEATHER CONDITIONS	28
3.7 PLANT AND ANIMAL STRESS	29
3.8 CLIMATE CHANGE AND LOSS OF BIO-DIVERSITY	29
3.9 BUSH ENCROACHMENT AND INVASIVE SPECIES	30
3.10 IMPACT ON WATER SOURCES, SUPPLY AND DEMAND	30
3.11 CLIMATE CHANGE AND TRADITIONAL INSTITUTIONS	31
3.12 CLIMATE CHANGE AND CONFLICTS	31
3.13 IMPACT ON GENDER	32
3.14 CLIMATE CHANGE, LIVELIHOODS AND FOOD SECURITY	33
3.15 INCREASING POVERTY AND DISRUPTION OF FAMILIES	34
3.16 MARRIAGE AND REPRODUCTION	35
4.0 ADAPTATION/COPING STRATEGIES AND TRADE OFFS	36
4.1 COMMERCIALISATION OF MILK	36
4.2 PRODUCTION AND SALE OF CHARCOAL	36
4.3 OUT-MIGRATION	37
4.4 FENCING OFF COMMUNAL LAND (ENCLOSURES)	38
4.5 SHIFT TO AGRICULTURE	39

5.0	CONCLUSION AND RECOMMENDATIONS	40
5.1	CONCLUSIONS	40
5.2	POLICY OPTIONS AND STRATEGIES TOWARDS CLIMATE CHANGE	41
5.2.1	POLICY ADVOCACY AT NATIONAL AND INTERNATIONAL LEVELS	41
5.2.2	WATER MANAGEMENT AND FLOOD REDUCTION	41
5.2.3	SOIL CONSERVATION AND FLOOD REDUCTION	42
5.2.4	SUSTAINING PASTORALISM	42
5.2.5	AGRICULTURE	43
5.2.6	PROMOTE ECONOMIC DIVERSIFICATION AND ALTERNATIVE LIVELIHOODS	43
5.2.7	RESEARCH, DEVELOPMENT AND KNOWLEDGE MANAGEMENT	44
5.2.8	CROSS-CUTTING ISSUES (EQUITY, JUSTICE, GENDER, GOVERNANCE)	45
6.0	BIBLIOGRAPHY	46
7.0	LIST OF APPENDICES	48
7.1	PERIODS OF POSITIVE AND NEGATIVE RAINFALL AND VEGETATION INDICES	48
7.2	SEASONAL CALENDARS	49
7.2.1	Bali Gubadle 2007	49
7.2.2	Bali Gubadle 2008	49
7.2.3	Salaxley 2007	49
7.2.4	Salaxley 2008	50
7.4	AREAS OF ENCLOSURES AND CHARCOAL PRODUCTION	51

One: Introduction

1.1 Background to the study

Pastoralism is a traditional land management and production system which mimics wildlife in its basic principles. Through its dynamic, flexible and complex structures it has proved to be mostly adapted to the erratic climate and changing natural conditions of dry lands by providing and conserving a large array of ecosystem services in semi-arid to arid areas.

During the last decades it has been increasingly recognized that pastoralism is essential for the sustainable management and ecological health of dry lands, but also highly sensitive to increasing environmental degradation and global warming. It is threatened by several factors like the sedentarisation policies, intensive agriculture, ecological degradation and low social status accorded to pastoralists among many others. Pastoralism is a system which can be assumed to be mostly capable of dealing with climate change by making best use of patchy vegetation, erratic rainfalls and coping with increasing droughts. However, climate change itself affects pastoralism and all ecosystem services it provides.

Global climate models predict changes over the longer term such as increased temperatures, shifts in rainy seasons, intense rains over much of East Africa, which will result in a mosaic of changing climate conditions with serious implications on land use. According to Intergovernmental Panel for Climate Change (IPCC), Climate projections in the Horn of Africa for 2080-2090 predict medium projected temperature and precipitation of 3.2°C and 7% rise respectively. This trend will be characterized by “successive poor rains, increase of

drought-related shocks, and more unpredictable and sometimes heavier rainfall (which are) likely to continue over the medium term”¹.

The role of pastoralism in contributing to climate change and the impact of climate change on pastoralism is the subject of this report. The report analyses how climate change impacts the ecosystem services and socio-economic and environmental coping strategies employed by pastoralists.

1.2 Objectives of the Study

This study is an attempt to document the impact of climate change on pastoral livelihoods in the two districts of Salaxley and Balli-Gubadle in Somaliland. The outcome of the study will contribute to understanding the causes of the rangeland degradation and the vulnerability of the pastoralists, which makes many people believe that this mode of production system has outlived its usefulness.

The study details the impact of climate change on pastoral livelihoods in the two selected areas with particular emphasis on the natural biodiversity; land use and its contribution to conflicts; seasonal migration; rainfall and temperature; livestock productivity; socio-economic impacts; and finally, the impact of climate change on traditional weather forecasting.

1.3 Scope, Approach and Methodology

An intensive investigation was made in the selected areas which are semi-arid. Generally semi-arid ecological zones are known to be the most vulnerable to climate change more than arid zones themselves and areas with higher rainfalls. The study is a micro level monitoring of climate change and vulnerabilities of local people in the past 30 years.

A number of research questions were developed that guided this study: (i) How do pastoralists perceive changes of climate and weather patterns and which are their major indicators? (ii) What is the impact on vegetation cover, biodiversity, soil/ soil fertility and livestock? (iii) How does climate change affect supply and resilience of various goods and services produced

1 Helen Bushell, Pastoralism and Climate Change in East Africa: Enabling Adaptive Capacity, OGB

by pastoralism? (iv) What is the role of institutions in adapting to climate change? (v) What are the trends of the overall carbon balance of the pastoral system under the current conditions? (vi) Finally, which would be appropriate adaptation and mitigation strategies to climate change for the country?

The study relied more on primary data collected through participatory tools such as Participatory Rural Appraisal (PRA) -observation, semi-structured meetings, and unstructured interview, cross checking, timeline/historical profile, and Focused Group Discussions (FGD). A household assessment was undertaken as well as interviews with key informants in the community. Special consideration was given to women to elaborate changes in their roles, especially in regard to decision making and labour distribution. Pastoral Sahan (scouts) were major source of information on impacts of climate change, since they are periodically on move in search for better pasture and water for their animals. They also play a pivotal role on decision making processes on migration patterns. The research was supported by already available vegetation and soil maps and data from Somalia Water and Land Information Management (SWALIM) and by an evaluation of climate data over the last 30 years also available from SWALIM.

The study team comprised of members from Candlelight and Amoud University with the interdisciplinary knowledge. These brought in expertise in livestock husbandry, veterinary sciences, biodiversity, sociology, hydrology and water management; soil sciences and agricultural extension.

Two: Description of the area of study



2.1 Geographical Coverage

The study was undertaken in Salahley and Baligubadle districts located to the south of Hargeisa city, Somaliland². The total area of the Republic of Somaliland is 137,600 km² with a coastline of 850 kilometers. The country is semi-arid and has a warm climate. The average daily temperatures range from 25-35°C. The sun passes vertically overhead twice a year, on 22nd March and 23rd September. Somaliland consists of three main topographic zones, the coastal plains (Guban) meaning burnt the coastal range (Ogo), and the plateau (Haud).

Figure 1: Map of Somaliland

² Somaliland, formerly North West Somalia, is located in the Horn of Africa. It borders the Gulf of Aden to the north, Somalia to the east, the Federal Republic of Ethiopia to the south and the Republic of Djibouti to the west. Somaliland was formerly known as the Somaliland Protectorate under the British rule from 1884 until June, 26th 1960 when Somaliland got its independence from Britain. This independence was short-lived as the new republic merged few days later (July 1 1960) with the former Italian Somalia to form the Somali Republic. The merger did not work according to the aspirations of the people, and the strain led to a civil war which dragged from 1980s to the demise of the Somali Republic. In 1991, representatives from the various clans of Somaliland held a congress in which it was decided to withdraw from the Union with Somalia and to reinstate its sovereignty. Since then, Somaliland has been peaceful, stable, with a functioning national government for over a decade, but the country remains unrecognized in the international arena.

2.2 Population

The population of Somaliland is estimated at around 3.5 million. The average population growth rate is 3.1%. Population density is estimated at approximately 25 persons per sq. kilometer. Fifty-five percent of the population is either nomadic or semi-nomadic, while 45% live in urban centers or rural towns. The average life expectancy for the men is 50 years while for women it is 55 years³.

2.3 Climate, vegetation and wildlife

2.3.1 Climate and rainfall

The climate is influenced by the northerly movement of the Inter Tropical Convergence Zone (ITCZ), which is responsible for the bi-modal rainfall pattern experienced annually. The general climate is hyper-arid, arid and semi-arid. Records collected for over 40 years for Hargeysa indicate that there is the probability of rains during five months of the year but the actual amounts vary considerably. The rainy season has two peaks. The first occurs during April to June and is the more important of the two rainy seasons. This is locally known as the "Gu" and is of significant importance to the nomads and the agricultural communities. This rain is brought up by the south-west monsoon which blows during this period. Temperatures at this time of the year are somewhat above the yearly average of 21.7°C⁰ with the highest temperature (around 40°C) occurring in the last half of June. This rainy season is followed by a short period with less rainfall but with, more significantly, dry strong winds. These winds reach their highest velocities in July. And they have a very serious desiccating effect on vegetation and

³ <http://www.somalilandgov.com/cprofile.htm>

the annual crops in the agricultural areas. They are most uncomfortable for the human population as well. Deyr (Autumn), the second rainy season is most significant, not only for the recovery of crops that had been damaged by the strong and dry summer (Hagaa) winds, but also for the short time crops such as maize and dwarf sorghum. This period sees the cessation of the strong winds of the preceding period. During winter (Jilaal) both the mean monthly temperature and rainfall drop, though this is associated with tremendous variations as mentioned earlier.

Evaporation rate is about 1000-3000 mm/yr, and is much higher than precipitation across the country, only temporarily rainfall can be higher than evapotranspiration sometimes during the rainy seasons. (See annex 7.1 and 7.2).

2.3.2 Vegetation

The area is located in the Haud⁴ area South and Southwest of Hargeisa, the capital of Somaliland, starting from the hilly areas outside Hargeisa Airport and reaching the Ethiopia-Somali border roughly 70 km south of Hargeisa. The mean annual rainfall in this zone is generally between 200-300mm and is characterized by mixed woodland of acacia type composed of *Acacia bussei*, *A. tortilis*, and *A. Senegal*. However, much of the tree component was destroyed by indiscriminate utilization mainly for charcoal production and for the establishment of enclosures. An extensive bun (treeless plain) known as Qool-Caday, which in the past used to have one of the best grazing grounds, is also lying within the area under investigation. Productivity in terms of edible and/or palatable forage for livestock has been greatly reduced by excessive grazing over the years. The reduction in the grass cover is very notable when comparisons are made between today's cover and that described by early travelers (Swayne 1895). For example, Drake-Brockman wrote in 1912 of millions of acres covered by *Chrysopogon aucheri*. However, this valuable grass and others, namely *Andropogon kelleri* ('duur') and *Sporobolus marginatus* ('dixi') has now been largely replaced by species which are less palatable

and less productive. According to Hemming (1966) common Daremo grass (*Chrysopogon aucheri*) is remaining under bushes or in vegetation arcs. Many areas are now converted into bare ground due to de-vegetation processes, long period of drought and over-grazing where the strong turbulent dust storms during Haggaa season (May-September) cause the soil to be transported. These areas are represented by wind-scoured or blown out areas where the finer particles of the topsoil have been blown away, sometimes leaving residual gravel, rock, or exposed roots on the soil surface⁵. The Garodi woodland just to the east of Qool-cadey plain was well known in the past for its richness in *Acacia bussei* ('galool') and *Sporobolus marginatus* ('dixi').

2.3.3 Wildlife

In the 19th century, Somaliland was teeming with wide variety of wildlife. There is mention of elephants and rhinoceros around Manderla between Hargeisa and Berbera (Swayne, 1895). Large mammals, including endemic Somali wild ass, were concentrated on diverse habitats of the country. These included lions, elephants, Gazelles, *Dorcatragus Megalotis* ('Beyrac'), *Ammodorcus clarkie* ('dib-tag'), *Gazella soemmeringi* ('Cawl'), *Oryx* (*Oryx gazella*) and so forth. Traditionally, hunting the wildlife for subsistence and economic gain was an uncommon practice and indeed was regarded as the task of the inferiors. Predators (lions, leopard, cheetah, hyena etc) were controlled by bonfire, which was a common defense mechanism against them before the acquisition of the gun. Pastoralists burned large patches of forest or woodland in places ridden with predators in order to drive them out. However, long before the civil war, some major mammals such as elephants, giraffe etc disappeared whilst the lion, *Oryx*, *Alcelaphus buselaphus swaynei* ('Siig') and The Somali wild ass populations declined significantly.

Among the most common wildlife remaining are the baboon (*Papio hamadryas*), warthog (*Phacochoerus aethiopicus*) which have been prohibited from hunting by the religious belief that consuming their meat is impure. Speke's gazelle and Gerenuks can still be encountered

⁴ Haud is the plateau towards south of the Golis Range mountain which runs parallel with the Gulf of Aden

⁵ C.F. Hemming: *The Vegetation of the Northern Region of the Somali Republic* (1966)

in the area in few numbers, while Dik-dik (*Madoqua* species) are still numerous, thanks to their smaller body which makes it difficult target for poachers using guns. Remaining carnivores include hyena, bat-eared fox, wild cat (*Felis lybica*).

2.4 Socio-economic profile

Pastoralism is the principle mode of production in the area of study as well as most parts of Somaliland whereby inhabitants with their livestock (cattle, camels, sheep/goats) follow seasonal migration patterns, mainly north/south movement depending on the availability of rainfall and pasture. However, in the last 30 years, there have been dramatic changes in the socio-economic status of the pastoral population which were triggered by the breakdown of wet and dry season grazing patterns, loss of the natural bio-diversity, recurring droughts, changing land use, which in turn had negative implications on availability of fodder, thereby negatively affecting livestock health and production. It is estimated that 60-80% of food and income sources of the pastoral communities is derived from livestock and livestock products (milk and Ghee⁶). Agro-pastoralism is practiced towards the southern fringes of the study area where the topography is hilly and offers fertile depressions. Sorghum, maize and cow peas are the principle crops while Qat (*catha edulis*)⁷, is becoming popular throughout the area as a cash crop due to its high demand in both urban and rural areas.

The area used to be a wet season grazing zone before the breakdown of seasonal grazing patterns. Pastoralists with their livestock came to the area during the two rainy seasons (Gu' and Deyr). Rainwater filling natural depressions made possible the temporary stay of pastoralists and their animals in the area; but once these are exhausted they used to move back to their traditional water points in the Golis area and further north to the Guban coastal plains during Jilaal (winter) when the temperature is bearable.

According to Food Security and Nutritional Analysis Unit- Somalia (FSNAU)⁸ the area is borderline-food

insecure, and although this means that food security is continuously at the edge, the area is still a little bit better off than other pastoralist areas in the country. This is due to its proximity to Hargeisa city, whereby the inhabitants have better access to markets and, moreover, getting a fairer share of humanitarian assistance compared to other remoter parts of the country. Nevertheless, communities have faced high losses of livestock over the years and particularly in 2009, following the failure of spring (Gu') rains. Figure 3 below is a photo indicating the severity of drought induced losses of herds.

Figure 2: A dead donkey in Qool-Caday plain, near Salaxley: Drought have not even spared the lives of some the most hardy animals in the country.



⁶ Clarified butter

⁷ An evergreen shrub and a mild stimulant whose leaves are chewed mostly by men which cause euphoric effects

⁸ www.fsau.org

Three:

Climate change and its impacts

3.1 Community Perceptions of climate change

Pastoralists within the study area inhabit a fragile environment where living conditions are harsh and challenging, characterized by an extreme variability of rainfall between different years and between different places in the same year. Consequently, the seasonal variability of vegetation and vulnerability caused by recurrent droughts has been a common phenomenon, regularly witnessed by local pastoralists for centuries. The findings of the study indicate three major perceptions as to the impacts of climate change: It is believed that climate change has had impacts on the indigenous knowledge on weather forecasting, change in mating calendar of sheep, and mating behaviour and time of wildlife.

3.1.1 Changes in weather pattern

There is a growing concern among community members that there are changes in the weather pattern in comparison to the past, for example changes in temperature and rainfall levels. However, the predominant belief is that these changes are due to “God’s punishment” for the “sins and transgressions” of humankind. The observations made by the pastoral communities in the study also seem to confirm the scientific facts that climate change is occurring and impacting livelihoods and ecosystems.

The traditional knowledge and information system⁹ has
9 Given the importance of such traditional weather knowledge and the role it plays in coping with the significant threats from the climate change and variability phenomenon taking place, the study team organized a number of focused group discussion with knowledgeable elders and traditional weather forecasters.

prominent role in rangeland and livestock management, and has been developed under conditions where climate and calendar were in harmony; and where the climate was mainly influenced by the relative positions of the sun, moon and earth to each other and by the movement of trade-winds.

To reduce the devastating effects that often result from unpredictable and variable weather patterns, pastoralists have developed a culturally rich early warning system based on long-term observation and centuries old accumulated experience which was highly regarded as a source of inspiration, guidance and a tool for decision making. For example, rain forecasting has been a developed art among Somalis. This art was born from a synthesis of Persian and African astronomy. The northern Somali forecaster is called Xidaar¹⁰ or otherwise Xiddigiye (astronomer). These classes of people were very much respected as their predictions were generally believed to be precise.¹¹ Local astrologers predicted the probable course of events and on the basis of the information generated, pastoralists used to base their decision on issues related to their day to day life, whether climatic (rains, droughts) or social (migration, tribal warfare, marriage etc).

The following poem, narrated by a Somali pastoralist, generally alludes to the change in the weather and climatic conditions, particularly during the serious drought of Daba-dheer (which literally means long-tailed or long-lasting) which occurred in the northern regions of Somalia during 1974-75.

10 someone warning against something ominous, such as drought, tribal conflict or heralds something good such as rain

11 Ahmed Awale, Climate Change Stole our Mist, (2007), Candlelight

Box 1: Poem

Ninka faalka Moorada Cirkiyo Dirirka maankiisa

Majjiraha Cirka seermaweydo iyo

Cawal mudduu muran ka taagnaaye

Mushkil baa ku dhacay Geydhe iyo

Muhandistiisiye

Laxaa marida loo eegi jireey, maalin haysimo e

*Balse ninka sii miliilicayoo Mooshinkii
haloowye.*

Miiraalihii roob Gud-gude soo mirkici waaye

*Halkuu waqalka soo marin jiruu dhigay
mandheertiye*

*Waayahanba miid lagama helin madaxyo
weyntiye*

Masqal baa ku toolmaday maydal dheeraha e

Wixii caano laga maali jirey maato sabi-waaye.

Ragii Maahir dunida u lahaa, una madiixaayey

*Inay webiga Maatada dhigeen uumiguu
maqalye*

*Masruufna waxay ku qaataan galey maalin loo
qado e*

Majhiibaa kor loo eegayaa madaxii hooseeyo

Waxaan Muuqan jirin ayaa manta la hayaaye

This poem demonstrates the disturbance in the traditional weather forecasting to an extent that the predictions are not valid anymore and how the local communities argue in vain about the decrease of rainfall, animal products, particularly milk and meat. The poem mentions how change in rainfall patterns, distribution and intensity, for example Gud-gude and Miiraale, both illustrating heavy night rains, are not as heavy as they used to be in the past. It observes a change in the traditional sheep calendar whereby pastoralists used to lose the

ram into ewes for mating, and indicates how change in rainfall pattern observed in the area immediately affected livestock production and their products (Milk, Ghee etc). The poet further laments the catastrophic effects of Daba-Dheer drought (1974) which triggered mass displacement of tens of thousands of pastoral households, mostly in the three eastern regions of Somaliland (Sanaag, Togdheer and Sool). Tens of thousands of the affected camel-herding households moved to the riverine areas of Southern Somalia to start a new settled life based on agriculture and fishing. The poet describes the change in the lives of the former pastoralists as if “their heads were turned down to take the place of legs” and finally concludes his poem with “what can be witnessed today is something never seen before”!

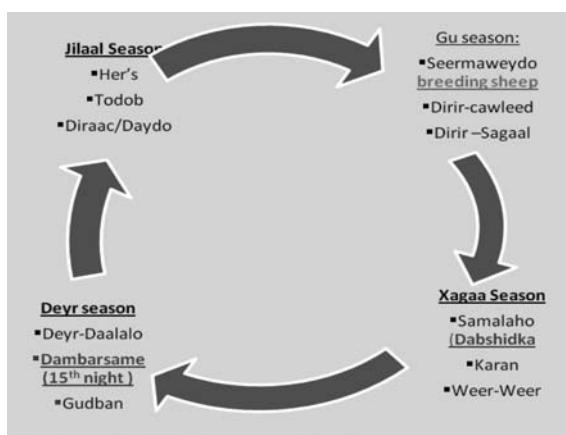
3.1.2 Change in Mating Calendar of Sheep

Somali pastoralists keep rams and ewes apart throughout the year, to control mating and prevent ewes from giving birth to new born lambs in the dry season, when the feeding resources will not be enough for the next generation. “Dambasame” is the night when Somali nomads let loose the rams with the ewes for mating, because it was about 150 days gestation period, until the beginning of the Gu rains. Dambasame night occurs exactly 120 days following the Dabshid (Nouruz) which marks the 1st night of the Somali year. It is the night when in the middle of autumn (November) the moon is in conjunction with the Urur/Pleiades on the 15th day of the lunar month or full moon. The Pleiades constellation is very important for Somali nomads and is also known as “Urur” or “Laxo”, while “Laxo” means also sheep.

The mating time is therefore determined by using the Urur/Pleiades as a point of cue, and also as a precursor for tracking the time period left until the rains will begin in spring (Lewis 1955). In this way mating time is determined in a way that the lambs, which will be born about 150 days later, are delivered in a season of abundance in the middle of the Gu rains (spring) around 15th April. This is the time the Pleiades will start to set at about twilight described by the following proverb: “markey laxo dhacaan ayey laxo dhalaan”, “When the laxo star in the sky goes down, then the sheep bring birth”. This also expresses the double meaning of “laxo” as a star and

as a sheep. The calculation of mating and delivery time of sheep in relation to the Dambasame night, as practiced until 1975, before the 'first' evidences of climate change was felt, is illustrated below.

Figure 3: The traditional sheep calendar prior to 1975



Source: Prepared by Ahmed Jama Sugulle

While the night of "Dambasame" is still used to calculate the beginning of the Gu season, nowadays pastoralists are well aware of the changes of season and the unreliability of the onset of the Gu season, which is expected now to start about 30 days later than before (around May 15th earliest, sometimes even on June 15th). Therefore, from recent local experience, showing that Gu' rains shifted roughly around 30 days into the summer time, mating of the rams and ewes are not any more organized at Dambasame night, but 30 days later, meaning around December 15th. This demonstrates the adaptive capacities of this traditional forecasting and decision making system.

The rough calculations on the basis of Dambasame night are still at risk of becoming victims of the unreliable beginnings of the Gu' season. There is another method for the determination of the proper mating time, which is said to be almost infallible: It is correlating the mating time of sheep with the mating time of the Cawl. The cawl gazelle (*G. soemmeringii*) is the only gazelle species which mates outside the normal mating season, when

all animals or gazelles are busy mating. Whenever there is a drought because of failures of Gu rain, many of the newborn offsprings of the other gazelle species suffer and die. However, the same is not true for the cawl gazelle.

There is a well known folklore which says that Cawl gazes at the stars before it mates and is said to be able to read the stars better than humans "For you will never see a 'cawl' gazelle with new born off spring in times of failed spring rains, like you do with the other gazelle species" (Somalilandtimes 2005). Also some modern researchers assume a relation of the mating behaviour of *Gazelle soemmeringii* related to a certain photoperiodism (Spinage, 1973). According to Somalilandtimes (2005) some nomads used to go far in the middle of the night to keep a track on a nearby herd of 'cawl' gazelles, so that they know when to let their rams mate with the ewes, and all this depended on whether the 'cawl' stag gazelles had started to mate or not. Because, in the time period which 'cawl' gazelles give birth to new born offspring is about the same time as sheep give birth to their new born lambs (five months from the time of conception).

There are countless phrases, songs, proverbs and poems in Somali, which ascribe these skills to the cawl gazelle and countless other wild animals. The poem of Cali Dhuux ascribes these skills to the 'cawl'¹²:

12 www.somalilandtimes.net/somstars/forward.html

Box 2:

Markuu cawlku cawlaa orgayn, waa u cibaaroone,

Cisaday ku uuraysatiyo, caadadu garane,

Cashaday calool gelahayaan, cannugga beertiisu,

Curcurradiyo lawyada intuu, ku cuskaduu saaro,

Cirridiyo cagaar miday ku dhalan, caadka kor u eegye,

Hadba cirirka loo nuuriyuu, ku cimro-qaataaye

When the male 'Cawl' wishes to mate with his females,

He first makes astronomical calculations,

He knows their menstrual periods and the techniques of mating,

The day he wishes to cause to propagate and have off springs,

He, placing first his front knees on to the female's back,

Judges whether the young will be born in sun or green

from the signs in the heavens,

His decision whether to continue mating or to descend is

in accordance with his celestial inductions

The above story links indigenous knowledge, myth, and current changes. An ungulate “reading” the stars is fascinating. However, if we try to match this indigenous knowledge with the later scientific findings, it is true that some ungulates have the ability to delay the birth date for a period of time if conditions are not suitable, thus ensuring the survival of the calf. This means that the cawl gazelle will always deliver its calves during a rainy season! Unfortunately the gazelle *soemmeringii* is now rated as ‘vulnerable’ in the International Union for the Conservation of Nature (IUCN) red list of threatened

species¹³ due to rangeland degradation and hunting. Therefore, its rarity and decline in number makes it inadequate as an indication for proper mating dates.

Figure 4: Artistic illustration of *S. Gazelle (Cawl)* grazing at Pleiades to decide it's mating date



Except the Cawl, which is able to fully integrate the effects of climate change into its mating behaviour, there is confusion in mating behaviour to other wildlife.

3.2 Change in drought patterns

A drought is defined as a period of months or sometimes years when an area or a region experiences a deficiency in its water supply due to consistently below average precipitation. Although a natural phenomenon, its effects can be worsened by anthropogenic factors. Usually droughts can persist for several years although even a short, intense drought can cause significant damage (IWMI, 2007).

There are biophysical droughts caused by lack of precipitation and water availability, social and political droughts caused by failures of institutions to establish the necessary infrastructure for the required provision of water or due to increased water demand by growing populations and several others (IWMI, 2007). The 13 A small herd of 'Cawl' gazelles, maybe some of the last herds in Somaliland, consisted of a stag and two females were recently (October 2009) sighted and photographed by a staff member of Candlelight in Aroori Plain to the south of Burao.

pastoralists' view on droughts is a complex, holistic and spatial one including all areas they usually migrate to and comprises all types of biophysical droughts, as the absence of rain in the Gu season, a decline of rainfall in the Deyr season, lack of water in berkads due to construction or maintenance failures, loss of run-off water due to erosion and decline of water storage capacities of soils.

Decline in livestock and livestock products are indicators of drought, for example lack of offspring, emaciated animals and low milk production. Informants described the development of weather patterns since 1980 as follows:

Table 1: Rainfall pattern of Salahley and Baligubadle in 1980-2009

Year	No rain	Poor rains	Good rain	much rain	Comments
1980	√				Drought "Lafa'ad" {white bones} – 90% of livestock, particular shoats died, and Carcasses piled en masse.
1981				√	lots of rains
1982			√		normal rains
1983			√		Farms and rains were prosperous
1984		√			less rain, 60% of livestock died
1985		√			good year, plenty of vegetation in the beginning, but then the rains stopped during the last two months and water trucks had to come from Hargeysa and many animals died
1986	√				Pastoralists went to Ethiopia where rainfall conditions were better
1987					Alright
1988 - 1991			√√√		Almost all the inhabitants of Hargeysa as well as nearly all pastoralists in the project area fled to Ethiopia
1991			√		returned in 1991 and the vegetation then recovered and was rich, so they had some good time
1992	√				poor rains
1993		√			Poor rains
1994	√				Drought
1997			√		The Deyr was exceptionally good and was named as Biyo-badan (plenty of water)
1998			√		normal rains,
1999	√				Drought, water was delivered by trucks
2000 - 2002	√				Droughts, water was delivered by trucks
2003		√			poor rains
2004			√		normal rains
2005	√				Droughts, water trucking
2006			√		Good rains
2007	√				Drought
2008	√				Drought
2009		√			Gu' rains failed, lot of livestock deaths, but the Deyr rains were good

Source: Author

Drought conditions have always been a recurring feature in the long history of pastoral production in the region. Droughts have also their gradations and almost all severe droughts were marked with a name, for example, Haraama-cuune (1914) - a period of bad drought complicated by internecine warfare and looting of property among tribes on one hand and the British campaigns against the warrior Mullah, Mohamed Abdulle Hassan, on the other. Some of the major droughts of the last century were Dooryaale (1928), Siiga-case (1954), Gaadhi-gaadhi saar (1964-65) and Daba-dheer (1974-75). While it has been common understanding among pastoralists that droughts occur about every 10 years (see table 2 below), other observed cycles are seven, thirty, fifty, or eighty years (sideetan guuro) and if one cycle fails, the next one becomes operative. However, it is important to note that

the occurrences of those cyclic droughts during the past 30 years or so were becoming more frequent and more hard-hitting than ever before. Most people in the project area conceded that in the later years, only 2004 and 2006 had good rainfall. In 2006 there were 80 nights of rainfall and camels got pregnant, which is, together with camel milk production, an important indicator for prosperous years. Before that there was not much rain, and after that the drought 2007/8 was one of the worst continuing in most areas until present.

During the early part of the last century, there was an average of a ten year interval before the next severe drought struck, against four year interval during the last few decades of the last century. Again it seems now that a drought condition is experienced once in every other year.

Table 2: Major droughts in the living memory occurred once in every decade

No	Drought name	Year
1.	Xaaraame –xune	1914
2.	Hawaara	1924
3.	Adhi-gaba	1934
4.	----- ²	1944
5.	Siiga-case	1954
6.	Gaadhi-gaadhi saar	1964
7.	Dabadheer	1974
8.	Dhibi-jaale	1984
9.	Soor & Biyo-waa	1994

Increase in temperatures and reduction of precipitation has contributed to these drought scenarios which have caused the death of myriads of animals and exposing thousands of pastoral households to the ever present risk of asset depletion and ending in a state of destitution.

3.3 Changes in wind speed and direction

Wind speeds have been reported to have increased, leading to dust and sand storms which reach up to Hargeisa, forming sand dunes or and blowing away or evaporating rains before they touch the ground. This might have macroclimatic as well as microclimatic reasons, deforestation and decline of vegetation sited as

the major ones. Sand and dust storms are also triggers for the formation of sand dunes especially during the Xagga season as well as for causing droughts through increased evapotranspiration.

3.4 Climate change and desertification

Climate change has also triggered desertification. There are huge amounts of literature about the correct use of the term desertification and its meaning. In this study, desertification is referred to the process of soil degradation in the area, which is semi-arid to arid. Desertification takes place when litter production is reduced due to an overall decline of biomass production as a consequence of increased evapotranspiration rates and seasonal rainfalls, which hamper the development of plants. Reduced litter production leads to a decrease of organic matter content of the soil, which reduces soil structure, increases soil compaction and reduces water storage capacity leading to almost unproductive, downright sterile soils in extreme conditions which increase surface runoff. Increased runoff leads again to thinner soils and drier edaphic conditions and for the first time the area around Gumar near the Ethiopian border experienced floods in 2008, and a large number of animals drowned.

Figure 5: Reduced litter production, and erosion rills filled with sand near Bali-gubadle





Reduced landscape rugosity from tree and shrub elimination results in faster wind speeds at soil surface level and also in a higher albedo, hence increased potential evapotranspiration, increased water and wind erosion, and therefore drier microclimatic conditions because of the lack of windbreak and shading effects (Le Houerou 1991).

Sheet erosion by wind has removed almost all topsoil in the plains. In other areas wind and water have removed fine particles leaving gravels on the surface of regosols behind, all processes which are difficult to reverse. Sand has been deposited through rains in almost all riverbeds and the surface of drainage channels and erosion rills which have been formed by water erosion are quickly filled with sand sediments.

Higher soil surface daily maximum temperatures and therefore elevated potential evapotranspiration due to the lack of shading leads to a decline of organic matter and an overall decline of growing seasons, leading to a change of species, which is partly responsible for the decline of grasses in the area like Dareemo (*Chrysopogen aucheri*). These processes create less favourable conditions for germination, as well as emergence and establishment of seedlings which is hampering the re-growth of natural vegetation. This reduces the recovery time of trees after clear-cuts for charcoal burning.

Wind erosion (creeping, saltation, reptation, suspension, corrosion) causes frequent and heavy

sandstorms especially during the Xagga season, and sand dunes are forming within hours. Wind deposition of sand during these storms results in the formation of dunes, where trees do not act as windbreaks, creating new soil types in these areas - arenosols. Arenosols have been formed in certain areas during the last few years through the sudden emergence of sand dunes. Interviews with key informants reveal that the formation occurred very sudden during the last 5 years. Sand dunes are mostly overspreading the remaining ground cover like hiil and dixii, which becomes unavailable as a feed for shoats. Transported soil also oversilts berkads (in ground cemented water cistern) in some areas and therefore negatively affects the availability of water.

Figure 6: Sand dune formation between Hargeysa and Salaxley



Photo: FSAU 2009

Fertile soil particles are blown up to Europe, fertilizing the soils there, reducing nutrient contents of Somali soils to a further degree. These processes have also expanded the spaces between the different tiger bush bands (Barbier et al 2007).

3.5 Degradation of Vegetation: Climate Change or Overgrazing?

The study reveals that biomass of the vegetation has declined in the last few decades, and species lost. Among

the major grass species, like in other areas, *Chrysopogon aucheri* and *Sporoborus variegatus* are unavailable. The loss of underground cover like *hiil* (*Vernonia cinerascens*) reduces mainly the fodder basis for sheep. Among the trees, the *galool* (*Acacia bussei*), has become the major victim of charcoal burning. Discussions have been devoted to the question whether it is climate change or overgrazing, which causes the current reduction in species composition and diversity. The interviewed groups clearly indicated that it is consecutive droughts and seasonal rains. They observed that vegetation does not reach the flowering period or dries up during the flowering period therefore sexual reproduction fails, the biomass of the whole plant is reduced and does not cover the ground properly, resulting in more soil and water erosion. Subsequent erosion either bares the roots, or covers upper parts of the plant with sand dunes, in both of which cases vegetative reproduction is hampered, so that the original vegetation decreases in quantity. This gives either room for an iterative feed-back-loop which leads to more and more thinning of native vegetation due to increased erosion, or it invites other more competitive plants to proliferate. This can lead in the best case to a selective invigoration of local trees, which are more resistant to erosion and water scarcity on the cost of grasses, shrubs and forbs which are more and more suppressed, in the worst case to the spreading of invasive species which are mostly unpalatable.

Overgrazing can have similar effects. However, latest research has proven that vegetation even after overgrazing can recover soon once there is enough rain. So it is both pastoralist's perception as well as the one of modern scientific research which sees the causes for decline of biomass and the invasion of new species in climatic reasons. This is supported by findings of Schwennesen (2008) who states that: "Grazing, like other uses, may cause a change in the species composition of rangelands, but if rangeland degradation is defined as a long-lasting or permanent reduction in livestock production, the evidence of widespread rangeland degradation under pastoral grazing is shaky". Nevertheless, while climate change also reduces the carrying capacity of rangeland, overgrazing has become a secondary effect of climate change.

3.6 Change in weather conditions

Extreme weather conditions in the form of storms, icy rains and flash floods have been experienced in many parts of the country during the past ten years or so. The extreme weather¹⁴ caused the uprooting of thousands of acacia trees, particularly the *Acacia bussei* species and mature umbrella thorn *Acacia* (*Acacia tortilis*). The selective harvesting of mature trees for charcoal production increases open batches in the wooded areas, thus making the remaining trees vulnerable to the uprooting effects of the winds.

Increased temperature levels, either caused by changes in land use as a result of the continuing denudation of vegetation from the ground, or by the global effects of climate change, has also been experienced in the study area and the country in general. The seemingly declining use of some Somali terms expressing cold weathers is another indicator of climate change. Words like "gabadano, gawre and juube" which were used to denote severe cold weather conditions is rare to hear nowadays.

3.7 Plant and animal stress

The prolonged droughts, increased wind speeds and temperatures are some of the most prominent stress agents that impact on plant dynamics. The respondents mentioned the new phenomenon of a quick shriveling up of grass due to increase of temperature levels compared to earlier periods. The common Somali term *Sirir* (wilted) translated as a negative and abnormal condition in plant growth which heralds its death, probably caused by inadequate precipitation coupled with higher temperature, pests or diseases.

¹⁴ The high mortality rates for both *balanites* and *Acacia tortilis* have been observed near Berbera. The frequency of extreme weather conditions such as storms, dust storms and floods has also tremendously increased, and icy rains occurred for the first time in the country (Yufle in Sanag and Baki in Awdal in 2007). Umbrella acacias (*Acacia tortilis*) were uprooted due to increasing winds as a result of secondary effects of climate change due to deforestation. Declining precipitation and droughts affected the growth of many plant species like *Boswellia*. Biodiversity of rangeland is negatively affected both by climate change and resulting changes of grazing patterns altogether, in a way that palatable species like *Chrysopogon aucheri* and *Sporoborus variegatus* declined in favour of unpalatable ones (Ahmed Awale 2008).

Respondents mentioned that there is an average increase in temperatures resulting in heat stress on animals. The possible results of heat stress include less feed intake, which may lead to less milk production and less body weight. Different animals also have different tolerance levels to heat, cold weather and rain. For example, goats are less tolerant to cold weather and rain than sheep possibly due to their scanty hair, but the later are less comfortable with heat stress. Haraaryo (panting for breath) is very common among sheep and is characterized by rapid shallow open mouth breaths caused by heat stress usually when the sun is at the zenith. In such a condition, sheep stop grazing and in the absence of a shade, particularly in bans (open treeless plains) each and every animal lowers its head and drives it under the standing body of another sheep to seek shelter against the heat of the sun.

3.8 Climate change and loss of bio-diversity

There are more than a dozen wild food species, mostly edible succulents and fruit bearing shrubs, which have been either pushed to extinction or are in a very short supply since the past thirty years. The elderly members of the communities visited passionately relate to “the good old days” and “times of plenitude” when they speak of these species. . These include *Glossonema Hispidum* (‘Sobkax’), *Caralluma* sp. (‘Gacayro’), *Edithcolea sordid* (‘Xamakow’), *Digera alternifolia* (‘Carab-lo’aad’), *Grewia tenax* (‘Dhafaruur’), *Grewia erythraea* (‘Midhcaanyo’) among others. One could be very fortunate enough to come across a remnant plant from the above category in an enclosure, as a result of the controlled grazing and the existence of shrub layers to protect shy plants from trampling – the greatest immediate threat posed by animals and humans. Moreover, many of the smaller shrubs, grasses and forbs were also victims of the coverage by sand dunes due to increased sand storms.

3.9 Bush Encroachment and Invasive species

The disappearance of rangeland species gave room to bush encroachment and invasive species. Invasive species in their ecological functions are seen as invasive when they lead to a decline of biodiversity in an area and in

their economic impacts when they do not contribute to land user’s incomes. These includes, *Prosopis juliflora* (Garanwe), *Parthenium hysterophorus* (Keliginooole,) and *Opuntia ficus indica* (Cactus). While on one hand the change of vegetation in Somalia can prominently be seen as a shift to more drought-resistant species and hence a secondary consequence of climate change, the mentioned species are rather better adapted to degrading land. This causes a tertiary consequence of climate change seen in invasion after decline of vegetation re-growth due to seasonal rainfalls and subsequent soil erosion triggered by decrease of soil cover.

3.10 Impact on Water Sources, Supply and Demand

Consecutive droughts have led to chronic water scarcity across the area, leading to acute water crises. This means all areas, which are normally dependent on berkads, are getting exposed to water shortage in the years where the seasonal rainfalls performs poorly and fail to recharge the berkads fully. For centuries, the study area has been a wet season grazing rangelands whereby pastoralists and their animals used to sojourn during the rainy season. Water harvesting structures were introduced in the 1950’s. Berkads and ballehs became increasingly important as a source of water. The berkads are purely private owned, as anybody who can afford to construct their own in their clan territory can construct it. The owner of the berkads has full control over the use of the water. Ballehs are mostly communal and have been either dug by the Government and/or development agencies, but most by clan members and often carry the name of a distant grand-father. Depending on the impermeability of the soil, shallow wells are dug around some ballehs and percolated water is extracted after the water in the balleh is exhausted.

Higher temperatures mean higher evaporation levels and higher water demand by humans and animals. Moreover, the ongoing desertification process causes fine soil particles carried into water sources, thus accelerating siltation processes and ultimately reducing their water storage capacities. Some of the plant species most suited for shading berkads such as *Vernonia cinerascens* (‘Hiil”) and *Andropogon Kelleri* (‘Duur’) aimed at reducing

evaporation and heat induced cracks of berkad walls are now very rare to get, as mentioned above. Therefore, other than structural defects, this may also contribute to the existence of high number (nearly 50%) of non-functioning berkads in the study area.

Apparently there is a change in water demand both for human and animals. The increased demand in water consumption can be attributed both to increase of temperature levels and increasing wind speeds on one hand and the changing lifestyles of pastoralists and animal management. In the past, distance of travel for water collection or watering animals was longer than today. For example, camels used to go for long periods (in extreme cases over 25 days) without water. But how long a ruminant remains without water varies and depends on a number of factors, such as the succulence of the feed, air temperature and the amount of work being performed. Camel herders used to drive their herds for distances ranging between 40 and 60 km to permanent water points during dry seasons and the period between two Kal (watering sessions) ranged between 20 and 25 days. However, recent estimates on periods between two kals are 10 days for camels and 4-7 days for sheep and goats (Nele Foech, 2003, Caritas Swiss Report). It can be argued that both men and their animals were better adapted to those harsh conditions in the past compared to today when water points of different types mainly berkads (cemented in ground water tanks) and ballehs (man-made surface water reservoirs) are many in the study area.

3.11 Climate change and Traditional Institutions

Though indirectly, climate change is perceived to have led to the erosion of traditional institutions and the overall disorientation of environmental governance, leading to environmental degradation and increased conflicts, especially on land. There are two major types of traditional institutional arrangement which helped in the management of community resources: The degaan ownership, which describes the traditional claim for land ownership by certain clan-group; and the Xeer agreements where affairs of the community are regulated by contracts between clan groups. These contracts define

rules for the management of land and other issues, and set up sanctions for the case that agreements are broken by one of the parties. The responsibility over these institutions was held by the clan authorities: Clan elders regulate clan affairs on behalf of their people especially in regard to access to natural resources and land conflicts (APD 2008). However, changes in land use patterns eroded these institutions. Many elders reported that they have lost their authority, and, while traditional institutions lost their significance, modern institutions are not yet ready. This is especially relevant in regard to land grabbing for the establishment of enclosure or for appropriation of communal land for charcoal burning, where traditional land use agreement almost lost control. Therefore, the degradation of communal land can mainly be seen as the consequence of the collapse of traditional institutions. In the case of Somaliland, institutions for rangeland management broke down several times within the dynamic history of the country.

3.12 Climate change and conflicts

Although it is complex to link, there is growing evidence that scarcity of resources and most importantly biodiversity loss can increase internal communal conflicts. There is already a rush for land grabbing, establishment of enclosures and breakdown of common user rights. The proliferation of enclosures has become one of the most serious problems in recent years in the study area. Enclosures obstruct free access to permanent water sources and to the main grazing plains and valleys and became a recipe for insecurity and conflicts which are usually on the rise during the dry periods. Drought cycles often result in pastoralists trespassing the enclosed area and thus sparking tensions.

Charcoal production, another contested issue in the study area, has become an important coping mechanisms for poor pastoral households, whose livelihoods may have been affected by the effects of recurring droughts and vegetation loss. As competition for resources increase, conflicts have arisen between and among herders, charcoal producers and wildlife.

Climate change has also exacerbated human-animal conflicts. While most of the wild animals have been decimated in the past by poaching and habitat loss, baboons and warthogs have somehow increased in number. The scarcity of wild foods sources and pasture is driving these animals to adopt aggressive grazing and food collection habits which bring them into conflict with humans. There are even reported cases where baboons become very aggressive and violent than ever before, attacking human habitation in search of food and water. Monkeys eating small ruminants and attacking children were also reported. Monkeys are omnivores, though the majority of their diet is plant matter.

3.13 Impact on Gender

Somali women play a significant role in Somali society; the division of labour is clearly defined and heavily weighted towards women. Traditionally, the nomadic woman milks the animals, processes the milk, feeds the family, and cares for and watches the livestock. She also collects firewood, cooks, feeds the children, cleans the house and washes the clothes and the utensils. In addition to that, women have the responsibility of “building and dismantling the nomadic aqal (home)” as they move from place to place in search of grass and water for their livestock. The men were to “move, arrange additional transport from other families” and look after the camels (Rhoda 1991). In all villages of the study area many women are involved in small income generation activities such as running small shops, selling tea, Qat etc but also a few are engaged in livestock trade and charcoal business as wholesalers while men produce it as illustrated above.

Climate change and the resulting loss of livestock, water and vegetation has changed this traditional workload. The table below is a typical daily schedule for women in Ina Igare village.

06.30:	Preparation of breakfast for children
07.30:	Washing dishes and other domestic work
08.30:	Looking after animals
12.00:	Preparation of lunch, mostly rice or pasta
12.30:	Praying
13.00:	Taking a nap
13:30:	drawing water
14.00:	Cleaning of animal stable
14.30:	Looking after animals
15.30:	Preparation of firewood
16.30:	Praying
17.30:	Looking after animals and returning them home
18.00:	Directing animals to their stable
18.30:	Praying
19.00:	Preparing dinner
19.30:	Praying

3.14 Climate change, Livelihoods and Food Security

Bearing in mind that the collapse of herd size recorded can be inferred to suggest increasing threats to the traditional livelihood of the pastoral communities; the extent to which the reduction in herd sizes affects the viability of pastoral production systems was examined. In identifying the basis for analysis on whether the current livestock holding per family meets the necessary requirements/needs for the pastoral households within the study area, an attempt was made to identify whether there is an established normal threshold herd size for pastoral households at the community level, as scientific information on this issue is not available. Drawing on the responses of the respondents in regard to what is seen as the normal wealth threshold herd size for a pastoral household of seven (7), the outcome is summarized in the following table:

Table 3: A typical traditional women’s daily schedule

Time	Typical daily activities
05.30:	Praying ³ , preparation of <i>loxox</i> (Somali bread), milking sheep, preparation of tea (milking camels is usually done by men, although sometimes women can do

Table 4: Livelihood ‘normal’ threshold herd size in accordance with the target groups

Species	‘Normal’ threshold herd size for family of 7 Persons	
	Single species	Mixed species

Camel	40 Heads	25 camels/200 shoats or
Small ruminants	400 Heads	
Cattle	50 heads	30 cattle/200 shoats 2 camels or 3 donkeys
Burden animals	2 camels or 3 donkeys	

From the above figures, it can be concluded that the number of animals that can shape a minimum livestock of normal holding per person in pastoral areas are 7 camels, 57 shoats and 8 cattle in the case of single species, whereas the numbers for mixed species holding are 3 camel, 28 shoats and 4 cattle.

Moreover, focus group discussions disclosed that the current livestock holding for over 80% of the pastoral households within the study area remain at least 40% below the figures indicated in the above table. An increase in the person to herd ratio will mean fewer livestock numbers per a household and, therefore, this situation makes the pastoral family more vulnerable to destitution in times of droughts. In such difficult times, poor pastoral households are forced to sell animals of higher value such as pregnant and milk animals which they normally retain in normal times.

However, coupled with lack of diversity of livelihood options and access to resources, poor pastoralists believe that there is only a little opportunity for recovery, as the traditional coping mechanism in the form of social support has become over-stretched. Therefore, there is a great likelihood that those who have fallen into destitution will abandon pastoral life and settle in the urban centers as environmental internally displaced persons in major towns. Apparently, one can draw from the foregoing that pastoral households in the study area are at most times deficient in subsistence level and are, therefore, depended on external assistance.

Another serious challenge which directly affects the recovery process and resilience of the long term pastoral livelihood is the low recovery capacity of the environment resources, mainly pasture material. Climate change along with other social and environmental factors has changed pastoral livelihoods in various directions, which also has affected women's livelihoods, their coping strategies and their social position.

3.15 Increasing poverty and disruption of families

Further increase of poverty due to the decline of the natural resource base induced by climate change can lead to a disruption of pastoralists' families. Men migrate to towns to look for jobs, while women are left behind to take care of the children and the remaining livestock. Usually this is a desperate situation for the women and children, not having more than a few goats left behind, living in a small aqal in an environment they are not used to. One woman in Salahléy said, when she got married 7 years ago, she and her husband were moving around with 400 shoats looking for grazing areas. Now, due to consecutive droughts only fourteen remained, and she settled down in Salahléy with her five children without being familiar with the people living there. Other women moved back home to their parent's families when the family lost all their livestock. Usually these women felt less desperate, more food secure and better protected than the women living on their own.

This is actually the better case, since also the income base for the family is better, and in general families who can employ this type of response strategies have higher livestock numbers and better incomes.

3.16 Marriage and Reproduction

The declining number of livestock during droughts also affects the number of marriages since some livestock is needed for dowry. It was said, during the current long drought, almost no marriages took place. Traditionally, marriages and festivities were conducted during the rainy season. On the other hand, since the loss of livestock requires less labour, the spared time is used for increased reproduction activities. As a consequence, while the unmarried women stay unmarried longer, the married women get more children.

Four: Adaptation/ coping strategies and trade offs

As a result of climate change, the pastoralists' way of life is undergoing great transformation and the trend is moving towards higher vulnerability, loss of solidarity mechanisms for coping with droughts, destitution and dropping off from pastoral life. The pastoral production system depends on the availability of natural resources which are sensitive to climate change. What complicates their situation is that pastoralists do not have a diversified pool of resources to draw from, thus rendering them more vulnerable. Due to the prevailing vulnerability of pastoralists as well as uncertainties over the pastoral productivity, many households have diversified their means of livelihoods to cope with climate change. The following section describes some of the coping strategies as observed in the community.

4.1 Commercialisation of milk

Selling milk in the past was uncommon and a lowly business to an extent that any person or family involved in selling milk was dubbed as "caano-dhiiq" (literally milk-seller). Surplus milk was always kept and freely given to guests and travellers. In a pastoral encampment, consisting of a number of families, it was the responsibility of women to contribute, collect and store milk into one gourd which is then kept under a tree with the intention of satiating the hunger and thirst of weary travellers. Nowadays, selling milk is a well organized business with a well established network of collection. The commercialization of milk in the pastoral areas and the increasing demand in the urban areas has had negative impact on nutrition, particularly for children and the elderly. Nevertheless, milk sale is an important contributor to pastoral household income. More attention among pastoralists is now on higher milk yielding animals rather than emphasis on body weight.

4.2 Production and sale of charcoal

Charcoal production is one of the strategies to cope with economic losses as an indirect consequence of climate change and the ban of livestock sales to Arabian countries between 1999 and 2007. Charcoal production is a fallback option for poor pastoralists who are unable to carry on with their traditional way of life. Charcoal making is widely practiced in the study area and it remains the most important option for generating alternative income to the number of people involved. A substantial number of the pastoralists East and South of Salaxley currently base their income on charcoal burning, and the economic returns realized from charcoal production are competitive to returns from livestock. Charcoal is widely produced and presents a market opportunity that requires low investment as well as the free access to trees for charcoal production. It is the major income source for more than 70% of poor and middle level households, and contributed approximately 75 % of their total income per month (\$ 60 per month on average) varying from household to household or area to area.

Table 5: Charcoal producing households in Salahley and Baligubadle districts of Somaliland

Name of the Village	Number of households engaged in charcoal production
Laan-qayrta Celiyo	110
Laan-qayrta qool-dhuxulaale	60
Qool-buullale	300
Libaax qawdhama	70
Balli mataan	300
Balli kaliil	133
Qori-jabley	300
Qool-caday	20
Raydabka	18
Aden Abokor	15
Balli ciise	30
Ina igare	46

Source: Field study

Licensed charcoal cooperatives were the only producer groups before the year 2000. However, the heavy involvement of pastoral households in charcoal production started soon afterwards. The main driving force was the restrictions on livestock imports to Saudi Arabia and other Gulf countries due to the alleged Rift

Valley Fever said to have affected livestock in the Horn of Africa as early as 1999. The widening and increasing consumption of Qat among pastoral youth and the deteriorating livestock herd sizes also led to increased charcoal production.

To gauge the extent this coping mechanism contributes to mitigating adverse impacts on pastoral livelihoods, one can argue that it is an effective strategy since it provides contingent income needed by poor households as a distress coping strategy. However, it is important to highlight its negative impact on environment and the permanent loss of livelihoods which could result from charcoal production. The regeneration of acacia species is very slow and it usually takes at least thirty years for a tree to mature and produce a minimum of 50kg of charcoal.

4.3 Out-migration

An increasing number of pastoralists who lost their animals are leaving livestock production altogether, making their way to major urban centres, particularly Hargeisa town. The combination of increased climatic shocks, practices which hinder mobile pastoralism (enclosures) and a lack of other viable livelihood options is pushing more and more pastoralists out of the system, many of them ending up in urban areas as environmental internally displaced persons. Their remaining herds are left behind under the care of elderly family members and children. As a coping strategy, family members that succeed in getting employment in the urban areas support their families in the rural areas. On the negative aspect, there is increased dependency of these rural families.

4.4 Fencing off communal land (Enclosures)

Huge amounts of literature focuses on movement and migration of pastoralists as an ecologically preferred and appreciated coping strategy to deal with erratic rains, patchy vegetation and droughts. Nevertheless, more and more individuals fence communal land for their own exclusive use to ensure continuous access to grazing land. Academy for Peace and Development (APD) describes four major types of enclosures: the enclosures around guri degaans¹⁵, to demarcate ownership around

¹⁵ Guri-deegaan: Semi-permanent settled area by a agro-pastoral household

homeland; pure farming enclosures to protect farm land; comprehensive¹⁶ enclosures consisting of plots for farming, grazing resources and grown-up trees for charcoal production sites; and grazing enclosures mostly to raise and sell grass or charcoal. Appendix 7.4 is an example of enclosures as witnessed in the study area.

Enclosures have a socio-economic and a biophysical aspect. The socio-economic part is much contested as enclosures, especially comprehensive and grazing ones deny other members of the community access to formerly shared grazing land, which poses a challenge to cultural norms and values of the Somaliland society. Also trekking routes to water points and markets are blocked. The increasing commitment to a sedentary way of life has greatly disadvantaged pastoral communities in Balli-gubadle, while owners of comprehensive enclosures became strikingly wealthy. Hence enclosure and land grabbing tendencies effectively reduce the amount of freely accessible grazing areas and lead to increased livestock pressure and overgrazing on the remaining open rangeland, increased income differences among and within communities, and exacerbates conflict potentials in this way.

Nevertheless the common view among the population in Balli-gubadle is that enclosures are already highly integrated into their livelihoods and can therefore not be removed easily. In addition, considering the investment costs that people have put into their enclosures, it is clear that they are not ready to dismantle them without receiving any benefits in return. According to an APD (2008) study many enclosure owners explained that without alternative income opportunities, such as agricultural extension programmes in which at least farming tools and trainings are provided, the dismantling of grazing and comprehensive enclosures would be impossible. Therefore, by providing support to farmers, the shift from pastoralism to cultivation could be promoted, leading to a reduction of grazing and comprehensive enclosures. While privatization has been frequently promoted as a “rational” response to the “tragedy of the commons”, private enclosures are sometimes assumed to

¹⁶ Banned by law and also disliked by communities. The average size of comprehensive enclosures is 0,250 km² (500m wide) to 1 km² (1000m wide). This is the most common type of enclosures around Bali Gubadle which extend frequently up to 1500 linear meters of thorn fences.

cause a “tragedy of privatization”, where pastoral people are impoverished because land holdings are too small to support their livelihoods in dry grazing lands.

4.5 Shift to agriculture

In the past, pure pastoralism was the principal mode of living in the project area. They used to follow seasonal migration patterns, mainly north/south movement depending upon rainfall and pasture availability. However as pastoralism is becoming more intricate than ever before, those herders who are losing their grip on this age-old system are increasing year after year. The pattern of land use is undergoing a great transformation, particularly in the hilly areas towards south of Hargeysa. More and more ex-pastoral households are settled and establishing rain-fed farms. The principle crops are sorghum, maize, cowpeas as well as fodder production, tomatoes, papaya, salad, and sometimes Qat (*Catha edullis*), although the quality of the later is poor compared to the one coming from Ethiopia. They also rear smaller number of livestock and usually keep the milking animals, mainly camels and goats, for the purpose of selling milk to the market and for household consumption.

According to Academy for Peace and Development (APD), products of small rain-fed farms become the main source of living in years with normal rainfall, while during the rainy season their livelihood depends mainly on the products of their livestock (milk, meat, selling of animals). Some farmers practice farming to produce maize or millet mostly to feed their animals. According to the study, most pastoralists would build berkads to harvest rainwater and start farming to ensure continuous production and water supply. This, however, was opposed by most elders who emphasized on the need of sharing land and water resources for pastoralism.

After two consecutive years of drought, there was not much evidence that agriculture would be a viable risk reduction strategy or production alternative to pastoralism. In fact, agricultural yields have been zero during the previous years due to consecutive droughts and degraded land. FSAU statistics show the same for almost all of Somalia except for some riverine areas (FSAU 2009). Also the land use suitability studies by FAOSWALIM do not even give any major evidence that

the country is suitable for agriculture with the exception of some certain areas around Borama (Awdal region).

Farmers’ skills, the availability of labour, and access to resources outside the farm are other factors that determine farmers’ ability to adapt their farming practices to the new degraded dry land conditions of higher temperatures and increasing seasonality of rainfalls. Since there was hardly any agriculture practiced in previous Somali history, Somali pastoralists of the North can hardly build up on rich traditional agricultural knowledge with few exceptions.

Five: Conclusion and recommendations

5.1 Conclusions

Global warming has led to drought incidences and created shocks which destroyed the regenerative capacities of the human and environmental system. In many cases, vegetation does not reach the stages of reproduction since rainfall distribution is too erratic, too short during the growing season or too low in quantity, while vegetative parts like roots of plants are eaten by animals and hardly anything is left. The reproductive capacities of livestock is also affected since the scarcity of vegetation leads to lower reproduction rates of livestock and high losses of animals due to lack of grazing stock. Many animals are lost during the longer distances of movements. While the adaptation capacities of vegetation and livestock are exhausted, humans have to find new adaptive and coping mechanisms.

The current trends are all in favour of sedentary lifestyle, uncontrolled out-migration to towns, and decline of mobility due to reduction in herd size or switching to small scale agriculture. Pastoral institutions too like the Xeer (customary law) and Xiddigiye (astrology) have lost their importance, so that the original high capacities of traditional institutions have been eroded or completely lost. Interestingly in this respect is that climate change, mostly triggered by industrialisation and urbanisation is triggering changes in the lifestyles of pastoralists. Current coping strategies practiced can only be considered as a means to cover short-term needs for cash and survival. However, developments of enclosures exacerbate social and environmental injustice and are not capable of mitigating or adapting to the conditions of climate change in the long run.

Key areas for future adaptation strategies can certainly be seen in carbon sequestration through improved understanding and management of the interactions of grazing and vegetation recovery, as pointed out by Schwennesen (2008), and in assessing the true potential of water harvesting for agricultural purposes without negatively impacting pastoralism. Finally new social mechanisms for adaptations could be identified, as for instance insurance systems, as a support to the currently overstretched traditional solidarity systems, which would also help to avoid overstocking and hence overgrazing.

Due to the specific political situation of the country, it is not yet part of international adaptation schemes, therefore cannot benefit from prospective global climate change adaptation and mitigation, including the financing mechanisms.

5.2 Policy options and strategies towards climate change

5.2.1 Policy advocacy at national and international levels

- Somaliland is not internationally recognized as a nation and therefore not represented in the UNFCCC either as a party or as an observer state. This is one of the reasons why the country is not involved into any international efforts of mitigation or adaptation to climate change. Despite its isolation, Somaliland should develop strategies to deal with the threats of global warming in any capacity.
- Linking civil society and governmental organizations with the political instruments of the UNFCCC and other forums of international advocacy work on climate change. Since the government cannot present itself at the UNFCCC, international NGOs and UN organizations should inform civil society and governmental organizations about their obligations and opportunities.
- Even though the country is not a party, for the design of establishment of adaptation policies it might be recommendable to build up on the recommendations and lessons learnt by the UNFCCC, which has established a comprehensive

compilation of experiences, strategies, and guidelines.

- Climate change represents a new challenge to the traditional and modern institutions ability to respond. There is therefore need to build the capacity of these institutions in designing and implementing climate change programmes.
- In emergency response policies, there is need to introduce climate change adaptation into the concept of “crisis as an opportunity”, as it is for instance mentioned in the FAO Phase Classification, and it will involve the introduction of risk and vulnerability reduction programmes towards droughts and natural disasters into these policies.
- Cooperating with international donors to develop a viable financing strategy that rewards pastoralists and farmers for adaptation and mitigation and other environmental services.

5.2.2 Water Management and Flood Reduction

- Increasing water use efficiency and productivity- Since more and more water resources are lost due to run-off on the progressively denuded land, appropriate water management will have the highest potential to restore and increase productivity both of pastoral and of agricultural land. Entry points will be diminishing run-off water in rangeland through water harvesting, increase of water infiltration.
- In agriculture more efficient use of green water¹⁷ through restoration of soil organic matter, selection of seeds with highest water use efficiency and water saving systems for blue water like drip irrigation etc. would increase productivity. In general it is agreed upon that optimized use of green and blue water¹⁸ can extend these resources.
- Targeting the specific needs of pastoralists and pastoralism in water supply by designing aid

¹⁷ Green Water: is the water infiltrated into the soil, taken up by roots, used in photosynthesis and transpired by the crop.

¹⁸ Blue Water is made up from run-off to rivers and deep percolation to aquifers that finds its way to rivers indirectly. Moreover, White Water is the water intercepted and directly evaporated by the crop canopy and the ground surface.

programmes in a way that they give incentives to pursue pastoralism and appropriate resource management rather than discouraging it

- Also an oversupply of water source in certain areas has to be avoided. As indicated in the study, the proliferation of berkads has led to a reduction of mobility and to overgrazing around water sources. Mainstreaming climate change considerations into water, sanitation and hygiene (WASH) programmes by coherent management plans for the proper location of water points would help to avoid these problems in future.

5.2.3 Soil Conservation and Flood Reduction

- Soil conservation is of paramount importance both for water management as well as for the maintenance of vegetation on pasture and arable land. Making better use of rain (e.g. rainwater harvesting) as well as improving and maintaining soil porosity and water holding capacity of soils following soil improvement with organic matter should be further assessed.
- All measures should be taken to conserve soil, increase soil infiltration rates and reduce the risk of floods. Sand dune stabilization is of special concern to protect open water resources, pasture and agricultural land. Pastoralists in some parts of Togdheer region, for instance, stabilize sand dunes by Commiphora cuttings, which reproduce themselves even without the presence of water and organic matter. Restoration of the vegetation as well as control of gully erosion, establishing wind breaks, earth and stone dams and bunds is of paramount importance.

5.2.4 Sustaining Pastoralism

- There is need to maintain and strengthen pastoralism¹⁹ in Somaliland. To adapt present

¹⁹ Pastoralism is still the backbone of the present Somali economy and will be in future. It shapes the cultural, social and political system of Somaliland, and, in respect to climate change, pastoralism is optimally adapted to the erratic nature of precipitation and vegetation growth. Future monetary returns for pastoral products will also be promising, especially since markets reopened after the termination of the Arab meat ban.

pastoralism to climate change conditions will require restoration and improvement of the current grazing land, the livestock management system and to adjust mobility patterns to meet the needs of people and environment.

- Another area of intervention would be improving grazing base rather than destocking- although there is an interaction between weather, vegetation base and livestock. The focus of management efforts should preferably be put in the improvement of the grazing base, while for livestock it should be introduction of heat resistant species, vaccination programmes etc. which could be complementary. Rather than reducing livestock numbers it might be better to target the necessary threshold number of livestock as a minimum requirement, which should in turn be subjected to further and intensive research.
- Social services provided by livestock should be replaced if necessary. Livestock does not only provide milk, hide and meat but also provides insurance, bride price, and is considered a sign of wealth and prestige. If numbers of livestock have been reduced, either due to voluntary destocking or through droughts, these services have to be replaced by other mechanisms, for instance by international insurance systems as currently tested in Ethiopia, and finding new forms of social respect and marriage ceremonies.

5.2.5 Agriculture

With lesser returns from pastoralism agriculture is more and more preferred not only by the people in the study areas, but in drylands worldwide. Agriculture is still more in its experimental phase and it is doubtful if agriculture under the climate conditions of the study area will be a viable option on larger scale. However, there might be some opportunities, which will have to be carefully explored. Agricultural policies should therefore focus on research and extension services, especially support rural people in the identification of proper land for agriculture and give training on crop cultivation, irrigation, fertilization and pest management, provide seeds, tools and other input materials.

5.2.6 Promote economic diversification and alternative livelihoods

- Support of women's organizations and milk trade will have positive effects since this will create positive synergies between family livelihoods and environmental conservation. As it has been shown in the study, it is mostly women's income which sustains the families, while man's income, though larger, is mostly diverted into qat consumption. Moreover, women's economy is environmentally sustainable, since it depends mainly on livestock production and not on clear cutting. Strengthening women's economy will therefore both benefit families and environment.
- To generate income without putting additional pressure on land, land independent economic diversification will be advisable. Recommendations usually given are related to the establishment of new economic sectors; like handcraft production, energy etc. However, it should be realistically surveyed, if these new alternatives are really feasible and preferable to the reestablishment, improvement or partial change of a system which is proven and well-known as in this case, pastoralism.
- Promotion of agro-forestry and beekeeping as synergistic measures - Agro forestry will be a system to be newly introduced and if done properly can represent a compromise between agriculture and pastoralism, which also needs trees as a feed especially for camels. Beekeeping does not only create income through honey and wax production, but also increases the productivity of agriculture and forestry through pollination services.

5.2.7 Research, Development and knowledge management

- There is need for preserving traditional knowledge by "translating" and mainstreaming it into education programmes.
- Another strategy would be development of a hybrid knowledge system for environmental and socio-economic monitoring. Modern knowledge information system for monitoring climate is hardly

accessible to common land users, who almost completely rely on traditional systems. To share the benefits of both knowledge systems, it is advisable to mainstream traditional knowledge, especially indicator systems, into modern monitoring programmes and make modern monitoring systems more accessible and user friendly.

Trade-offs in water use between pastoral and agricultural²⁰ land will have to be carefully assessed and discussed and mediated among all affected stakeholders to avoid conflicts and losses of productivity.

It will be useful to explore new ways of adapting to changing environmental conditions through research programmes. To adapt to the new environmental conditions there will be need for further research beside enhanced monitoring and passing on of traditional knowledge. While traditional knowledge has sustained the land use systems over centuries, these have been impacted by many factors among which climate change is only one of many. It may therefore not be still viable under changing environmental conditions and land tenure systems. And although the country is scrutinized by modern monitoring, it will need some further research, preferably on the following topics:

- i. Development of scenarios of vegetation succession dynamics in rangelands for dry and wet years and successive droughts.
- ii. Development of different scenarios on rangeland biomass productivity under different succession patterns.
- iii. Development of different scenarios for dry and wet years on agricultural productivity
- iv. Valuation of ecosystem services under different scenarios
- v. Comparison of land, water and energy productivity and monetary returns between pastoralism of agriculture on geographical scales of high resolution

vi. Comparison of calorie intake available for human consumption through pastoralism and agriculture taking into account the energy losses throughout the food chain

vii. Multi-Criteria assessments and cost benefit analyses of the most preferable solutions

5.2.8 Cross-Cutting Issues (Equity, justice, Gender, Governance)

There are certain advantages and disadvantages of the establishment of enclosures. The disadvantages affect mostly the more vulnerable parts of the society which are excluded from using the land inside of the enclosures, while the stronger parts take advantage both of their enclosed land as well as of communal land. This is the reason why enclosures are strongly condemned by everybody who is advocating for equity and justice. However, it cannot be overlooked, that the enclosing of land is a trend which is taken over already by the majority of pastoralists. Since it is very difficult, if not impossible, to implement land policies against the will and the practice of the majority, dialogue forums should be created between enclosure owners and full pastoralists to negotiate an equitable cost and benefit sharing regime, opening or widening corridors, compensation for mutual services, introduction of land taxes etc.

It will be important to give special consideration and support to single-headed households. This situation rarely affects me as they are seldom left alone in an area far from their homestead with a couple of goats to take care for a number of children. This problem is mainly experienced by women, and these will have to be targeted by special programmes, which support them through provision of supplementary food or livestock or some support in labour, in case the community solidarity systems will not work.

While climate change cannot be blamed for all these developments, the continuous decline of returns from livestock have left especially the male parts of the communities in frustration and despair, which is expressed through overconsumption of Qat , which in turn leads almost to a complete

²⁰ Presently the Agricultural Ministry is conducting assessments on the successes of farming in the area and lessons learnt which can be built upon.

readiness to sell out the whole environment as a cash resource for Qat. This is especially conspicuous in the charcoal economy as shown in section 4.2, and leads into another vicious cycle of inertia towards the environment and poverty. Therefore, the study recommends psychosocial support for individuals involved in Qat consumption, and provision of other alternative sources of income.

Six:

Bibliography

Ahmed Ibrahim Awale (2007): Climate Change Stole our Mist. Candlelight Hargeisa

APD (2008): Land-Based Conflict Project. Somaliland Report. No more “Grass Grown by the Spear”. Addressing Land Based Conflicts in Somaliland. Hargeisa 2008

Barbier, N., P. Couteroni, R. Lefever, V. Deblauwe, O. Lejeune (2008): Decoupling of Facilitation and Competition at the Origin of Gapped Vegetation Patterns. *Ecology* 2008, vol. 89, no6, pp. 1521-1531.

Blench, Roger (2001): “You Can’t Go Home Again.” Pastoralism in the New Millennium. ODI Paper, London.

Bushell, H. (2009): Pastoralism and Climate Change in East Africa: Enabling Adaptive Capacity, Oxfam Great Britain. Paper prepared for presentation at the World Conference of Humanitarian Studies. Groningen, The Netherlands, 4- 7 February 2009

FAOSWALIM (2007): Field Survey Manual. http://www.faoswalim.org/ftp/Land_Reports/Cleared/L-01%20Field%20Survey%20Manual.pdf

FAOSWALIM (2007) Soil Report

FAOSWALIM (2007) Land Cover Report

Foech, N. (2003): Caritas Wash Berkad Report. Caritas Switzerland

Hemming, C.F. (1966): The vegetation of the northern region of the Somali Republic.

Proceedings of the Linnean Society of London. Vol. 177, No. 2, Pg. 173 – 250. DOI: 10.1111/j.1095-8312.1966.tb00958

IPCC (2007) : Working Group I: The Physical Science Base. IPCC 4th Assessment
<http://www.ipcc.ch/ipccreports/ar4-wg1.htm>

IWMI (2007): *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture*. Ed. D. Molden, Earthscan, London and International Water Management Colombo Institute.

<http://www.iwmi.cgiar.org/assessment/Publications/books.htm> Millennium

Ecosystem Assessment (2003): *A Framework for Assessment*. www.maweb.org

Mucheri P.W. (2007): *Climate of Somalia*. Technical Report No W-01, FAO-SWALIM

Lewis, I.M. (1955): *People of the Horn of Africa*. International African Institute.

Reynolds, J.F. (2007): *Global Desertification. Building a Science for Dryland Development* Science 316, 847 (2007); http://www.biology.duke.edu/aridnet/pdfs/Science-en_sp/2007-Reynolds_Science_en.pdf

Rhoda Ibrahim (1991) "The changing lives of Somali women", "Changing perceptions: writings on Gender and Development", ed. Tina Wallace with Candida March, Oxfam publications, Oxford.

Schwennesen, E. *Overgrazing: The Crux of the Pastoralist Controversy*. <http://www.drylands-group.org/noop/file.php?id=667>

Swayne, H.G.C, 1895, *Seventeen trips through Somaliland*, London: Rowland Ward.

Seven:

List of appendices

7.1 Periods of positive and negative rainfall and vegetation indices

Deviations of Rainfall (RFE) and Vegetation Index (NDVI) from long-term medium in months

RFE positive	Total	Gu	Deyr	Dry Season	
Nov 97 – May 98	7	2		1	4
May 98 – July 99	15	2		8	5
Oct 03 – July 04	10	3		2	5
Jan 07 - June 07	6	3			3
Σ	38	8		11	17

RFE negative

Sept 96 – March 97	7	0	2	5
August 99 – May 00	10	2	2	6
Oct 00 – sept 03	36	9	6	21
Mar 05 – May 05	3	2		1
Σ	56	13	10	33

NDVI positive

Oct 06-Nov 07	14	3	4	7
Σ	14	3	4	7

NDVI negative

June 00 – June 02	25	7	4	14
Oct 02 – May 05	31	8	6	17
Sept 05 – Nov 06	14			
March 08				1
Σ	70	15	10	32

Source: (FSAU 2009) - Summarized from FSAU data compared to long-term average

7.2 Seasonal Calendars

7.2.1 Bali Gubadle 2007

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Precipitation	■	■		■	■	■						
Water	■	■		■	■	■						
Food	■	■	■	■	■	■	■	■				
Fodder	■	■	■	■	■	■	■	■				
Human	Diarrhoea									Malnutrition		
Disease	Respiratory									Diarrhoea		
Animal			tick borne							Anthrax	Tick borne	
Disease									Black Quarter			
Income	■	■	■	■	■	■	■	■				■
Expense	■	■	■	■	■	■	■	■				■

7.2.2 Bali Gubadle 2008

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Precipitation	■	■		■	■	■						
Water	■	■	■	■	■	■						
Food	■	■	■	■	■	■	■	■	■			
avail.	■	■	■	■	■	■	■	■	■			
Fodder	■	■	■	■	■	■	■	■	■			
Human	Diarrhoea									Malnutrition		
Disease	Respiratory									Diarrhoea		
Animal			Tick Borne							Anthrax	Tick borne	
Disease									Black Quarter			
Income	■	■	■	■	■	■	■	■	■	■	■	■
Expense	■	■	■	■	■	■	■	■	■	■	■	■

7.2.3 Salaxley 2007

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Precipitation	■	■		■	■	■						
Water	■	■	■	■	■	■						
Food	■	■	■	■	■	■	■	■				
Fodder	■	■	■	■	■	■	■	■				
Human	Diarrhoea									Malnutrition		
Disease	Respiratory									Diarrhoea		
Animal			tick borne							Anthrax		
Disease									Black Quarter			
Income	■	■	■	■	■	■	■	■				
Expense	■	■	■	■	■	■	■	■				

7.2.4 Salaxley 2008

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Precipitation	■	■			■							
Water	■	■			■	■						
Food		■	■	■	■	■	■	■				
avail.												
Fodder	■	■	■	■			■					
Human	Diarrhoea									Malnutrition		
Disease	Respiratory									Diarrhoea		
Animal		Three days	Tick Borne						Anthrax		Tick borne	
Disease									Black Quarter			
Income												
Expense	■	■	■	■	■	■	■	■	■			

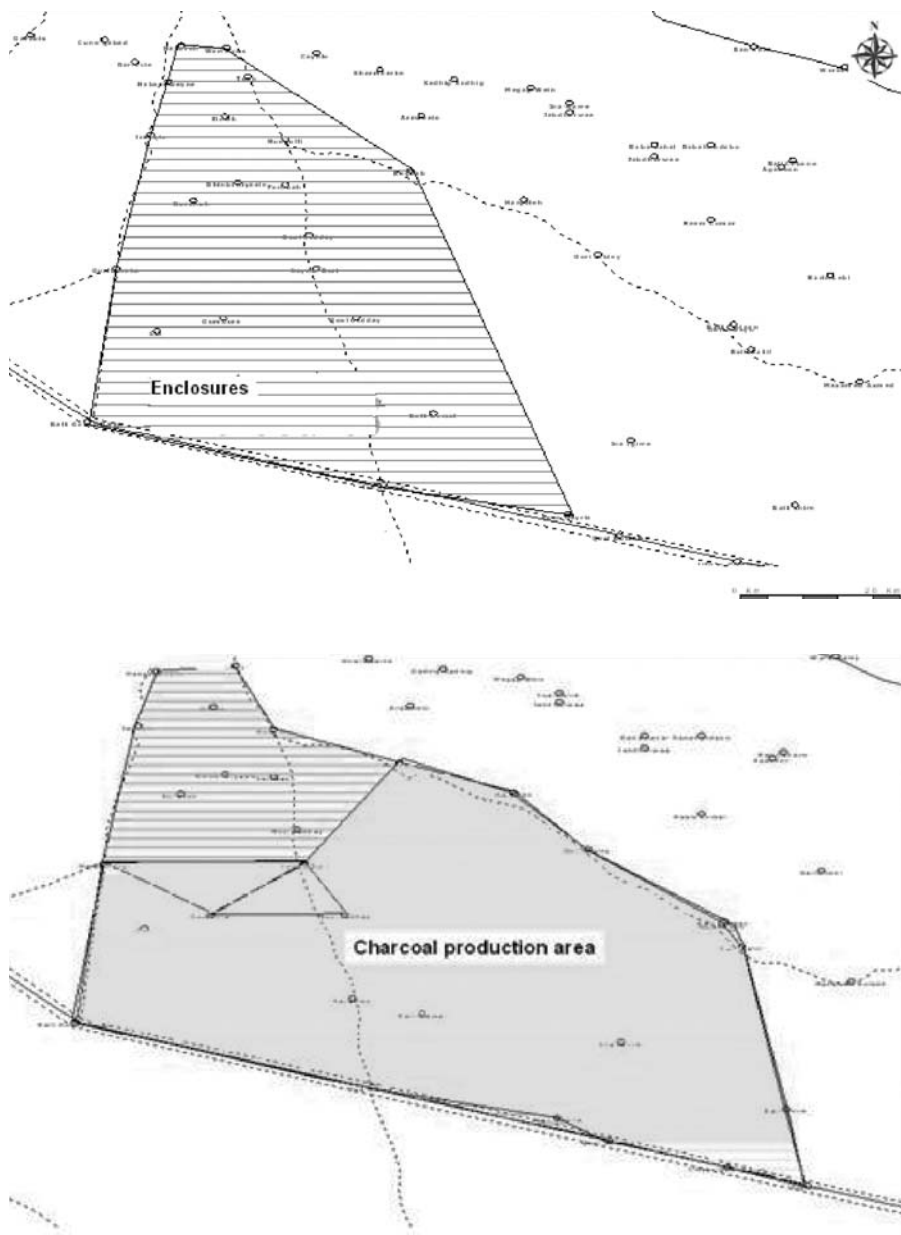
7.3 Village Transect Salaxley

West > East
Town Center Outskirts Open Land

Parameters	Zone 1	Zone 2	Zone 3
Soil Type	Sandy loams with gravel, sandy clay	Sandy – with clay and gravel	Sandy clay
Crops	Maize, sorghum, cowpea	Cowpea, vegetable, maize	Tomatoes, Maize
Water	Berkads, balley	Balley, Berkad	Berkad, Balley
Socio-Economic	Hut, grass-thatched. Most unemployed men + women	Teashops and small stores, specially run by women	Nomadic Huts, Water Reservoirs
Infrastructure	Sheet erosion	Small gully erosion	Sheet Erosion
Erosion			Small Gully Erosion
Vegetation	Cadaad, Qudac, Maraar, Galool, Bilcan, Small Shrubs	Meygaag, Cadaad, Qansaax, Small Shrubs	Small Scattered Shrubs

2 km West to East, Town Center to open land

7.4 Areas of Enclosures and Charcoal Production



(Footnotes)

1 Gaadhi-gaadhi-saar: as the name indicates, this was the first time trucking water on trucks started in Somaliland.

2 Name not known or couldn't be established

3 Prayer times are conveniently inserted in this table. In the real sense, in a male dominated pastoral society, women play an essentially passive role in religious life and are essentially are not expected to be as devout as men are. A wife may always make water for ablution and the prayer rug ready for her husband but at the same time may not perform her daily obligatory prayers.

About the Heinrich Böll Foundation

The Heinrich Böll Stiftung / Foundation (HBF) is the Green Political Foundation, affiliated to the “Greens / Alliance ‘90” political party represented in Germany’s federal parliament. Headquartered in Berlin and with offices in more than 25 different countries, HBF conducts and supports civic educational activities and projects world-wide. HBF understands itself as a green think-tank and international policy network, working with governmental and non-governmental actors and focusing on gender equity, sustainable development, and democracy and human rights. HBF’s Regional Office for East & Horn of Africa operates in Nairobi, Kenya, since 2001.

Contact:

Heinrich Böll Foundation, Regional Office for East & Horn of Africa,
Forest Road, P.O. Box 10799-00100, GPO, Nairobi, Kenya
Tel: ++254-20-2680745, 2613992, 2613997
Email: nairobi@hbfa.com
Web: www.boell.or.ke