Institute for Environmental Security

INSTITUTE FOR ENVIRONMENTAL SECURITY

horn of africa

Environmental Security Assessment

Environmental Security for Poverty Alleviation Programme

| Eric van de Giessen |

January 2011

Horn of Africa

Environmental Security Assessment

Eric van de Giessen

Project Coordinator East Africa
Programme on Environmental Security for Poverty Alleviation

Institute for Environmental Security

January 2011

Horn of Africa

Environmental Security Assessment

Author/Editor: Eric van de Giessen, Project Coordinator East Africa, IES
Programme on Environmental Security for Poverty Alleviation (ESPA), IES

Cover design: Géraud de Ville, IES
Cover photo: Blue Nile Falls, Amhara region, Ethiopia
Photo courtesy of Eric van de Giessen, IES

Published by:

Institute for Environmental Security
Anna Paulownastraat 103
2518 BC The Hague, The Netherlands
Tel: +31 70 365 2299 • Fax: +31 70 365 1948
www.envirosecurity.org

ISBN/EAN: 978-94-6055-005-8
NUR: 907

Report published by the Institute for Environmental Security in the context of the Programme on Environmental Security for Poverty Alleviation (ESPA), supported by The Netherlands Ministry of Foreign Affairs.

Acknowledgements

This Environmental Security Assessment on the Horn of Africa has been drafted in the context of the Environmental Security for Poverty Alleviation (ESPA) programme. The IES would like to express its gratitude to the Netherlands Ministry of Foreign Affairs for kindly supporting this 5-year programme.

This report reflects the outcomes of a two year research period during 2009 and 2010, largely based on desk research, a field trip to Ethiopia and intensive email and phone correspondence with many stakeholders in the region.

The project team is particularly grateful to the following persons and organizations for their involvement, valuable input, ideas and feedback during the development of this study: Mrs. Janny Poley, Ministry of Foreign Affairs; Mrs. Henriette Geiger, European Commission; Mr. Tezera Getahun, Pastoralist Forum Ethiopia; Mr. Valdemar Holmgren, UNDP; Mr. Rem Neefjes, SNV-Ethiopia; Mr. Ben Irwin, Bale Eco-Region Sustainable Management Programme; Mr. Bedru Sultan, Greener Ethiopia; Mr. Steven Lovink, Planet2025 Network; Mr. Sanne van Aarst and Dr. Satishkumar Belliethathan, Horn of Africa Regional Environment Centre and Network; and Dr. Marcel Leroy, University for Peace in Addis Abeba.

Project Team:

Eric van de Giessen	Project Coordinator East Africa, IES
Ronald A. Kingham	Director, IES
Wouter J. Veening	Policy Advisor, IES
Selamawit Zewdu Yetemegn	Researcher
Patrice Yamba T. Kantu	GIS Coordinator, IES
Jeanna Hyde-Hecker	Methodology Coordinator, IES
Géraud de Ville	Information Coordinator, IES
Roald Fekken	Researcher
Fabio Odaguiri	Researcher
Rob Huysmans	Researcher

Contents

List of figures

List of tables

List of text boxes

Abbreviations

ACTS	African Centre for Technology Studies
AMESD	African Monitoring of the Environment for Sustainable Development
AU	African Union
AVHRR	Advanced Very High Resolution Radiometer
CBO	Community Based Organisation
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CLEAA	Capacity development & Linkages for Environmental Assessment in Africa
CLIP	Climate-Land Interaction Project
COMESA	Common Market for Eastern and Southern Africa
COP	Conference Of the Parties
DRC	Democratic Republic of the Congo
EAC	East African Community
ECA	Economic Commission for Africa
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessments
EPRDF	Ethiopia People's Revolutionary Democratic Front
ESA	Environmental Security Assessment
ESIA	Environmental and Social Impact Assessment
ESPA	Environmental Security for Poverty Alleviation
EU	European Union
EWCA	Ethiopian Wildlife Conservation Authority
EWCP	Ethiopian Wolf Conservation Programme
FAO	Food and Agriculture Organisation
FESS	Foundation for Environmental Security and Sustainability
GDP	Gross Domestic Product
GEF	Global Environment Facility
GPS	Global Positioning System
HoA-REC/N	Horn of Africa Regional Environment Centre / Network
IBC	Institute for Biodiversity Conservation
ICPAC	IGAD Climate Prediction and Application Centre
ICRAF	International Council for Research in Agroforestry (now World Agroforestry Centre)
IDP	Internally Displaced Person
IES	Institute for Environmental Security
IGAD	Inter-Governmental Authority for Development
IIED	International Institute for Environment and Development

ILRI	International Livestock Research Institute
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
IUU	Illegal Unreported and Unregulated (fishing)
LRA	Lord's Resistance Army
MDG	Millennium Development Goal
MW	Megawatt
NASA	National Aeronautics and Space Administration
NBI	Nile Basin Initiative
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organisation
NOAA	National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Cooperation and Development
ONLF	Ogaden National Liberation Front
ORDA	Organization for Rehabilitation and Development in Amhara
PENHA	Pastoral and Environmental Network in the Horn of Africa
PPP	Purchasing Power Parity
REDD	Reducing Emissions from Deforestation and forest Degradation
SNNPR	Southern Nations, Nationalities and Peoples' Region (Ethiopia)
SPLM	Sudan People's Liberation Movement
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UN-DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for the Refugees
UNMIS	United Nations Mission In Sudan
USAID	United States Agency for International Development
USD	United States Dollar
WFP	World Food Programme
WWF	World Wildlife Fund (also known as the World Wide Fund for Nature)

SUMMARY

The availability of life-supporting ecosystem services and goods for human needs and natural processes is under threat in many parts of the Horn of Africa. Overexploitation of resources brings about land degradation, biodiversity loss and resource scarcity. These resource-related problems exacerbate food and water insecurity in the Horn of Africa and seriously threaten human well-being.

This Environmental Security Assessment gives an overview of these social and environmental problems and describes their impacts on man and nature. It also analyses the different factors driving these changes (e.g. demand for land and wood) and the structural factors underlying these driving forces (e.g. population growth). The gravity of the situation is more pronounced in certain regions than in others; some of these hotspots are described in more detail. On the basis of the analysis, policy recommendations are formulated, which are aimed at enhancing environmental security in the Horn of Africa.

Environmental degradation

In the Horn of Africa, increasing scarcity and degradation of natural resources seriously threatens human well-being. The population in the region (Ethiopia, Eritrea, Sudan, Djibouti, Somalia, Kenya and Uganda) has increased fourfold in the past 50 years and continues to grow rapidly. Farmers need to feed more mouths and extra areas of land are needed, at the expense of forest and pasture lands. With a high and stable number of pastoral communities and decreasing amount of pasture land, pressure on land and water grows. The mounting need for fertile soils and irrigated land is intensified by high international demands for food and energy. Investors from all over the world are ready to invest in commercial farming in Sudan, Kenya, Uganda and Ethiopia. With inadequate soil and water management measures being taken, this growing pressure on natural resources leads to a decrease in the quality and quantity of soils, forests and water resources.

The region contains many protected areas (forests, lakes, wetlands and grassland ecosystems) with high biological diversity, some of which are inscribed on the UNESCO World Heritage List. Not all protected areas are adequately guarded by the responsible authorities against the threats faced by increasing demands for land and wood, which seriously disturbs the hydrological, economic, social and cultural services these ecosystems provide. Land tenure systems, resource allocations and planning processes insufficiently take into account people's needs and this whole set of ecosystem services.

Overexploitation of wood, fish, farm lands and grazing lands can thus lead to tremendous forest degradation, biodiversity loss, land degradation and resource scarcity. This exacerbates food and water insecurity in many parts of the region. Deforestation, for instance, can heavily disturb climatic and hydrological regimes. This is demonstrated in the Mau Forest, Kenya's largest "water tower". Despite its official status as protected area, thousands of farmers entered the Mau forest in the past 20 years. Large parts of the forest were cut to prepare the land for cultivation. This tremendous forest degradation seriously

disturbed the hydrological function of the area as a water reservoir, with dramatic consequences to the water level and the local climate. This heavily affected millions of people in the wider region depending on the water for farming and pastoralism.

National governments in Sudan, Ethiopia and Kenya are renting out many large land areas to (domestic and foreign) investors, who put up large agricultural and horticultural companies for cultivating biofuels, flowers and food crops. In making these land deals, there is often only limited consideration for the interests of local communities, who had previously used the common lands for farming or pasture. Furthermore, there are many examples of large scale farms, seriously exhausting and polluting the land and water resources, without being required to restore or provide compensation. These matters often spark heavy frustrations among (original) communities, which sometimes even lead to violent confrontations.

Security threats

Resource-related security threats are numerous. Pastoralists are faced with declining amounts of water and grazing land for their cattle, especially during periods of extreme drought. Regular food insecurity affects millions of people. In a continuous struggle for water and land, resource conflicts often occur between - and among - farming and pastoral communities. Such conflicts mainly occur in arid and semi-arid areas and played a role in the origins of the violence in Darfur, for instance. Faced with these tensions and insecure land tenure systems, many people are forced to migrate to other – both urban and rural - areas. Currently 5 million people in the Horn of Africa are permanently displaced and forced to live in refugee and IDP camps. Vicious cycles of resource pressure, conflict and migration have very serious destabilizing effects on the region.

In the border regions between Kenya, Ethiopia, Uganda and Sudan, 'cattle raiding' is the cause of many tribal conflicts. Although this is not at all a recent phenomenon, the increasing pressure on pastoralists and the use of highly available fire arms in this war-torn region give these 'traditional conflicts' an increasingly grim character.

In (potentially) oil rich areas, heavy struggles exist for access to the land and its oil deposits. In Sudan, for instance, oil resources generate additional interests and concerns in the border tensions between Sudan and Southern Sudan. The outcome of the referendum of January 2011 is likely to further intensify existing conflicts in this border region.

The Nile River is a source of life, but also a source of conflict. The river supplies water for millions of people in the Horn of Africa - up to Egypt. Plans to allocate more water for irrigated agriculture in Uganda and Ethiopia, to replace rain-fed agriculture, face a great deal of resistance from downstream states Sudan and Egypt. The planned construction of hydro-electricity dams in Uganda and Ethiopia adds to this perceived security threat. To prevent upstream countries from using the water for these purposes, the governments of Egypt and Sudan refer to old colonial agreements on the distribution of Nile water, with the government of Egypt even threatening with war in case these old agreements are violated. These ‘hydro-political’ tensions add to the already significant instability in the Horn of Africa.

Moreover, hydrological changes caused by the dam constructions, bring about many social tensions within the various countries. For instance, it is feared that the livelihoods of about half a million Ethiopians and Kenyan is threatened by the construction of dams in the Omo River, in the south west of Ethiopia. This can have a big impact on fishermen in Lake Turkana, in the north of Kenya.

Many fishermen in Uganda and Kenya, already face declining fish stocks, due to overfishing and the use of illegal fishing techniques. This problem is also significant in the Gulf of Aden and the Indian Ocean. These are largely the effect of large scale illegal fishing by European, Asian and American fleets. These fleets can illegally exploit marine resources in the Somali waters, as official Somali coast protection and international inspection is totally lacking.

In Somalia, heavily affected by violent conflict for almost 20 years, support for Islamic fundamentalism is growing strongly. Additionally, the lack of a functioning government facilitates the unhindered plundering of natural resources. This is not only related to illegal, unreported and unregulated fishing, but also to the international trade in (illegally logged) wood and charcoal, making the prices of already scarce fuel and building materials go up.

The resistance of Somali young men, which started as some kind of 'coastal protection' against illegal fishing fleets and toxic waste dumping, has transformed into a very dangerous form of piracy. All types of international vessels are violently captured and released in exchange of hard cash. Piracy has developed in one of the main international security problems, and is still growing every year

It can be concluded that the allocation, use and management of natural resources such as water, fertile land, pasture land, trees, but also oil, lead to large internal and international tensions in virtually all countries of the Horn of Africa. Natural resources play a role in the origin and dynamics of many conflicts in the region. Through political tensions and grievances about the loss of livelihoods among farmers, pastoralists and fishermen, regional insecurity is rapidly increasing. Already 5 million refugees and internally displaced persons live in the Horn of Africa.

The challenge

Changes are badly needed. These changes need to come from communities, the public as well as the private sector. The challenge for the Horn of Africa is to combat the loss of fertile land by deforestation and erosion, to slow down natural population growth and to integrate the maintenance of ecosystem services into planning and decision-making processes. In all countries it is essential to strengthen institutional capacities for disaster response, waste management and enhancing food and water security.

The international community can contribute significantly to reforestation, agro-forestry and forest protection measures in order to maintain the ecosystem services, on which economies and societies in the region depend. Re-greening the Horn will improve energy, food and water security and will help to alleviate poverty, by ensuring a sound basis for economic development and human well-being.

Summary of policy recommendations

Science and Innovation

Monitoring system

An international vegetation monitoring system including 'evidence from space' is essential to monitor the adaptation, reforestation and forest protection measures eligible for support under the financial climate mechanisms. See recommendations below. A leading role herein can be assumed by the New Partnership for Africa's Development (NEPAD). Since the EU will remain in the forefront of international climate and biodiversity policy and the financing of those policies, it stands to reason that the European Space Agency (ESA) will be employed to provide the needed satellite imagery.

Natural resources and conflict

Competition over natural resources can catalyze violent conflicts in the Horn of Africa. Research programmes, such as the Dutch CoCoon programme, should focus on the dynamics of conflict and cooperation around natural resources in the Horn.

Diplomacy and governance

Nile River Cooperation

Water makes or breaks relationships. The EU and its member states should intensify their support for the Nile Basin Initiative and the Nile Basin countries in the Horn to find peaceful and fair solutions for the rising tensions over the distribution of the waters of the Nile River.

Land use planning

By creating corridors to facilitate the movement of pastoralists and their herds and securing access to water and grazing lands, land use planning can be a vital peacebuilding tool. Considering the impacts of climate change and population growth in time, the international donor community should assist national and local authorities to develop long-term regional outlooks, identifying the values, strengths and strategic opportunities of a region. Local land use plans should be based on these integrated regional visions, in which unique ecosystem values should be pivotal elements.

Food security

Rather than relying on food aid, preparing for recurrent hazards like droughts, floods and diseases is essential to feed the region's growing population. National governments are advised to take the lead in drafting and implementing strategies to boost resilience to disasters in line with the 'Africa Regional Strategy for Disaster Risk Reduction'.

Law

Land tenure security
Significant structural changes are needed to improve land access and ownership for millions of people who risk losing land through competing claims or eviction plans. The international programme of the Dutch Land Registry Office (Kadaster) is encouraged to extend its services also to assist the governments of the Horn to improve handling of records and update cadastres as soon as possible, while developing transparent land registration procedures.

Environmental Assessments
Institutional capacity for carrying out Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs) should be strengthened in cooperation with the Capacity Development and Linkages for Environmental Assessment in Africa (CLEAA) Network with support from the Netherlands Commission for Environmental Assessment (NCEA).

Piracy, illegal fishing and illegal waste dumping
Careful consideration should be given to the implementation of Security Council Resolution no. 10092, adopted on 23 November 2010, to fight piracy off the coast of Somalia, while also stressing the importance of preventing illegal fishing and illegal dumping of toxic waste. The EU through its Common Fisheries Policy should ensure that European vessels involved in illegal fishing will not receive any support from the EU. The International Maritime Organisation (IMO) and INTERPOL should step up their efforts to track down and prosecute illegal waste dumping.

Overfishing
The national governments of Uganda and Kenya are advised to take the lead in combating overfishing in Lake Victoria and other vulnerable lakes, by stopping illegal fishing and by developing criteria to reduce the numbers of operational fishermen.

Land grabbing
If requested, the international community should assist the national governments, and in particular the new government of Southern Sudan, in preparing for the influx of large scale land investors, supporting them to develop policies and laws to regulate this development.

Finance and Economics

Payment for biodiversity conservation
Protecting biodiversity is an essential service to the rest of the world, which should be adequately compensated by the global community. Ethiopia, as one of the eight 'Vavilov Centers of Crop Origin', has a special responsibility to protect the sites of wild original crops. It is recommended to design contractual arrangements between the Global Environment Facility (GEF) and the authorities responsible for protecting these sites.

Sustainable energy
Developing new and innovative energy solutions with large potential, such as micro-hydro,

solar power and geothermal power, will stimulate sustainable economic development. Given the large investments, broad applicability and significant profits, public-private partnerships are likely to be suitable institutional arrangements for developing such sustainable energy solutions.

Green Climate Fund
The region is vulnerable to the impacts of climate change - to which it hardly contributes. The Horn countries therefore qualify for financing adaptation measures out of the Green Climate Fund, as decided in the UNFCCC COP16 in Cancún in December 2010. Large-scale tree planting sequesters CO_2 from the atmosphere and is eligible for financial compensation through the selling of carbon credits under the Clean Development Mechanism.

Re-Greening the Horn
The international community and national governments are advised to invest in re-greening the Horn, through improved water and soil conservation, agro-forestry and reforestation projects. Governments are also advised to strengthen their forest protection mechanisms. In particular, church forests in Northern Ethiopia offer great opportunities for the conservation of biodiversity. The government of Ethiopia is advised to actively promote the establishment of corridors for the protection of (church) forests' genetic diversity. Remaining forest estates in the Horn may benefit from the REDD+ financial provisions currently being developed. As the global community wants to ensure that it gets what it pays for, a reliable and transparent monitoring system has to be put in place (see first recommendation above).

Waste management
To lower the health risks of millions of citizens, private and public organizations are advised to invest heavily in improving the handling of waste on household level, and in strengthening waste management infrastructure (collection, transport and treatment) in all countries of the Horn.

Education and Empowerment

Invasive species
Invasive species such as 'prosopis' and parthenium weed pose a serious environmental security threat. Eradication of the invasive species may require a massive operation, for which the involvement of the military, following the example of Djibouti, should be considered.

Emergency response
It is crucial to integrate environmental considerations in emergency aid and recovery programmes, to minimize their negative impacts on the natural environment. Humanitarian aid organizations should therefore integrate the Green Recovery and Reconstruction Toolkit into the training programmes of their personnel.

For more details and recommendations, see chapter 10.

PART I – Introduction

Many people would typically describe the Horn of Africa as a doomed desert area, where primitive tribes continuously fight each other to death over food, cattle and water, where famine rules and rules do not exist; as a part of the world without any further importance to the rest of humanity, moreover. Less people perceive it as a region endowed with great natural resources and an extraordinary variety of flora and fauna, a region inhabited by powerful people with very rich cultures, who have also proved to be well capable of realizing firm economic development.

Given the strengths, opportunities and importance of the Horn of Africa, descriptions of continuous disaster, doom and insignificance do not do justice to the region. On the other hand, many parts of the Horn of Africa are no dreamland either. Food and water insecurity, social and political tensions, violence, displacement and poverty persist on quite a large

scale. Many of these important security issues are somehow related to environmental matters like land fertility, resource extraction, land tenure issues and distribution of water.

Shedding some light on how environment and security are related in the Horn of Africa is one of the main objectives of this Environmental Security Assessment. The analysis serves to help formulate policy recommendations in order to achieve greater security, development and sustainability in this very special and important part of the world.

The report

This first part of the report is of an introductory nature. Chapter 1 provides an introduction to environmental security and the work of the IES. In chapter 2, the Horn of Africa will be briefly introduced, with sections on geography, population, economy, insecurity and transnational cooperation.

Part II demonstrates what the main environmental and social concerns are. Chapter 3 presents the current major environmental problems: forest degradation and deforestation, land degradation and desertification, pollution and biodiversity loss. The related social issues of food and water insecurity are elaborated upon in chapter 4. This part of the assessment is mainly descriptive, although some brief information is provided on what are believed to be the causes and implications of the various environmental and social problems.

Part III contains the analysis of these problems. The processes and forces causing these problems are presented in chapter 5 as “environmental security threats”. These threats are strongly related to the growing need for resources. Structural matters, such as population growth, land tenure insecurity and climate change underlie this growing need for resources and other driving forces. Chapter 6 is devoted to explaining these structural, underlying matters. Concluding remarks on the drivers and structures behind environmental security and its implications on society are made in chapter 7.

In some areas the problems of environmental security, including food and water security, are more serious than elsewhere. Part IV focuses on that. First, chapter 8 tries to present some examples of environmental security hot-spots in the region, such as the Kenyan Mau forest and the Ethiopian Bale Mountains. Then, the security implications per country are schematically assessed in chapter 9.

Part V presents some of the policies needed, which can be regarded as 'pathways to action'. As environmental problems are transboundary by nature, and many countries are facing similar problems, the regional multilateral institutions can play an exceptionally important role. Chapter 10 is dedicated to a long range of policy recommendations, in the fields of science, diplomacy, law, finance and education. These are presented here to provide assistance and inspiration to national governments, multilateral institutions, bilateral donors, academic institutions, NGOs and local communities in order to help restore environmental security in the Horn of Africa.

CHAPTER 1. BACKGROUND

The Institute for Environmental Security (IES)
The Institute for Environmental Security (IES) is an international NGO that was established in The Hague in 2002. It has an additional office in Brussels and representatives in London, Beirut, California, New York, Toronto and Washington, DC. The mission of the IES is to advance global environmental security by promoting the maintenance of the regenerative capacity of life-supporting ecosystems, making it the core principle of international environmental policies.

The need to draw the necessary political attention to environmental security to prevent conflict and instability prompted the design of the Institute's work programme, in which IES takes a multidisciplinary approach consisting of five components:

- Science: Create enhanced decision tools for foreign policy makers, donors and their target groups on regional, national and local levels;
- Diplomacy: Promote effective linkages between environment, security and sustainable development policies.
- Law: Contribute to the development of a more effective system of international law and governance;
- Finance: Introduce new and innovative financial mechanisms for the maintenance of the globe's life supporting ecosystems; and
- Education: Build the environmental knowledge capital of people and organizations.

Specific initiatives and proposals exist for each of these five pillars, though their interdisciplinary nature brings about many overlaps between these initiatives. Recent work programmes of the IES include:

Climate Change and International Security (CCIS)
The IES programme on Climate Change and International Security was set up shortly after the Bali UNFCCC COP 13 to provide policy makers with creative and combinable solutions with regards to climate change and international security. The programme focuses on the organisation of conferences and workshops.

Climate Change and the Military (CCTM)
The project, based on the cooperation of a group of leading think tanks, aims at delivering a strong message from the security sector to global policy makers in view of obtaining a strong international commitment to mitigate and adapt to climate change.

FUEL: Integrating Energy Needs in Humanitarian Crisis Situations
The FUEL project is a diplomacy and education project set up to integrate energy needs in emergency response operations – after natural disasters and violent conflicts. Refugee camps and settlements often have large ecological impacts, which have disastrous consequences for people's livelihoods in the long term. This project aims to enhance policies

and practices of emergency aid organisations, especially on fuel-related issues, in order to avoid such negative impacts.

Global Policy Coherence (GPC)
The project on Global Policy Coherence aims for an improvement of the compatibility of existing trade and financial regimes with the new post-2012 climate change agreement.

The Hague Environmental Law Facility (HELF)
The HELF Project investigates the usefulness and necessity of a facility in the field of environmental law in The Hague. This facility would have an advisory function with regards to facilitating access to justice and an auxiliary training function aimed at improving the knowledge and skills of civil servants, diplomats and negotiators on issues of implementation, enforcement and compliance.

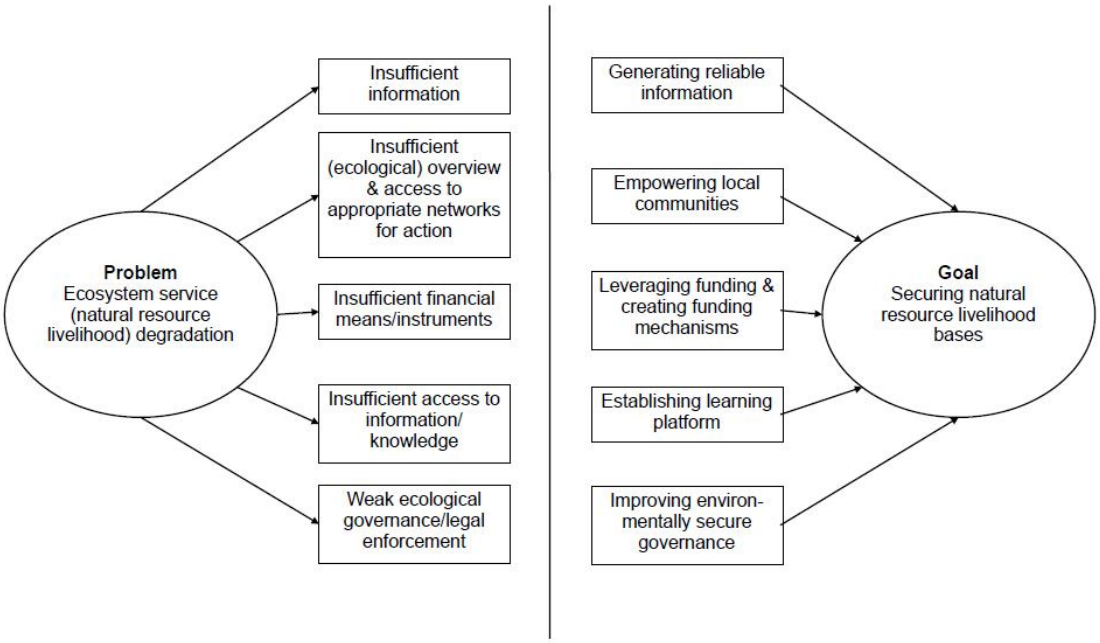
Pathfinder
The Pathfinder Programme is a multi-disciplinary programme with the aim of restricting the import of illegally extracted resources from zones of conflict by promoting the strengthening of legal mechanisms that importing and transit states could use to block illicitly obtained natural resources from entering their markets.

ESPA programme
The Environmental Security for Poverty Alleviation (ESPA) programme aims to integrate the different activities of the IES. It is a five year programme (2006-2010), funded by the Netherlands Ministry of Foreign Affairs, with the overall objective of *securing the natural resource livelihood bases of local communities*.

To achieve this overall goal, the following specific objectives are identified:
- To detect areas with threats to environmental security;
- To prevent threats to environmental security, monitor and anticipate potential environmental insecurity and conflicts;
- To investigate the role of violence and poverty in threats to environmental security;
- To investigate whether or not the integration of the environmental aspect via ecosystem goods and services helps in the prevention and/or reduction of violence and poverty.

The diagram in figure 1.1 outlines the rationale of the ESPA programme.

Figure 1.1. The rationale behind the ESPA Programme[1]



Environmental security

Many definitions of environmental security exist in the world. For instance, Nils Peter Gleditsch from the International Peace Research Institute in Oslo sees environmental security as "the freedom from environmental destruction and resource scarcity." The IES has defined environmental security as:

"the current and future availability of life-supporting ecosystem services and goods for human needs and natural processes."

Central element in the approach of the IES is the maintenance of healthy ecosystems services. Ecosystem services are the benefits obtained from ecosystems. The Millennium Ecosystem Assessment published in 2005 explains that ecosystem services include "provisioning, regulating, and cultural services that directly affect people and the supporting services needed to maintain other services". Many of these are highly interlinked.

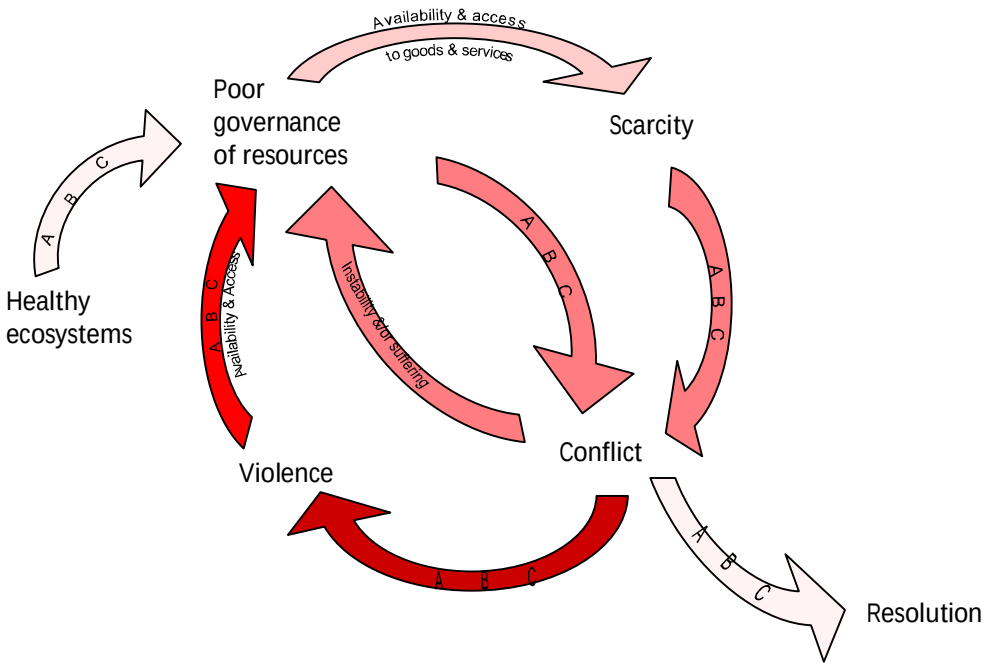
Methodology

As part of the ESPA programme the IES carries out Environmental Security Assessments (ESAs) in vulnerable areas, which rely on a network of existing organisations and individuals involved in environmental conservation, poverty alleviation, natural resource economics and sustainable development activities from the perspective of any of the five aforementioned components: science, diplomacy, law, finance and education.

[1] Hyde Hecker, J. (2011) *Peace and Sustainable Development through Environmental Security: a Methodology for Environmental Security Assessments*, Institute for Environmental Security, The Hague, January 2011.

Information and experience gained by these organisations, combined with desk studies, will contribute to discussions and advocacy in order to enhance sustainable management of life-supporting ecosystems, promote poverty alleviation and strengthen tools for conflict prevention.

Figure 1.2. Model of the relationships between environment and conflict[2]



A B C = Attitudes, Behaviour and social (social, political and economic) Conditions which are contributing factors to the relationships at various stages in the cycle.

In the case study assessments by the IES the Millennium Ecosystem Assessment 'Conceptual Framework of Interactions' proves its value (see figure 1.3). This framework clarifies how indirect drivers of change (population, technology, lifestyle, etc.) can bring about direct drivers of change (land use, technology use, introduction of species, etc.). These direct drivers of change have an effect on the provisioning, regulating, cultural and supporting services provided by ecosystems. In turn, this may strongly affect human well-being.

Environmental Security Assessment Horn of Africa

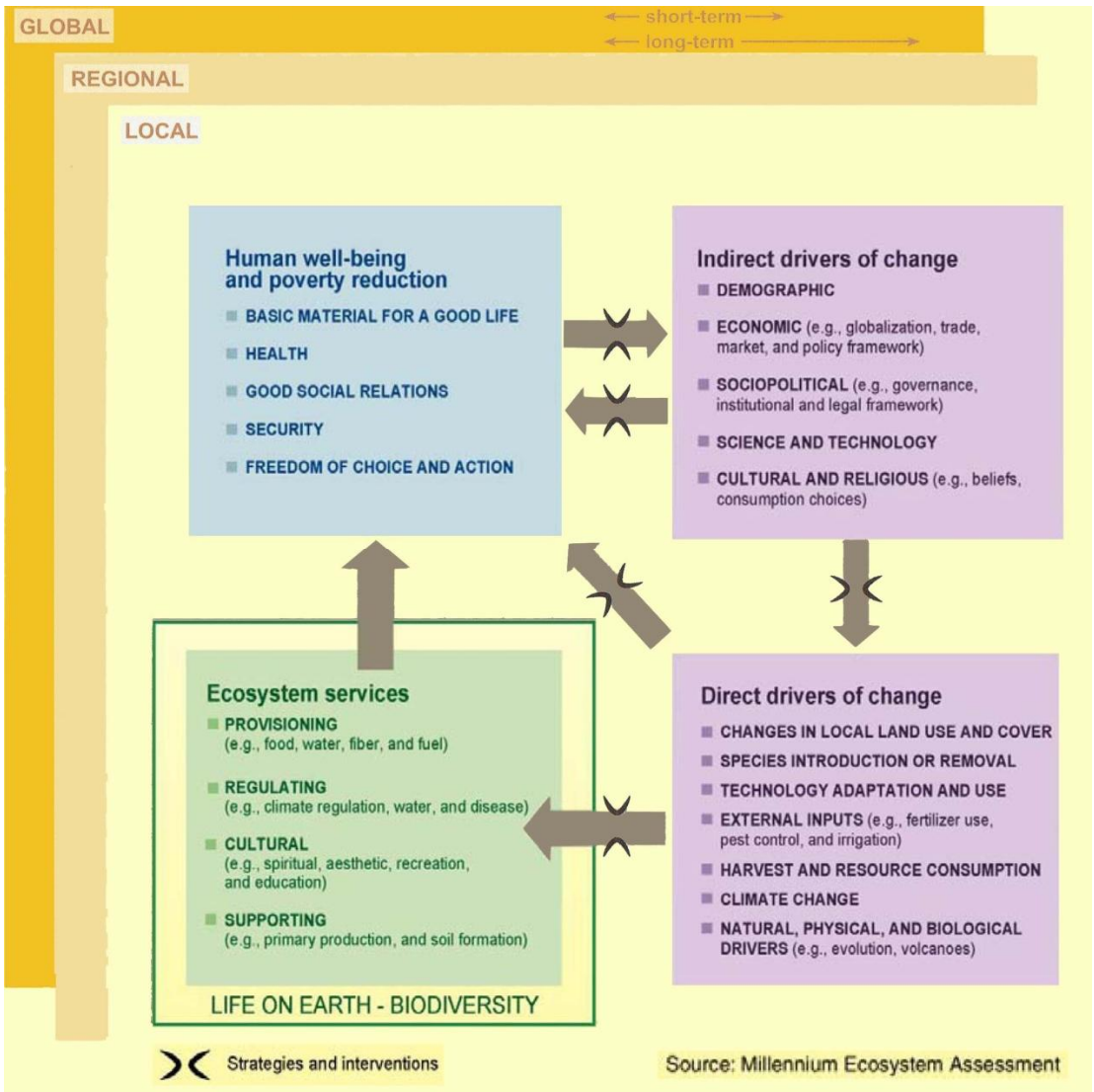
The Horn of Africa was selected as IES' fifth case study area, as a region where all elements of environmental security come together. Healthy ecosystems are under threat, large geo-political tensions exist related to the distribution of the Nile water, amongst others, and resource conflicts occur on local and regional level.

In this Environmental Security Assessment on the Horn of Africa the main aspects of ecosystem service degradation will be depicted: deforestation, land degradation, food and water insecurity, pollution, and loss of biodiversity. Important themes like land tenure

[2] Hyde Hecker, J. (2011) *Peace and Sustainable Development through Environmental Security: a Methodology for Environmental Security Assessments*, Institute for Environmental Security, The Hague, January 2011.

security and population growth will be addressed. This description of the ecosystem services and its implications in chapters 3 and 4 largely corresponds with the left part of the Conceptual Framework in figure 1.3. The core of the analysis consists of an assessment of driving forces responsible for environmental degradation, including: increasing demands for wood, expansion of agricultural areas, inadequate natural resource management and protection, population growth, conflict and insecurity. The analysis of these driving forces and underlying causes in chapters 5 and 6 corresponds to the 'drivers of change' as depicted in the right part of the Conceptual Framework above.

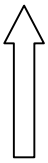
Figure 1.3. Conceptual Framework of Interactions[3]



[3] Millennium Ecosystem Assessment (2005), *Ecosystems and Human Well-being: Synthesis.* Island Press, Washington, DC.

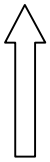
Environmental and social problems *(chapters 3 & 4)*

- Deforestation and forest degradation
- Land degradation and desertification
- Pollution
- Biodiversity loss
- Food and water security



Driving forces *(chapter 5)*

* Increasing demand for wood
* Expansion of agricultural areas
* Inadequate resource management and protection,
* Illegal resource extraction
* Overgrazing



Underlying causes *(chapter 6)*

- Rapid population growth
- Poverty
- Dependence on natural resources
- Land tenure insecurity
- Land use planning
- Knowledge, attitude and behaviour
- Conflict and insecurity
- Climate change

Based on the input of our research team and partners, concrete policy recommendations are formulated, mainly directed at Horn of Africa's national governments, the European Commission, donor countries, development organisations, (international) NGOs, the World Bank, and private sector organisations. In order to formulate these recommendations, IES works in close partnership with some of the direct stakeholders and other involved organisations. The outcomes of the analysis and the recommendations will be presented to a wide audience, through the publication and distribution of a report, maps and posters.

CHAPTER 2. HORN OF AFRICA

The Horn of Africa is often associated with armed conflicts, failed states, refugee flows, widespread famine, drought and poverty. Some regions, however, also experience large economic growth and rapidly improving living conditions. This chapter aims to give a broad picture of these diverse issues. The geography, history, population as well as current demographic, economic and political developments in the Horn of Africa will be described here briefly.

2.1. Geography

The easternmost part of the African continent is often referred to as the Horn of Africa. This region is located at the coast, along the Red Sea, the Gulf of Aden and the Indian Ocean. The northern, western and southern borders of 'the Horn' are not as clearly defined by natural features though. This gives rise to a multitude of definitions.

Figure 2.1. Map of the Horn of Africa[4]

[4] Courtesy of the University of Texas Libraries, The University of Texas at Austin. Available at: http://www.lib.utexas.edu/maps/africa.html

Definition

According to most geographers, the Horn of Africa is comprised of Ethiopia, Eritrea, Somalia and Djibouti[5]. In the definition of the International Crisis Group and the Netherlands Ministry of Foreign Affairs[6] the 'Horn' also includes Sudan. The Horn of Africa Regional Environment Centre and Network includes Kenyan - and soon probably also Ugandan – organisations. Due to the complexities in defining the region, some organisations apply the term 'Greater Horn of Africa'. Major political organisations - including the European Commission and the Intergovernmental Authority on Development (IGAD) - use the term Horn of Africa to refer to the states of Ethiopia, Eritrea, Somalia, Djibouti, Sudan, Kenya and Uganda.

The Institute for Environmental Security in this assessment applies the latter definition of the Horn of Africa, including the territory of, and people living in, the states of Ethiopia, Eritrea, Somalia, Djibouti, Sudan, Kenya, and Uganda. The Horn of Africa in this definition covers an area of more than 5 million km^2 and almost 220 million people[7].

Surrounding countries play a very important role in certain developments in the Horn. As most people and economies in this region heavily rely on natural resources such as land and water, which are transboundary by nature, regional interdependencies are very strong. Land use changes in one area can therefore easily lead to climatic and hydrological disruptions in other regions. Therefore, applying a limited definition of the Horn of Africa is only useful for the practical purpose of limiting the scope of this study, rather than for a sound understanding of regional dynamics.

Hydrology

The Horn of Africa is exceptionally interesting from a hydrological perspective. The determining aspect here is the general aridity of the region. For many areas precipitation is the sole source of water, as rivers and streams do not or hardly exist. Given this water scarcity, the available hydrological assets in the region, such as the Nile River and its various tributaries, are exceptionally strategic and important from a political and socio-economic perspective. The Nile River flows from Central Africa, through the Horn of Africa, to Egypt. The *White Nile* originates in the African Great Lakes region, including Africa's largest fresh water lake - Lake Victoria. Through the territories of Uganda and Sudan, the White Nile flows to Khartoum, the capital of Sudan, where it meets the waters of the *Blue Nile*. The Blue Nile originates in the Ethiopian Highlands. From Khartoum up to the Mediterranean Sea, the combined watercourse (White Nile + Blue Nile) is called the Nile River.

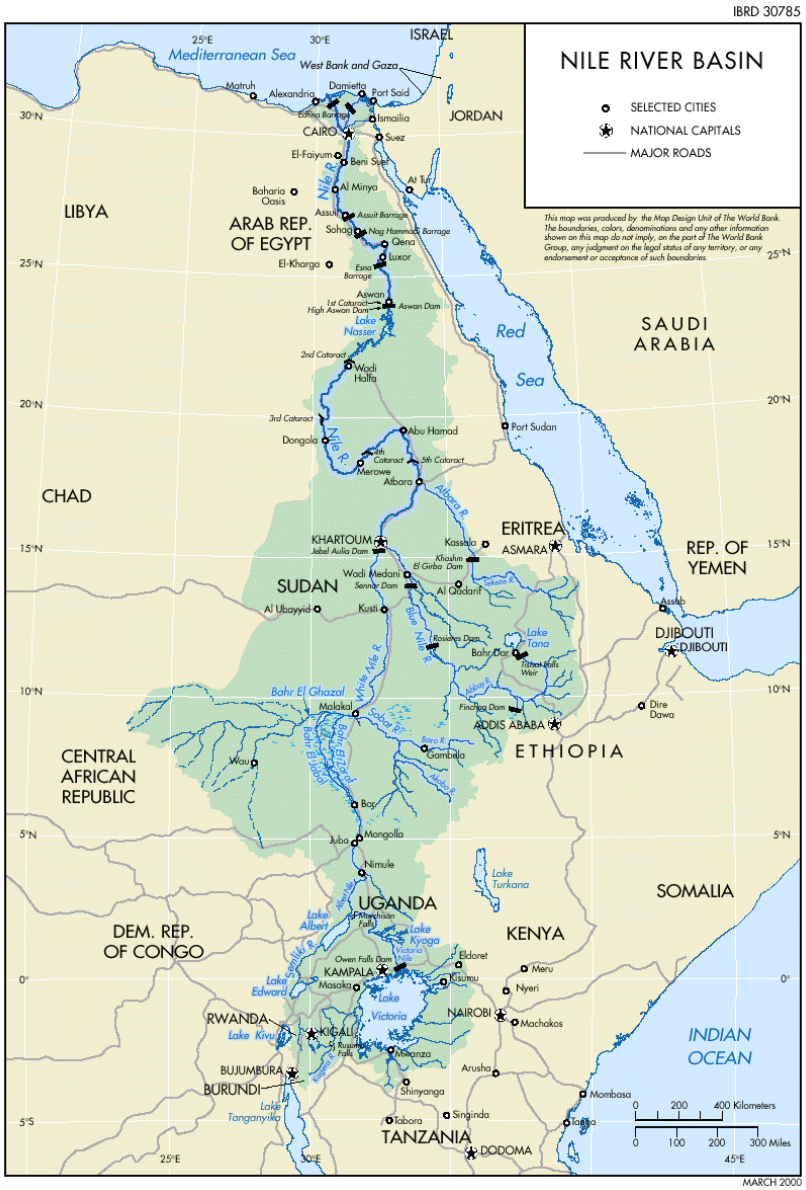
The flow of the Nile River as described above already hints at another major hydrological asset in the Horn of Africa: the Ethiopian Highlands. This group of mountains in Ethiopia, Eritrea and northern Somalia is sometimes also called the Ethiopian Plateau. With an altitude of over 1500 meter, the Ethiopian Highlands form the water tower of the region. The Ethiopian highlands are also the source of the Tekezé River, which forms the upper

[5] Stock, R. (2004), *Africa South of the Sahara, 2nd edition: A Geographical Interpretation*, The Guilford Press, 2004
[6] Netherlands Ministry of Foreign Affairs (2004), *Hoorn van Afrika notitie.*
[7] Based on the United Nations Population Division (2010). Retrieved at 22 November 2010 from http://esa.un.org/unpp/

course of another tributary to the Nile River: the Atbarah River. The Atbarah is the last major tributary to the Nile River before it reaches the Mediterranean Sea[8]. Land erosion and deforestation in the Ethiopian Highlands are major problems for the hydrological service of the region, as will be explained later in this report.

Of the major fresh water bodies in the Ethiopian Highlands, Lake Tana is the largest. The Foundation of Environmental Security and Sustainability (FESS) has carried out an environmental security assessment of Lake Tana, demonstrating the importance of the lake and its surroundings for the wider region[9].

Figure 2.2. Flow of the Nile River[10]



The other large lakes of the region, such as Lake Turkana and Lake Victoria, also have great transboundary significance. The importance of Lake Victoria has already been mentioned

[8] Wikipedia (2009), *Atbarah River.* Available at: http://en.wikipedia.org/wiki/Atbarah_River

[9] FESS (2009), *Lake Tana Watershed, Ethiopia.* Unfortunately, the results of this study are not yet made publicly available. Summary is available at: http://www.fess-global.org/Lake_Tana.cfm

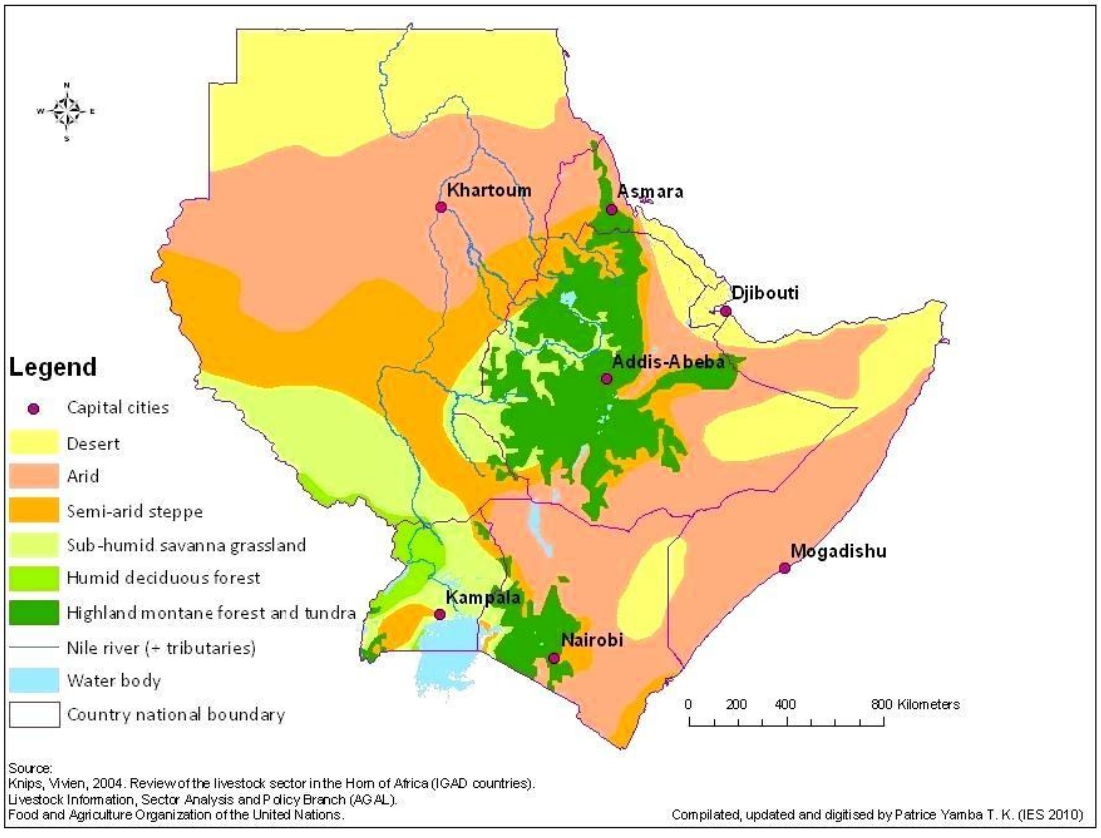
[10] World Bank (2000), *Map of the Nile River Basin.* Available at: http://go.worldbank.org/4DF3FD8CY0

above, as a key water body in the origin and flow of the Nile River. As Africa's largest fresh water lake, Lake Victoria further provides the basis of water, food and livelihoods for millions of people in the region. Lake Turkana, located in a very arid region in the north of Kenya, is among the world's largest salt lakes. About 80 percent of Lake Turkana's waters are received from the inflow of the Omo River from Ethiopia[11]. Threats to the continuous flow of the Omo River can therefore have major implications to the Lake Turkana ecosystems and to the people that depend on its services, such as water and fish.

Vegetation

The Horn of Africa is not a total desert or dry wasteland, as it is often considered. Vegetation of the region is quite varied and spatially correlated with precipitation levels and the systems of rivers and lakes, as described above. Very generally, the drier eastern parts of the Horn of Africa consist of desert, semi-desert and steppe vegetation, while in areas located closer to the major hydrological assets savannah grasslands and deciduous forest vegetation occur. In the Ethiopian highlands and in the southwest of Kenya even montane forest – tundra vegetation and temperate and mountain grasslands occur. Part of the coasts of Kenya and part of southern Somalia are characterised by East African coastal forests[12].

Figure 2.3. Ecological Zones



[11] International Rivers (2009). *Lake Turkana People's Declaration.* Available at: http://www.internationalrivers.org/en/node/3891

[12] Unfortunately, figure 2.3 does not demonstrate the coastal forests mentioned in the text.

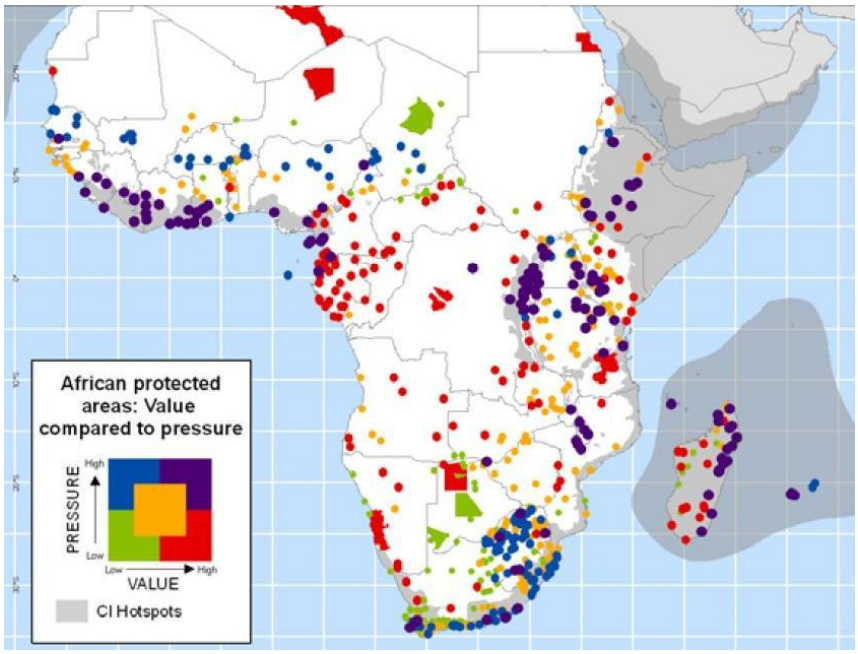
Biodiversity

The region includes many areas of great biological diversity. Many decades of research have pointed out the genetic importance of Ethiopia, recognized as one of the eight so-called Vavilov Centers of Crop Origin. Especially the Ethiopian highlands can be regarded a historical “gene centre”, a centre of origin for many agricultural crops, such as tef, sorghum, finger millet, safflower, castor bean, and sesame[13]. Another major crop is arabica coffee, which stems from the wild forests of the southern Ethiopian highlands.

Several hundreds of these biodiversity hotspots are officially dedicated to the protection and maintenance of biological diversity, and managed through legal or other means. The purposes for which protected areas are managed, and the means to do so, differ greatly. Whereas recreation and tourism development are major objectives in 'National Parks', for instance, scientific research and environmental monitoring are the key objectives in the so-called 'Strict Nature Reserves'. In certain protected areas in the Horn of Africa local communities are strongly involved in resource management, while in other cases they are strictly kept out.

In "The Assessment of African Protected Areas" the conservation value of protected areas and threats thereto are analysed. Among many other things, this study shows that high-value protected areas located in Kenya, Uganda and the Ethiopian highlands face large human pressures[14].

Figure 2.4. Priority areas of Conservation International in Africa[15]



Priority areas are indicated in grey.

[13] UNEP (2002). *Africa Environment Outlook.* Nairobi, 2002.

[14] Hartley, A.J., A. Nelson, P. Mayaux and J-M. Grégoire (2007), *The Assessment of African Protected Areas. A characterisation of biodiversity value, ecosystems and threats to inform the effective allocation of conservation funding.* Joint Research Centre and Institute for Environment and Sustainability, 2007.

[15] idem

This large biological diversity and conservation value has resulted in the inscription of some areas in the UNESCO World Heritage List. In Kenya, this applies to the Lake Turkana National Parks and the Mount Kenya National Park / National Forest. Also, Bwindi Impenetrable National Park and Rwenzori Mountains National Park, in south-eastern Uganda, are included on the distinguished World Heritage List. Furthermore, Simien National Park, located in the north of Ethiopia and home to some extremely rare animals such as the Gelada baboon, the Simien fox and the Walia ibex, is inscribed on the UNESCO List of World Heritage in Danger.

2.2. Population

History

The mainstream position held within the scientific community, based on currently available genetic and archaeological evidence, is that modern humanity originates from East Africa[16]. In 1974, American and French researchers discovered a 3.2 million-year-old hominid fossil in Danakil Desert, northeast Ethiopia, naming it "Lucy". It is widely assumed that a variety of peoples, with different cultures and ethnicities, has inhabited the Horn of Africa over thousands of years, sharing resources and fighting over them at times.

In the past 2000-3000 years, like in many other parts of the continent, the Horn of Africa witnessed the establishment of large empires, such as the Kingdom of Aksum, and various smaller kingdoms. Moderately influenced by traders from Greece and from the Arab and Indian peninsulas, many ancient and modern cultural achievements have been attained in this part of the world, including in the fields of agriculture, architecture, art, cuisine and music. Some conserved historical landscape elements are currently inscribed on the UNESCO World Heritage List, such as the fortified historic town of Harar, the rock-hewn churches of Lalibela, the ruins of the ancient city of Aksum (situated in modern-day Ethiopia) and the old town of Lamu (on the coast of Kenya).

Traditional governance structures lasted for many centuries. Many of these traditional empires, kingdoms, city-states and chiefdoms even remained intact after the arrival of European (colonial) powers. The basis of the European interest in this part of Africa was formed by the growing demand for certain African products including ivory and cloves. Between 1850 and 1900 A.D., these trading objectives started to transform into the mounting desire to establish control of these resource-rich territories of Africa. This 'Scramble for Africa' was largely settled at the Berlin Conference of 1885, during which the European powers organised a regulated 'distribution' of Africa amongst themselves. It was at this conference that territorial borders were established that later transformed into national boundaries. Considerable parts of the Horn of Africa were colonized by Italy: Eritrea, the Italian Somaliland and a brief occupation of Ethiopia (1936–1941), while France took control of Djibouti (French Somaliland). The main colonial power, though, was Britain,

[16] Hua Liu, et al (2006), "A Geographically Explicit Genetic Model of Worldwide Human-Settlement History. " *The American Journal of Human Genetics*, 79 (2006), pp. 230–237.

which occupied Kenya, Uganda, North Somalia (British Somaliland) and Sudan (together with Egyptian rulers).

Modern days

Most countries gained independence around 1960, at the time of the Cold War. The eastern and western blocks both tried to impose their 'grand theories' about the ideal organisation of society on the newly arising African states. Moreover, colonial rule had often damaged traditional governance structures and the region had been divided by artificial 'national' boundaries. As a result, setting up functioning governance structures proved very challenging during these first decades of independence, in the Horn as well as in most other African countries. This caused political and social instability in and between many countries. Combined with the unequal distribution of resources along traditional (ethnic, tribal) lines, huge tensions arose, that sometimes erupted into violent conflicts.

This has only been made worse by the exponential population growth in the past 50 years. From 1960 to 2010, the population of the Horn of Africa has increased fourfold, from about 53 million to the current (estimated) 218 million inhabitants.

Table 2.1. Population figures per country[17].

	Population 1960	Population 2010 (est.)	Population 2025 (est.)
Djibouti	85.000	879.000	1.111.000
Eritrea	1.424.000	5.224.000	7.404.000
Ethiopia	22.550.000	84.976.000	119.822.000
Kenya	8.104.000	40.863.000	57.573.000
Sudan	11.683.000	43.192.000	56.688.000
Somalia	2.819.000	9.359.000	13.922.000
Uganda	6.787.000	33.796.000	53.406.000
Total	*53.452.000*	*218.289.000*	*309.926.000*

Population growth in the Horn of Africa is among the highest in the world. The concentration of people is still modest in most areas; the humid and fertile Ethiopian Highlands are characterised by very high population density, however. More than 30% of the population in the Horn of Africa live in the Ethiopian Highlands, covering less than 10% of the total territory of the region[18].

[17] Based on the United Nations Population Division (2010). Retrieved at 22 November 2010 from http://esa.un.org/unpp/.

[18] The UN Department of Economic and Social Affairs (DESA) currently estimates the total population of the seven Horn-countries at 218.3 million. Most sources indicate that at least 80% of Ethiopians live in the Ethiopian highlands. According to the current population figures of UN-DESA, the total Ethiopian population is estimated at 84.9 million. So (80% of 84,9 million =) 68 million people live in the Ethiopian highlands. This implies that (68 million / 218.3 million =) 31% of the people in the Horn of Africa live in the Ethiopian Highlands.
Nationmaster reports the territory of Ethiopia is 1,104,300 km^2. FAO states that the highlands cover about 45% of the territory of Ethiopia: This equals 496,935 km^2. This is 9,5% of the total territory of all countries in the Horn.
UN-DESA: http://esa.un.org/unpp/
Nationmaster: http://www.nationmaster.com/graph/geo_sur_are_sq_km-geography-surface-area-sq-km
FAO: http://www.fao.org/docrep/006/y5359e/y5359e0f.htm

Urban areas in the whole region are also growing rapidly and are expected to continue to grow (see table 2.2). It is estimated that the capitals Mogadishu and Kampala have population sizes of about 1,5 million inhabitants, while Addis Ababa (2,9 million), Nairobi (3,5 million) and Khartoum (5,2 million) are already significantly larger. Figure 2.6 on the next page shows that urbanisation is continuing and accelerating over time. In the coming decade this urbanisation rate is expected to increase even further in most countries[19].

Figure 2.5. Population development in the Horn of Africa[20]

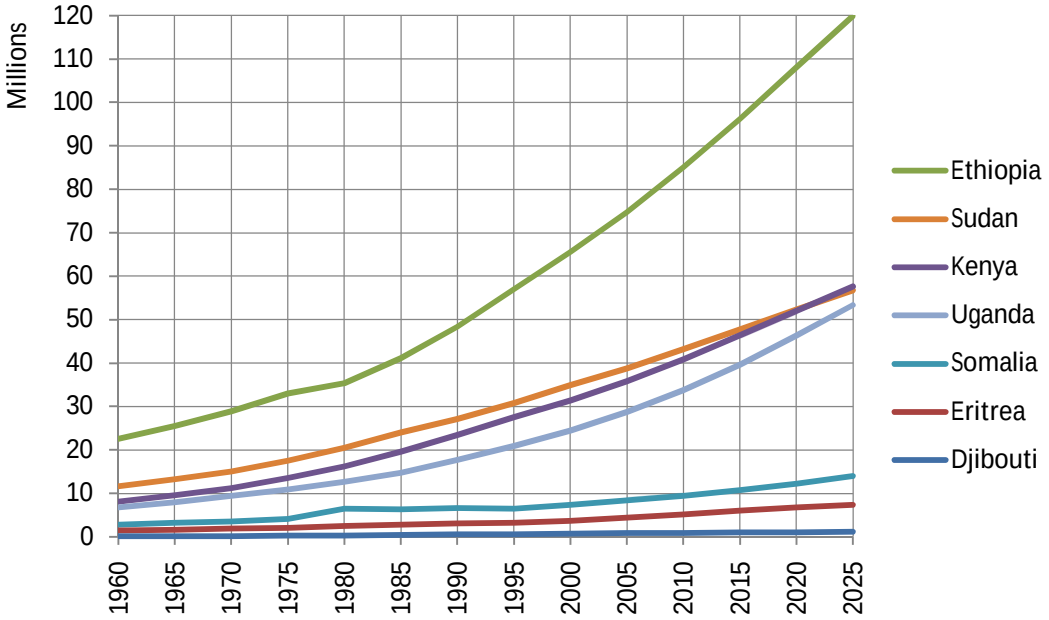


Table 2.2.
Average annual rate of change (%) of urban agglomerations in the Horn of Africa[21,22]

City	Population (est. 2010)	Population (est. 2020)	2000 - 2005	2005 - 2010	2010 - 2015	2015 - 2020
Addis Ababa, Et	2,930,000	3,981,000	2.05	2.13	2.77	3.36
Mombasa, Ke	1,003,000	1,479,000	3.79	3.78	3.86	3.91
Nairobi, Ke	3,523,000	5,192,000	4.65	4.5	4	3.76
Mogadishu, So	1,500,000	2,156,000	3.28	1.17	3.59	3.67
Khartoum, Su	5,172,000	7,005,000	2.69	2.7	3.12	2.95
Kampala, Ug	1,598,000	2,504,000	3.68	3.85	4.31	4.67

These urbanisation trends are inextricably linked to economic developments. It can be assumed that when large-scale agricultural production displaces peasant farmers in the rural areas, they then move to urban areas to seek employment. The development of the industrial sector and the service industry (financial, communication, transport, distribution,

[19] Included are urban agglomerations with 750,000 inhabitants or more (2009)
[20] Population Division of the Department of Economic and Social Affairs of the UN Secretariat (2009). *World Population Prospects: The 2008 Revision and World Urbanization Prospects: The 2009 Revision.* Available at: http://esa.un.org/wup2009/unup/
[21] idem
[22] Included are urban agglomerations with 750,000 inhabitants or more (2009)

retail, entertainment, research, restaurants) brings about a wide variety of employment opportunities in urban areas.

Figure 2.6.
Percentage urban in the Horn of Africa[23]

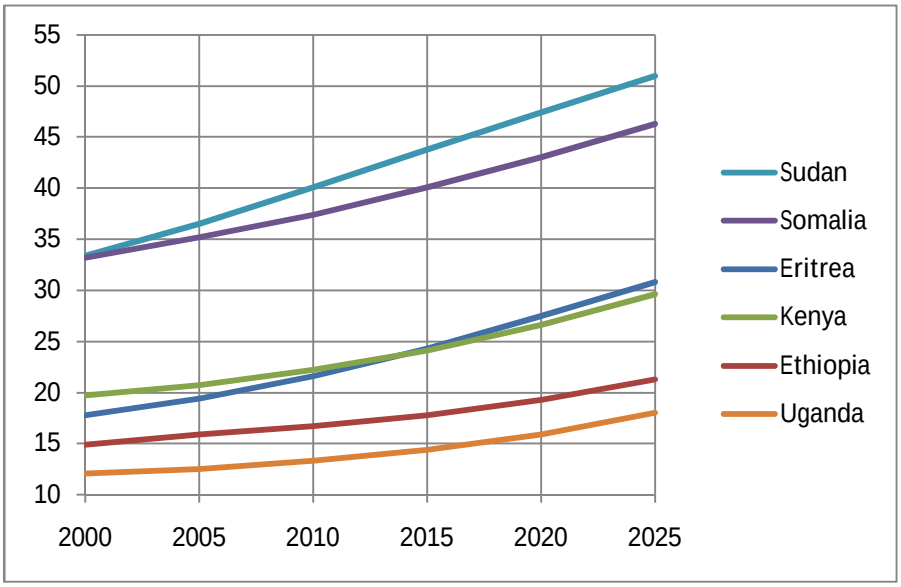
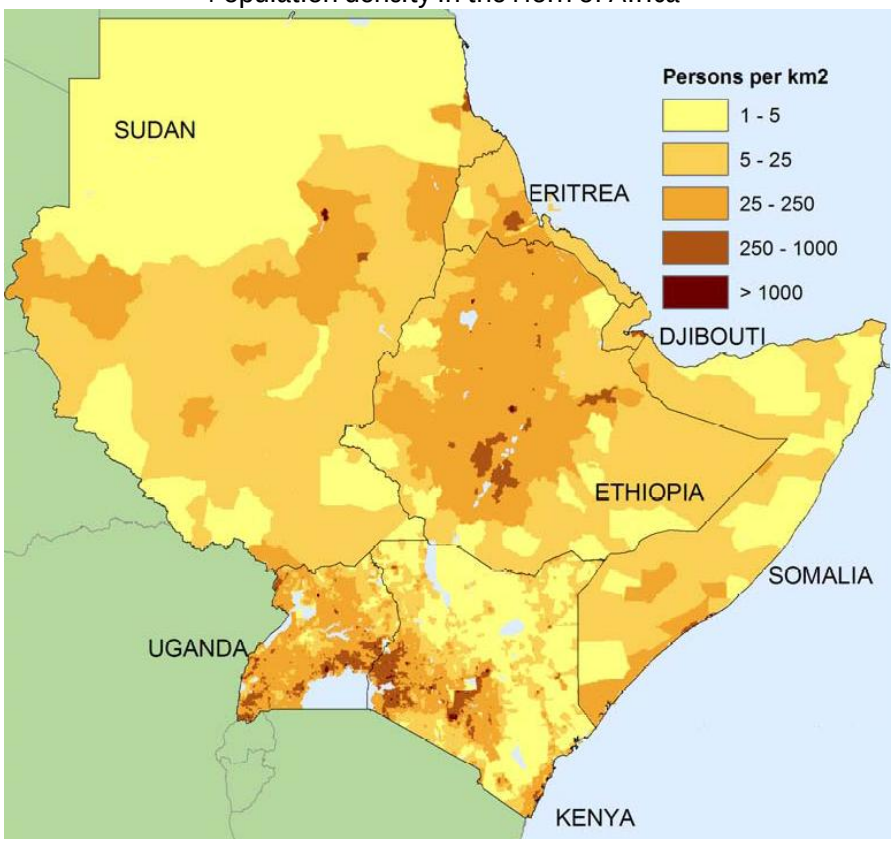


Figure 2.7.
Population density in the Horn of Africa



[23] Population Division of the Department of Economic and Social Affairs of the UN Secretariat (2009). *World Population Prospects: The 2008 Revision and World Urbanization Prospects: The 2009 Revision.* Available at: http://esa.un.org/wup2009/unup/

2.3. Economy

Economic development has been quite impressive in various countries in the past decade. This is presented in table 2.3.

Table 2.3. Economic development[24]

	Annual real GDP growth (average over 2001-2009)	GDP per capita (PPP valuation $, 2009)
Djibouti	3.8 %	2262
Eritrea	0.8 %	752
Ethiopia	8.0 %	872
Kenya	4.1 %	1568
Somalia	-	-
Sudan	7.1 %	2258
Uganda	7.7 %	1426

Especially in Sudan, the importance of oil is very high. In 2009, oil represented 93 percent of export revenues and 50 percent of domestic revenue in Sudan. In the other countries, agricultural products (tea, coffee, vegetables, sheep, and cattle) account for the largest part of the growth. See table 2.4.

Agricultural sector

Similar to other African regions the economy of the Horn of Africa is dominated by the agricultural sector. Depending on the availability and amount of rainfall, livelihoods of most people are based on farming or pastoralism. The farming mechanism can be classified as subsistence, semi-commercial and commercial. Most farmers in the Horn of Africa are subsistence farmers; they grow only enough food to feed their families. In many countries semi-commercial and commercial farming is slowly emerging, partly as a result of government interventions, such as in Ethiopia.

Pastoralism can be regarded as a traditional way of life and a traditional form of natural resource use and management. It comprises a variety of systems, ranging from pure nomadism, characterized by long-distance migration searching for pasture lands, to seasonal movements over shorter distances. As livestock production is highly dependent on the availability of natural resources such as water and pasture, the welfare of pastoralist communities is directly related to environmental factors; scarcity of water and grazing lands pose natural threats to pastoralist livelihood systems. Some pastoralists combine livestock keeping with seasonal farming; this is known as agro-pastoralism[25]. The Pastoral and Environmental Network in the Horn of Africa estimates that there are over 25 million pastoralists in the Horn of Africa. Pastoralists are generally found in lower rainfall areas. In regions with substantial rainfall agro-pastoralism and mixed farming dominate.

[24] African Economic Outlook (2010), *Basic indicators 2009*. Available at: http://www.africaneconomicoutlook.org/en/data-statistics/table-1-basic-indicators-2009/

[25] UNDP (2009), *Reduction of Resource Based Conflicts among Pastoralists and Farmers*. Available at: http://www.sd.undp.org/projects/cp3.htm

Table 2.4. Agricultural imports and exports per country[26]

Countries	Exports		Imports	
	Products	Value (USD)	Products	Value (USD)
Djibouti	camels	> 18 million	palm oil	> 68 million
	cattle	> 15 million	sugar	> 42 million
	sugar	> 14 million	rice	26 million
	rice	> 3 million	vegetable oil	> 15 million
Eritrea	sesame seed	> 2 million	wheat	> 21 million
	maize	> 300.000	sugar	> 19 million
	sheep skins	190.000	flour	> 13 million
	cattle hides	> 170.000	sorghum	> 5 million
Ethiopia	coffee	> 416 million	wheat	210 million
	sesame seed	> 132 million	palm oil	> 61 million
	beans	> 39 million	sugar	> 24 million
	chick peas	> 25 million	malt	> 24 million
	cattle	> 24 million	vegetable oil	18 million
Kenya	tea	> 698 million	palm oil	> 314 million
	vegetables	169 million	wheat	> 144 million
	coffee	> 155 million	sugar	> 94 million
	cigarettes	> 94 million	rice	> 69 million
	pineapples	> 55 million	tobacco	> 42 million
Somalia	goats	36 million	refined sugar	> 66 million
	sheep	19 million	palm oil	> 43 million
	cattle	> 16 million	rice	> 40 million
	sugar	> 2 million	raw sugar	> 30 million
Sudan	sesame seeds	> 86 million	wheat	> 286 million
	sheep	> 54 million	refined sugar	> 153 million
	cotton	> 34 million	dried milk	> 82 million
	sorghum	> 26 million	palm oil	65 million
	camels	> 20 million	coffee	> 53 million
Uganda	coffee	> 226 million	wheat	> 117 million
	tobacco	> 65 million	palm oil	> 100 million
	tea	> 47 million	sugar	> 63 million
	oil -hydrogenated	> 45 million	sorghum	>19 million
	barley beer	> 23 million	peas	> 18 million

[26] FAO (2007), *Export and import commodities.* Available at: http://faostat.fao.org/site/342/default.aspx

Figure 2.8 Cattle, Amhara region, Ethiopia

Table 2.5. Significance of pastoralism[27]

Country	Pastoralist Groups	Number	% of total population
Djibouti	Afar, Somali	100,000	16 %
Eritrea	Tigre, Rashaida, Hidarib, Afar	1,000,000	28 %
Ethiopia	Somali, Boran, Afar plus 15 others	7,070,000	11 %
Kenya	Turkana, Pokot, Tugan, Massai, Gabbra, Sakuye, Rendille, Sambura, Dassanetch, Boran, Oroma, Somali	7,500,000	25 %
Somalia	Somali	4,800,000	55 %
Sudan	*East*: Beja, Beni Amer, Shukriyya, Rashaida *West*: Kababish, Zaghawa, Rizeigat, Messiriya, Fallata; *South*: Dinka, Nuer, Mundari, Topposa. + *many others*	4,700,000	15 %
Uganda	Ateso, Nuer, Karamojong, Banyankore, Basongora	1,030,000	5 %

[27] PENHA Network. *Horn of Africa.* Available at: http://www.penhanetwork.org/pages/Horn-of-Africa-general.html

Agricultural overview per country

Djibouti

Almost 78% of the people living in Djibouti base their livelihoods on agriculture[28]. Therefore, most parts of Djibouti are allocated for agricultural activities (56% of the total land area). Almost all land is used for pasture, although there are some smaller areas for the production of crops, mainly vegetables and fruits.

Eritrea

Similar to the neighbouring Djiboutians, agriculture provides the livelihood basis of more than 3 out of 4 Eritreans (77%). Agricultural land covers 74% of the total land area, largely for pasture land. The low profitability of this sector is illustrated by the fact that only 10% of the total GDP is generated from the agriculture sector[29]. Domestic food production covers little more than two thirds (69%) of the total national food demand, while the other 31% has to come from import and food aid[30]. Main crops produced include sesame seed, sorghum, roots and tubers, pulses, oil seeds and vegetables.

Ethiopia

At least 4 out of every 5 Ethiopians depend on agriculture; pastoralists and farmers together contribute over half of the total GDP (52%). Agricultural land accounts for 31% of the total Ethiopian land area (20% of the land is used as grazing land, 11% is arable land). The agricultural sector covers 95% of the food demand; the other 5% is covered from imports and food aid[31]. The major crop commodities of the country include roots and tubers, cereals, coffee, spices and vegetables.

Both farming and pasture are mainly centred in the Ethiopian Highlands. Over 75% of the livestock population live in the highlands (mainly cattle, mutton, goats and chicken). The other 25% is held in the arid and semi-arid extensive grazing areas in the southern, eastern and western lowlands, where cattle are generally managed in migratory pastoral production systems. Livestock is very important in Ethiopia, as cattle provide milk, meat, manure, traction power, and income, also providing a hedge in times of drought[32].

Kenya

While the agricultural sector in Kenya is a source of livelihood for 75% of the population, it only contributes to one quarter (26%) of the total GDP. Almost half of the land (47%) is used for agricultural, mostly pastoral, activities. In 1993 the Kenyan government started to apply macroeconomic policies and structural reforms focused on economic growth and poverty

[28] FAO (2005), *Livestock sector brief, Djibouti.* Retrieved at 13 April 2010 from: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_DJI.pdf
[29] FAO (2005), *Livestock sector brief, Eritrea.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_ERI.pdf
[30] Earth trends (2003), *Agriculture and food, Eritrea.* Available at: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_232.pdf
[31] Earth trends (2003), *Agriculture and food, Ethiopia.* Available at: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_231.pdf
[32] FAO (2004), *Livestock sector brief, Ethiopia.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_ETH.pdf

alleviation. Major food crops include cereals, roots, tubers and pulse[33]. Export crops include crops like flower, tea, coffee and oilseeds. However, more than one fifth of the total food demand has to be covered from food aid and imports[34].

Somalia

Pastoralism exists everywhere throughout Somalia with high concentrations of pastoralists in the north and central areas of the country, and pastoralists and agro-pastoralists in the southern regions. Rainfall patterns are the major driving force for a complex series of movements in search of grazing-land between the different seasons[35].

In the arid and semi-arid areas of Somalia also crop production is normally possible. There are two main agricultural seasons, from April to June (Gu) and from October to December (Deyr). The areas in Somalia with the highest potential for crop production are the regions with relatively high rainfall levels ranging from 400mm to 600mm. These are found in the northwest and in the riverine area between the Shabelle and Juba river valleys. Two other focus regions are the coastal "cowpea belt zone" in Central and Southern Somalia, and the "sorghum belt" in Bay and Bakool Region[36].

Sudan

About half of the land in Sudan is used as pasture land, and about 7% is under permanent crops. Main crop products of Sudan include sorghum, ground nuts, cereals, vegetables and fruits. While traditional rain-fed farming has long been the major crop production system, over the past years irrigated farming and mechanized farming have strongly gained in importance[37]. The agricultural sector generally covers 87% of the food demand in Sudan; the remaining amount has to be covered from food imports and food aid[38].

Uganda

Almost two thirds (63%) of the total land of Uganda is used for agricultural activities. About 4 out of 5 people in Uganda are working in the agricultural sector, contributing to 39% of the total GDP. Major food and agricultural commodities produced in Uganda include cassava, sweet potato, beans, coffee, fruits and vegetables. The Ugandan agricultural sector is, however, not able to provide the total food demand; 6% has to be covered by food aid and imports[39].

This section demonstrates that, although agriculture is the foundation of most people's livelihoods and the regional economies, the countries are not self-sufficient and dependent

[33] FAO (2005), *Livestock sector brief, Kenya.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_KEN.pdf.
[34] Earth trends (2003), *Agriculture and food, Kenya.* Available at: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_404.pdf.
[35] Food Security and Nutrition Analysis Unit - Somalia (2010), Available at: http://www.fsnau.org
[36] Food Security and Nutrition Analysis Unit - Somalia (2010). Website. Available at: http://www.fsnau.org
[37] Mahgoub, G. Z. (2000), *Country pasture forage resource profile, Sudan.* Available at: http://www.fao.org/ag/AGp/agpc/doc/Counprof/Sudan/sudan.htm
[38] FAO (2005), *Livestock sector Sudan.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_SDN.pdf
[39] FAO (2005), *Livestock sector, Uganda.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_UGA.pdf

on food imports and aid. Table 2.4 has already provided more information about the officially imported and exported products. Although normally food shortages do not need to exist, the Horn of Africa has been affected by various food crises in recent decades. Food insecurity has (had) a major impact on the lives of millions of people. Chapter 4 will elaborate on that.

Text box 3.1. Chat

It is noteworthy that, although not mentioned in the official figures, chat is also claimed to be a major agricultural export product. According to officials from the Ethiopian Ministry of Trade and Industry, chat has great economic potential[40]. Chat, or khat, is a mild stimulant harvested from a shrub (*Catha edulis*), the fresh leaves of which are chewed, and popular in the arid regions of Ethiopia, Kenya, Djibouti, Somalia as well as on the Arabian Peninsula. Especially in Somalia and in the southeastern areas of Ethiopia chat is a major source of revenue; the bulk of the crop is being transported by air and truck to Djibouti, Somaliland and beyond[41]. The drug can be legally exported to the United Kingdom and the Netherlands.

Energy

Economic growth has wide implications on society: energy demands from the agricultural, industrial, mining and transport sector in and around the Horn of Africa are increasing, to the extent that current grids do not meet the growing demands[42]. If not well planned, electricity generation can have detrimental effects on ecosystems in the region. The increased energy needs of these economic sectors will mainly need to be covered by hydro-, gas- or petroleum-generated electricity. An overview of energy production in the region:

Hydro-power

For its electricity provision, the region is largely dependent on hydro-power. In Kenya, for instance, hydroelectricity plants provide between 60 and 75% of all electrical output, mainly

[40] African Press Agency (2008) "Ethiopia can earn $100 million from khat export, minister said." *Ethiopian Review, 26 August 2008.* Available at: http://www.ethiopianreview.com/content/3595

[41] USDA Foreign Agricultural Service (2002), *Crop Characteristics Ethiopia.* Available at: http://www.fas.usda.gov/pecad2/highlights/2002/10/ethiopia/baseline/Eth_Crop_Production.htm

[42] ESI-Africa (2010), *Electrifying African interest in renewable energy*. Available at: http://www.esi-africa.com/Electrifying/African/interest/renewable/energy

supplied by large power stations in the Tana River[43]. The Nile River and its tributaries, as well as the Omo River, further provide many opportunities for Uganda, Sudan and Ethiopia to develop large hydro-electricity projects. These dam constructions (such as Bujagali in Uganda, Merowe in Sudan and Gil Gel Gibe in Ethiopia) are almost without exception controversial projects. Such contention stems largely from their impacts on local communities, who need to resettle and are in danger of losing their sources of livelihood. The Gil Gel Gibe project, for instance, will be further discussed in chapter 8.

Geothermal

The Great Rift Valley offers opportunities for producing geothermal energy in Kenya, Ethiopia, Uganda, Eritrea and Djibouti. The early leader is Kenya, where natural steam tapped from volcanic-active zones generates electricity at the Olkaria power plants, which is fed into the national grid[44]. With the support of the World Bank, Kenya plans to raise the electricity generated from geothermal to a minimum of 5000 MW by 2030[45]. Beyond geothermal electrical generation, geothermal energy can be used directly - without conversion into electricity - to heat homes and greenhouses and as process heat in industry.

Biomass

Given the high population growth rates in the region, it can be assumed that also household energy demands will continue to increase. It is estimated that almost 90% of the total energy consumption in the Horn comes from biomass[46], with estimates varying from about 70% in Kenya to 95% in Uganda[47], largely depending on availability. It is expected that this dominance of biomass will not change much in the coming decades[48]. The most important biomass resource is wood, mostly collected from surrounding forest lands and shrubs and mainly used for cooking and heating purposes, also in the form of charcoal. Other biomass energy sources – though generally less significant in terms of their contribution to the total energy consumption – are agricultural residues, animal waste and human wastes.

Oil and gas

The exploration and production of oil and gas has great economic potential. Economic and strategic interests over access to oil reserves have been a major source of discontent and (violent) conflicts in many parts of the region, as in many other parts of the world. In the semi-autonomous Somalian region Puntland, for instance, contracts regarding the exploration and production of oil led to major internal unrest. In other countries similar problems occurred:

In Ethiopia oil explorations are going on in Gambella (in the west) and in the Ogaden basin (in the south-east). The assumption that the remote Ogaden desert is rich in mineral

[43] Mbendi (year unknown), *Electrical Power in Kenya.* Available at: http://www.mbendi.com/indy/powr/af/ke/p0005.htm
[44] idem
[45] ESI-Africa (2010), *WB approves $330 million for Kenya.* Available at: http://www.esi-africa.com/node/11262
[46] Biomass is often defined as "combustible renewable and wastes"
[47] Karekezi, S. and W. Kithyoma (2003), *Renewable Energy in Africa: Prospects and Limits*. Available at: http://www.un.org/esa/sustdev/sdissues/energy/op/nepadkarekezi.pdf
[48] Dalelo, A. (2002), *Rural electrification in Ethiopia: opportunities and bottlenecks*. Addis Ababa University.

deposits like oil and gas has drawn interest from foreign oil and gas companies, as well as from the Ogaden National Liberation Front (ONLF) that demands autonomy for the (ethnically Somali) Ogaden region. The potentially significant oil and gas reserves in the region added some severity to the conflict. ONLF rebels have been actively and violently protesting in the Ogaden region for over 25 years, thereby killing large numbers of Ethiopian soldiers, oil workers and civilians. The movement is demanding Ethiopian authorities and foreign oil and gas companies to stop exploration of resources in the Ogaden region. Meanwhile, their claim for autonomy is largely ignored by the Ethiopian government[49,50].

Oil has recently been discovered in Uganda. In and around Lake Albert, which is shared by Uganda and the DR Congo, substantial amounts of oil have been discovered in recent years. In 2007, violent confrontations between Ugandan and Congolese forces took place over access to the oil. Although the agreement in March 2009 of President Museveni of Uganda and President Kabila of DRC to work together in exploiting the oil is a positive development, the dispute is not entirely resolved. According to a report on the website of the Guardian: *"The ingredients for the so-called "resource curse" are all in place: contract secrecy, government corruption, commercial disinformation campaigns, with environmental protections ignored, and a simmering border dispute with the Democratic Republic of the Congo frozen rather than resolved[51]."*

Spurred by the oil and gas discoveries in Uganda and Tanzania, the government of Kenya has recently signed various oil exploration deals with American and Chinese companies, in the hope that significant oil reserves will be discovered. The explorations are ongoing in various places, such as the Anza Basin, Mandera-Lugh basin and the offshore Lamu coastal basin.

The largest reserves of oil are found in Sudan. As mentioned in chapter 2.3, the oil sector plays a major role for the Sudanese economy. Sudan's main oil producing region Abyei is located on the north-south border, giving the region great economic and political significance, and even a special administrative status. The situation of Abyei will be further described in chapter 8.

[49] Mbendi (year unknown), *Electrical Power in Kenya.* Available at: http://www.mbendi.com/indy/powr/af/ke/p0005.htm

[50] Black Marlin, *Black Marlin in Ethiopia.* Retrieved from: http://www.blackmarlinenergy.com/Kenya-Oil-Exploration/ethiopia.aspx

[51] Guardian, The (2010), *Uganda oil contracts give little cause for optimism.* The Guardian, 18 January 2010. Available at: http://www.guardian.co.uk/katine/katine-chronicles-blog/2010/jan/18/uganda-oil-profits

2.4. Insecurity

The region has long been tormented by food insecurity. In the 1980s major famine brought the Horn of Africa – and especially Ethiopia and Sudan - in the spotlight of global media attention, leading to major operations for distributing food aid. Still, the Horn of Africa is one of the most food insecure regions in the world. Chapter 4 will elaborate on food and water security.

In the past three decades the Horn of Africa has also been the stage of various violent conflicts, locally as well as on a regional, national and even international scale. It is important to see the Horn of Africa as a regional security complex, in which the security problems of one region depend very much on the security of all. Many conflicts in the region are somehow related to the distribution of natural resources such as fertile land, grazing land, water and oil. Furthermore, the region is characterized by tribal conflicts. The huge availability of small firearms in many parts of the Horn strongly adds to the extremely violent character of some of these conflicts.

Although bloody fighting between Eritrea and Ethiopia has stopped in 2000, the border demarcation dispute still exists. In 2002, the Eritrea - Ethiopia Boundary Commission, under the Permanent Court of Arbitration in The Hague, presented its legally binding decision on delimitation of the physical boundary between the two states. However, military tensions in the border region remain. The Eritrea-Ethiopia case further demonstrates that different conflicts feed into each other: the battleground of this long-term border dispute has more or less moved to Somali territory. Somalia has not had a widely respected government authority for almost two centuries now. In 2008, the Western-supported transitional government was taken over by hard-line Islamist insurgent groups that currently control much of the south. The transitional federal government is backed by the Ethiopian federal government, whereas the Islamic forces receive Eritrean support[52].

The self-declared "Republic of Somaliland" in the northern part of Somalia has not been recognized internationally; nevertheless it is a self-governed and relatively peaceful region. A similar situation exists in Puntland, an eastern Somalian region, which is perceived as a semi-autonomous part of Somalia. In the east of Ethiopia, the Ogaden National Liberation Front (ONLF) is seeking autonomy for the ethnically Somali Ogaden region, so far without success.

In Sudan the violent conflict around Darfur is still not definitely settled; re-escalation of conflict can easily be triggered. The same is true for South Sudan. The situation here has been relatively stable since 2005, when the national government and the Sudanese People Liberation Movement (SPLM) signed a peace agreement that ended the civil war. However, the referendum for independence that is scheduled for early 2011 is being looked at with great anxiety. Meanwhile, local (tribal) tensions are growing, especially in the state of Jonglei, where tensions between pastoralist communities are aggravated by pervasive tribalism, widespread food insecurity and land disputes. According to the International Crisis

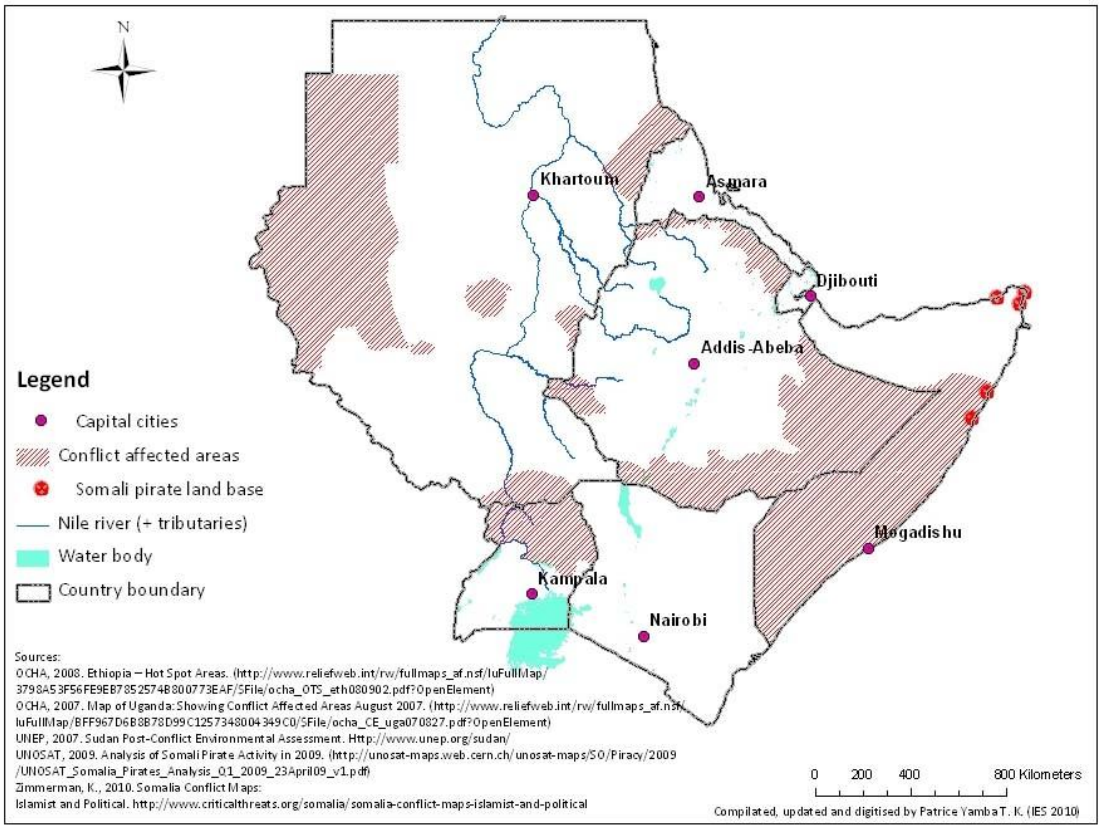
[52] Healy, S. (2008), *Lost Opportunities in the Horn of Africa: How Conflicts Connect and Peace Agreements Unravel.* Published by Chatham House - Royal Institute of International Affairs, London, United Kingdom, 2008.

Group, access to water and grazing areas, as well as cattle rustling, are primary triggers of conflict here[53].

In Kenya, tensions following the national elections held in December 2007 erupted into ethnic violence, causing a lot of unrest in the otherwise relatively stable country. As underlying grievances - partially related to unequal land distribution - have not been resolved afterwards, many Kenyans fear that violence may break out again. The large number of people escaping the violence in Somalia also builds up hostility in the northeast of Kenya (around Dadaab camp) and in the Kenyan capital Nairobi. Moreover, the sparsely populated border regions between Kenya, Ethiopia, Sudan and Uganda face many security problems due to pressure on pastoralism and violent livestock raids.

This is, unfortunately, not a complete overview of the conflicts and security threats in the region. Conflicts arise also on a more local scale, often because traditional customs regarding the access and sustainable use of land and water are shifting. These shifts can be attributed to a variety of factors, which will be explored in part III of this assessment (analysis). Further information on specific conflicts will be provided in part IV (environmental security hotspots).

Figure 2.9. Conflict affected areas



[53] International Crisis Group (2009), *Jonglei's tribal conflicts: countering insecurity in South Sudan.* Africa Report N°154, 23 December 2009.

2.5. Transnational Cooperation

African Union (AU)

All of the countries of the Horn are member states of the African Union (AU). The department Rural Economy and Agriculture of the African Union has a division on environment and natural resources, which strives to enhance sustainable natural resource use in the member states[54]. In the past years, the African Union has presented some ambitious plans for integrative policies and actions. This ranges from preparing a rapid-reaction force for the implementation of peacekeeping missions from 2010 onwards, to setting up an African Economic Community with one single currency in 2023[55]. Its vision is to have full political integration, aiming to achieve a United States of Africa (federation or confederation) in the long run[56].

Despite the different regional impacts of climate change that are predicted, the African Union has also taken some concrete steps to move towards a more unified approach in the climate change negotiations. At UNFCCC Conferences of the Parties (COP 15 and 16) in Copenhagen and Cancun in 2009 and 2010, unified delegations, led by Prime Minister Meles Zenawi of Ethiopia, conducted the negotiations on behalf of the African Union member states[57].

In 2007, the EU and the African Union adopted a joint strategy, defining the long-term policy orientations between the two continents, based on a set of shared vision and common principles, such as recognition of the interdependence between Africa and Europe, respect for human rights, democratic principles and the rule of law, and respect for international law and agreements. Main objectives of this joint strategy include promoting peace, security, democratic governance and human rights; sustainable economic development, including industrialisation; regional and continental integration; and ensuring that all the Millennium Development Goals are met in all African countries by 2015. The Strategy's First Action Plan outlines eight areas for strategic partnership for 2008 to 2010. Especially the action plans on peace and security, Millennium Development Goals, energy and climate change are significant in the context of environmental security. The action plan on energy indicates the willingness of the EU and the AU to intensify cooperation on energy security and energy access. The climate change action plan includes the promise to cooperate in addressing land degradation and increasing aridity, including the "Green Wall for the Sahara initiative".

Economic Commission for Africa (ECA)

The Economic Commission for Africa (ECA) was established in 1958 as one of the five United Nations' regional commissions. ECA's mandate is to promote the economic and social development of its member states, foster intra-regional integration, and promote international cooperation for Africa's development. By carrying out policy analysis, serving as

[54] African Union, Website. Available at: http://www.africa-union.org/root/au/index/index.htm
[55] BBC (2009), *Profile: African Union*. Available at: http://news.bbc.co.uk/2/hi/country_profiles/3870303.stm
[56] African Union (2004), *Strategic Plan Of The African Union Commission, Volume 1: Vision and Mission of the African Union*, May 2004.
[57] Pham, J.P. (2009), "Strategic Interests: Climate Change and Security in Africa". In: *World Defense Review, 3 November 2009.*

a policy advocate and by promoting regional partnerships, ECA encourages initiatives and reforms necessary for economic and social advancement in Africa. In the past few years, ECA has facilitated and encouraged discussions on various topics related to environmental security, such as agro-businesses, climate change adaptation, and land tenure security.

Common Market for Eastern and Southern Africa (COMESA):
With the exception of Somalia, all countries in the Horn of Africa are member states of COMESA. The vision of this organization is focused on enhancing the economy of the region through trade and investment. As a result its policies and strategies are economically oriented.

East African Community (EAC)
The EAC is the regional intergovernmental organization of five East African countries (Kenya, Tanzania, Uganda, Rwanda and Burundi). The EAC has developed an environmental protocol through which the states try to improve natural resource management and pollution control. According to the protocol the partner states commit themselves to ensure sound natural resources management in their country and to cooperate in realizing this obligation, for instance by trying to synchronize the policies on the Lake Victoria Basin[58].

Inter-Governmental Authority on Development (IGAD)
All of the countries of the Horn of Africa are member states to the Inter-Governmental Authority on Development (IGAD). IGAD has an environment and agriculture division that focuses on natural resource utilization and sustainable development[59]. IGAD clearly recognizes the relationship between environment and intra- and interregional conflicts. Its 'Environment and Natural Resources Strategy' states that "Environmental quality and sustainable natural resources management is a pre-condition for peace, security and development". This strategy was adopted in 2007 to enhance environmental governance and research, in order to promote sustainable development and regional security.

The IGAD Climate Prediction and Application Centre (ICPAC) is a specialized institution providing climate information, prediction and early warning for applications in support of environmental management. It is also responsible for the management of a recently set up programme: the African Monitoring of the Environment for Sustainable Development (AMESD) Programme, funded by the European Development Fund from 2010-2013. Objective of this programme is to enhance monitoring for sustainable management of the environment, thereby contributing to poverty alleviation. The AMESD activities in the Horn of Africa will focus on the assessment and monitoring of land degradation and natural habitats for sustainable land management.

[58] East African Community (2005), *Protocol on Environment & Natural Resource Management*, Draft 5, June 2005.
[59] IGAD (2010), *Agriculture and Environment.* Available at:
http://igad.int/index.php?option=com_content&view=category&layout=blog&id=43&Itemid=126

Nile Basin Initiative

The rising tension over the use of the Nile's waters therefore brings along the risk for further political instability in the region. Realizing this large threat, riparian states have developed the Nile Basin Initiative (NBI). Set up in 1999 and supported by a large variety of bilateral and multilateral donors, the NBI serves as a platform for dialogue. It is a partnership led by the Council of Ministers of Water Affairs of the Nile Basin states: Rwanda, Burundi, DR Congo, Uganda, Tanzania, Kenya, Ethiopia, Sudan and Egypt. The NBI brings these ministers together regularly, in order to find ways to manage the river in a cooperative manner, share substantial socio-economic benefits, and promote regional peace and security.

PART II – Environmental and social concerns

This part of the assessment describes various threats to environmental security in the Horn of Africa. First, in chapter 3, the current major environmental problems are described: forest degradation and deforestation, land degradation and desertification, pollution and biodiversity loss. Food and water insecurity are not only environmental security issues, but largely human security problems; these will be described separately in chapter 4.

The processes and forces that cause these problems are referred to here as "environmental security threats". The growing need for resources initiates overgrazing and expansion of agricultural lands, for instance. Other driving forces are poor waste management and illegal fishing, for instance. These environmental security threats that drive many of the problems explained in the two earlier chapters (3 and 4) will be analysed in chapter 5.

Structural matters, such as population growth, underlie the growing need for resources and other driving forces. Therefore, attention will be paid to these underlying matters, in chapter 6, with special attention to land tenure insecurity and the impacts of climate change.

CHAPTER 3. ENVIRONMENTAL PROBLEMS IN THE HORN

The region currently suffers from several major environmental problems, among which forest degradation, land degradation and desertification, pollution and biodiversity loss are the most significant. In some cases a lack of up-to-date, measurable data exists on the causes and extent of these problems. Nevertheless, efforts are made here to describe the environmental concerns and their impacts.

3.1. Deforestation and forest degradation

It is estimated that almost one fifth of the land in the Horn of Africa is covered by forest[60]. As mentioned in chapter 2, the forest in this region provides a wide variety of highly valuable ecological, economic and social services. However, forests are heavily threatened. Extensive deforestation has been the major factor contributing to forest degradation. In the period from 2000 to 2005, forest cover decreased by almost 1% per year, as table 3.1 shows. In relative and absolute figures, especially Sudan, Ethiopia, Uganda and Somalia are accountable for this change.

Table 3.1. Forest cover changes[61]

	Forest cover (2005)		Annual change rate (2000-2005)		Total land area
	(1000 ha)	(%)	(1000 ha)	(%)	(1000 ha)
Djibouti	6	0.2	0	0	2318
Eritrea	1554	15.4	-4	-0.3	10100
Ethiopia	13000	11.9	-141	-1.1	100000
Kenya	3522	6.2	-12	-0.3	56914
Somalia	7131	11.4	-77	-1	62734
Sudan	67546	28.4	-589	-0.8	237600
Uganda	3627	18.4	-86	-2.2	19710
Total	*96386*	*19.7*	*-909*	*-0.94*	*489376*

Text box 3.1. What's the difference?

Deforestation involves a quantitative decrease in the area covered by forest.

Forest degradation does not involve a reduction of the forest area, but rather a quality decrease in its condition, related to one or a number of different forest ecosystem components (vegetation layer, fauna, soil, etc.).[62]

[60] FAO's definition of forest is *"land with tree crown cover (or equivalent stocking level) of more than 10% and area of more than 0.5 ha. Trees should be able to reach a minimum height of 5 m at maturity in situ. May consist of closed forest formations where trees of various storeys and undergrowth cover a high proportion of ground or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10%."* See also: http://www.grida.no/publications/other/ipcc_sr/?src=/Climate/ipcc/land_use/124.htm

[61] Figures and calculations based on FAO (2009), *State of the World's Forests*, Rome, 2009.

[62] Lanly, J.P. (1982), *Tropical forestry resources*. FAO Study: Forests 30. Rome.

Causes

Deforestation and forest degradation is caused by a complex set of factors, such as cutting wood for energy and the conversion of forest into agricultural land. Underlying these driving forces are various structural matters such as population growth, poor forest protection and a limited awareness of the importance of forest services. These will be presented and explained in chapters 5 and 6.

Text box 3.2. Cutting forest to claim land

In many parts of the Horn of Africa, clearing the land has become an effective way to lay claim to it. The forests have traditionally been used for slash-and-burn agriculture and settlement by local people who had customary rights to those resources. For people that are not members of the local community, cutting down trees has become a way to acquire land. This has also resulted in the clearing of land on an extensive scale.

Impacts

The cutting of wood can of course have positive effects on the lives of people and the economy of a region. Increased farm land, as well as the provision of energy and the availability of construction wood can provide significant economic benefits. They can expand livelihood opportunities of local people through food production, direct employment, trade, etc. In addition, development activities such as road construction and building dams strengthen the physical infrastructure of the region, which enhances economic development opportunities.

Negative consequences of deforestation and forest degradation are often only realized in the long term; massive clearing of forests can have devastating effects on the well-being of ecosystems and people. Forests provide a habitat for many plant and animal species. Destruction of forest habitat for agricultural purposes, energy needs and commercial logging, can greatly affect biological diversity. One of the main threats to vegetation and biodiversity in the Horn of Africa is the uncontrolled collection of firewood and production of charcoal, to cover both domestic fuel needs and for export to countries in the Arabian Gulf region. The most popular tree for charcoal production is *Acacia bussei*[63]. Although the tree itself is not a threatened species, woodlands formerly dominated by *Acacia bussei* are rapidly dwindling as the destruction of big trees changes the composition and structure of the ecosystems. This phenomenon directly affects other flora and fauna that are an intrinsic part of the ecosystem.

Deforestation can change microclimates by reducing the amount of shade, by altering rainfall patterns, augmenting air movement, and by changing the humidity regimen[64]. Through the loss of vegetation root systems that absorb rain water and hold the soil

[63] Conservation International (2007), *Biodiversity hotspots, Horn of Africa*. Available at: http://www.biodiversityhotspots.org/xp/hotspots/horn_africa/Pages/default.aspx

[64] Reiter, P. (2001), "Climate change and mosquito-borne disease". Environ Health Perspect 109: 141–161. In: Junko Yasuoka and Richard Levins, 2007. Impact of Deforestation and Agricultural Development on Anopheline Ecology and Malaria Epidemiology. *American Journal of Tropical Medicine and Hygiene, 76(3), 2007, pp. 450-460.*

together, deforestation and forest degradation can destruct the infiltration capacity of the land, accelerate loss of topsoil, disrupt nutrient cycles and reduce biodiversity[65].

Partly as a consequence of never-ending deforestation, many regions in the Horn, such as Afar (Ethiopia) and parts of Somalia have become less viable areas to live for both humans and animals. Another example is the Mau forest, Kenya's largest "water tower", where profound forest degradation decreases the buffering (water storing) capacity of the land, weakening the capacity of the land to endure long drought periods[66]. Also, degradation of mangrove forests and coastal vegetation in Somalia has taken away the natural buffers that protect coastal communities from the impacts of storms and waves, such as the tsunami in 2003. More structurally, the mangroves in Somalia, that also perform various ecological services including water supply, fish habitats and biodiversity preservation, play a vital role in reducing shoreline erosion[67].

Major causes of deforestation and forest degradation	*Impacts on ecosystems & human well-being*
Uncontrolled collection of firewood Increasing energy needs for cooking and brick production Conversion of forest into agricultural land Concentrations of displaced persons and refugees Commercial logging Poor forest protection	Land degradation (erosion, nutrient cycles, soil protection) Increased flood risk Declining disaster tolerance Water insecurity Destruction of habitats, biodiversity loss Climate change

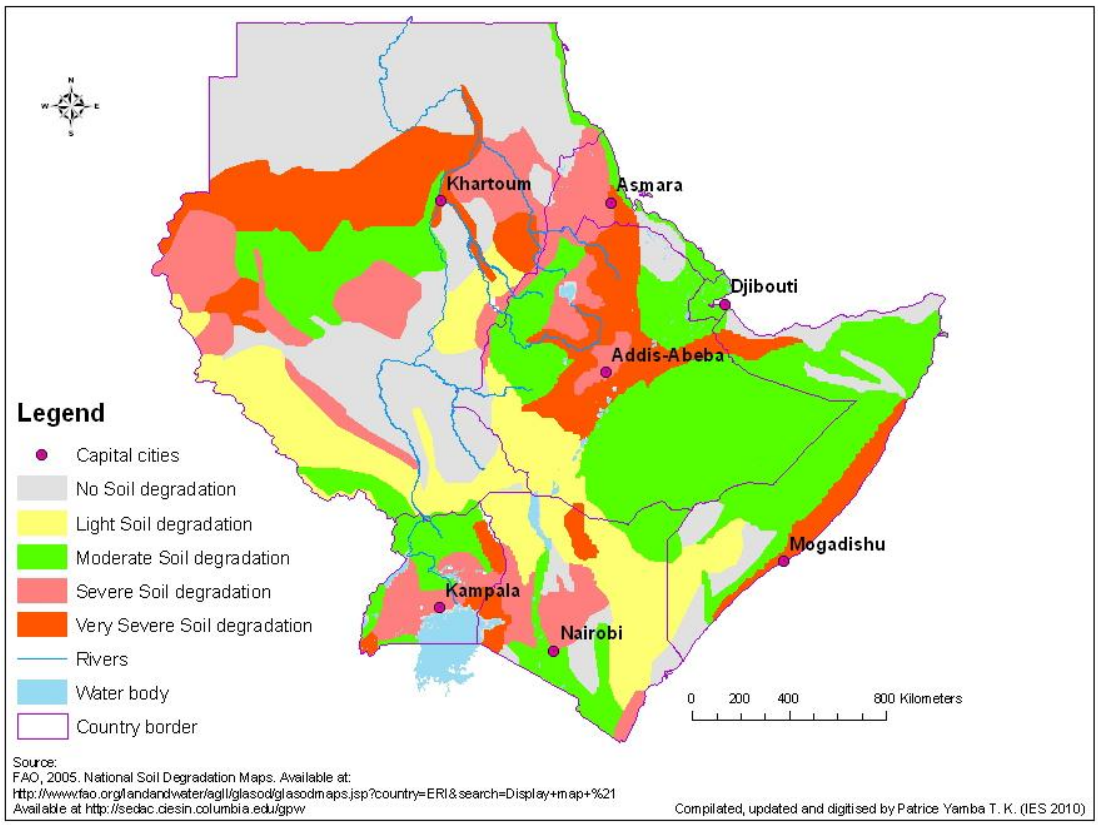
[65] Douglas, E.M., S. Wood, K. Sebastian, C. J. Vörösmarty, K. M. Chomitz and T. P. Tomich (2007), "Policy implications of a pan-tropic assessment of the simultaneous hydrological and biodiversity impacts of deforestation". *Water Resources Management,* 21, pp. 211-232.
[66] BBC (2009), *Kenya's heart stops pumping*. Available at: http://news.bbc.co.uk/2/hi/africa/8057316.stm
[67] UNEP (2005), *Somalia*. Available at: http://www.unep.org.bh/Publications/Somalia/Tsunami_Somalia_Layout.pdf

3.2. Land degradation and desertification

Closely related to deforestation and forest degradation, land degradation is one of the most serious environmental issues threatening the region. Land degradation refers to loss in productivity of land and loss of its ability to provide goods or services, as a result of natural and human-induced changes in physical, chemical and biological processes[68]. It manifests itself through erosion of the soil by wind and water, soil acidification, soil salinization and destruction of soil structure including loss of organic matter.

The assessments of FAO (2008) indicate that moderate to severe land degradation is taking place in the Horn of Africa which is directly affecting the wealth and economic status of the region[69].The principal "soil loser" in the region seems to be Ethiopia. Annually, Ethiopia loses over 1.5 billion tons of topsoil from the highlands to erosion[70].

Figure 3.1. Soil degradation



[68] Blaikie, P. and Brookfield, H. (1987), *Land Degradation and Society*. Methuen and Co. Ltd., London.
[69] FAO (2008), *Challenges for Sustainable Land Management (SLM) for Food Security in Africa*. Available at: ftp://ftp.fao.org/docrep/fao/meeting/012/k1820e.pdf
[70] Tamene, L. and P. L. G. Vlek (2008), Soil Erosion Studies in Northern Ethiopia. In: *Land Use and Soil Resources*, 2008, pp. 73-100.

Desertification

The term desertification describes a situation in which land degradation occurs in the drylands. More specifically, this type of land degradation is expressed by "a persistent reduction of biological productivity in the drylands relative to the natural productivity typical to each of these dryland types"[71]. The term drylands is used here for arid, semi-arid and dry sub-humid areas, consistent with the definition of the United Nations Convention to Combat Desertification (UNCCD). Since 65% of the lands in the Horn of Africa can be characterised as 'drylands', it is more appropriate to use the term 'desertification' in these cases.

Text box 3.3. Desertification

The term desertification is highly contentious, especially since it has been used in various ways. Contrary to what is most often believed, 'desertification' does not necessarily imply the "the advancement of the desert or the transformation of non-desert ecosystems to desert ecosystems[72]". However, in certain cases land degradation in the drylands does indeed look like the desert is expanding, with only the most drought- and erosion resistant vegetation remaining.

"It is estimated that the livelihoods of more than 1 billion people globally are at risk from desertification, which may eventually force 135 million people off their land", according to UNEP's Africa Environment Outlook[73]. The problem appears to be highly severe especially in Sub-Sahara Africa and the Horn of Africa, as about two thirds of the land area in the Horn of Africa can be characterized as drylands[74]. Most drylands have a very low renewable water supply, low and variable precipitation, high temperatures and low soil organic matter. All these features together make drylands highly vulnerable for land degradation or, more appropriately termed, desertification.

Desertification in the Horn of Africa, as in most arid places, is a process of environmental degradation under fragile ecological conditions, climate variation and intensive human activities. Manifestations of desertification include accelerated soil erosion by wind and water in the highlands, increasing salinization of soils and near-surface groundwater supplies and a reduction in soil moisture retention[75].

Somalia, Djibouti, eastern Ethiopia and northern Sudan have been recorded as hot spots, with manifestations of increasing surface runoff and stream flow variability, reductions in species diversity and plant biomass, and reductions in the overall productivity of the dryland ecosystems. However not all scholars consent to the conclusion that desertification is increasing. Using the Normalized Difference Vegetation Index for satellite data, from the NOAA AVHRR sensing system, for the period 1982–1999, Olsson and others observe other

[71] Safriel, U. (2009), Deserts and Desertification: Challenges but also Opportunities. *Land degradation & development*, *20, 2009, pp. 353–366.*

[72] idem

[73] UNEP, 2006. *Africa Environment Outlook 2 – Our Environment, Our Wealth*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.

[74] Calculation based on data from 1950-1981. Earth Trends. Available at: http://earthtrends.wri.org/text/forests-grasslands-drylands/datatable-42.html

[75] Mwendera, E. and S.M. Mohamed (1997), "Infiltration rates, surface runoff, and soil loss as influenced by grazing pressure in the Ethiopian highlands". *Soil Use and Management* volume 13-1 ,1997, pp. 29–35.

trends, pointing at increasing vegetation all across the Sahel zone[76]. This would indicate that desertification is not increasing in the north part of the Horn (the Sahel) as generally assumed. Most research points out, though, that in the drylands of the Horn of Africa land degradation is most certainly a matter of great concern.

Causes

Land degradation and desertification can be caused by both human and climatic factors. Yet, the discussion of the relative importance of climatic versus human causes remains a contentious issue[77]. It is widely assumed that both climatic and human factors play an important role in land degradation in the Horn of Africa. Main causing factors that will be explained in chapters 5 and 6 are: insufficient and highly variable rainfall; unsustainable exploitation of farm land; overgrazing; the use of vulnerable lands, for instance on steep hills; and the increased use of chemicals in agriculture.

Table 3.2. Human induced land degradation* [78]

	None	Light	Moderate	Severe	Very Severe	Cause	Type
Country	%	%	%	%	%		
Djibouti	0	0	100	0	0	O	N
Eritrea	11	0	17	43	7	O	W, N
Ethiopia	4	10	57	8	20	O	W
Kenya	7	41	22	19	11	O	W
Somalia	23	10	52	0	15	A, O	W
Sudan	46	13	11	15	15	O	W, N
Uganda	4	1	43	41	12	A, O, D	W
Total (%)	27	14	30	14	8		
Total [79] (1000 km$^{2)}$	1422	751	1565	722	438		

Cause: A=agriculture, O=overgrazing, D=deforestation
Type: W=water erosion, N=wind erosion

[76] Olsson, L., L. Eklundh, J. Ardo (2005), "A recent greening of the Sahel—trends, patterns and potential causes." *Journal of Arid Environments*, volume 63, 2005, pp. 556–566.
[77] Helldén, U. (2008), "A Coupled Human-Environment Model for Desertification Simulation and Impact Studies". *Global and Planetary Change* - accepted September 2008
[78] FAO, Land and water development division. Website. Available at: www.fao.org/nr/land/information-resources/terrastat/en/
[79] Please note these figures are based on slightly different "total area" figures than those used in chapter 3.1 on deforestation.

Impacts

Increasing rates of land degradation (soil erosion, loss of nutrients) further reduce the agricultural productivity and the per capita share of arable land. Some experts stress that land degradation, particularly due to declining soil fertility, is the fundamental biophysical cause of declining per capita food production in the Horn of Africa[80]. Sub-Saharan Africa has been classified as the only region in the world where per capita food production has been on the decline for the last two decades. Figures and more information on this will be presented in the section on food security.

The continuing change in land cover has reduced the stability of water catchment areas, increased surface runoff and the vulnerability of lowland areas to flooding and habitat destruction. The floods of 2006 in Ethiopia, Kenya, Somalia, and Sudan have had devastating effects on people and their lands.

With continuing degradation and increasing scarcity of natural resources, the struggle and competition for the remaining resources are likely to become a potent source of conflict and migration among communities in the Horn of Africa[81].

Major causes of land degradation and desertification	*Impacts on ecosystems & human well-being*
Deforestation and forest degradation Overgrazing Unsustainable exploitation of farm land Use of vulnerable lands, e.g. steep hills Use of chemicals in agriculture Insufficient and highly variable rainfall	Lower agricultural productivity Food insecurity Water insecurity Increased flood risks Increased migration and displacement Increased conflict risk

[80] Sanchez, P.A., Shephered, K.D., Soule, M.J., Place, F.M., Buresh, R.J., Izac, N.A.-M., Mokwunyu, A.U., Kwesiga, F.R., Ndiritu, C.G., Woomer, P.L. (1997), "Soil fertility replenishment in Africa: an investment in natural resource capital". In: Buresh RJ, Sanchez PA and Calhoun FG (eds), *Replenishing Soil Fertility in Africa, pp 1–46. SSSA Special Publication Number 51. Soil Science Society of America, Madison, WI, USA*

[81] Wood, A., Stedman-Edwards, P. and Mang, J. (2000), *The Root Causes of Biodiversity Loss; Macroeconomics for Sustainable Development, WWF-International, Earth scan, London, p. 399*.

3.3. Pollution

In various regions within the Horn of Africa, severe pollution-related problems exist. These problems, generally caused by poor waste management, are often concentrated in urban areas, with high concentrations of population and economic activities. Major rivers are chopped with pollution leading to a total decline in the biodiversity. Domestic waste accounts for the larger proportion of the total waste generated in the region. There is also a considerable amount of industrial and hospital waste, which often contains material of hazardous nature. The same is true for toxic waste allegedly being dumped by foreign vessels on the coasts of Somalia. Such waste can result in severe and long lasting damage on the environment and human health[82].

Different types of pollution

Surface water

Many urban rivers and surface water bodies in the region are chocked with pollution. The Nairobi and Njoro rivers in Kenya, the Akaki and Mojo rivers in Ethiopia, the Wabishebele River in Somalia and the White Nile in Sudan can be mentioned as examples[83,84,85,86]. In most of the countries, surface water mainly serves as an outlet for liquid and solid domestic and industrial waste material. As a result, most urban rivers are now close to biological death. Industrial zones in the south and west of Addis Ababa are seriously polluting the nearby rivers. Pollution of coastal waters from leaking oil barrels and hazardous substance containers are also occur[87].

Ground water

In some parts of Somalia ground water has been contaminated with hazardous substances infiltrated from hazardous waste disposal sites[88]. Ground water pollution has also been detected in the water wells of the Sudanese capital Khartoum[89]. Moreover, the assessment of ground water carried out by the United Nations Environmental Program in 2006 revealed that major parts of Addis Ababa and Nairobi are at medium and large risk of contamination with hazardous substances[90].

---

[82] Daniel, F., F. Itana & M. Olsson (2007), "Total Contents and Sequential Extraction of Heavy Metals in Soils Irrigated with Wastewater, Akaki, Ethiopia". *Environmental Management*, volume 39, 2007, pp. 178-193.
[83] Jimma Times (2009). "Oromia-Ethiopia: Industrial pollution of Akaki, Modjo and Sebeta rivers", *Jimma Times,* 5 January 2009. Available at: http://www.jimmatimes.com/article/Latest_News/Latest_News/OromiaEthiopia_Industrial_pollution_of_Akaki_Modjo_and_Sebeta_rivers/32201
[84] UNEP (2007), *Sudan Post-Conflict Environmental Assessment*, Nairobi.
[85] Paul T. et al. (2008), "The effect of in-stream activities on the Njoro River, Kenya. Part II: Microbial water quality", *Physics and Chemistry of the Earth*, Parts A/B/C, Volume 33, pp. 729-737.
[86] Alemayehu, T. (2001), "The impact of uncontrolled waste disposal on surface water quality in the city of Addis Ababa, Ethiopia." *SINET Ethiopian Journal of Science* , volume 24, pp. 93 – 104
[87] ITOPF (2001), *A summary of oil spill response arrangements and resources worldwide*. Available at: http://www.itopf.com/_assets/country/djibouti.pdf
[88] Farah, Q.H. (2005). *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html
[89] Maha Abd Alghaffar Abd Alraheem (2000), "Pollution in the water supply wells of Khartoum, Sudan." *Engineering Geology and the Environment*, volume 58, no.4, pp. 257 – 264.
[90] UNEP (2006), *Assessment of ground water vulnerability in African cities*. UNEP, Nairobi.

Landscape pollution

Landscape pollution is a common scene in and around the urban centres in the region. Public places, such as markets and roadsides, are crowded with huge piles of waste. This is caused, amongst other factors, by inadequate facilities for disposal of solid waste in the towns, lack of designated dumping sites and inadequate capacities of the authorities in environmental management. Sea shores of the region are also severely polluted from domestic and port activities[91,92]. Shoreline pollution also includes large amounts of spill over from poor waste management elsewhere.

Toxic waste

Treatment and disposal of toxic waste in Europe or in other industrialized regions are costly operations. With disposal costs being far cheaper in developing countries, many African coastal regions are being used as dumping grounds. Dumping of hazardous waste alongside the long coast of Somalia by foreign companies has been evident since the early 1990s[93]. The dangerous situation during the civil war in Somalia left this matter largely out of reach of (international) media attention. This is exacerbated by the very high interests of the waste dumping industry (dumping companies and Somali warlords), putting anyone investigating or revealing the issue at grave risk. This is demonstrated by the case of two Italian reporters who were killed while carrying out research in Somalia into the waste dumping industry. The 2004 tsunami, however, uncovered the issue by scattering toxic wastes, leaking barrels and radioactive and chemical waste containers on the Somali shoreline[94].

The hazardous waste dumped along Somalia's coast comprised uranium, radioactive waste, lead, cadmium, mercury, industrial, hospital, chemical, leather treatment and other toxic waste. Most of the waste was dumped on the beaches in containers and disposable (and leaking) barrels, ranging from small to big tanks. These activities suggest that neither the health effects for the local population nor any potential environmentally devastating impacts have been considered[95]. Although hard evidence is lacking, there are many signals that mainly European companies are involved. Also Iran has been mentioned as a source of some of the vessels[96]. In 1992, Swiss and Italian firms were allegedly involved in dumping toxic waste, after having made a deal with a former official appointed to the government of Ali Mahdi Mohamed, just after the start of the civil war. These waste dumping companies are clearly violating international treaties. The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal prohibits the shipping of hazardous waste to a war zone. The convention also states that, unless there is a special agreement, shipments to a country that has not signed the Convention are illegal.

---

[91] Abubakr M. Idris (2008), "Combining multivariate analysis and geochemical approaches for assessing heavy metal level in sediments from Sudanese harbors along the Red Sea coast." *Microchemical Journal*, 90, pp 159-163

[92] Farah, Q.H. (2005), *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html

[93] Mohamed, A.E. (2001), *Somalia's degrading environment: causes and effects of deforestation and hazardous waste dumping in Somalia*. Available at: http://www.mbali.info/doc331.htm

[94] Times Online (2005), *Somalia's secret dumps of toxic waste washed ashore by tsunami.* Available at: http://www.timesonline.co.uk/tol/news/world/article418665.ece

[95] UNEP (2005), *Somalia*. Available at: http://www.unep.org.bh/Publications/Somalia/Tsunami_Somalia_Layout.pdf

[96] Eden, D. (2008), *Somali pirates: the other side of the story.* Available at: http://viewzone2.com/piratesx.html

Text box 3.4. "International garbage can"

Huge amounts of hazardous wastes transported and dumped in to the Somalia sea shores has led the authors of the Rapid Environmental Assessment of Somalia in 2005 to labelling Somalia as an "international garbage can" [97]. Somalia appears to be attractive for industrialised countries to dump their hazardous waste because of the lack of a central government, political instability in the country since 1991, low public awareness and the high availability of potential dumping sites. Worth mentioning, also, is the suitable geographical location of the Somali coast, situated close to a busy international shipping corridor, making it easy to reach Somalia and reducing the cost and the time of waste transport.

Soil pollution

Agricultural soils are mainly polluted with pesticides and chemical fertilizers. This is a major problem in the agrarian countries such as Ethiopia, Kenya, Eritrea and Sudan. Ethiopia has a particular problem related with the management of obsolete pesticides and agrochemicals. In addition, unsafe disposal of industrial effluents is gradually causing more soil pollution in the region. For instance, around Kisumu, on the Kenyan side of Lake Victoria, discharges from an oil refinery as well as other industrial and shipping activities are causing considerable levels of soil pollution[98]. Consequently, the soil irrigated with the already contaminated rivers is experiencing a significant pollution[99].

Air pollution

Emissions from vehicles and industries are the main origins of air pollution, which is only prevailing in urban areas. Studies done in Nairobi, Addis Ababa and Djibouti City indicate significant levels of air pollution in these countries[100, 101].

[97] Farah, Q.H. (2005), *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html

[98] Caleb, M., et al. (2007), "Environmental risks of urban agriculture in the Lake Victoria drainage basin: A case of Kisumu municipality, Kenya." *Habitat International*, 31, Issues 3-4, September-December 2007, pp 375-386.

[99] Daniel, F., F. Itana and M. Olsson (2007), "Total Contents and Sequential Extraction of Heavy Metals in Soils Irrigated with Wastewater, Akaki, Ethiopia". *Environmental Management*, volume 39, 2007, pp. 178-193.

[100] UNEP (year unknown), *Basic environmental problems in Djibouti City*. Available at: http://www.unep.or.jp/ietc/publications/TechPublications/TechPub-17/djibouti2.asp

[101] Galcano C. M. and L. W. Kariuki (2001), *Mapping and analysis of air pollution in Nairobi.* Available at: http://www.fig.net/pub/proceedings/nairobi/mulaku-kariuki-TS3-2.pdf

Table 3.3. Summary of pollution problems in the Horn of Africa.

Types of pollution	Major pollutants	Sources
Surface water pollution	Domestic and industrial waste	Households, industry
Ground water pollution	Leach and infiltration of hazardous substances	Unsafe waste disposal sites, industry
Landscape pollution	Domestic and industrial waste, hazardous substances	Households, stores, Markets, industry, inter-national waste dumping
Soil pollution	Pesticides, herbicides, salt	Agriculture, industry, mining
Air pollution	Vehicle emission, industrial gases, burning of biomass	Transport sector, house-holds and industry

Causes

Poor waste management seems to be the major causal factor for pollution of surface and ground water, landscape, soil, biota and air. In all of the countries, institutional frameworks for the management of waste are significantly lacking. As a result systems for collection, transport and treatment of domestic and industrial waste are in an early stage. Meanwhile, waste is often disposed along the roads, in open land spaces, in surface water, or burned in open air.

Increasingly intensive agricultural practices in the region are also a growing matter of concern. The use of agrochemicals (fertilizers, pesticides, herbicides and insecticides) tends to have a large impact on conditions of the soil and on the organisms that depend on the soil[102]. Although this problem is shared by all countries in the Horn of Africa, especially the main crop farming countries Ethiopia, Kenya, Eritrea and Sudan face increasing problems of chemical soil pollution. Moreover, irrigation of farm lands with industrial water, and rivers contaminated by industrial effluents are becoming a serious threat.

The disposal of hazardous waste, mainly in Somalia, can be explained by the lack of effective control, high economic returns for the processing of hazardous waste and low public awareness about the waste and its impacts.

Impacts

Pollution has both short and long term impacts on ecological systems and human life. A particular problem is the high persistence of pollution. Ground water, for instance, once polluted can remain hazardous for decades or even centuries[103]. Treating a polluted environment therefore requires large investments and a long period of time. The various impacts of pollution are briefly discussed below.

[102] Institute for Biodiversity Conservation (2005), *National Biodiversity Conservation and Action Plan, Ethiopia.* Available at: http://ibc-et.org/ibc/pubn/files/NBSAP.zip

[103] Misra, V., S. Pandey (2005), "Hazardous waste, impact on health and environment for development of better waste management strategies in future in India." *Environment International*, volume 31, 2005, pp. 417-431.

Ecological impacts

Inland wetlands are the principal source of renewable fresh water for human use. Disruption of wetland purification processes with pollution and other threats can have devastating impacts at the source and further downstream. Agricultural schemes in the Rift Valley and along rivers in Somalia and Ethiopia also threaten the biodiversity of riparian habitats. The pollution of water bodies result in reduction of the quantity and quality of aquatic life. In Kenya the death of flamingos has been related to contamination of Lake Nakuru with industrial hazardous wastes[104]. Also the coastal zones of the region are increasingly affected by pollution, with significant impact on fish life and marine ecosystems. The Somalia sea shores are the most affected with pollution caused by hazardous wastes[105]. Also, the Kenyan and Eritrean sea shores are affected by increasing pollution.

Soil pollution can seriously affect all organisms that depend on it, altering natural processes taking place in the soils and impact the entire food web[106]. Through absorption of hazardous substances, either directly from the soil or along the food chain, biota - the combined fauna and flora of the region - is affected. Health defects in crops irrigated with contaminated water in Sebeta and Modjo, Ethiopia, have recently been discovered[107].

Socio-economic impacts

As soil pollution can result in soil degradation, agricultural productivity is affected, reducing both the quantity and quality of agricultural products. This problem is pronounced in all countries of the Horn of Africa[108]. Pollution of grazing land and water bodies affects the health of the livestock and alters the quality of the livestock products, such as milk and meat. As stated above water pollution reduces the quantity and quality of aquatic ecosystems. A report from Somalia demonstrates how pollution of a marine ecosystem can significantly affect the local fish production[109], thereby destroying the bases of livelihood of fishermen.

Another impact of pollution is on tourism. Landscape pollution, air pollution, surface water and groundwater pollution negatively affect the region's image and tourism appeal. It can also result in long lasting damage of potential tourist attractions, by causing wildlife and bird's habitat destruction, such as the contamination of Lake Nakuru in Kenya, and Lake Awasa in Ethiopia. Moreover, cultural heritage such as the old town of Lamu, can seriously be affected by pollution[110]. The impact of pollution on tourism can have a major effect on

---

[104] Gough, D. (2000), "Pollution blamed for the death of thousands of flamingos". *The Guardian, 6 March 2000.* Available at: http://www.guardian.co.uk/world/2000/mar/06/1

[105] Federico, C., G. Accordi (2000), "The Indian Ocean Coast of Somalia." *Marine Pollution Bulletin, volume 41*, pp.141-159

[106] Demlie, M. and S. Wohnlich (2006), "Soil and groundwater pollution of an urban catchment by trace metals: case study of the Addis Ababa region, central Ethiopia." *Environmental geology, 2006, pp. 421-431.*

[107] Jimma Times (2009), "Oromia-Ethiopia: Industrial pollution of Akaki, Modjo and Sebeta rivers", *Jimma Times,* 5 January 2009. Available at: http://www.jimmatimes.com/article/Latest_News/Latest_News/OromiaEthiopia_Industrial_pollution_of_Akaki_Modjo_and_Sebeta_rivers/32201

[108] Ethiopian Environmental Protection Authority (2006), *Soil degradation and pollution*.

[109] Farah, Q.H. (2005), *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html

[110] Gettleman, J (2010), "Future Kenya port could Mar Pristine Land". *New York Times, 11 January 2010.* Available at: http://www.nytimes.com/2010/01/12/world/africa/12lamu.html

the economies of Kenya, Ethiopia and Uganda, while cutting off prospects for expanding tourism in other countries such as Sudan.

Health impacts

Pollution can be perceived as a potential source of health problems. It may lead to a reduction of people's life expectancy and quality of life[111]. Health defects caused by pollution are a common feature in the Horn of Africa. Various reports indicate the existence of diseases as a result of pollution, such as water born diseases, respiratory diseases, skin diseases, reproductive abnormalities, alterations of immune biological homeostasis, and central nerval system disorder[112,113,114].

Major causes of pollution	*Impacts on ecosystems & human well-being*
Inadequate waste management institutions Industrial discharges Careless use of agro-chemicals Lack of awareness about the impacts Dumping of hazardous waste offshore and on beaches	Ecological impacts (water, soil, food webs) Agricultural decline (quality and quantity) Threat to tourism (physical damage + appeal) Human health problems (diseases)

[111] Misra, V. and S. Pandey (2005), "Hazardous waste, impact on health and environment for development of better waste management strategies in future in India." *Environment International*, 31, 2005, pp. 417-431.
[112] AFP (2008), "South Sudan villagers, environment suffer from oil boom." *Sudan Tribune, 5 March 2008*. Available at: http://www.sudantribune.com/spip.php?article26231
[113] Farah, Q.H. (2005), *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html
[114] Jimma Times (2009), "Oromia-Ethiopia: Industrial pollution of Akaki, Modjo and Sebeta rivers." *Jimma Times,* 5 January 2009. Available at: http://www.jimmatimes.com/article/Latest_News/Latest_News/OromiaEthiopia_Industrial_pollution_of_Akaki_Modjo_and_Sebeta_rivers/32201

3.4. Biodiversity loss

The Horn of Africa, being home to various indigenous plant and animal species, has a very rich biological diversity. This has been introduced in chapter 2.1. It is, however, also among the most threatened eco-regions in the world[115]. Mainly as a result of high population pressure many conflicting interests occur between human activities and the natural environment. This often results in destruction of habitats of wildlife and aquatic species[116]. Habitat destruction typically results in migration and death of animal and plant species. Many of these species are critically endangered, such as the African wild dog in Djibouti; the Ethiopian wolf and the walia ibex in Ethiopia; the African wild ass in Eritrea and Somalia; hunters antelopes and black rhinos in Kenya; the Burton's gerbil and the four-spotted gerbil from Sudan; and mountain gorillas and water shrew from Uganda[117].

Table 3.4. Animals on the IUCN Red List[118]

Horn of Africa	Endangered*	Vulnerable	Lower risk**	Total number of species on the Red List
Djibouti	7	72	677	756
Eritrea	12	76	953	1,041
Ethiopia	32	47	1,174	1,253
Kenya	83	125	2,051	2,259
Somalia	19	87	1,145	1,251
Sudan	14	74	1,578	1,666
Uganda	65	56	1,667	1,788

The Horn of Africa is endowed with both fresh water and marine fishery resources. Some of these aquatic species are critically endangered. Sudanese and Eritrean fishing resources in the Red Sea are relatively intact. There are also many lakes and rivers, for instance in Ethiopia, where exploitation of fish is significant, but considered sustainable. Nevertheless, especially Somalia, Uganda and Kenya are experiencing serious depletion of marine and fresh water fish resources due to overfishing. Many of the originally profitable fish species in Lake Albert, Lake George, (Uganda), Lake Naivasha and Lake Turkana (Kenya) show serious

[115] Conservation International (2007), *Biodiversity hot spots, Horn of Africa*. Available at: http://www.biodiversityhotspots.org/xp/hotspots/horn_africa/Pages/default.aspx
[116] Institute for Biodiversity Conservation (2005), *National Biodiversity Conservation and Action Plan, Ethiopia*. Available at: http://ibc-et.org/ibc/pubn/files/NBSAP.zip.
[117] Animal Info (2009), *Uganda.* Available at: http://www.animalinfo.org/country/uganda.htm
[118] IUCN Red List (2008), Based on tables 6a and 6b, available at: http://cmsdata.iucn.org/downloads/2008rl_stats_tables_all.xls
* Category endangered includes official categories: "Critically endangered" and "Endangered"
** Category lower risk includes official categories: "Lower risk/conservation dependent", "Near threatened", "Data Deficient" and "Least Concern"

signs of depletion[119,120]. Overfishing is also a major concern in Lake Victoria, which has lost many native fish species in the past 60 years[121].

Table 3.5. Plants on the IUCN Red List

Horn of Africa	Endangered*	Vulnerable	Lower risk**	Total no. of species on the Red List
Djibouti	1	1	1	3
Eritrea	0	3	2	5
Ethiopia	1	21	36	58
Kenya	19	84	43	146
Somalia	3	14	44	61
Sudan	2	15	12	29
Uganda	6	32	20	58

Causes

Most of the biodiversity loss and threats on existing biodiversity are a consequence of human activities. A main threat is the overexploitation of the natural environment, through the use of soils, water, forests and grasslands. Climate change is a growing concern as well: the expected increase in temperature can push many vulnerable organisms to extinction. Disease can also have disastrous impacts on biodiversity. Rabies, for instance, has killed almost 70% of the Ethiopian wolf population in the Bale Mountains in the early 1990s. Domestic dogs are expected to be the reservoir for rabies. Transmission of the disease by domestic dogs living around Bale Mountains National Park therefore continues to threaten the Ethiopian wolf population in this region[122]. Furthermore, intentional or unintentional fire hazards are a big threat to biodiversity. Ecosystems threatened with fire include the montane evergreen forest, woodland and savannah of the region[123,124]. The exceptionally destructive forest fires that occurred during 1998 and 2000 in Bale, Borana, East Harerge, North Omo zones and other places in Ethiopia devastated over 155,000 hectares of forest land[125]. The major explanation for the depletion of fish species is overfishing. The major causes for overfishing in the Horn of Africa differ per region. Generally it is related to an increased number of (local) fishermen, the expansion of commercial fishing, lack of regulation, destructive fishing practices, and/or the use of more sophisticated and efficient fishing techniques. The introduction of non-indigenous fishes also played a role in various lakes, of which Lake Victoria is the most famous example. The booming international

[119] FAO (year unknown), *Management of fish stocks and fisheries of deep and shallow lakes of Eastern, Central and Southern Africa.* Available at: http://www.fao.org/docrep/005/AC751E/AC751E01.htm

[120] Report of the First Lake Victoria Fisheries Organization and FAO Regional Technical Workshop on Fishing Effort and Capacity on Lake Victoria. Dar es Salaam, Tanzania, 12-14 December 2005, pp.8-10

[121] Encyclopedia of Earth (2008), *Eastern Africa and coastal and marine environments*. Available at: http://www.eoearth.org/article/Eastern_Africa_and_coastal_and_marine_environments

[122] Randall, D.A, S.D. Williams, I.V. Kuzmin, C.E. Rupprecht, L.A. Tallents, Z. Tefera, et al. (2004), "Rabies in endangered Ethiopian wolves." *Emerging Infectious Diseases,* December 2004.

[123] Institute for Biodiversity Conservation (2005), *National Biodiversity Conservation and Action Plan, Ethiopia*. Available at: http://ibc-et.org/ibc/pubn/files/NBSAP.zip

[124] UNEP (2007), *Sudan Post-Conflict Environmental Assessment*, Nairobi.

[125] Soromessa, T. (2007), *Mountain resources and conflict instigating issues*, Addis Ababa University, Ethiopia.

demand for fish is the major explanation for the rapidly growing fish export industry. In the Indian Ocean, illegal, unreported and unregulated fishing is also a significant issue, which will be elaborated upon in chapters 5.3 and 5.4.

Impacts

The resilience of an ecosystem is to a large extent dependent on its buffering capacity provided by biological diversity. Biodiversity plays a major role in maintaining all kinds of provisioning, regulating and supporting services. Animals, for instance, are crucial actors for the survival of forest ecosystems through the dispersal of seeds among others. Loss of biodiversity is therefore not only a major problem because of nature's intrinsic value, it can also greatly disturb these ecosystem services on which nature and humanity heavily depend. Overexploitation of certain fish species can have disastrous effects on the food chains in the entire ecosystem. Loss of biological diversity can therefore affect food and water security, health and the economy in a variety of ways:

Food insecurity

Biodiversity provides a flexible range of food options. It provides the conditions in which people can fish, farm, keep livestock and cook. Also, nature serves as a direct source of food. Many of the rural poor are dependent on fishing, hunting and harvesting wild products like berries and mushrooms as a direct source of food. It is expected that these people will directly and severely suffer from the consequences of biodiversity loss and depletion of e.g. fish stocks[126].

Health

Nature provides drugs and species of high medicinal value for both traditional and modern communities in the Horn of Africa. In addition, biodiversity helps in purifying water through the removal of excess nutrients and other pollutants and toxic agents[127]. Loss of biodiversity may therefore have a significant impact on health.

Economy

The economic infrastructure of the region relies heavily on the well being of nature and diversity of life. Environmental degradation and biodiversity loss therefore, jeopardize this infrastructure and further aggravate poverty. Tourism can easily be affected as the recreational and aesthetic benefits gained from nature will reduce immediately when biodiversity declines. Certain endangered or vulnerable key species, such as the mountain gorilla, the Ethiopian wolf, the lion and the rhino are crucial for attracting tourists to Uganda, Ethiopia and Kenya respectively. Fishery is already in great trouble as a result of declining fish stocks in different Kenyan and Ugandan lakes[128,129]. As overfishing lowers the regenerative capacity of marine fish resources, it also reduces the quality and quantity of fish stocks in the long term, strongly affecting the income of fishermen.

---

[126] Secretariat of the Convention on Biological Diversity (2006), *Global Biodiversity Outlook 2*. Montreal, 2006.
[127] idem
[128] Institute for Biodiversity Conservation (2005), *National Biodiversity Conservation and Action Plan, Ethiopia*. Available at: http://ibc-et.org/ibc/pubn/files/NBSAP.zip
[129] Kamau, C. (2009), *Human activities and nature conservation conflicts at the Kenyan coastline*. Available at: http://www.marbef.org/wiki/Human_activities_and_nature_conservation_conflicts_at_the_Kenyan_coastline

Low disasters tolerance

Biodiversity loss affects the resilience of ecosystems to shocks and disturbances. The damage to coastal communities from floods and storms, for example, can increase dramatically following conversion of wetland habitats and destruction of mangroves, as the natural protection offered by these ecosystems against wave action, tidal surge, and water run-off from land is compromised. This reality is underlined by various recent natural disasters, like the tsunami on the Somalia coast and flooding in Sudan and Ethiopia[130,131].

Major causes of biodiversity loss	*Impacts on ecosystems & human well-being*
Expansion of agriculture Deforestation Invasive species Inadequate nature protection Diseases Fire hazard Poaching Illegal fishing Destructive fishing practices	Disturbing ecosystems Food insecurity Health Economic deterioration (agriculture, tourism) Livelihood collapse for fishing communities Water insecurity Low disaster tolerance

[130] UNEP (2006), *Assessment of ground water vulnerability in African cities*. UNEP, Nairobi.

[131] Farah, Q.H. (2005), *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html

CHAPTER 4. FOOD AND WATER SECURITY

The Horn of Africa is among the most food insecure and water stressed regions in the world. As food and water insecurity are so closely interrelated, these phenomena are jointly described in this chapter.

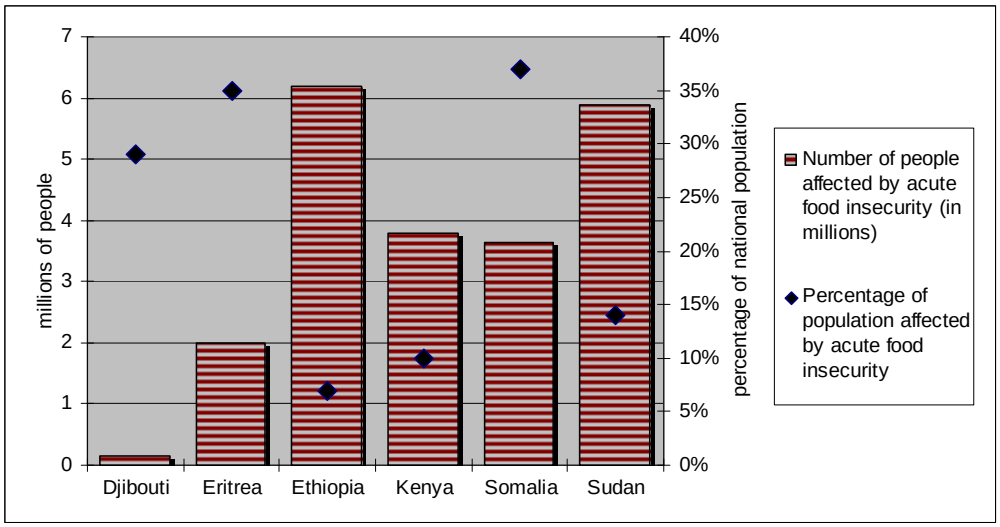
4.1. Food insecurity

In the region as a whole, more than 40 percent of people are chronically undernourished. In Eritrea and Somalia the proportion rises to 70 percent. These people generally live in drought prone arid and semi arid areas. Over the past 30 years, these countries have been threatened by famine at least once every decade. In four countries - Eritrea, Ethiopia, Kenya and Somalia - the average per capita dietary energy supply (DES) is substantially less than the minimum requirement[132].

Text box 4.1. Definition food insecurity

According to the widely recognised definition by the Food and Agriculture Organization (FAO), food insecurity is a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth, development and an active and healthy life. It may be caused by the unavailability of food, by insufficient purchasing power, as a result of inappropriate distribution or through inadequate use of food at the household level at a certain time.

Figure 4.1. People affected by acute food insecurity, 2009 (est)[133][134]



[132] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action; summary report*. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm
[133] Food insecurity figures: World Food Program (2009). Available at: http://www.wfp.org/countries
[134] Population figures: CIA (2009), *The World Factbook*. Available at: https://www.cia.gov/library/publications/the-world-factbook

Table 4.1. Food insecurity in the region per country[135]

Country	People affected by acute food insecurity (2009)		Most seriously affected regions	Vulnerable groups
	Number of people (est)	% of total population		
Djibouti	150,000	29%	North West and South East and Djibouti city	Pastoralists, urban poor, refugees,
Eritrea	2 million	35%	Gash Barka, Anseba	Farmers, woman, urban poor
Ethiopia	6.2 million	7%	SNNPR province, lowlands of Oromia, Somali region, Tigray, Amhara, Afar	Farmers, pastoralists, refugees, urban poor
Kenya	3.8 million	10%	Marsabit, Isiolo, Samburu, and Tana River districts , Mwingi and Kitui districts	Farmers, urban poor, pastoralists, refugees,
Somalia	3.6 million	37%	Central and Southern regions	Internally displaced people, pastoralists
Sudan	5.9 million	14%	Darfur, Central, east and Kassala and Red Sea regions	Internally displaced people, refugees, and pastoralists
Uganda	1.34 million	4%	Karamoja region, West Nile, Southwest	Pastoralists, refugees, internally displaced people

From these 22 million people that were subjected to acute food insecurity in the region in 2008-2009, nearly 4 million were under five years of age[136]. The Global Acute Malnutrition (GAM) rates were reported to be above emergency thresholds, reaching as high as 20 % in parts of Somalia and 25 % in parts of Sudan[137]. The most affected people were pastoralists, subsistence farmers, refugees, internally displaced people and urban poor who already live on the margins of survival due to conflict, displacement and chronic poverty[138].

Although the food security maps on the pages 67 and 69 do unfortunately not include food security data for Eritrea and northern Sudan, they show that many parts of Ethiopia, Somalia and Kenya are heavily impacted; many parts of those countries are highly and extremely food insecure.

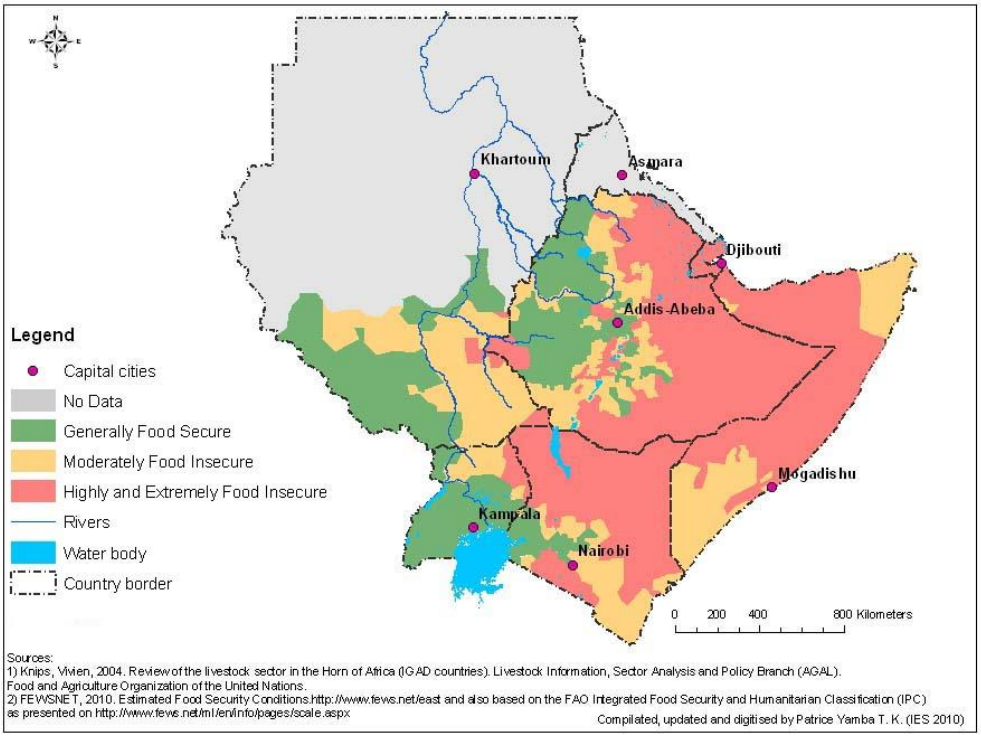
[135] Food insecurity figures: World Food Program (2009). Available at: http://www.wfp.org/countries
Population figures: CIA (2009), *The World Factbook*. Available at: https://www.cia.gov/library/publications/the-world-factbook

[142] Asmarino (2009), "Chronic food insecurity threatens lives of children in the horn of Africa." *Asmarino Independent, 9 May 2009*. Available at: http://asmarino.com/en/news/167-chronic-food-insecurity-threaten-lives-of-children-in-the-horn-of-africa

[137] World Food Program (2009), *Sudan*. Available at: http://www.wfp.org/countries/sudan

[138] Red Cross (2008), *Report on the Horn of Africa Food Crises*. Available at: http://www.ifrc.org/Docs/pubs/disasters/Horn-of-Africa/Report-Horn-Africa.pdf

Figure 4.2. Food security conditions



4.2. Water security

Water security can be defined as the availability of potable water for human needs and natural processes. This is highly problematic in many parts of the Horn of Africa, especially in the arid and semi-arid regions. First of all, lack of drinking water gives rise to all kinds of direct and indirect physical disorders. Water insecurity can be regarded as the main constraint for development. Disputes about use and allocation of water may also strongly impede peaceful relations between different communities and between countries.

The major problems related to water security in the Horn are water scarcity and temporal variability of rainfall. The recently published "Africa Water Atlas" demonstrates that the Ethiopian highlands have a large annual rainfall surplus, whereas all other regions (except for large parts of Uganda) face significant annual rainfall deficits. Floods can occur sometimes quite unexpectedly. This can result in loss of life, destruction of physical infrastructure, field crops and food stocks, as the 1997-1998 floods in the Horn of Africa have demonstrated[139]. Generally, however, the effects of scarcity are much larger in terms of the number of people affected[140]. The next section will elaborate on drought, as a causal factor for food and water insecurity. Water scarcity obstructs proper hygiene and sanitation, irrigation, production of food crops, cash crops, livestock development as well as hydropower production.

The water security situation in the Horn of Africa is more serious than in many other parts of Africa, let alone other parts of the world. This is largely due to the existing climate. However,

[139] UNEP (2010), *Africa Water Atlas*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.
[140] idem

not only natural factors are to blame. Also skills and institutional infrastructure play a large role in maintaining - or overcoming - water insecurity. For instance, the potential of rainwater harvesting and irrigation is significant, but greatly underutilized. In Ethiopia and Kenya, only 6,5 percent and 9,6 percent of the potentially irrigable land is under irrigation[141]. This implies that people can enhance water security themselves, by adopting innovative adaptive measures or by mitigating some causal factors.

4.3. Causes

Food and water insecurity are partly the result of climate induced factors: drought and land degradation are believed to cause famine about once every ten years.

Drought

"Drought originates from a deficiency of precipitation over an extended period of time[142]"
At a certain moment, depending on a combination of physical and social factors, a prolonged dry period becomes a drought.

Rainfall in most of the countries in the Horn of Africa is low, unevenly distributed, highly variable and therefore unreliable. In the Horn of Africa, less than 1 per cent of the cultivable area is under irrigation; in other words, the farmers' dependence on rainfall is huge[143]. As the region has limited other water resources, the scale and duration of rainfall is the main climatic factor determining land productivity. Excessive drought periods do not only have a negative direct impact on land productivity (impacting croplands and grazing areas), but have also stimulated further land deterioration through desiccation processes, causing shrinkage and cracking of the soil. It therefore negatively impacts food security both directly and indirectly. The maps on the page 69 demonstrate this. A comparison between food security conditions and ecological conditions, figure 4.3, shows a remarkable correlation between food insecurity and aridity. In many of the desert, arid and semi-arid steppe regions of Ethiopia, Somalia, Djibouti, Kenya and Uganda, food security is highly and extremely insecure. This indicates the importance of drought in explaining food insecurity.

There have always been cycles of drought and flooding in the Horn of Africa. Hence, the population of the region has always lived with an unstable environment, and has therefore developed specific coping strategies. Pastoralists often split their herds, migrate or try to set aside pastureland as grazing reserves. Farmers can plant different crops, slightly delay the planting season, or resort to other livelihood strategies such as hunting and gathering. During extended droughts, however, even the best coping mechanisms provide insufficient

[141] Ministry of Water Resources Development (2001), "Water and Development Bulletin" , no. 20, 2001, Ministry of Water Resources Development, Addis Ababa, Ethiopia. In: UNEP, 2006. *Africa Environment Outlook 2 – Our Environment, Our Wealth*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.
[142] National Drought Mitigation Center (2006), *What is drought?* Available at: http://www.drought.unl.edu/whatis/what.htm
[143] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action: final report.*

Figure 4.3. Ecological zones

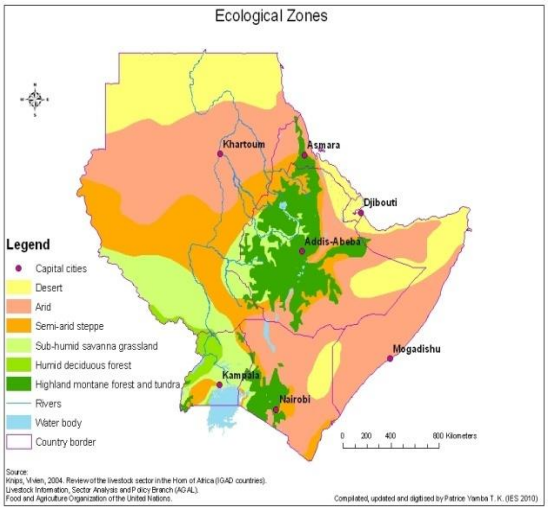
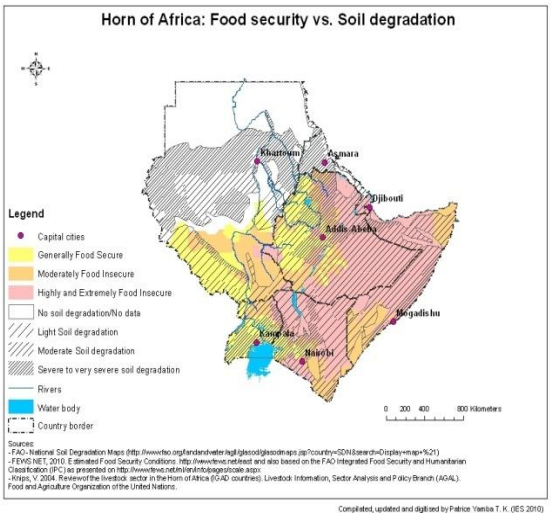


Figure 4.4. Food security and soil degradation



protection for the affected pastoralists and farmers alike[144],[145]. According to deputy humanitarian director at Oxfam, Jeremy Loveless, about the situation in Somaliland: "*With each drought, people become more impoverished, and they do not have time to recover their savings and their income before the next drought occurs*[146]*."*

Land degradation

Soil erosion and soil degradation are expected to be an important factor contributing to the regular food insecurity in many parts of the region. The combination map below demonstrates that soil degradation is correlated with food insecurity. Unfortunately – again – there is no food security data for Eritrea and northern Sudan. Chapter 3.2. has already demonstrated that the extent of soil degradation in the region is striking. Looking at the areas with severe to very severe food insecurity (pink), a remarkable parallel exists between the extents of soil degradation (///) especially in Ethiopia, Djibouti and Somalia. This example, however, does not serve as convincing evidence for the (causal) relationship between soil degradation and food insecurity. (Looking at the differences between Kenya and Uganda, for instance, points out that other factors must also be playing an important role in explaining food insecurity. Why can one country, despite the high extent of soil degradation, be generally food secure (Uganda), whereas many parts of the other country (Kenya) are terribly food insecure, despite much lower levels of soil degradation?) It can therefore not be concluded that food insecurity is largely determined by soil degradation, although it may play a role.

[144] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action: summary report*. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm

[145] Menghestab, H. (2005), *Weather patterns, food security and humanitarian response in Sub-Saharan Africa.* Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1569582/#bib41

[146] VOA (2009), *Group warns drought worsening in East Africa as more rains fail*. Available at: http://www1.voanews.com/english/news/africa/Group-Warns-Drought-Worsening-in-East-Africa-as-More-Rains-Fail-79443377.html

Text box 4.2. Climate trends

During the period 1970 to 2004 most of the countries of the Horn of Africa have reported at least 10 occurrences of drought; this comes down to an average of once every 3 years[147]. According to FAO, the climate in the Horn of Africa is becoming increasingly unstable and the weather events are more severe[148] . Similar observations are made by Oxfam Novib, claiming that Kenya had three successive seasons of poor rains, Ethiopia had four and Somalia had even five of these failed rains in a row[149] *.

The good news is that the Intergovernmental Panel on Climate Change (IPCC) suggests that in the long term in East Africa the average rainfall is expected to increase[150]. Water stress will therefore possibly decrease in large parts of the Horn[151]. Although large variations in rainfall (e.g. floods) can have a destructive effect on crops this climatic change may generally have positive effects for agricultural development and food security in the region. So, although temperatures are expected to have an adverse effect, rainfall patterns may positively affect food security in the Horn of Africa[152].

For more information on the effects of climate change in the Horn of Africa, see chapter 6.

Next to drought and land degradation, also other natural and social factors play a role in increasing the frequency of food and water insecurity in the region[153]..

Rising food prices

Due to inflation, growing demand and declining harvests, food prices in the region have increased seriously, as they have done in the rest of the world. The price of the staple grains (maize, sorghum, teff and wheat) showed a dramatic increase in all drought affected places. As 70% of the food intake depends on these grains the price rise significantly challenged people's access to food. In Somalia, for instance, the food price has shown eight fold increases between 2007 and 2008[154].

[147] Economic Commission for Africa (2008), *Africa Review Report on Drought and Desertification*. United Nations Economic Commission for Africa, Addis Ababa, Ethiopia

[148] Menghestab, H. (2005), *Weather patterns, food security and humanitarian response in Sub-Saharan Africa*. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1569582/#bib41

[149] Oxfam (2009), *East African food crisis*. Available at: http://www.oxfam.org.uk/oxfam_in_action/emergencies/east_africa.html

[150] Arnell, N.W. (2006), "Global impacts of abrupt climate change: an initial assessment." Working Paper 99, Tyndall Centre for Climate Change Research, University of EastAnglia, Norwich, 37 pp

[151] Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda (2007), *Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.), Cambridge University Press, Cambridge UK, pp. 433-467.

[152] FAO (2006), *Food security.* Available at: ftp://ftp.fao.org/es/ESA/policybriefs/pb_02.pdf

[153] International Institute for Rural Reconstruction (2009), *Facilitating Community Managed Disaster Risk Reduction Course.* Available at: http://www.unisdr.org/preventionweb/files/7881_DRR20Flier.pdf

[154] Red Cross (2008), *Report on the Horn of Africa Food Crises*. Available at: http://www.ifrc.org/Docs/pubs/disasters/Horn-of-Africa/Report-Horn-Africa.pdf

Poor distribution

One very important factor, greatly affecting food security, is the quality of distribution. Often the amount of food produced is sufficient; even in the worst famine years; food production has shown only a 7% decline from the long term average production[155]. However, the shortage of physical infrastructure (such as transportation and markets); the lack of food handling technology, capacity and regulation, (such as refrigeration and storage); and adequate source and supply logistics (including food processing industries) result in poor distribution patterns.

Lack of response capacity

Governments, both local and national, seldom have sufficient data or (analytical) capacity to respond quickly to changing circumstances such as drought, floods, natural disasters and population growth. Thanks to improved meteorological information, early warning systems have been set up in many crop production areas. In many instances, however, there is insufficient communication to the field and a lack of follow-up action; not enough responsive activities are undertaken by the particular governments. When such early warning systems for instance indicate that a period of extreme drought is on the horizon, farmers have insufficient means to take responsive or preventative actions to cope with that situation. [156]

Insecurity

Insecurity, due to social tensions, violent conflicts, (im)migration and land tenure insecurity, may also restrict farmers' investments on their lands. Combined with other factors, as explained above, this may be restrain farmers to produce more than what they need for self-subsistence, even during good growing seasons. In times of need, this has serious repercussions. More on land tenure insecurity and other underlying forces will be discussed in more detail in chapter 6.

4.4. Impacts

Food insecurity has clearly established impacts on human life. Malnutrition has a devastating effect on children, in particular, who face life-long physical and cognitive disabilities. Food insecurity can further induce and exacerbate conflicts, as has been the case in Somalia, the Somali region of Ethiopia, Kenya and Sudan. Food scarcity also diminishes people's productive capacity and forces people to focus on short-term solutions (provision of food), rather than longer term resource management.

In addition, food insecurity and resulting conflicts over food are among the main causes of internal displacement and migration of people. Subsequently, increasing population pressure in and around refugee centres can also lead to rapid (and sometimes irreversible) degradation of natural resources like land, water and wood. Although this problem should not be exaggerated, it should also not be overlooked, as it can seriously damage the (ecological) livelihood bases of displaced people as well as host populations in the short and

[155] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action.* Summary report. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm

[156] Environmental Analysis and Remote Sensing. *Monitoring and Early Warning.* Available at: http://www.earlywarning.nl/frames/Frame_links.htm

long term. The situation in and around the refugee camps in Northern Kenya exemplify this negative effect.

Shortage of water and struggles over (user rights of) water sources already lead to many conflicts in the region. This is especially the case, he indicated, in pastoral regions, on the borders with Djibouti, Somalia, North Kenya as well as South Sudan. Numerous examples of how water is a source of strive (between regions and villages, within local communities, even within schools) suggest that the relation between environmental scarcity and insecurity is very significant[157].

Textbox 4.3 Measures

In Ethiopia, new policies to tackle disaster risk have already been announced. Ethiopia's draft policy promises a structural shift, which aims to break with the strong dependence on emergency relief operations. *Prime Minister Meles Zenawi said in September 2010 that the country would no longer need food aid by 2015, through prioritizing national preparedness and engaging the private and voluntary sectors and international agencies only where needed. In the past, "the disaster response structure was excessively reliant on external resources", the document states. In the latest policy a new Federal Disaster Risk Management Council, chaired by President Meles Zenawi, is proposed as the top decision-making body.*[158]"

Major causes	*Impacts*
Drought Land degradation Deforestation (impacts hydrology) Lack of response capacity Rising food prices Poor distribution patterns Immigration and population growth Conflict and insecurity Land tenure insecurity	Malnutrition / Starvation Lower productive capacity Poor resource management Physical and cognitive disabilities Loss of cattle Migration Conflict and insecurity

[157] Personal communication with Country Director of SNV-Ethiopia, April 2009.
[158] All Africa (2010), "New Policy to Tackle Disaster Risk in Ethiopia." *All Africa, 27 September 2010.* Available at: http://allafrica.com/view/group/main/main/id/00011809.html

PART III – Analysis

The different manifestations of environmental insecurity – forest degradation, land degradation and desertification, pollution, biodiversity loss, and food and water security – cannot be assessed separately. They are strongly interlinked. Water security, land degradation and biodiversity loss, for instance, are all strongly affected by deforestation. It can be stated that most of the main environmental problems described in chapter 3 are caused by a combination of driving forces, such as increasing need for wood, expansion of farm lands, and overgrazing. These driving forces will be depicted in chapter 5. Underlying, structural and institutional causes such as population growth and poor land tenure security will be described in chapter 6. Following that description, the effects of this complex set of driving forces and underlying causes on environmental security will be described in chapter 7. These conclusions will serve as input for policy recommendations.

CHAPTER 5. DRIVING FORCES

The processes, or driving forces, behind the environmental problems identified in chapter 4, are threatening environmental security in one way or another. This chapter will elaborate on the main driving forces. Some of these important processes (increasing demand for wood, the expansion of agricultural areas, poor resource management and protection, illegal unreported and unregulated fishing, overgrazing and the failure of traditional coping measures) are elaborated here.

5.1. Increasing demand for wood

Economic development in the Horn of Africa is hopeful and creates opportunities for many people in the region. However, economic growth has much wider – and not only positive – implications on society. For instance, energy demands are increasing, a large majority of which comes from biomass[159], as introduced in chapter 2.3. Combined with growing population and increasing housing needs, this leads to increasing demand for wood.

Building wood

In the Horn of Africa, similar to many other regions in the developing world, wood is typically used for house-building and furniture construction[160]. Even for the production of bricks a lot of wood is used, as a source of energy.

Figure 5.1 Wood is used for all kinds of constructions

Wood used for scaffolding in Addis Ababa, Ethiopia


Wood used for hotel construction, Bahir Dar, Ethiopia

Energy

Given the high population growth rates in the region, it can be assumed that also household energy demands will continue to increase. The need for energy at household level is a major driving force for forest degradation in many parts of the Horn of Africa. It is estimated that almost 90% of the total energy consumption in the Horn comes from biomass[161], with

[159] ESI-Africa (2010), *Electrifying African interest in renewable energy*. Available at: http://www.esi-africa.com/Electrifying/African/interest/renewable/energy

[160] Global Forest Coalition (2010), *Getting to the Roots: Underlying Causes of Deforestation and Forest Degradation, and Drivers of Forest Restoration*, December 2010

[161] Biomass is often defined as "combustible renewable and wastes"

estimates varying from about 70% in Kenya to 95% in Uganda[162], largely depending on availability. It is expected that this dominance of biomass will not change much in the coming decades[163]. The most important biomass resource is wood, mostly collected from surrounding forest lands and shrubs and mainly used for cooking and heating purposes, also in the form of charcoal. Other biomass energy sources – though generally less significant in terms of their contribution to the total energy consumption – are agricultural residues, animal waste and human wastes.

Figures on the production and consumption of (biomass) energy are not structurally collected in all countries and datasets are not always maintained. Therefore, table 5.1 below uses different indicators and datasets to demonstrate the significance of biomass in the total energy balance of the countries in the Horn of Africa.

The majority of people use these traditional biomass energy sources for cooking purposes. The production (burning) of bricks is another significant biomass consumer. The overall increase in biomass needs stems from the combination of population growth, changing 'lifestyle demands' (such as brick houses) and a slow development of alternative energy sources such as hydropower, gas, and geothermal energy.

Table 5.1.
Significance of biomass energy in the total energy balance in the Horn of Africa[164]

Country	Biomass energy consumption as % of total energy consumption
Djibouti	-
Eritrea	-
Ethiopia	86%
Kenya	70%
Somalia	87%
Sudan	84%
Uganda	95%

Figure 5.2.
Collecting wood, eastern Uganda

[162] Karekezi, S. and W. Kithyoma (2003), *Renewable Energy in Africa: Prospects and Limits*. Available at: http://www.un.org/esa/sustdev/sdissues/energy/op/nepadkarekezi.pdf
[163] Dalelo, A. (2002), *Rural electrification in Ethiopia: opportunities and bottlenecks*. Addis Ababa University
[164] Anderson, T. et al. (1999), *Rural Energy Services: A Handbook for Sustainable Energy Development*. IT Publications, 1999.

International energy demand

The increasing and changing demand for energy from countries outside the Horn of Africa also have a large effect on ecosystems in the region. For instance, the production of charcoal is also strongly encouraged by overseas trade with the Gulf States. A high and increasing demand for charcoal exists in Saudi Arabia, Qatar and the United Arab Emirates, creating great economic opportunities for large profits for Somali traders. This high demand is the result of a combination of high (oil-based) energy prices and - ironically - strictly enforced regulations to mitigate deforestation in these Gulf states. Because of the environmental implications, in the 1990s a temporary ban on charcoal trade was put in place in (parts of) Somalia. As a result of the lack of government control, corruption and strong economic incentives, these days the charcoal trade is a thriving business again for many Somali traders and businessmen. This charcoal mainly originates from Somalia's acacia groves, which are located in the area between the Juba and Shabelle rivers in southern Somalia. The charcoal is mostly exported out of Kismayo, although much is also shipped to Mogadishu for export and domestic use. Most charcoal is made between Brava and Kismayo[165].

International energy policies, which have been taken to mitigate climate change, have contributed to the high and growing demand for biofuels. This leads to great expansion of agricultural areas for growing biofuels. The next section will elaborate on this phenomenon.

[165] Baxter, Z. (2007), *Somalia's Coal Industry*, ICE Case Studies, no. 201, May 2007. Available at: http://www.american.edu/ted/ice/somalia-coal.htm

5.2. Expansion of agricultural areas

A particular problem in the Horn of Africa is the conversion of dry and fragile range lands and forest lands into croplands and pasture lands. In addition to settlers seeking new land for relatively small-scale farming and pastoral activities, large scale farming of cash crops, flower farming and animal ranching have recently become increasingly important driving forces for converting dry lands and forest lands[166].

Migration and Settlement

Direct conversion to permanent agriculture (especially small-scale agriculture) accounts for more than 70% of forest loss in Africa[167]. Similar dynamics are in place in the Horn of Africa, where forest areas or 'idle' grazing lands are a frequent destination for settlers seeking new land. Such migrations range from spontaneous movements to government-organized programmes, as they took place in Ethiopia in the 1980s[168]. Forests have been cleared up to construct settlements, develop livelihood activities and fulfil their energy needs. In some cases this even includes 'protected areas'. Migration has been anticipated to have an enormous impact on the ecology, as the population pressure increases and as the new population may not be accustomed to the local ecology.

Land deals

In recent years especially Ethiopia, Kenya and Sudan have become actively involved in leasing out vast fertile farmlands to foreign governments and multinational corporations. The size of the land area involved varies from a few hundred hectares to 10,000 hectares or more. States from East Asia (China, South Korea) and the Gulf region (Saudi Arabia, Qatar, United Arab Emirates) have emerged as key sources of investment. Contracts generally give lease rights from 10 to 50 years[169].

Several factors seem to underpin this process of intensifying land acquisitions, in more sceptical wording called 'land grabbing'. Analysis made by different studies mentioned the following factors as a reason for accelerated land grabbing[170]: food crisis and volatility of food prices; global demand for biofuels; expectations of rising rates of return in agriculture and land values; and policies in home and host countries.

The internationally growing demand for relatively clean biofuels has spurred interest of several governments and farmers in the Horn of Africa. Under current EU policies, for instance, European member states are aiming to produce 10% of their transport fuels from biofuels by 2020. In different parts of Ethiopia, Kenya, and Uganda, (plans to set up) large scale biofuel plantations exist. Although this may be a reasonable response to fulfil international (and national) energy needs, the lack of land use planning, and general lack of

---

[166] Nyssen, J., H. Mitiku, J. Moeyersons, J. Poesen and J. Deckers (2003), "The environmental policy in Ethiopia." *Journal of Modern African Studies*, 2003.

[167] FAO (2009), *State of the World's Forests*, Rome, 2009

[168] Huysmans, R. (2009), *Land security and livelihoods,* IES report

[169] Cotula, L., S. Vermeulen, R. Leonard, J. Keeley (2009), *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* IIED/FAO/IFAD, London/Rome

[170] Public Broadcasting Service (2010), *Ethiopia abundant farming leaves many still hungry*. Public Broadcasting Service, April 22, 2010. Available at: http://farmlandgrab.org/12321

consideration for social and environmental aspects raises concerns with regards to respecting human rights and protecting the environment. After all, more agricultural lands are needed to fulfil these energy demands. The expansion of agricultural areas can pose major threats to grazing lands and valuable forests and can result in a violation of people's (traditional) rights to use these resources[171].

The matter of land deals has gained significant cover in the media and created concern among various humanitarian and environmental groups. The major concern is related to the paradox that many of these African countries, known for severe food insecurity and not always able to nourish their own population[172], allow their fertile arable lands to be used by foreign owners aiming at securing the food demands of their own population. Many anticipate that outsourcing food production will ensure food security for investing countries but will bring about food insecurity for local populations[173]. In 2009 a coalition of international organizations (The United Nations Food and Agricultural Organization, the International Institute for Environment and Development and the International Fund for Agricultural Development) conducted a study that looks at land acquisition in various African countries, including Sudan and Ethiopia. This study, *"Land grab or development opportunity? Agricultural investment and international land deals in Africa",* shows that in the period between 2004 and early 2009 significant amounts of land were allocated to investors: around 470,000 hectares in Sudan and over 600,000 hectares in Ethiopia[174], mainly in areas suitable for rain-fed crops. In Ethiopia, domestic investors account for the large majority of these agricultural projects[175].

The environmental consequences of land grabbing for intensive farming can be very serious[176]. The first negative effects of land grabbing are related to the clearing of land and the subsequent loss of biodiversity. In Ethiopia, arable land and wooded areas are being cleared without the guarantee that biodiversity values are properly taken into consideration. In most of the countries environmental impact assessments are not prerequisite or are performed in an ad hoc manner. For example in Ethiopia, local activists claim that 75 percent of the land allocated to foreign biofuel firms are located in forests that will be cut down[177]. For example Flora Eco Power Ethiopia, operated by a German private company, purchased 200,000 hectares to plant castor seeds for biodiesel production. By 2008, they had cultivated 15,000 ha in several woredas in East and West Hareghe Zones, for which 10,000 hectares of virgin forestland had been cleared. Besides, part of the land is attached to Babile elephant

[171] GRAIN (2007), *Seedling: agrofuels special issue,* GRAIN, Barcelona, Spain.
[172] Taipe times (2010), *Food shortages drive new foreign land grab in Africa*. Taipe Times, 12 March 2010. Available at: http://www.taipeitimes.com/News/editorials/archives/2010/03/12/2003467789
[173] De Volkskrant (2009), "Experts worry over land grab by foreigners in Ethiopia". Available at: http://www.vkblog.nl/bericht/273580/Experts_worry_over_land_grab_by_foreigners_in_Ethiopia
[174] not counting land allocations less than 1,000 hectares
[175] Cotula, L., S. Vermeulen, R. Leonard, J. Keeley (2009), *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* IIED/FAO/IFAD, London/Rome
[176] The Guardian (2009), *How food and water are driving the 21st land grab in Africa*. The Guardian, 7 March 2009, Available at: http://www.guardian.co.uk/environment/2010/mar/07/food-water-africa-land-grab
[177] Vallely, P. (2009), *A new trend: Industrialized nations lease fertile land in Africa to meet food demands*. The Independent, 10 August, 2009. http://sanhati.com/articles/1734/

sanctuary, which could bring about human-animal conflicts[178]. Furthermore, the use of agrochemicals and pesticides on these large scale farm lands can cause soil degradation and pollution of surface water and ground water[179,180]. Water resources are often equally affected. As a result, the problem is not only land grabbing but also water grabbing[181].

Second, large scale land allocations have the potential to result in loss of land for large numbers of people. Despite growing concern from local communities and international organisations national governments claim there is abundant unused land, which can easily be leased out. These claims need to be treated with caution, however. In many cases seemingly 'idle' lands are in fact used seasonally or claimed by pastoral communities, farmers, food gatherers or other stakeholders. Recently the Ethiopian Prime Minister Meles Zenawi explained that his government is comfortable with the present way of leasing land to (foreign) private actors. On the other hand, the report by the FAO, IIED and IFAD claim that in Ethiopia *"all land allocations recorded at the national investment promotion agency are classified as involving 'wastelands' with no pre-existing users. (…) However, evidence collected by an in-country research team suggests that at least some of the lands allocated to investors in the Benishangul Gumuz and Afar regions were previously being used for shifting cultivation and dry-season grazing*[182]*".*

Concluding, leasing out land to foreign investors creates both economic opportunities and social and economic risks. On the one hand, increased investment may bring macro-level benefits, such as GDP growth and improved government revenues, and may create opportunities for economic development and livelihood improvement in rural areas. On the other hand, large-scale land acquisitions without land use planning, public discussion and transparent decision-making may result in local people losing access to the resources on which they depend for their food and water security.

Text box 5.1. Public protest in Uganda

In Uganda there has been a strong public outcry against the allocation of national forest reserves in Bugala and Mabira to foreign plantation companies for establishment of palm oil and sugarcane plantations. Civil society concern has been expressed through demonstrations in Kampala, a series of NGO-led court cases, a boycott of Lugazi sugar, petitions and a mobile phone messaging campaign. The Ugandan government has subsequently withdrawn Bugala forest reserve from conversion to sugarcane[183].

[178] Pampazuka News (2009), *Land grabbing in Africa; the why and the how.* Available at: http://www.pambazuka.org/en/category/features/59291

[179] The New Security Beat (2010), *Land grab sacrificing the environment for food security.* Available at: http://newsecuritybeat.blogspot.com/2010/01/land-grab-sacrificing-environment-for.html

[180] Finfacts Ireland (2009). *Study warns of impact of "land grab" deals in Africa and other continents by foreign countries and private groups*. Available at: http://finfacts.ie/irishfinancenews/article_1016761.shtml

[181] The Independent (2009), *Wish you weren't here: the devastating effects of the new colonialists.* Available at: http://www.independent.co.uk/environment/nature/wish-you-werent-here-the-devastating-effects-of-the-new-colonialists-1767725.html

[182] Cotula, L., S. Vermeulen, R. Leonard, J. Keeley (2009), *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* IIED/FAO/IFAD, London/Rome

[183] Tenywa, G. (2007), "Uganda: Bidco Drops Bid for Bugala Forests", New Vision,Uganda, 24 May 2007,. In: Cotula, L., N. Dyer, and S. Vermeulen, 2008. *Fuelling exclusion? The biofuels boom and poor people's access to land*, IIED, London.

5.3. Inadequate resource management and protection

Previous sections have shown that the expansion of agricultural areas and increasing demand for wood puts tremendous pressure on available resources. Nevertheless, thorough management and protection of resources have the potential to mitigate the worst consequences of this pressure and to prevent resource induced conflicts. However, in many instances, such 'traditional' systems of sound natural resource management are under stress, as a direct or indirect result of underlying factors such as population pressure, land tenure insecurity, modernization and changing values and needs.

Overexploitation

Land degradation caused by droughts can be recovered if the land is left to a period of fallow. However, due to a variety of factors this traditional management approach is under stress: excessive human pressure, land tenure insecurity and high demands on the land to overcome the stressful situation during droughts (low food production, low growth of grasslands) make it increasingly difficult for farmers to incorporate such a recovery period into current agricultural practices.

Harmful agricultural practices in the region, such as overexploitation of land, overgrazing, bush fires, and the cultivation of marginal and easily eroded lands have intensified the degradation of the soil and led to a rapid decline of land productivity[184,185]. Land cover and land use are important determinants of infiltration capacity and erosive processes of rainfall, and therefore of biological integrity and stream water quality.

Poor waste management

As demonstrated in chapter 3.3, pollution is starting to pose serious threats to the environment of the Horn[186]. Poor waste management is a major constraint for tackling this problem. In all countries of the Horn, there is a significant lack of infrastructure, policy and institutional framework for the management of waste. Systems for collection, transportation and treatment of domestic and industrial waste are in an early stage. There is a lack of designated dumping sites and inadequate capacities of the authorities in environmental management As a result, waste is often disposed along the roads, in open land spaces, in surface water and/or burned in open air.

Poor nature protection

Even though many areas in the region are gazetted as protected areas, actual enforcement of protection rules is not always carried out strictly enough. Gambella National Park, Bale Mountains National Park (Ethiopia) and Mau Forest (Kenya) are examples of protected areas

[184] Darkoh, M. B. K. (2003), "Regional perspectives on agriculture and biodiversity in the dry lands of Africa." *Journal of Arid Environments,* Volume 54, Issue 2, June 2003, pp. 261-279

[185] Teketay, D., Fetene, M., Abate, A. (2003), "The state of the environment in Ethiopia: Past, present, and future prospects." In: Sahlu, H. 2004. Population, Development and Environment in Ethiopia. *Environmental Change and Security Project report, volume 10, 2004.*

[186] Many pollutants travel incredibly quickly and cover a broad area. Long-term pollution is also a great concern, even at low levels, because it can affect entire ecosystems through the chain of life. Dilution of fertilizers in water bodies is affecting the aquatic ecosystems by increasing the nutrient load. Increasing nutrient load (eutrophication) creates a low-oxygen or "dead zone" that is incapable of supporting animal life.

where poor enforcement of protection have caused large problems in the long term. These examples will be discussed later in this report. In many protected areas, the nature protection authorities have allowed human settlement and human activities beyond the physical and legal boundaries of official protection. Later on it often proves difficult – if not impossible - to undo these failures to protect, as the Mau Forest case has shown.

Text box 5.2. Church forests

One traditional institution that still exists and functions very well in forest management is the Ethiopian church. Because of the church's long standing forest conservation practice and strategy, there are still many patches of pristine church forests left in the northern part of Ethiopia. These forest areas are virtually untouched and harbour valuable genetic plant material. The spiritual value of the church forests and the modes of protection applied by the church, like religious sanctions and legal protection, are important explanations for the successful conservation of these forest areas. According to Dr. Alemayehu there are over 35,000 Ethiopian Orthodox churches in northern Ethiopia, each enveloped by forest area of 0.5 ha to 100 ha, some of which date as far back as the 4th century. As a result, church forest offers opportunities for conservation, restoration of vegetation and supporting re-greening initiative in the area which can be scaled up to the other parts of the countries[187,188]

Introduction of exotic species

Measures applied to adapt to the impacts of climate change can severely damage the regional environment, especially if they are not well thought through. A good example of this is the introduction of alien species in new habitats, without detailed research on the impacts on the endemic species of the region. According to the Institute for Biodiversity Conservation in Addis Ababa, hundreds of alien species have entered Ethiopia, intentionally as well as unintentionally. Recently, it has become clear that several alien species are spreading at alarming rate, threatening agricultural lands, rangelands, national parks, waterways, lakes, rivers, power dams, roadsides and urban green space. After all, some ecosystems simply have little immunity to new species, especially when the "intruder" has different traits than the original species[189].

One of the most damaging invasive species is Parthenium weed *(Parthenium hysterophorus)*. This weed can cause severe human health problems as well as agricultural losses, as it contains 'sesquiterpene lactones', which induce severe allergic dermatitis and other symptoms[190]. Other species that cause large problems to their "new environments" are water hyacinth *(Eichhornia crassipes)*, Lantana camara, Acacia spp and mesquites *(Prosopis juliflora)*[191].

[187] Eshetu, B. (2010), "Orthodox Church Conservation Efforts Appreciated." In: *Addis Ababa Highlights, Vol.7, No.5.* Available at: http://www.unep.org/roa/addis_ababa_site/Documents/Highlights/highlight2010/May10.pdf
[188] Personal communication, Netherlands Embassy Addis Ababa, on 3 April 2009.
[189] Trowbridge, J. (2001), *The Significance of Biodiversity: Why We Should Protect the Natural Environment*. Available at: http://serendip.brynmawr.edu/exchange/node/1692
[190] Picman, A.K. and G.H.N. Towers (1982), "Sesquiterpene lactones in various populations of Parthenium hysterophorus." *Biochemical Systematics and Ecology, Volume 10, Issue 2, 1982, pp. 145-153*
[191] Institute for Biodiversity Conservation (2008), *The impacts of Prosopis Juliflora on Biodiversity in the Desert and Semidesert Ecosystem, Northeast Ethiopia.* Available at: http://ibc-et.org/ibc/pubn/files/Prosopis_juliflora_Biodiversity.pdf

Text box 5.3. Invasion of prosopis juliflora

Another main reason for concern, mainly in the desert and semi-desert, is the invasion of *prosopis juliflora*, also widely known as *mesquite .* This very strong shrub, or small tree, was intentionally introduced by FAO and other organisations from Latin America in efforts to combat desertification in Eritrea, Djibouti, northern Somalia and north-east Ethiopia. Furthermore, the intention was to use it for fodder and energy purposes (charcoal).

However, *prosopis juliflora* strongly impairs the growth of the original vegetation, extracts a lot of water from the soil, and prohibits grazing and farming. Other negative effects of the invading tree are related to the spines, which are poisonous to livestock and people, and the pods, which form balls in the stomach and kill livestock. As a result, in Kenya *prosopis juliflora* is already officially declared a noxious weed. This strong thick rapidly growing vegetation quickly reduces biological diversity in the area. In Ethiopia, prosopis juliflora has invaded hundreds of square kilometres in the Afar region. This region is inhabited by Afar, Somali and Oromo tribes, whose livelihoods are largely based on cattle keeping. The invasion is now also threatening the biodiversity of Awash National Park. In the limited territory of Djibouti, 200 km^2 has already been invaded by the tree[192,193].

"Simply cutting Prosopis is not a viable clearing strategy as it only spawns quick re-growth"[194].

Government interventions

Subsidies and tax incentives for investment in plantation, flower farms and cattle ranching have unintended consequences on the environment. Without structurally integrating proper checks and balances to ensure sound environmental management, these incentives support activities that can be quite destructive. In the Bale Mountains, for instance, a large threat to the forest comes from large scale investors, who have received land from the government for large scale mechanized agriculture[195]. In an effort to promote economic development, the government is enabling these investors to acquire land, thereby destroying the long-term natural assets of the communities living in, and those dependent on, the Bale Mountains. Chapter 8 will focus more in-depth on the situation in the Bale Mountains.

[192] idem
[193] Personal communication, Netherlands Embassy Addis Ababa, on 3 April 2009.
[194] Photo courtesy of Øystein Nedrebø/Royal Norwegian Embassy in Addis Ababa. *Combating Prosopis in Afar*. Available at: http://www.norway.org.et/News_and_events/DevelopmentCooperation/Development-Cooperation/Combating-Prosopis-in-Afar/
[195] Personal communication, BERSMP, April 2009.

Text box 5.4. Lake Victoria

To compensate for decreasing commercial fisheries in Lake Victoria during the 1950s and 1960s, non-indigenous fish species were introduced in the lake. The Nile Tilapia, *(Oreochromis niloticus)* and Nile Perch *(Lates niloticus)* are well-known examples. Within a few decades after the introduction of Nile Perch from Lake Albert and Lake Turkana, this large predator fish became a very dominant species in Lake Victoria. This coincided with a drastic decline in populations of many indigenous fish species[196].

Remarkably enough, however, it was recently found that intense fishing on the non-indigenous and valuable Nile perch may have enabled the resurgence of some indigenous species, re-strengthening the biological diversity of the lake.

Nevertheless, the original situation is not at all restored. The resurgent fauna is expected to differ in richness and composition from the original fauna, and the introduction of non-indigenous species has definitely had a huge and partially irreversible impact on compositions, functional relationships and biological diversity of the lake.

5.4. Illegal resource extraction

Illegal trade in natural resources deprives the citizens of the Horn of Africa of their right to security, health and development, while damaging ecosystems. Gold mining in Sudan and Uganda, illegal stone, sand and lime mines in Eritrea, illegal logging in Kenya and Somalia are especially serious.

Illegal trading of ivory, turtle and ostrich eggs, as well as crocodile, python and other animal skins is putting these species in danger in the various parts of the Horn. The Eritrean Coastal Desert eco region, which runs along the southern coast of the Red Sea from Balfair Assoli in Eritrea to Ras Bir near Obock in Djibouti, is highly threatened by illegal trading of turtle eggs. Illegal trading of ivory and crocodile skins is a common practice in Sudan and Ethiopia[197]. Bush meat consumption and trade is believed to be the main cause of the local extinction in Southern Sudan of larger edible mammals such as buffalo, giraffe, zebra and eland, after the north-south war.

Illegal, unreported and unregulated fishing

Overfishing is one of the major threats to aquatic biodiversity. Despite various international legal arrangements, as explained in text box 5.5, marine fish resources are seriously threatened by illegal, unreported and unregulated fishing, putting “unsustainable pressure on fish stocks, marine wildlife and habitats”, according to the 2006 report from the High Seas Task Force asserts. It ignores rules that have been set up to protect juveniles from being harvested, minimise by-catch of non-target species, and avoid fishing on spawning

[196] Balirwa, J.S., A. Colin, L. Chapman, I.G. Cowx, K. Geheb, L. Kaufman, R. H. Lowe-McConnell, O. Seehausen, J.H. Wanink, R.L. Welcomme, and F. Witte (2003), "Biodiversity and Fishery Sustainability in the Lake Victoria Basin: An Unexpected Marriage?" *Bio Science, August 2003, Vol. 53 No. 8, pp. 703-716.*

[197] UNEP (2007), *Sudan Post-Conflict Environmental Assessment*, Nairobi, 2007.

grounds[198]. This problem is most pronounced in Africa's largest coastal country Somalia. Hundreds of foreign fishing vessels are illegally operating in the Somali waters[199,200] exploiting high value species such as tuna, shark, lobster and deep-water shrimp. A report from 2006 from the international Task Force on IUU Fishing on the High Seas estimates that about 700 illegal vessels navigate the Somali waters, clearly violating international fishing agreements. Examples of such illegal activities include reflagging of fishing vessels to evade controls, fishing in areas of national jurisdiction without authorization by the coastal state and failure to report (or misreporting) catches.

Textbox 5.5. UN Legal Arrangements

According to the UN Convention on the Law of the Sea, coastal states have rights and responsibilities for the management and use of fishery resources within the area of their national jurisdiction (EEZs). This Convention recognizes the sovereign rights of coastal states to explore, exploit, conserve and manage those resources in areas under their jurisdiction[201]. The UN also formulated an International Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing.

The 1995 UN Fish Stocks Agreement for Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks also sets out principles for the conservation and management of those fish stocks and establishes that such management must be based on the precautionary approach and the best available scientific information[202]. According to this agreement, countries are entitled to order their fishing vessels to fly their country's flag, record the fishing vessels, cooperate and exchange information with other states and etc[203].

Damaging fishing methods

In attempts to create efficiency gains, also the relatively small scale fishermen on the region's lakes and at the coasts are looking for technologically more advanced fishing methods, using motorized canoes and modern fishing gear. Some of these 'modern' fishing methods are extremely damaging, and are therefore often considered illegal. Examples of such damaging fishing techniques are dynamite fishing, the use of more nets per boat, smaller meshed gillnets, or doubling the depth of nets. By catching even the smallest and most juvenile fish, many of these methods have the potential to rapidly eliminate entire species and destroy ecosystems and livelihoods.

[198] High Seas Task Force (2006), *Closing the net: Stopping illegal fishing on the high seas*. Governments of Australia, Canada, Chile, Namibia, New Zealand, and the United Kingdom, WWF, IUCN and the Earth Institute at Columbia University.
[199] Somalia Watch (2000), *Firefight over fish in Somalia waters.* Available at: http://www.somaliawatch.org/archive/000114101.htm
[200] UNEP (2005), *National Rapid Environmental Desk Assessment – Somalia*. Available at: http://ocha-gwapps1.unog.ch/rw/RWFiles2006.nsf/FilesByRWDocUNIDFileName/TKAE-6TV94M-unep-som-2005.pdf/$File/unep-som-2005.pdf
[201] FAO (2002), *Implementation of the International Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated.* FAO Technical Guidelines for Responsible Fisheries. Available at: http://www.imcsnet.org/imcs/docs/implementation_for_ipoa.pdf
[202] UN (2010), *Overview – Convention of the Law of the Seas & Related Agreements.* Available at: http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm
[203] FAO (1995), Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. Available at: http://www.fao.org/docrep/meeting/003/x3130m/X3130E00.htm

5.5. Overgrazing

Overgrazing occurs when a vegetated area is exposed to excessive grazing, without sufficient time to recover. As a result, the vegetation will change significantly, or disappear entirely.

Increasing demand for farm land (for food production) often comes at the expense of available (seasonal) grazing land. This demand for land encourages farmers to start cultivating drier and less productive lands. Also, governments give away dry season grazing lands to large commercial farms, (flowers, biofuels, etc.) as explained in chapter 5.2. Moreover, pastoralists are increasingly restricted to migrate as a result of the closing of migration routes. This occurs for biodiversity conservation (setting up of protected areas), tensions with other communities, or ongoing conflicts in the region. This forces pastoralists to move with their goats, sheep, cattle or camels to, or through, other areas. Land policies of most national governments do not sufficiently support pastoralism.

Despite the declining amount of grazing land, the number of pastoralists is not decreasing. Pastoralism is an integral element of the culture of about 25 million people in the Horn of Africa; it lies at the heart of their existence. Therefore, people are generally not easily giving up pastoralism.

The consequence is that existing pasture areas in the Horn of Africa are increasingly exposed to excessive grazing. In arid and semi-arid areas this causes desertification, which further reduces the amount of grasses and fodder available. Hence the pressure on remaining grazing lands grows. With stable pastoral populations and herd sizes, this process will have significant impact on ecosystems and future livelihoods. Especially in vulnerable areas, soil erosion can easily occur. Underlying these driving forces are more structural factors, such as rapid population growth and instability in the region. These will be explicated in chapter 6.

Figure 5.3. Grazing increasingly exceeds sustainable levels

Cattle keeping can very well be done in a sustainable way, allowing grasses to recover (left), though in vulnerable areas soil erosion may occur, e.g. on this hill in southern Uganda (right)

CHAPTER 6. UNDERLYING CAUSES

The environmental concerns and their driving forces described in chapters 4 and 5 are influenced by a wide array of more structural underlying causes and catalytic factors, such as climate change, land tenure insecurity and population growth. The aim of this chapter is to further analyse these structural, underlying factors.

6.1. Rapid population growth

Whether the problem stems from overgrazing, expansion of farm lands or overfishing, increasing resource exploitation through population growth is very often an underlying element. Chapter 2.2 has stated that the combined population of all seven countries of the Horn of Africa has increased fourfold in 50 years, from about 53 million to the current estimated 218 million inhabitants[204]. Although the role of population in forest degradation varies considerably depending on the local patterns of human occupancy and economic activity, the reports of the Food and Agriculture Organisation (FAO) and other studies relate the increased rate of deforestation in the Horn of Africa to the increased population pressure and its associated demands for cultivable and pasture lands, settlements, fuel wood, construction material, etc. These demands have mostly been discussed in chapter 5. The growing population of the region is clearly not in parallel with the available resources, the rate of reforestation, soil formation and the level of resource management and protection[205].

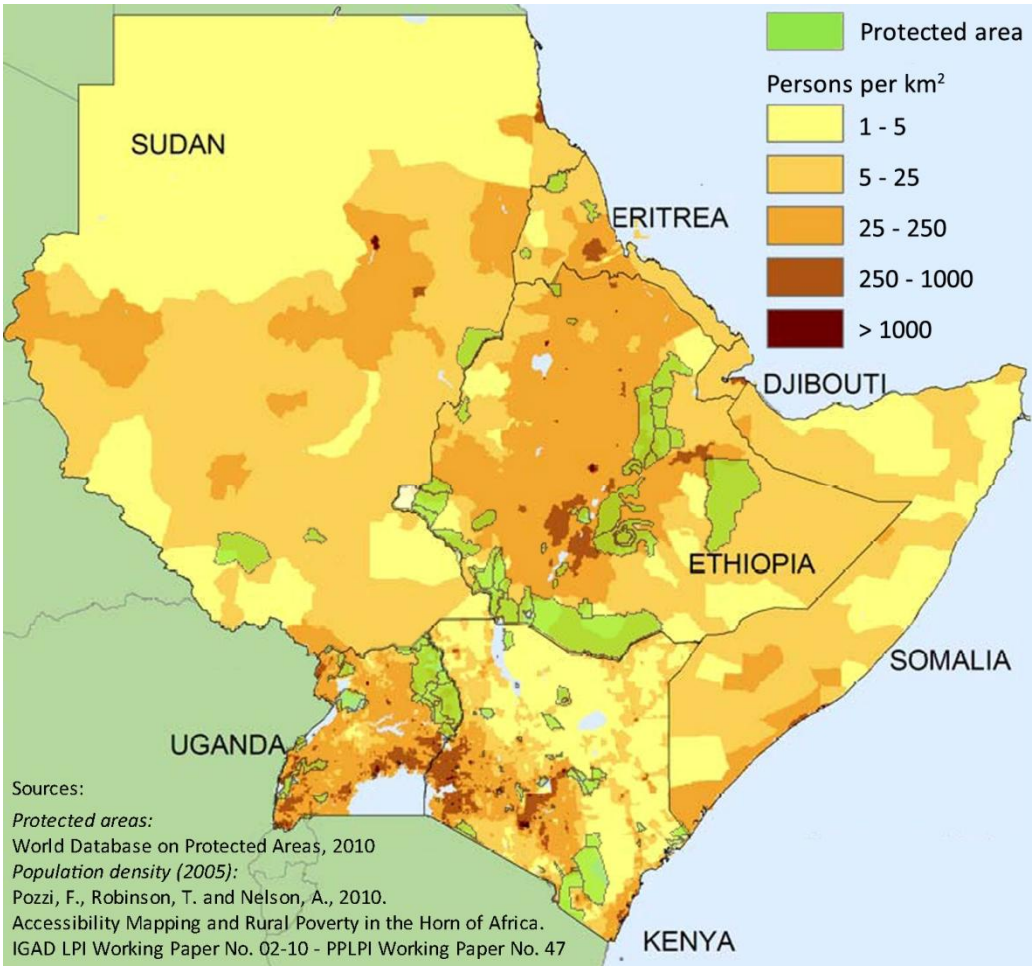
The impacts on land degradation, forest degradation and biodiversity are evident. Most areas of high biological diversity in the Horn - the highlands and the moist lowlands - are areas of higher and regular rainfall. These climatic factors and the ensuing high soil productivity make these areas attractive for human habitation. A relatively high population pressure in these biologically diverse areas is the result, as figure 6.1 shows. The expansion of farm land goes at the expense of forests, grazing lands and other ecosystems, and causes increased risk of human-wildlife conflict.

6.2. Poverty

Chapter 2 has demonstrated that, especially in rural areas, the standard of living and the level of economic development is generally low. Education levels are very low among the majority. Understandingly, for many people the demand for basic needs in the short term has a priority over sound resource management, such as forest preservation or leaving land fallow for some years. The focus on achieving short term basic needs triggers many people and their governments to overlook the longer term environmental costs, when e.g. forests are converted to cropland, or fish resources are overexploited.

[204] United Nations Population Division (2010). *World Population Prospects: the 2008 Revision Population Database.* Available at: http://esa.un.org/unpp/. Retrieved at 14 June 2010.
[205] FAO (1989). "Forests, trees and people." *Forestry Topics Report*, 2. Rome.

Figure 6.1. Many areas of high conservation value are densely populated



6.3. Dependence on natural resources

The livelihoods of the people in the Horn of Africa region strongly depend on agriculture, fishery and tourism. Agriculture employs about 60-80% of the population, as chapter 2.3 has already described. At the same time, only between 4-10% of the land area in the Horn of Africa is classified as arable. Low productivity of farm lands, in combination with very high population growth rates, forces people to cultivate marginal lands more intensively, with fewer opportunities to replenish the soil[206]. However the studies of Jan Nyssen et al. (2004) indicate that especially large scale and mechanized agricultural systems have a wide impact on biodiversity loss[207]. The recent boom in large scale farming of cash crops, biofuels and flower farming, as well as animal ranching, and the consequential need of fertile land, resulted in a reduction of forest cover. The dependence on biomass for energy should also be mentioned in this respect. As pointed out in chapter 5.1, the large majority of people use traditional energy sources like wood and other biomass, which is usually collected from surrounding forest lands, shrubs and plantations.

[206] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action.* Summary report. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm

[207] Nyssen, J., H. Mitiku, J. Moeyersons, J. Poesen and J. Deckers (2003). "The environmental policy in Ethiopia." *Journal of Modern African Studies*, 2003.

Livelihood mechanisms of many people (partly) fail, e.g. due to loss of land, resource scarcity or decreasing land productivity. This may lead them to shift to other livelihood activities. Often these new activities are again resource-based. Fishing has become such as new, or additional, livelihood activity for many communities, such as for pastoralists from the Lake Turkana area[208]. This consequently increases the number of people that depend on fish as a source of food and income generation. Growing pressure on these resources may eventually (again) result in exploitation beyond sustainable levels. In other words, as long as people's dependence on the earth's natural resources is high, resource pressure remains significant.

6.4. Land tenure insecurity

In a region with such a strong dependence on natural resources, access to land is vital. This is probably the most important constraint for food security in the region. However, if people own land, it is usually only a very small plot. FAO reports, for instance, that in Ethiopia, *"more than 60 percent of farm households have no more than 1 ha from which to support a family of between six and eight people.[209]"*

Generally, access to land is gained on the basis of traditional, locally organized, land tenure systems[210]. Although a wide variety of such customary tenure systems exist in different parts of the Horn of Africa, these systems are generally based on communal ownership[211] . Communal tenure systems give the rights to access land, and inheritance of land, whereas leaders of the community traditionally handle issues like land distribution and disputes over land. By not giving clear and uncontested rights to land holders, these traditional tenure systems are considered very problematic.

Recognizing this, and in order to enable farmers to cope with changing conditions such as land degradation and land scarcity, some national governments in the Horn of Africa partly abolished the customary system and started implementing reforms. Djibouti, Kenya and Sudan carried out a tenure system that combines privatization and government ownership, while Eritrea and Ethiopia carried out government ownership with user rights for 'land holders'. These reform programs were thus envisaged to strengthen people's tenure security. Hence they would create incentives for investment on land, productivity and food security of the region. It was also anticipated that these modern regimes would solve the increasing land disputes.

However, many studies indicate that the reform programmes have not been a great success so far. In most countries the programmes fail to address their objectives. In all countries, land tenure systems are still very complex, lacking transparency, coherence and fair

[208] BBC (2009). *The dam that divides Ethiopians*. BBC News, 26 March 2009. Available at: http://news.bbc.co.uk/2/hi/africa/7959563.stm
[209] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action.* Summary report. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm
[210] Cotula, L. (2007). *Changes in customary land tenure systems in Africa.* Published by IIED and FAO, 2007.
[211] Grigsby, W.J. (2002). "Subsistence and land tenure in the Sahel." *Agriculture and Human Values* 19 (2), 2002, pp. 1-14

implementation[212]. In addition, the tenure system is impacted by discretionary application and interpretation of regulations by local bureaucrats[213]. As a result, land tenure insecurity is still a common problem for most people in the Horn of Africa. The problems are most pronounced in Eritrea, Ethiopia and Kenya[214] [215]. In Ethiopia and Eritrea the insecurity arises from a risk of relocation and eviction, whereas in Kenya poor handling of records and out-of-date cadastres pose a threat to tenure security. As a result, millions of people face the risk that their land rights will be threatened by competing claims or eviction plans.

Land tenure insecurity tends to deteriorate the sense of ownership and responsibility for the land. This is clearly restricting farmers' investments on their lands, such as planting (fruit) trees or perennial crops.

Moreover, the small size of the available plots do not allow farmers to implement adequate soil conservation measures such as fallow, crop rotation, etc. As a result of land tenure insecurity, most farming households need to adopt survival strategies, concentrating efforts on subsistence crops for the current harvest, without making many, if any, investments for the future. This situation does not allow, or encourage them, to produce more than they possibly can during good growing seasons. In times of need, this has serious repercussions. This highly increases the risks of poverty and food and water insecurity. Furthermore, strong grievances about the lack of private land ownership can become an ingredient of social tensions within and between communities.

6.5. Land use planning

Planning is a tool to manage changes in a rational way. Careful land use planning is therefore essential to manage and mitigate (potential) conflicts between natural processes and human activities, now population is growing, migrating, and resources are becoming scarce. Most of the countries lack comprehensive and functioning land use planning systems at local level though. Even when land use plans and planning mechanisms exist, public participation in the process is often lacking. As a result, the public often does not 'connect' and adhere to the plans.

In the past years, countless initiatives have been started to promote participatory land use planning in all countries in the Horn, mostly initiated by international organisations. These planning exercises generally serve to prevent user conflicts, e.g. between wildlife migratory routes and pastoral areas, between farming and pastoralism, or between using the land and conservation for tourism and biodiversity, e.g. through spatial zoning. Evaluation of these initiatives learns that participatory land use planning is very well possible and gives people a

[212] Gräfen, C., B. Debele (1996). *Land Tenure and Resource Management in the IGAD region: Summary of Findings and Major Conclusions of the sub-regional Workshop for East African Land Tenure Issues in Natural Resources Management*. Workshop held in Addis Ababa 11 - 15 March 1996.
[213] Haileselassie, A. (2004). "Ethiopia's struggle over land reform." *World Press Review* 51 (4), 2004, pp. 51–55
[214] Solomon, A.H. (2004). "A reality check on the quest for tenure security and land administration in Ethiopia." Paper presented at the Expert Group Meeting on Secure Land Tenure: New Legal Frameworks and Tools, 10–12 November, 2004, Nairobi
[215] Kabubo-Mariara, J. (2007). "Land conservation and tenure security in Kenya: Boserup's hypothesis revisited" *Ecological Economics* 64, 2007, pp. 25-35.

sense of ownership and inspiration. Nevertheless, structural integration of these participatory planning processes into governance systems has not yet materialized in many places.

As long as clear, up-to-date and participatory land use plans, maps and agreements are lacking, actors (farmers, pastoralists, people collecting firewood, logging companies, etc.) do not have significant structural incentives to respect certain spatial boundaries nor conserve biodiversity. This situation promotes land and water degradation, overexploitation of forest resources, biodiversity loss and serious land use conflicts. This threat is quite severe for virtually all ecosystems and countries in the Horn.

6.6. Inadequate governance capacity

Governments, both local and national, seldom possess sufficient data or capacity to respond quickly to changing circumstances such as drought, floods, natural disasters and immigration. Despite the set up of early warning systems for crop production areas in the Horn of Africa, to mitigate food and water insecurity, the responsive capacity is low. Even though the predictions are usually highly valuable, insufficient communication about these forecasted meteorological data to local authorities often leads to a lack of timely follow-up action. Also, when such early warning systems indicate that a period of extreme drought is on the horizon, local governments and farmers have insufficient means to take responsive or preventative actions to cope with that situation[216]. Many just do not know what to do.

Enforcement of rules to tackle illegal practices is also often insufficient. Even if one assumes there is sufficient political and public willingness to effectively combat the illegal activities mentioned earlier (poaching, illegal trade, illegal fishing), there is still a lack of law enforcement capacity. Overfishing is a good example here: whereas the coastal states of the Horn of Africa clearly have legitimate rights over their marine resources, they hardly have the capacity to patrol their waters. Although illegal, unreported and unregulated (IUU) fishing practices are well known, it is almost impossible for Somalia to catch the vessels and/or bring these practices to court. The country lacks a central government to monitor and safeguard its long coastline and territorial waters. Also, the water legislations in these countries do not have the 'legal teeth' to enforce these laws and protect their resources from outside fishing vessels. It is even repeatedly reported that IUU fishing vessels open fire when they are caught in the act[217].

Another example of poor governance is the inefficiency, mismanagement and corruption in the forest management sector, which hinders the effective conservation of forest. The lack of commitment from some responsible bodies to enforce forest protection is striking[218].

---

[216] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action.* Summary report. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm

[217] UNEP (2005), *National Rapid Environmental Desk Assessment – Somalia*. Available at: http://ocha-gwapps1.unog.ch/rw/RWFiles2006.nsf/FilesByRWDocUNIDFileName/TKAE-6TV94M-unep-som-2005.pdf/$File/unep-som-2005.pdf

[218] Personal communication, Ethiopia, April 2009.

6.7. Knowledge, attitude and behaviour

Society's attitude and values towards nature and conservation have a significant impact on the wellbeing of resources. For example, a lack of recognition of the value and role of forests in supporting life, development and health may lead to misuse and mismanagement of forest. Indigenous knowledge and value systems based on centuries of observation that developed in response to changing social and environmental conditions are crucial ingredients for forest conservation. A good example of this is the Guji Oromo tribe in the southern highlands of Ethiopia. Although the livelihoods of its members largely depend on agriculture and pasture, this tribe generally respects and protects the forest and its surrounding nature. Another good example of the importance of indigenous value systems is the careful conservation of the forest reserves around religious sites such as churches and mosques (see text box 5.2 on church forests). In many cases, however, local communities and these indigenous knowledge and value systems are not sufficiently involved in the management of the forests. Urban-biased policies that consider the economic value of mining, agriculture, transport and energy superior over the value of forests, also contribute to forest degradation in the region[219].

6.8. Conflict and insecurity

Repeated conflicts and civil war in various parts of the region have displaced thousands of people from Kenya, Uganda, Sudan, Ethiopia, Eritrea and Somalia. Some find shelter – often provided by UNHCR and other aid organisations – in camps within their own country (IDP camps). Others are crossing the border and have taken shelter in refugee camps over there. Nowadays, especially the fighting in Somalia brings about huge displacement. Many Somali entering Kenya arrive in Dadaab, just past the Somali border. Three overcrowded camps there house 270,000 people. Extension of the camps is desirable but complex, as there is simply not enough land for the thousands more expected to arrive[220]. This situation has caused loss of critical infrastructure and markets, wiping out the regional agricultural production capacity.[221] Massive displacements of population due to prolonged conflict and instability disrupted the critical time of planting and harvesting for large parts of the farming community[222]. Furthermore, the inflow of refugees from Somalia and Eritrea altered the food security situation in Kenya, Djibouti and the Somali and Afar regions of Ethiopia. Migration from Ethiopia and Somalia also has a tremendous effect on food insecurity in Djibouti City. Although the southern part of Sudan is very fertile, the acute malnutrition rate in this region is one of the highest in the world due to conflict and displacement of people[223].

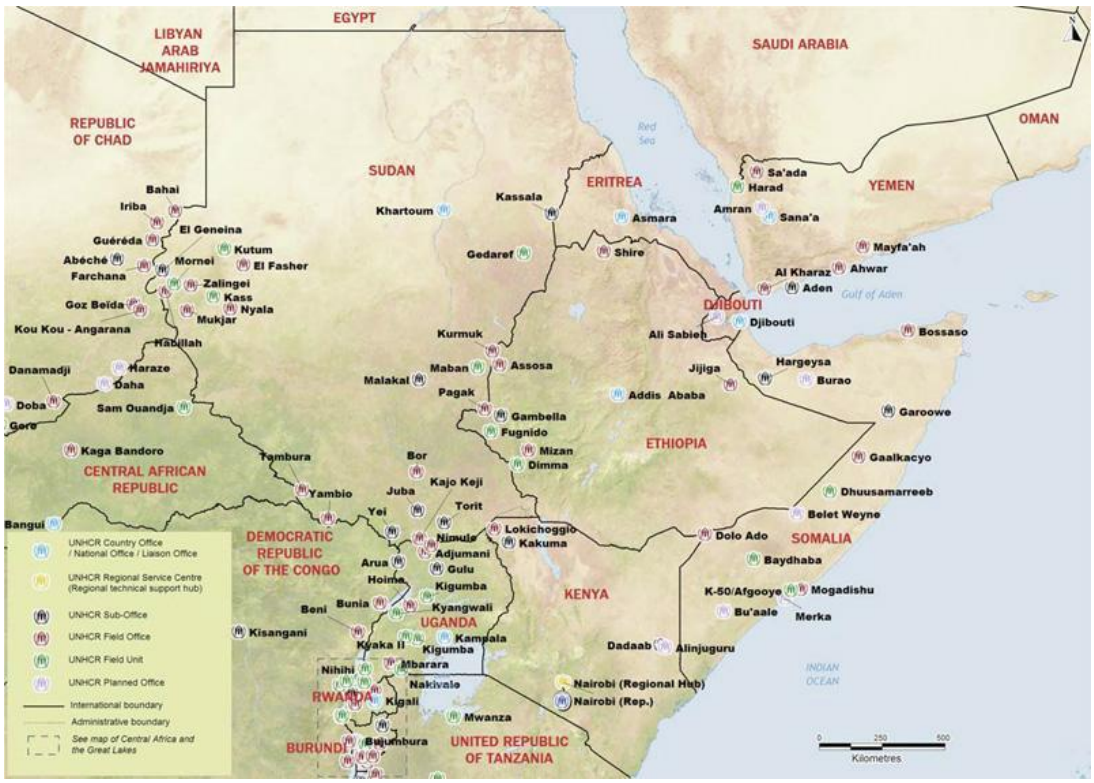
Mass migration also strongly affects the level of forest degradation. For instance in Darfur, where two million displaced people have been living in camps since 2003, there has been

[219] Baland, J.M., and J.P. Platteau (1996). *Halting Degradation of Natural Resources: Is there a Role for Local Communities?* Oxford University Press, Oxford.
[220] UN News Service (2010). "Somali refugees strain resources of neighbouring countries, UN official warns". *UN Daily News*, 3 May 2010. Available at: http://www.un.org/news/dh/pdf/english/2010/03052010.pdf
[221] Red Cross (2009). *Horn of Africa: Exceptional Food Security Crisis Appeal and Budget revision*. Available at: http://www.ifrc.org/docs/appeals/08/MDR64003REA.pdf
[222] WFP (2010). *Somalia.* Available at: http://www.wfp.org/countries/somalia
[223] WFP (2009). *Djibouti.* Available at: http://www.wfp.org/countries/djibouti

severe deforestation around the larger camps. Between 2003 and 2005, international agencies were the main consumers of construction timber as they set up the infrastructure for IDP camps. It is estimated that 1.5 million kg of firewood is needed on a daily basis to provide the 2 million displaced people with fuel[224].

The effects of violent conflict on biological diversity in the region are also mainly negative. Violent conflicts impacted the environment both directly (as a result of military action) and indirectly. Indirect impacts include the effects of displacement and poor environmental governance on ecosystems. Displacement in Sudan, for instance, resulted in deforestation and unsustainable groundwater extraction in and around IDP camps[225].

Figure 6.2. UNHCR offices and field units in the Horn of Africa[226]



[224] Van Dorp, M. (2009). *"Dealing with energy needs in humanitarian crisis response situations"*. Institute for Environmental Security, The Hague, 2009.
[225] UNEP (2007). *Sudan Post-Conflict Environmental Assessment*, Nairobi.
[226] UNHCR (2010). *Regional Operations Profile - East and Horn of Africa.* Available at: http://www.unhcr.org/pages/49e45a846.html

Conflicts can also weaken the ability of governments and wildlife authorities to enforce conservation and protected-area policies. This can have long-lasting devastating effects on the (protection of) biodiversity in conservation areas, even when a peaceful situation has been restored[227].

Recognizing this, Jacobs and Schloeder concluded in 2001 that Ethiopia's *"prolonged engagement in various armed conflicts in the last 25 years"*, has resulted in an *"increase in the number of threatened and endangered species and deleterious habitat modifications"*[228].

Another effect of war is the increased availability of guns. Modern weaponry provides warlords with the capacity to retain their dominant position. Especially when these warlords are involved in resource-based economies, such as logging or poaching (Sudan), or in dumping nuclear waste (Somalia), this can have a very serious effect on environmental security of the region. The huge availability of deadly weapons is an increasing problem in pastoral areas in Sudan, and northern Kenya and Uganda. Especially in times of drought and (food and water) insecurity, the use of weapons during 'traditional' grazing conflicts or cattle wrestling greatly enhances insecurity among pastoral communities.

6.9. Climate change

Climate change poses significant threats on ecology and human life worldwide. In the Horn of Africa climate has also shown some changes during the past decades. These changes included:

- an accelerating rise in night time temperature[229]; day time temperature seems to remain stable.
- an intensifying bipolar rainfall pattern, with increasing rainfall over the northern sector of the Greater Horn of Africa, and declining amounts over the southern sector (large parts of Kenya, Uganda, as well as Burundi, Rwanda and Tanzania)[230];
- an increase in the frequency of anomalously strong rainfall, causing floods[231];
- large geographical and temporal variation in the observed rainfall trends[232]; this variability can largely be explained by the occurrence of El Nino[233].

---

[227] Jacobs, M.J. and C.A. Schloeder (2001). *Impacts of Conflict on Biodiversity and Protected Areas in Ethiopia.* Washington, D.C.: Biodiversity Support Program.

[228] idem

[229] Christy, J.R. W.B. Norris, and R.T. McNider (2009). "Surface Temperature Variations in East Africa and Possible Causes." *J. Climate,* in press

[230] Schreck, C.J. and F.H.M Semazzi (2004). "Variability of the recent climate of eastern Africa". *International Journal of Climatology*, 24 (6), pp. 681-701.

[231] Shongwe, M.E., Van Oldenborgh and Van Aalst (2009). *Projected changes in mean and extreme precipitation in Africa under global warming, Part II: East Africa.* Nairobi, 2009

[232] Schreck, C.J. and F.H.M Semazzi (2004). "Variability of the recent climate of eastern Africa". *International Journal of Climatology*, 24 (6), pp. 681-701.

[233] Butterfield, R. (2009). *Extreme rainfall seasons in East Africa.* Available at: http://www.weadapt.org/wiki/Extreme_rainfall_seasons_in_East_Africa

Future

The region is seen as highly vulnerable to climate variability and change, e.g. due to the strong dependence on rainfed agriculture, the limited capacity of people and institutions to adapt to changing circumstances, as well as high poverty levels[234]. Therefore, fear about the future impacts of climate change is highly understandable. It is, however, not so easy to make predictions. In general, many regions in Africa will suffer from more droughts and floods, with greater intensity. Also, temperatures are expected to rise, resulting in a decrease of areas suitable for agriculture, as well as declining yields.

More uncertainty exists, however, at the regional level. In the IPCC report, restricted computational facilities, lack of human resources and insufficient climate data are blamed for the fact that very few regional to sub-regional climate change scenarios have been developed in Africa. Nevertheless, the reports by the Intergovernmental Panel on Climate Change (IPCC) suggest that in eastern Africa (including the Horn of Africa): temperatures will rise; average rainfall is expected to increase in the long term[235]; extreme weather events will occur more frequently; sea levels will rise; and marine acidification will increase.

Temperature rise

The increasing level of atmospheric carbon dioxide is causing a rise in atmospheric temperature[236]. One combination of models points out that for the period 2080-2099, annual mean surface air temperature is expected to increase between 3 and 4°C, compared with the 1980-1999 period. In equatorial and coastal areas this warming will probably be less significant. Other experiments point at even stronger temperature rises. It is hard to say, therefore, how large the temperature rise will generally be in East Africa. However, there is no doubt that temperature will rise.

Changing precipitation patterns

Whereas many regions in Africa are expected to become not only hotter but also drier, global climate models indicate that the Horn of Africa will experience wetter conditions in the course of this century, and more extreme weather events. Depending on the model used, climate change may result in increased flooding, but may also result in prolonged droughts – the other extreme[237]. Yet, the Royal Dutch Meteorological Institute (KNMI) concludes in a recent report that models show clear trends of increasing floods in East Africa[238].

[234] Slingo, J.M., A.J. Challinor, B.J. Hiskins and T.R. Wheeler (2005). "Introduction: food crops in a changing climate" *Philosophical Transactions of the Royal Society,* Series B 360, 2005, pp. 1983–1989.
[235] Arnell, N.W. (2006). "Global impacts of abrupt climate change: an initial assessment." Working Paper 99, Tyndall Centre for Climate Change Research, University of EastAnglia, Norwich, 37 pp.
[236] Intergovernmental Panel on Climate Change (2001). Third Assessment Report of Working Group II on Climate Change Impacts, Adaptation and Vulnerability, Summary for Policy Makers, 2001.
[237] Global Humanitarian Forum (2009).*The Anatomy of a Silent Crisis.* Human Impact Report Climate Change.
[238] KNMI (2006). *Changes in extreme weather in Africa under global warming.* Available at: http://www.knmi.nl/africa_scenarios/brochure_Afrika.pdf

The results of the CLIP regional model calibrated for East Africa show a high degree of variability within the region[239]. In some regions, such as Somalia and eastern Ethiopia, these results show a "double trend" of increasing intensity of both floods and droughts.

Sea level rise

Sea level worldwide is expected to show a rise as a result of glacier retreat, ice melt and thermal expansion of sea water in response to higher temperatures. This has serious implications for low-lying coastal areas of the region. Large parts of the coastal population in Djibouti (60,1%), Sudan (49,5%), Kenya (40,2%), Eritrea (31,2%) and Somalia (31%) would be subject to inundation risks from intensification of storm surges and sea level rise[240].

Enlarged marine acidification

Dissolved carbon dioxide is anticipated to increase as well, causing enlarged marine acidification. This significantly affects marine ecosystems and marine species[241].

Impacts of climate change in the Horn of Africa

Changing climatic patterns are expected to pose great threats to food and water security, public health, natural resources and biodiversity, also in the Horn of Africa[242]. Although certainty about these climate trends is still limited, the expected impacts on food security, ecology, livelihoods and health are briefly described here.

Food security

Large variations in rainfall, through strong floods and prolonged drought periods, can have a destructive effect on crop production. Moreover, rising temperatures are expected to have an adverse effect as well, contributing to food insecurity in the region. Climatic changes may, however, also have some positive effects on agricultural development and food security in the Horn of Africa. The expected increase in rainfall – also during dry seasons – may for instance compensate the negative impacts caused by temperature rise.

Health

Floods increase the risk for spreading diseases. This includes diarrhoea, rodent-borne diseases and vector-borne diseases such as malaria and dengue[243]. Along with an increase in

[239] Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda (2007). *Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, pp. 433-467.

[240] Dasgupta, S., B. Laplante, S. Murray, D. Wheeler (2009). Sea-Level Rise and Storm Surges: A Comparative Analysis of Impacts in Developing Countries. Policy Research Working Paper 4901, The World Bank Development Research Group, Environment and Energy Team, April 2009.

[241] Intergovernmental Panel on Climate Change (2001). Third Assessment Report of Working Group II on Climate Change Impacts, Adaptation and Vulnerability, Summary for Policy Makers, 2001.

[242] Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda (2007). *Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, 433-467.

[243] Red Cross Red Crescent Climate Centre (year unknown), *Health risk management in a changing climate: a global approach to building local capacity.* Available at:

temperature, vector-borne diseases will more easily extend to higher altitudes and higher latitudes. This may further prolong transmission seasons in some endemic locations. Moreover, floods may limit people to reach public health services, and may deteriorate public health infrastructure directly or indirectly. Furthermore, the declining food security situation is anticipated to cause malnutrition and related diseases[244].

Ecology

The changes in local and regional climates may accelerate extinction of endangered species and vulnerable ecosystems. Prolonged drought is causing animal migration and conflict between wild life and people in parts of Ethiopia, Kenya and Sudan. Temperature variations are expected to affect seasonality of the breading and flowering of fauna and flora. Forest fires are increasing in places where summers become warmer and drier. Prolonged periods of summer drought would transform areas already sensitive to fire into regions of sustained fire hazard. Mount Kenya and the Gambella region of Ethiopia, for instance, are already subject to frequent fires, which may intensify.

Also, marine ecosystems and marine species may be significantly affected by marine acidification. Calcifying organisms such as corals and shellfish are very vulnerable, due to their sensitivity to changes in carbon chemistry[245]. Moreover, the reproductive capabilities of some marine species are at risk.

Livelihoods and economy

The livelihoods of the people in the Horn of Africa strongly depend on rainfed agriculture, pastoralism and fishery. Agriculture employs about 80% of the population in Ethiopia, Eritrea and Sudan, 75 % of the population in Kenya and 65 % of the population in Somalia[246]. Yet this sector is challenged by many factors, among which climate-related disasters like droughts and floods[247]. The occurrence of more frequent droughts in the Horn of Africa would cause tremendous problems for those depending on agriculture for their livelihoods. As pastoralism is highly vulnerable to drought, the estimated 25 million pastoralists living in the Horn of Africa are expected to be among the major victims of climate change. (Due to severe drought caused by a shortage of rainfall for a prolonged period in 2009, 20 million people in the Horn of Africa were subject to food aid[248].)

---

http://www.climatecentre.org/downloads/File/programs/Rockefeller%20short%20project%20description%20for%20website.pdf

[244] UNEP (2006), *Africa Environment Outlook 2 – Our Environment, Our Wealth*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.

[245] Intergovernmental Panel on Climate Change (2001). Third Assessment Report of Working Group II on Climate Change Impacts, Adaptation and Vulnerability, Summary for Policy Makers, 2001.

[246] Central Statistics Agency (2004). *The Federal Democratic Republic of Ethiopia Statistical abstract for 2003.* CSA, Addis Ababa, 2004.

[247] Jones, S. P.G. and P.K. Thornton (2003). "The potential impacts of climate change in tropical agriculture: the case of maize in Africa and Latin America in 2055". *Global Environmental Change* 13, 2003, pp. 51–59.

[248] WFP (2009), *Hunger Lingers In Horn Of Africa Despite Rains.* Available at: http://www.wfp.org/stories/hunger-lingers-horn-africa-despite-rains

Climate change also poses a threat to other economic opportunities in the region such as tourism. Areas are becoming hotter and drier, which significantly reduces the scenic appeal for tourists and has a negative impact on tourism. The retreat of glaciers on Mount Kilimanjaro, Mount Kenya and the Ruwenzori Range may significantly affect mountain tourism, as well as animals and plants downstream, which depend on annual glacier-melt. This will directly disturb the tourism industry. Similarly, fishery may also be affected due to changes in marine ecosystems[249]. These effects outlined here clearly demonstrate how economic development can be hampered by current and future climatic changes.

[249] Brander, K. (2006), *Assessments of possible impacts of climate change on fisheries.* Berlin, 2006. Available at: http://www.wbgu.de/wbgu_sn2006_ex02.pdf

CHAPTER 7. CONCLUSIONS

The availability of life-supporting ecosystem services and goods for human needs and natural processes in the Horn of Africa is heavily threatened. Responding to these threats first requires a careful analysis of the different factors and actors on which environmental security - and insecurity – depends. This chapter starts with an assessment of driving forces and underlying causes for environmental insecurity, to some extent summarising chapters 5 and 6. The second part of the chapter will focus on the implications, in particular the relationship between environmental insecurity and human security and conflict.

7.1. Analysis of causes

Various areas in the Horn of Africa are in a state of environmental insecurity. Main problems include land degradation and desertification, deforestation and forest degradation, loss of biological diversity, pollution, as well as food and water security. In many parts of the region, these matters are very serious and lead to significant social, economic and health-related problems. Origins of the problems differ, though, and the gravity of the situation is more pronounced in certain regions than in others.

Table 7.1 Summary of threatened ecosystems[250]

Countries	Threatened ecosystems	Main direct threats
Djibouti	Mangroves, wetlands, semi-desert and marine	Overgrazing, overfishing, pollution, firewood
Eritrea	Dry ever green, marine	Deforestation, overfishing, illegal trade, war, firewood,
Ethiopia	Afroplain, sub afroplain, dry evergreen montane and grassland complex, moist evergreen forest, semi-desert and wetlands	Deforestation, overgrazing, charcoal production, fire, hunting, human encroachment, diseases, exotic species
Kenya	Afroplain, sub afroplain, dry evergreen montane and grassland complex, moist evergreen forest, wet lands and marine ecosystem	Overgrazing, overfishing, water pollution, illegal trade, alien species
Somalia	Coastal mangroves, wetlands, grass land, semi-desert	Deforestation, overgrazing, political instability, alien species
Sudan	Marine, desert, wetlands, afroplain and savanna	Illegal trading, deforestation, overgrazing
Uganda	Forest, savanna, moorlands and fresh water	Deforestation, overgrazing, pollution,

[250] Animal Info (2009), *Threatened ecosystems.* Available at: http://www.animalinfo.org/

* Category endangered includes official categories: "Critically endangered" and "Endangered"

** Category lower risk includes official categories: "Lower risk/conservation dependent", "Near threatened", "Data Deficient" and "Least Concern"

The assessment indicates that the problems are largely driven by the increasing demand for wood and expansion of agricultural areas. In the past decade, national governments have increasingly become involved in non-transparent and probably lucrative land deals, leasing out large areas of land to private investors for the cultivation of food crops, biofuel crops and flowers. The large demand for farm land, food and energy (biofuels, charcoal) from Europe, Asia and the Middle East has, for that reason, quite an impact on environmental security in the Horn of Africa. The expansion of farm lands has caused displacement and insecurity among the original land users. In many cases pastoralists are further marginalized and are forced to find green pastures elsewhere for their cattle, camels, sheep and goats. The inadequate management of waste, the poor protection of natural resources, and illegal resource extraction such as overfishing are other environmental security threats.

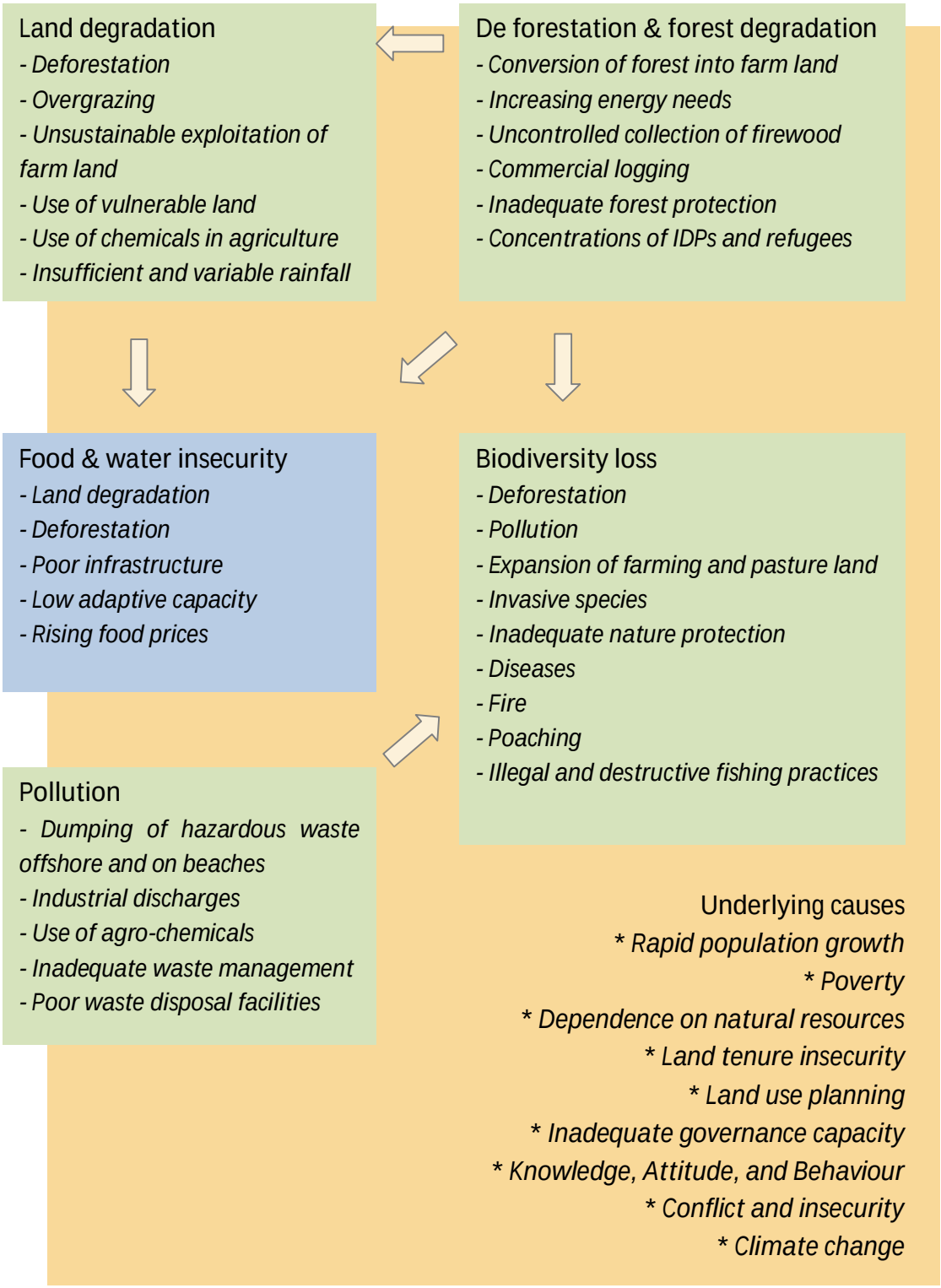
This whole set of threats, or driving forces, is rather diverse, although there are some common characteristics: increasing human pressure on the natural environment leads to excessive exploitation, while most of the actors involved are unable to manage these rapid changes in a fair and sustainable way. Hence overexploitation of resources damages ecosystems, at the expense of other stakeholders that are dependent on the services that these ecosystems (used to) provide. Intense conflicts of interest arise, not only locally, but also on a regional and even international scale. The political dispute on the Nile River demonstrates the seriousness of such resource conflicts. Many disputes have the potential to develop into very serious conflicts, often including a significant element of violence.

Conflicts arise also on a local level. Traditional customs regarding the access and sustainable use of land and water are shifting. Local leaders are suddenly faced by the influx of commercial farming on traditional pasture lands and increasing water scarcity. Traditional land management and dispute settlement systems are not well fit to respond to these modern challenges.

Rapid population growth adds to the gravity of these challenges. It can be regarded as a structural destabilizing factor in society, causing large disruptions in and between communities. Population growth can also lead to significant problems at a national scale. Many rural citizens whose traditional livelihood systems cannot feed them anymore feel forced to move to urban areas, where their situation is not likely to improve and where pressure on resources (energy, building wood, water) builds up.

Land tenure insecurity is another major structural factor, mainly – though not exclusively - in Ethiopia, Eritrea and Kenya. The chronic insecurity about ownership, use and succession of land prevents people from making long-term land investments, applying soil management techniques, planting trees and selling land when needed. Despite land tenure reforms in some countries, tenure systems are still very complex, lacking transparency, coherence and fair implementation. Therefore it still constitutes a common structural problem for millions of people in the Horn of Africa.

Figure 7.1. Analysis of causes



Insufficient waste management and poor protection of natural resources by the authorities are structural weaknesses through which forest and land degradation, pollution and biodiversity loss more easily occur. There is also a great need to better manage all these demographic and environmental changes; the current level and process of planning in most

regions is inadequate. To improve environmental security, overcoming these structural and institutional problems is absolutely crucial.

Structural	Institutional
Rapid population growth	Lack of regulation/law enforcement
Dependence on natural resources	Poor land use planning
Poverty	Policy and institutional failure
Failure of traditional livelihood systems	Knowledge, attitude and beliefs
Migration and human settlement	Poor waste management
Climate change	Land tenure insecurity

7.2. Implications

The various social and environmental problems discussed in previous chapters have wider implications with regards to:
* Time: environmental problems and resource use can have very serious implications on the longer term, even on future generations;
* Scale: resources in the region are strongly interrelated, especially with regards to hydrology; developments in one area can have huge effects on (people in) other areas;
* Level of concern: relatively small environmental problems can lead to health problems, water and food insecurity, economic damage, regional insecurity, and even violent conflicts.

Analysis of these problems demonstrates that many of these effects intensify the original problems: vicious cycles occur. This section focuses on the relationship between environmental problems and security.

Food insecurity and violent conflicts
When not addressed properly, land degradation sets in motion a vicious cycle. Land degradation reduces land productivity, negatively affecting the availability of food. It also impacts livelihoods and incomes of millions of already marginalized people that occupy these degrading areas. This further worsens food insecurity and poverty, which in turn exacerbates degradation, as people are forced to fully exploit their lands for survival. Low productivity of farm lands, moreover, forces people to cultivate marginal lands more intensively, with fewer opportunities to replenish the soil[251]. In doing so they further diminish its productivity and the cycle continues.

Such vicious cycles also occur in fishery. Many fishermen in Kenya and Uganda have experienced declining catches in the past decades. As a result, small fish that were traditionally never caught are now caught to make up for the declining yields. With high population growth rates and inadequate measures taken, fishery clearly exceeds sustainable levels. Similar patterns hold true for many other problems, such as poaching and overgrazing.

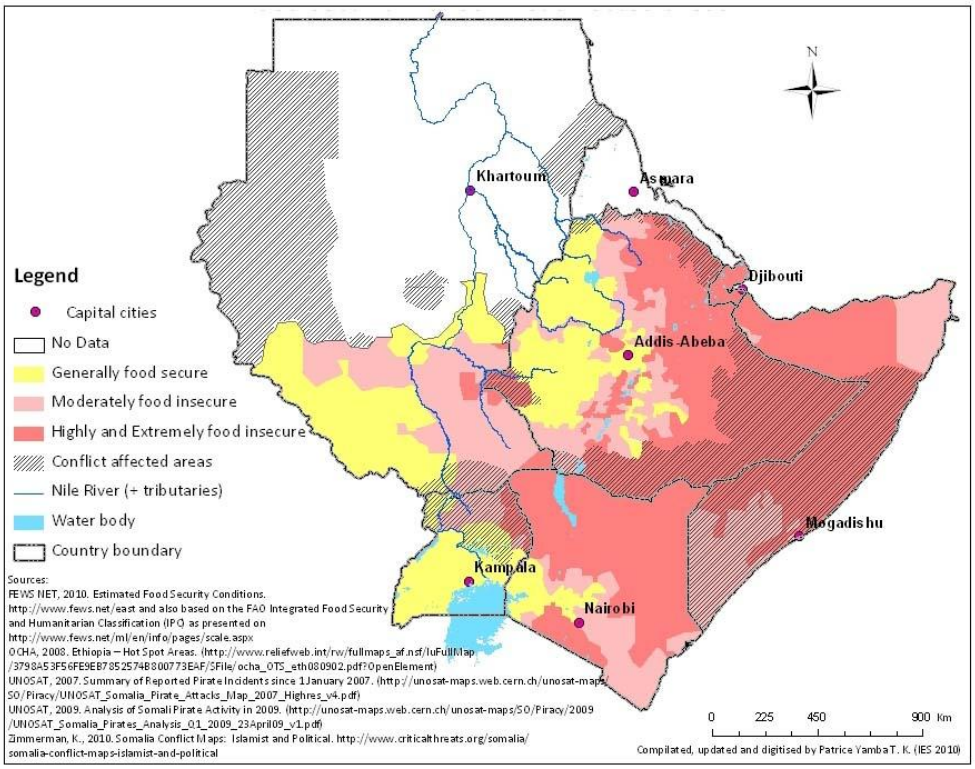
[251] FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action.* Summary report. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm

In addition to land degradation and other factors, political instability has also contributed to famine[252]. Repeated conflicts and civil war in various parts of the region have caused loss of critical infrastructure and markets that wiped out the area's agricultural production capacity[253]. Massive population displacements in Eritrea, Kenya, Sudan and Somalia due to prolonged conflict and instability disrupted the critical time of planting and harvesting for millions of farming households[254]. Furthermore, the inflow of refugees from Somalia and Eritrea altered the food security situation in Kenya, Djibouti and the Somali and Afar regions of Ethiopia, whereas migration from Ethiopia and Somalia had a tremendous effect on food insecurity in Djibouti City. Another example of the relation between political stability and food security is Southern Sudan. Although the region is very fertile, the acute malnutrition rate is one of the highest in the world, due to persistent conflict and displacement[255].

Apparently, collapsed livelihood systems result in unemployed youth and frustrated 'social infrastructure'. In places with hardly any alternative livelihood opportunities, this may lead unemployed youth to engage in crime and violence. This is clearly illustrated in the case of Somalia where desperate local fishermen have been confronting large illegal fishing vessels with violent means. For a long time, these local fishermen have been operating on both sides of a blurred line between protection of their marine resources and acts of piracy, without much attention from the international community. These days an increasing number of Somalian youngsters is converting to piracy as a last resort, now also heavily attacking many other types of international vessels[256,257]. As a result the Somali high seas are among the most insecure waters in the world, which has a very negative effect on global trade and causes a great deal of regional and international instability[258].

[252] UNEP (2006), *Africa Environment Outlook 2 – Our Environment, Our Wealth*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP), Nairobi, Kenya
[253] IFRC (2009), *Horn of Africa: Exceptional Food Security Crisis - Appeal and Budget revision*. Emergency appeal MDR64003, 23 June 2009.
[254] World Food Programme (2009), *Somalia.* Available at: http://www.wfp.org/countries/somalia
[255] World Food Programme (2009), *Djibouti.* Available at: http://www.wfp.org/countries/djibouti
[256] Merchant, B. (2009), *How Overfishing Almost Got Capt. Phillips Killed by Pirates.* Available at: http://www.treehugger.com/files/2009/04/overfishing-pirates-phillips-somali.php?dcitc=TH_rotator
[257] Waldo, M.A. (2009), "Somali Piracy: the other side of the coin." *Africa prospects*, October 2009, pp. 8-11.
[258] Davies, D. (2009), "Somali pirates increase the stakes." *Africa prospects*, October 2009, pp. 12-15.

Figure 7.2. Food insecurity and conflict affected areas



Water

Water security is a central element in livelihoods, economy, social life and politics in the Horn of Africa. As water availability is a precondition for peace and prosperity, water scarcity is a key factor in the origin of conflicts and loss of livelihoods. From large international political conflicts to local disputes about water use – and anything in between, water makes or breaks relationships.

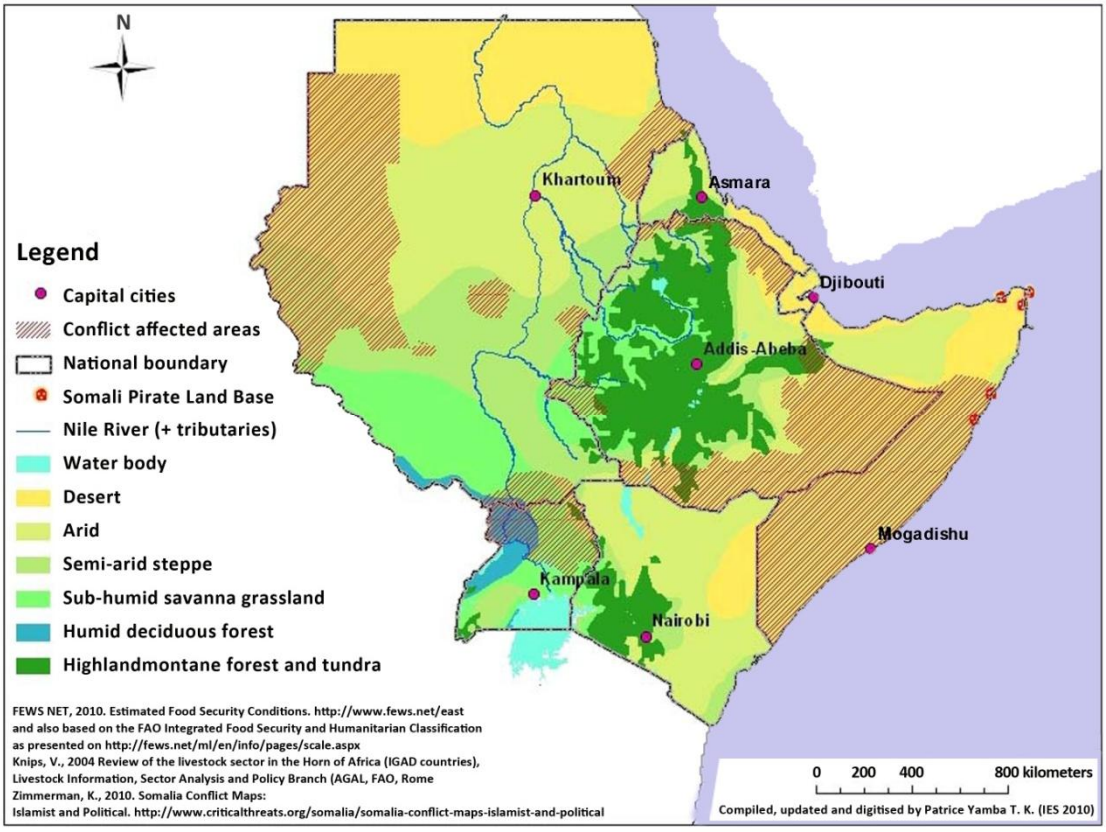
The Nile River is a good example of that; it is a source of life, as well as a source of conflict. The river supplies water for millions of people in the Horn of Africa - up to Egypt. Plans to use more water for irrigated agriculture in Uganda and Ethiopia, to replace rain-fed agriculture, face a great deal of resistance and are regarded as an assault on Egypt. The planned construction of hydro-electricity dams and plants adds to this perceived security threat. Allocation of the water is, to some extent rightfully, regarded as a zero-sum game: water used by upstream countries cannot be used by Egypt.

Another considerable threat to the Nile flow comes from some of the main environmental problems in the region: forest degradation and overgrazing. Normally, the roots of plants absorb and hold considerable amounts of water to be released slowly into the soil and – through evaporation – into the atmosphere. Moreover, vegetation holds and protects the soil. Disturbing this natural mechanism, through excessive depletion of trees, shrubs and grasses, thus leads to soil erosion and exacerbates drought. In Ethiopia, deforestation of the mountainsides around Lake Tana has seriously degraded water quantity and quality in the

lake[259]. As the source of the Blue Nile, the Lake Tana watershed has local and international significance. A deterioration of the hydrological integrity of the Lake Tana watershed, therefore, has very large implications for the lives and livelihoods of millions of Ethiopian, Sudanese and Egyptian citizens; effects that may be larger than all planned irrigation and hydro-electricity schemes combined.

The Nile River is not the only example of resource competition. All over the Horn of Africa - and beyond - small farmers, pastoralists, wildlife, agricultural companies, horticultural enterprises and other stakeholders are competing over land and water. In the past five decades almost all violent conflicts were to some extent linked to water access. These conflicts, especially severe during extreme weather circumstances, have displaced millions of people. Conflicts range from high intensity civil wars (Darfur-Sudan) to skirmishes between livelihood groups, as do often occur between different pastoralist communities, or between pastoralists and sedentary farmers. Of all the climatic elements, aridity and precipitation are known to be the major factor influencing conflicts in the region[260]. Forest, land and watershed degradation, therefore, strongly add to local and regional instability. Figure 7.3 below demonstrates that especially desert, arid and semi-arid regions in the Horn experience conflicts.

Figure 7.3. Ecological zones and conflict affected areas



[259] FESS (2009), *Lake Tana Watershed*. Available at: http://www.fess-global.org/Lake_Tana.cfm
[260] Nkomo, J.C., A. O. Nyong, K. Kulindwa (2006), *The impacts of climate change in Africa.* Available at: http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/media/8AD/9E/Chapter_5_The_Impacts_of_Climate_Change_in_Africa-5.pdf

7.3. Regional perspective

It is impossible to refer to the Horn of Africa as one single region. It consists of a great variety of ecological zones, from desert ecosystems to montane forests ecosystems. Vegetation of the region is highly varied and depends on precipitation levels, hydrological systems and altitude, which differ greatly throughout the region. Moreover, the Horn of Africa is very diverse socially and politically and economically. The existing problems are not identical. Relatively intact marine biodiversity in Sudanese coastal waters cannot be compared to the threats to the fish stocks in Lake Victoria; the level of forest protection in National Parks in the west of Uganda is different from conservation efforts in Southern Sudan; land degradation in some parts of Ethiopia is more significant than in other parts of the country.

Despite all differences, this assessment has demonstrated that it is necessary to adopt a regional perspective to the situation. First of all the Horn of Africa should be seen as a regional security complex, in which the security problems of one region depend very much on the security of all. Different conflicts feed in to each other, such as the Ugandan LRA destabilizing Southern Sudan; and the Eritrea-Ethiopia conflict that affects the civil war in Somalia. Also with regards to all kinds of social and economic developments, regions are closely interdependent. The use of natural resources in one area can have a big impact elsewhere. Millions of people depend on the services provided by ecosystems (often upstream, managed and shared by others), such as drinking water, ground water, climate regulation, clean air, etc. The role of the Ethiopian, Kenyan and Ugandan highlands is especially relevant in this respect, for the storage, buffer and provision of water for downstream communities.

The effects of internationalisation are also felt in the Horn: external actors and factors have a great impact. What happens in the region cannot be seen separately from developments in other parts of Africa and beyond. Some examples: Egyptian water needs impact the way in which countries such as Uganda and Ethiopia can develop irrigation and hydro-electricity schemes; charcoal trade with Saudi Arabia and the United Arab Emirates has led to resource scarcity in Somalia and already led to violent confrontations over access to the acacia groves in the south[261,262]; European energy policies that were taken to mitigate climate change lead to increasing demand for land to grow biofuels in Ethiopia, Kenya and Sudan, thereby affecting forests and grazing land.

These examples suggest that the net effects of internationalisation are negative. This is not necessarily true. International trade, tourism flows, international student exchange programs, water management projects, and development cooperation have many great positive effects, e.g. on economic development, nature protection, agricultural innovation and water and food security in the Horn of Africa. Many international organisations have initiated or supported projects aimed at enhancing the ability of communities to manage

[261] Baxter, Z. (2007), *Somalia's Coal Industry*, ICE Case Studies, 201, May 2007. Available at: http://www.american.edu/ted/ice/somalia-coal.htm

[262] Reuters (2010). "Somalia charcoal exports fuel war – minister." *Relief Web, 15 March 2010.* Available at: http://www2.reliefweb.int/rw/rwb.nsf/db900sid/SNAA-83L9CU?OpenDocument

natural resources in a sustainable way, monitor and adapt to changing climatic circumstances, settle disputes peacefully, etcetera. In annex A of this report some of these initiatives are described.

This Environmental Security Assessment underlines the multifaceted relationship between environment and conflict in the Horn of Africa. Environmental degradation can have significant consequences with respect to food and water security, social tensions and conflicts. Resource scarcity can manifest itself also directly and indirectly in increased tensions and conflicts over land or water sources. The next part of this report describes some hotspots; regions where the struggle over resources strongly affect human security and regional stability.

PART IV – Hotspots

Some specific areas characterised by environmental insecurity can be identified as hotspots and therefore deserve some more attention and explanation:
There are regions in which the struggle for distribution of resources has the potential to lead to violent conflict. Some of these (potential) conflicts will be portrayed: Ogaden region, and Southern Sudan (including Abyei), and the Boma-Gambella region This serves to demonstrate that resource factors often play an underlying or triggering role in the rise and the development of violent conflicts in the Horn.
Also there are regions in which sustainable resource development is key for the development of millions of people. It is important for scientists and policy makers to recognize this. These regions include the Mau Forest, Lake Tana, Omo river, Bale Mountains. There are great opportunities for (international) action to enhance environmental security in these areas.

Chapter 8 zooms in to many of these so-called environmental security hotspots. Chapter 9 makes an assessment of the security implications for the respective countries.

CHAPTER 8. HOTSPOTS

8.1. Mau Forest

The Kenyan Mau forest is a protected area at the heart of Kenya's natural water supply system. It is a closed-canopy forest ecosystem, covering over 400, 000 hectares. The 12 rivers stemming from the Mau forest are the lifeline for millions of people, making it a very important water tower. Its rivers feed many important ecosystems in the wider region, including Tanzania's Serengeti and Lake Victoria. As such, the forest supports key economic sectors in Uganda, western Kenya and northern Tanzania, including energy, tourism, subsistence crops, livestock and cash crops such as tea and rice[263].

Over the last more or less fifteen years these forests have been cleared by tens of thousands of people, to provide for settlement and agricultural production. It is estimated that about 116,000 hectares (about 27 percent of the forest cover) have been deforested as a result[264]. This has brought about huge disruption of the forest ecosystem as well as all the rivers and areas that depend on the hydrological services of the Mau forest. "This is no longer a Kenyan problem," said Kenyan Prime Minister Raila Odinga, emphasizing the large transboundary effects of the problem. As many of the rivers flow into Lake Victoria, the source of the Nile River, he added that even Egypt is "feeling the heat from the Mau"[265].

Many experts have warned that significant socio-economic and security effects will occur when encroachment and unsustainable exploitation of the forest ecosystem continue[266]. The Kenyan government therefore found - and still finds - itself in a quandary between the interests of thousands of Kenyan settlers in the Mau forest, and the interests of millions of people in Kenya and beyond.

A special Task Force appointed by the Prime Minister therefore stated that eviction of its inhabitants and replanting trees as the only solution to restore the region's water deficit. In 2009 and 2010 the Kenyan government has been developing plans for the eviction of settlers and rehabilitation of the forest. Almost 20,000 families in the hills of the Mau forest therefore needed to be evicted from their lands. Of those families living in the forest, less than 2,000 are estimated to have genuine title deeds. Even the legality of those 2,000 title deeds can be questioned, as the Mau forest has had a protected status for over many

[263] Republic of Kenya (2010), *Rehabilitation of the Mau Forest Ecosystem - Executive Summary*, Interim Coordinating Secretariat, Office of the Prime Minister, on behalf of the Government of Kenya, support from UNEP. Available at: http://www.unep.org/roa/kcp/Mau/Docs/MAU_Executive_Summary.pdf
[264] idem
[265] BBC News (2009), "Kenya's heart stops pumping", *BBC News, 29 September 2009.* Available at: http://news.bbc.co.uk/2/hi/8057316.stm
[266] Kenya Environmental & Political News Weblog (2010), "Mau Forest Appeal Brings Multimillion Dollar Pledges And Hope To Kenya". *Kenya Environmental & Political News Weblog*, 6 May 2010, Available at: http://kenvironews.wordpress.com/2010/05/06/mau-forest-appeal-brings-multimillion-dollar-pledges-and-hope-to-kenya/

decades. The planned evictions spurred ethnic tensions in the country, which has complicated decision-making enormously[267].

Funded by international donors, evictions and restoration activities have now partly been implemented. Over 20,000 hectares of land have been reclaimed by the government in 2009 and 2010, a few thousands of which have been replanted. The Kenyan government still finds itself in a very difficult position. The evicted people need to be relocated and need assistance in resettlement and employment creation outside the forest. Future invasions of the forest need to be overcome through good law enforcement. At the same time, it needs to take a careful approach to overcome the existing ethnic tensions. Plans and procedures are very well thought out, but whether and how the Kenyan government will further implement this very difficult and sensitive "Mau Forest Program" remains to be seen.

8.2. Southern Sudan

In Southern Sudan nothing is certain. Even when some kind of certainty exists, it never lasts for long. In 2005 the national government and the Sudanese People Liberation Movement (SPLM) signed a peace agreement that ended the civil war. Following that agreement stability returned to a certain extent. Violent confrontations continued in states like Abyei and Jonglei. Moreover, LRA rebels from Northern Uganda are attacking southern Sudanese villagers regularly. Also, the referendum for independence of Southern Sudan - scheduled for January 2011 - is currently upcoming. This referendum and its outcomes have the potential to turn the region upside down again.

Despite widespread poverty, the situation in many parts of (Southern) Sudan is relatively stable. Some states are characterised by considerable conflicts though. In the state of Jonglei local tensions are growing between various pastoral communities that are migrating with their cattle. According to the International Crisis Group, access to water and grazing areas, as well as cattle rustling, are increasingly important triggers of conflict here. Tensions between these communities are aggravated by tribalism, food insecurity and land disputes[268]. In the region of Abyei, located on the north-south border, a similar situation exists. Different pastoral communities compete for grazing land and water. Main groups are the Misseriya, who are generally loyal to the north, and the Dinka Ngok, part of the largest ethnic group of the south.

Abyei is the main oil producing region of Sudan. The 2005 Comprehensive Peace Agreement provides for an equal sharing of oil revenues between north and south, with special administrative status given to Abyei, as it is located on the border between north and south. A severe border dispute and a series of violent clashes followed, resulting from a complex combination of pastoral conflicts, political motives and, most certainly, huge oil interests. The clashes in 2008 killed dozens and displaced tens of thousands of people, mainly Dinka Ngok. Afterwards, both governments agreed to hand over the issue to the Permanent Court

[267] Rugene, N. (2009), "Endless feuding over Mau likely to stir ethnic tension." *Daily Nation, 20 June 2009.* Available at: http://www.nation.co.ke/News/politics/-/1064/613364/-/view/printVersion/-/rbqljm/-/index.html

[268] International Crisis Group (2009), *Jonglei's tribal conflicts: countering insecurity in South Sudan.* Africa Report N°154, 23 December 2009.

of Arbitration in The Hague. The Tribunal in the Peace Palace ruled on the border dispute in July 2009, redrawing the boundaries of Abyei, thereby decreasing the size of the region. This ruling put two of Sudan's oilfields in the north rather than as part of the Abyei region. In the upcoming 2011 referendum, the citizens of the Abyei region will decide whether to join the south or the north[269]. This decision has great impact on the future relations.

Good relations are especially important with regards to oil production, which is crucially important for the Sudanese economy – see chapter 2.3. Large oil deposits are located in the south, whereas the processing and marketing facilities are located in the north. Cooperation is therefore essential, and will benefit both Sudan and Southern Sudan. Experts view such 'built-in interdependence' between the countries as a good thing, assuming its potential peacebuilding effect.

In a country with many pastoral movements, free traffic of people and goods is crucial. However, with the 2011-referendum and probable declaration of independence coming closer, the boundary between Sudan and Southern Sudan became an increasingly worrisome obstacle for many pastoral communities in the 'border region'. The recent conclusion of an agreement between the two governments on making the north-south border a 'soft border', allowing for unhindered movement of people and goods, is therefore a good sign. It is seen as an important step towards peaceful relations between Sudan and South Sudan.

Nevertheless, what will happen in the near future remains to be seen. The Sudanese government is alleged of having strong connections with the LRA rebels whose continuing violent attacks create great chaos and panic in Southern Sudan. Given the polls, it is practically certain that Southern Sudanese will choose for independence when they get the chance. But what will happen in Abyei, and whether Sudan will respect the outcomes of the polls, is undecided. Only time will tell how (economic) cooperation between the countries will be like, and how the situation at the borders will develop. A further crucial question is whether the Government of Southern Sudan will be able to establish functioning and effective state institutions? Or will it become just another failed state on the African continent?

8.3. Ogaden

The Ogaden desert is the area in the eastern part of Ethiopia, bordering Somalia. It is mainly inhabited by ethnically Somali pastoralists, and was conquered by the Ethiopian emperor Menelik II in 1891. The ensuing territorial claims to the region by various Somalian rulers and 'liberation forces' have led to many violent confrontations in the region. In 1977 and 1978, Ethiopia and Somalia fought the Ogaden War over control of the desert and its peoples. Despite heavy conflicts and bloodshed, the situation has not changed much. These days, pastoralists demanding autonomy for the Ogaden region are gathered in the Ogaden National Liberation Front (ONLF).

[269] US Energy Information Administration (2010), *Country Analysis Brief Sudan.* Available at: http://www.eia.doe.gov/cabs/Sudan/Background.html

In the Ogaden desert oil explorations are taking place. The potentially significant oil and gas reserves in the region have drawn interest from (foreign) oil and gas companies, the Ethiopian government and from the people living in the region. The ONLF is demanding Ethiopian authorities and foreign oil and gas companies to stop exploration of resources in 'their' Ogaden region. The group said oil firms had cleared some 1,600 square kilometers, displacing locals and destroying vegetation. They also accuse the Ethiopian regime of committing genocide and war crimes in the region[270].

Protests from the ONLF rebels are characterised by heavy violence. Over the past 25 years they have killed large numbers of Ethiopian soldiers, oil workers and civilians. Meanwhile, their claim for autonomy is not taken very seriously by the Ethiopian government nor the international community[271, 272].

8.4. Conflicts over the Nile

The use of water resources of the Nile by different riparian countries is of special importance for this part of Africa. Contention over this issue has jeopardized political relations between the countries of the Horn of Africa and downstream countries Sudan and Egypt. The Nile is a vital water and energy source for the countries through which it flows. Especially the economy and livelihoods of downstream Egypt strongly depend on the Nile. Based on a colonial treaty, Egypt and Sudan claim the right to use all water from the Nile. This treaty was signed in 1929 by Egypt and Britain (which was the colonial power at that time in Kenya, Sudan, Tanzania and Uganda), and signed again in 1959 by Egypt and Sudan. It states that none of the other countries in the Nile basin can tap the river's water without permission from Cairo[273]. After more than 80 years, despite all political and economic transformations, these treaties still stand in international law.

Ethiopia, whose strategic central location in the Horn of Africa has its advantages as well as disadvantages, increasingly wants to use water for irrigation, hydro-electricity, and other development projects to feed its growing population[274]. The same is true for the other riparian countries, especially Kenya and Uganda. However, as Egypt must consent to other nations' use of the Nile's water, most of the other basin countries have not developed projects that use it extensively. Egypt's legal veto power, withholding development and increasing energy and food insecurity, brings about strong tensions in the other Nile basin countries. According to Patricia Kameri-Mbote, who has published widely on this topic, it is

[270] Reuters (2009), "Ethiopian rebel group threatens foreign oil companies." *Ethiopian Review, 3 June 2009.* Available at: http://www.ethiopianreview.com/content/9943

[271] Mbendi (year unknown), *Oil and gas in Ethiopia.* Available at: http://www.mbendi.com/indy/oilg/af/et/p0005.htm

[272] Black Marlin Energy (year unknown), *Ethiopia.* Available at: http://www.blackmarlinenergy.com/Kenya-Oil-Exploration/ethiopia.aspx

[273] Kameri-Mbote (2008), "Water, Conflict, and Cooperation: Lessons From the Nile River Basin", Environmental Change and Security Program Report 13, 2008-2009. Available at: http://www.wilsoncenter.org/topics/pubs/ECSPReport13_NavigatingPeace.pdf

[274] Flintan, F. and I. Tamrat (2009), "Spilling Blood over Water? The Case of Ethiopia", In: *Scarcity and Surfeit*; *the ecology of Africa's conflicts, Lind, J. and K. Sturman (eds), Institute for Security Studies, chapter 6, p.244.*

highly reasonable that other basin countries are increasingly contesting the validity of these old treaties[275].

These growing tensions have been intensified by threatening declarations by Egyptian politicians, such as the late President Anwar al-Sadat, who stated that *"any action that would endanger the waters of the Blue Nile will be faced with a firm reaction on the part of Egypt, even if the action should lead to war."* Given the relative strength of the Egyptian armed forces compared to the other military forces in the region, there is no doubt about who would win such a war.

Nevertheless, in May 2010, after years of unsuccessful negotiations with Egypt and Sudan, five Nile Basin nations (Ethiopia, Uganda, Tanzania, Rwanda and Kenya) have signed a deal that would replace the old treaty of 1929 and put in place a more equitable system of water management. The signing of this 'Cooperative Framework Agreement' has strongly angered Sudanese and Egyptian diplomats and politicians, and has put a temporary hold on Nile Basin Initiative (NBI) negotiations and technical cooperation.

8.5. GilGel Gibe dams

The Omo River runs over almost 1000 km of land in southwestern Ethiopia, draining into the Kenyan Lake Turkana. The long-term Gibe-Omo Cascade project was set up to build a series of dams along the Omo River. This project includes Gilgel Gibe I (which is operational), Gibe II (which is nearly completed) and Gibe III (which is under construction).This series of dams will physically and economically transform the region, bringing both positive and negative consequences to the wider region and its people[276]. The project has raised special concern to a number of stakeholders.

First of all, the Ethiopian government is enthusiastic about the project given its prospects for generation and export of electricity. According to the government, the dam would double the power-generating capacity of the nation with over 1800 megawatts of power. It also hopes to earn hard currency by selling excess power to Djibouti, Yemen, Kenya, Uganda, Sudan and Egypt[277]. Further benefits include a regulatory effect on the hydrologic balance of the Omo River system and Lake Turkana, thereby decreasing the likelihood of extreme and devastating floods[278]. In July and August 2006, floods killed hundreds of people and displaced tens of thousands[279]. Engineers state that such floods will not happen anymore when the Gilgel Gibe III dam is in place.

---

[275] Kameri-Mbote (2008), "Water, Conflict, and Cooperation: Lessons From the Nile River Basin", Environmental Change and Security Program Report 13, 2008-2009. Available at: http://www.wilsoncenter.org/topics/pubs/ECSPReport13_NavigatingPeace.pdf

[276] Graetz, R. (2008), *Environmental and Social Impacts of the Proposed Gibe III Hydroelectric Project in Ethiopia's Lower Omo River Basin*, African Resources Working Group, University of Montana, 2008, p.6., Available at: http://d.yimg.com/kq/groups/3764128/1939144819/name/Gibe

[277] VOA News (2009), "Environmentalists Ask Bank to Stop Funding Gil Gel Gibe III". *VOA News, 8 May 2009.* Available at: http://www.voanews.com/horn/Environmentalists-Ask-Bank-to-Stop-Funding-Gil-Gel-Gibe-III.cfm

[278] Ethiopian Electric Power Corporation (2009), *Gibe III EIA – Additional Study on Downstream Impacts*, 2009, pp. 3-4.

[279] IRIN News (2006), "Ethiopia: malaria a major threat as flood emergency continues". *IRIN News,* 24 August 2006. Available at: http://www.irinnews.org/Report.aspx?ReportId=60446

Environmental experts, however, draw attention to a possible catastrophe to the natural environment in the region. There is a natural cycle of events involving plants and animals because of the seasonal flood of the Omo River. About 200,000 people subsist from that natural cycle, be it directly through flood retreat cultivation or through other ways such as transporting and commercialising the goods, such as honey or fish, harvested or extracted from the region. Gilgel Gibe III could furthermore seriously impact the level of Lake Turkana, affecting the livelihoods of up to 300,000 people. This poses another major threat to security and stability in the region. In other words, about half a million people that depend on the river and lake, e.g. for recession cultivation, fishing and lakeside livestock grazing at the lake, may be seriously impacted.

Other scientists say the lake level will decrease with 7 to 10 meters in the first five years after the construction of the dam. They fear that resulting changes in the chemical balance of the water will threaten the region's tremendous biodiversity (including large populations of Nile crocodiles, hippopotamus, and over 40 different species of fish and snakes). The riparian forest, one of the last pristine dryland forests in Africa, would also be endangered[280]. Also, it is not clear yet how long it will take to fill Gibe III's massive reservoir, during which time dam operators may only release 25m^3 per second. This may create a prolonged dry season, which could last up to several years.

There is, however, strong disregard for these environmental and social matters, as demonstrated by the fact that an Environmental and Social Impact Assessment (ESIA) was not published until two years after the start of the construction work. Furthermore, many experts state that this study has been performed inadequately, by insufficiently taking into account the effects on the various downstream communities living near the Omo River and Lake Turkana. Because of these important shortcomings, the World Bank and the European Investment Bank have decided not to fund the project. For the Italian government and the African Development Bank (AfDB) however, this has not been a reason to reject funding[281].

The Gilgel Gibe III project plans lead to fears that major human rights violations will occur in southwestern Ethiopia. Various civil rights and economic and social rights are under threat, according to environmental experts and international lawyers[282]. Secondly, the belated release of the final ESIA report in January 2009 by the Ethiopian Electric Power Corporation – two years after construction had began – was a violation of Ethiopia's environmental laws, which require an impact assessment to be approved prior to the start of construction[283]. Thirdly, the non-inclusion of relevant stakeholders is not compliant with the OECD

[280] Angelei, I. (2009), "Ethiopia's Omo River dam to cause environmental disaster." *Ethiopian Review, 5 March 2009*. Available at: http://www.ethiopianreview.com/content/8785
[281] BBC News (2009), "The dam that divides Ethiopians", *BBC News,* 26 March 2009. Available at: http://news.bbc.co.uk/2/hi/africa/7959444.stm
[282] Odaguiri, F. (2009), *Possible violations of international human rights law in the region possibly affected by the construction of the hydroelectric dam Gilgel Gibe III in Ethiopia.* Research paper, Institute for Environmental Security, September 2009. Available on request.
[283] Muchira, N. (2010), "Ethiopia prepares case for mega-hydropower project funding." *Engineering News*, 5 February 2010. Available at: http://www.engineeringnews.co.za/article/ethiopia-prepares-case-for-mega-hydropower-project-funding-2010-02-05.

Guidelines on Multinational Enterprises. These are the key principles for ethical corporate behaviour for companies based in the member states of the Organisation for Economic Cooperation and Development (OECD). Although Salini Costruttori S.p.A. is based in Italy, a founding member of the OECD, the company clearly ignores these guidelines.

Despite the expected positive economic effects for Ethiopia, lives and livelihoods of the communities living around Omo River and Lake Turkana may be severely threatened by the construction of the Gilgel Gibe III Dam that is now under construction. This situation potentially causes severe frustrations among the affected population, and may have negative impacts on economic and political stability and security in this part of Africa for a very long time to come.

8.6. Bale Mountains ecoregion

Another region in Ethiopia that can be identified as a hotspot is the Bale Mountains ecoregion. It belongs to the western section of the south-eastern Ethiopian highlands with altitudes ranging from 2000 to almost 4400 meter. The mountains encompass Africa's widest expanse of alpine heaths and grasslands, and enclose one of the country's largest high tropical moist forests (Harenna forest). The Bale Mountains ecoregion, with its wide diversity of habitats and species, is an internationally recognized centre for endemism and biodiversity. A quarter of mammals, 6% of birds and a significant number of flowering plants in the area are endemic to Ethiopia[284]. In addition, it contains the entire global population of the Giant Mole rat, the largest global populations of endangered Ethiopian Wolves and the Mountain Nyala. The forests are the birthplace of the famous 'coffea arabica' and still keep the largest remaining natural stand of wild coffee genetic stock. To protect the indigenous flora and fauna species of the Bale Mountains, a National Park, Wildlife Reserve and Controlled Hunting Area have been established.

Flowing from this spectacular massif are many swamps and streams, 40 rivers and 5 major rivers that are vitally important to the unique semi-arid and arid ecosystems in the lowlands of south-eastern Ethiopia, Somalia and northern Kenya. In effect the Bale Mountains provide many ecosystem services to the large population of the region. Approximately 12 million people downstream in the Ogaden and Somalia are dependent on these ecosystems for their livelihoods[285]. Especially in drought seasons, therefore, the Bale Mountains serve as a safety net for surrounding communities. It is estimated that, theoretically, the value of all direct and indirect ecosystem services of the Bale Mountains together (hydrology, recreation and tourism, crop production, livestock, timber, firewood and non-timber forest products, wild food, medicinal resources, genetic stocks, carbon absorption, electricity production, soil stabilisation, flood prevention, etc.) is at least 812 million US dollar per year, and can add up to almost 1,8 billion US dollar per year[286].

[284] Oromia Authority for Research and Conservation of Cultural Heritage (2008), *The Bale Mountains National Park.* Available at: http://whc.unesco.org/en/tentativelists/5315

[285] Frankfurt Zoological Society (2007), *Bale Mountains General Management Plan: 2007 to 2017.* Available at: http://zgf.de/download/166/BMNP_GMP_2007.pdf

[286] Osterreichische Bundesforste (2009), *Assessment of the Value of the Protected Area System of Ethiopia,*

However, human activities such as deforestation, overgrazing, illegal logging and hunting are increasingly threatening the wellbeing of the eco-region[287]. It is estimated that almost 22,000 people are living inside the National Park, keeping cattle (livestock numbers are estimated at up to 168,000 in 2004) and cultivating teff, maize, potatoes and coffee[288]. As a result, forests in the whole region and the Harenna forest in particular are shrinking at an alarming rate. Elephants and buffaloes have already vanished from the Harenna forest in the 1950s. The destruction has accelerated in the past 40 to 50 years.

The causes of habitat destruction are deeply rooted in the increasing population pressure in the area and the lack of proper land use management. People are increasingly settling in the area, including on the most vulnerable parts of the mountains, as high as 3000 meters. Because of the use of the lower lying lands for farming activities, the indigenous pastoral communities have been pushed to higher and more sensitive parts of the afro-alpine ecosystem. Overgrazing on these parts of the mountain can cause irreversible damage to the ecosystem and biodiversity. All wolf populations below 3,700 meter are particularly vulnerable to further habitat loss[289]. The construction of a road to and through the Bale Mountains and the "land investment" policy of the government are other factors that further promote land degradation and habitat loss.

The Bale Mountains ecoregion lacks good land use management plans and appropriate institutional and policy frameworks for conservation-based development. Despite its official protected status since 1969, the National Park was never properly gazetted by the government[290]. Therefore, apart from some natural barriers like altitude and temperature there are no significant constraints to the use of land and other natural resources; it remains largely uncontrolled. The absence of land use planning processes further aggravates the problem created by population pressure: unplanned and unrestricted settlement by the local people and outsiders is mounting in the region[291].

The effects are threefold. First of all, the disruption of water catchment areas in the highlands has the potential to trigger water insecurity in the lowlands. It is expected that the reduced water flow from the highlands in the Bale Mountains can lead to lower agricultural productivity and tensions over water resources in lower-lying areas. Further it aggravates water insecurity in Somalian and Northern Kenyan regions, having an intensifying effect on desertification in these areas. Secondly, land use has become a source of tension between

---

"Making the Economic Case", Volume II: Main report, September 2009.

[287] Conservation International (2007) *Eastern Afromontanes.* Available at: http://www.biodiversityhotspots.org/xp/hotspots/afromontane/Pages/impacts.aspx

[288] Osterreichische Bundesforste (2009), *Assessment of the Value of the Protected Area System of Ethiopia, "Making the Economic Case", Volume II: Main report*, September 2009.

[289] Sillero-Zubiri, C., and J. Marino (2003), *Ethiopian Wolf; Canis simensis.* Available at: http://www.canids.org/species/Ethiopian_wolf.pdf

[290] Frankfurt Zoological Society (2007), *Bale Mountains General Management Plan: 2007 to 2017.* Available at: http://zgf.de/download/166/BMNP_GMP_2007.pdf

[291] Williams, S. (2005), *Review of activities and achievements, 2000-2004 and future work.* Ethiopian Wildlife Conservation Programme. Available at: http://www.carnivoreconservation.org/files/issues/wolf_ethiopian_conservation_achievements.pdf

farming and pastoral communities in the region. Scarcity-driven violent confrontations will likely erupt more often, as has already occurred on a modest scale. Similar struggles have been experienced in parts of Kenya and Sudan. Thirdly, as an internationally recognized biodiversity hotspot it is apparent that the Bale Mountains have immense tourism and eco-business potential. However, with the present alarming rate of destruction continuing, the possibility to exploit this potential is very low.

This region shows how management of resources in one particular region can be of vital importance for water and food security in other regions. In an effort to restore and rehabilitate the core of the area (the National Park), the Ethiopian Federal government has taken over the management of the National Park from the regional government of Oromia a few years ago. It is hoped that this will result in better management and protection. Given the continuing road construction and destructive land policies, however, this management shift may have come too late and may prove to be insufficient. The Bale Mountains, which always used to serve as a safety net for surrounding communities in drought seasons, may fail to feed its own population within only a few years.

8.7. Boma- Gambella ecoregion

The transboundary Boma-Gambella ecoregion extends from south-west Ethiopia to south-east Sudan and is comprised of the National Parks Gambella (in Ethiopia) and Boma (in Southern Sudan) and their immediate surroundings. Whereas Gambella National Park (2002) and Boma National Park (1977) have officially been designated as protected areas, both national parks have never been properly gazetted. Civil war in Southern Sudan and the discovery of commercial quantities of oil have obstructed the proper protection of Boma. The status and actual boundaries of Gambella National Park are still controversial; steps to fully protect the National Park by law have never been taken yet.

As landscape, climatic and hydrologic features are rather similar on both sides of the national border it can be referred to as one ecoregion. The region's ecosystems provide significant economic, esthetic and social services, on both sides of the border. Gambella National Park includes the largest low-lying wetland of Ethiopia. Many rivers – such as the Baro, Akobo and Gilo rivers - originate from the highlands of Ethiopia and flow through the lowlands of Gambella and the neighboring Boma region[292]. Boma National Park is located in-between rivers in the west (Kangen), east (Oboth) and south (Kurun) and borders the Guom swamps in the north. The plains of Boma are flooded regularly, as part of the Sudd fresh water wetland system, Africa's largest wetland[293]. The region's relatively intact ecosystems provide habitats for many wildlife including the endemic white-eared kob and Nile lechwe, elephant, giraffe, common eland, giant eland, oryx, lion, wild dog, buffalo, topic (locally called Tiang), waterbuck, Roan antelope, zebra, bushbuck, Abyssinian reedbuck, warthog,

[292] BirdLife International (2009), *Important Bird Area factsheet: Gambella National Park, Ethiopia.* Retrieved at 1 July 2010 from http://www.birdlife.org

[293] WCS (2007), *Boma-Jonglei , Southern Sudan.* Available at: http://www.wcs.org/saving-wild-places/africa/boma-jonglei.aspx

hartebeest and hyena[294]. Therefore, the tourism potential of the region is significant. The Austrian Forest Service has mapped the different functions Gambella National Park fulfills (such as agriculture, fishing, livestock grazing, household water, medicinal plants, carbon sequestration, biodiversity conservation, water quality control, flood mitigation) with an estimated value between USD 64 million and USD 2 billion per year[295].

The different ethnic societies[296] living in the region have a shared culture and history. Some ethnic communities (such as the Anuak, Murle and Maruwa) base their livelihood on cultivation, while others (like the Nuer, Maruwa and Sur) are primarily pastoralists. Population density in the ecoregion is rather low. Although these tribes have been living together in harmony for centuries, the combination of migration, growing pressure on land and food insecurity have intensified competition for control over natural resources[297]. This has led to violent confrontations between some of the tribes. Easy access to small arms and replacement of traditional conflict resolution mechanisms by dysfunctional government structures are exacerbating insecurity in the area.

Although ecosystems in the Boma-Gambella ecoregion are relatively intact, their long term well-being is now increasingly under threat[298]. Large scale irrigated agriculture is booming in the Boma-Gambella ecoregion, largely as a result of incentives from the governments of Ethiopia and South Sudan, promoting investment in this sector[299]. Despite the potential positive economic effects of these investments, they may give rise to some highly negative implications. The environmental impacts of intensive large scale agriculture include deforestation, land degradation, pollution with agrochemicals and loss of biodiversity.

Adding to these concerns is the rapid increase in foreign investment in agricultural land in Gambella for large-scale food production. Huge land deals are made by the government, despite the fact that original land users are hardly ever consulted during the planning and the acquisition process[300]. People have reported displacements and land grabbing without any compensation. A related matter of concern is the lack of a clear land use plan. Activities affecting these vulnerable ecosystems in the Boma and Gambella ecoregion are not based on a clear vision or plan, taking into account the various ecosystem services and ecological values of the region. The Ethiopian government, for instance, has claimed that large parts of

---

[294] WCS (2007), *Southern Sudan.* Available at: http://www.wcs.org/where-we-work/africa/southern-sudan.aspx

[295] Osterreichische Bundesforste (2009), *Assessment of the Value of the Protected Area System of Ethiopia, "Making the Economic Case", Volume II: Main report*, September 2009.

[296] The dominant tribes in the Boma region are Murle, Maruwa Jie, Suri and displaced people that are predominantly Dinka, according to Lual Deng (2001), *The impact of conflict on Boma National Park, the status of food security, livestock and wildlife.*
The tribes in Gambella region range from Anuak, Nuer, Majangir, Opo and the Komo, as stated in Huysmans R., (2009). *Land security and livelihoods,* research report Institute for Environmental Security. Available on request.

[297] Amum, P. (2008), *An Assessment Report on Illegal Bushmeat Trade and Consumption in and around Boma National Park in Southern Sudan, Draft Report.* College of African Wildlife Management, Mweka, Tanzania, 2007.

[298] USAID (2008), *Evaluation of the USAID/Sudan Sudan Transitional Environment Program (Step) implemented by International Resources Group (IRG)*. Available at: http://pdf.usaid.gov/pdf_docs/PDACM088.pdf

[299] Cotula, L., S. Vermeulen, R. Leonard, J. Keeley, 2009, *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* IIED/FAO/IFAD, London/Rome

[300] Gadaa.com (2009), "Ethiopia: UN Study Confirms the Land Grab in Oromia and Elsewhere Poses Risk to Farmers." *Gadaa.com*, 27 May 2009. Available at: http://www.gadaa.com/oduu/?p=646

Gambella are wasteland, and therefore available for large agricultural companies. Yet most of these lands have been reported to be community land and (seasonal) pasture land[301].

The current developments, which are most serious in Gambella region, lead to expanding deforestation, illegal settlements inside protected areas, and destruction of valuable and vulnerable wetlands, dehydrating the entire ecoregion. This situation may have major negative effects on food security, the potential for irrigated agriculture, as well as on social and political stability. It reduces the resilience of the already vulnerable region to natural disasters such as extreme events of flooding and droughts. Moreover, the declining ground water table can have disastrous implications for irrigated agriculture and for the potential for hydro-electricity generation, e.g. on the Baro river. The communities depending on the natural resources in the region are already marginalized economically and politically. Neglecting their rights from utilizing these resources may give rise to new grievances and conflicts, on both sides of the border.

Irrigated agriculture, wildlife conservation, tourism development, energy production and maintaining the well-being of local communities are all desirable, but do not always go hand in hand. Responsible choices need to be made by the various governing bodies. Unless carefully planned, a further growth of large scale agriculture is expected to have immense impacts on the well-being of the people and their ecosystems, and will intensify environmental insecurity and instability in the region.

[301] Cotula, L., S. Vermeulen, R. Leonard, J. Keeley, 2009, *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* IIED/FAO/IFAD, London/Rome

CHAPTER 9. COUNTRY OVERVIEW

Countries	*Main social and environmental issues*	*Main resource-related security implications (internal & international)*
Djibouti	• Land degradation • Food and water insecurity • Biodiversity loss (invasive species) • Water pollution	
Eritrea	• Land degradation and desertification (overgrazing) • Food and water insecurity	• Border dispute with Ethiopia • Presence of land mines
Ethiopia	• Land degradation • Deforestation • Food and water insecurity • Energy needs	• Pastoral conflicts (including cattle raids in the south) • Local resource conflicts • Impact of environmental degradation (e.g. Bale Mountains) on downstream communities • Impact of land and water allocations (land leases, dam constructions) on livelihoods of communities • Political tensions with Sudan and Egypt over distribution of the Nile waters.
Kenya	• Land degradation • Deforestation • Food and water insecurity • Overfishing in Lake Victoria and other lakes • Biodiversity loss	• Pastoral conflicts (including cattle raids in the north) • Resource scarcity adds to the existing (ethno-political) tensions in the south-west of the country • Mau Forest degradation impacts Kenyan and Tanzanian communities: source of tension
Somalia	• Food and water insecurity • Land degradation • Charcoal trade with Arab peninsula leads to deforestation • Overfishing in Indian Ocean • Pollution (including toxic waste)	• Warlords fighting over power, territory and scarce resources • Conflicts over acacia groves for charcoal production • Piracy • Millions of people seeking refuge in Kenya and on the Arab Peninsula

Sudan	• Land degradation • Deforestation • Food and water insecurity • Oil explorations	• Many pastoral conflicts (including many cattle raids in the south and east) • Tensions on expected independence of Southern Sudan (including interests of oil revenues in the south) • Political tensions with the other Nile Basin countries over Nile water • Security problems for (female) IDPs and refugees in Darfur and Southern Sudan
Uganda	• Food and water insecurity • Deforestation • Overfishing in some of the lakes • Oil exploration in Lake Albert • Land degradation	• Land related disputes (over grazing lands, boundaries, protected areas) • Tensions with Sudan and Egypt over distribution of Nile waters • Tensions over oil resources with neighbouring DR Congo • Cattle raids in the north (e.g. Karamojong)

PART V – Pathways to Action

Changing the trend and moving towards a Horn of Africa that is more ecologically, socially and economically sustainable is not easy. But it is possible. Many enthusiastic individuals in various private sector, governmental, non-governmental, academic and donor organisations can make a difference together. Already all kinds of initiatives and projects have been, or are being explored, in order to tackle environmental security threats. Some of them do not work, some do. This chapter is a modest effort to describe some potential pathways to action, based on the environmental security assessment.

The role of multilateral organisations

Many problems occur, in varying degrees, throughout the entire region. Given the transboundary character of many problems, cooperation between countries is essential. Therefore, the multilateral organizations - as mentioned in chapter 2.5: African Union (AU), Economic Commission for Africa (ECA), East African Community (EAC), Inter-Governmental Authority on Development (IGAD), Nile Basin Initiative - can play an important role in enhancing environmental security in the Horn of Africa, through:

Implementation of international environmental law

The different organizations can contribute to promote the implementation of regional and international environmental binding law. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Convention on International Trade of Endangered Species and the UN Law of the Sea are examples of international conventions that deserve improved and more serious implementation.

Capacity building

Multilateral organizations can serve as a platform to tackle major regional policy constraints such as lack of public participation and transparency. For instance, COMESA tries to encourage public participation in the policy making process through campaigns and discussion blogs. Further, these institutions can activate transparency in the policy implementation phase by building up information gaps between national governments, authorities and the people. Disclosing important information on national and regional issues (including on trade relationships, investments, environment and development) among the member states and to the public can play a role in building trust between governments and their people.

Promote cooperation

Geo-political tensions and lack of cooperation are two apparent constraints that retard regional unity in development. For instance, the opening of borders between countries could make traditional wildlife and pastoral migratory routes accessible and improve food security in the pastoral communities of the region. Furthermore intensive cooperation in natural resource management and trade issues (including banning the export, import and transport of illegally obtained natural resources) can improve the state of the environment in the region. In addition, it will increase stability and help the economy to recover.

Facilitate collective action

The need for comprehensive polices and collective action is becoming inevitable to address the region's complex socio-environmental problems. Multilateral organizations can serve as a platform to bring together governments to develop common stands and to design collective actions on their shared social and environmental problems such as food and water insecurity, climate change and biodiversity loss.

CHAPTER 10. POLICY RECOMMENDATIONS

A. Science and Innovation:

1. Monitoring system

In view of the pivotal role of information, governmental and academic institutions are encouraged to work together to establish environmental information systems for the Horn of Africa. Enhanced meteorological information systems providing data on climate change, rainfall, evaporation and crop production should support decision making by indicating when floods, water or food insecurity are expected. Close cooperation with existing initiatives such as SERVIR-Africa is recommended. Further, data sharing and training is essential to enable governments to organize an adequate and timely response.

Moreover, an international vegetation monitoring system including 'evidence from space' is essential to monitor the adaptation, reforestation and forest protection measures eligible for support under the financial climate mechanisms. A leading role herein can be assumed by the New Partnership for Africa's Development (NEPAD). Since the EU will remain in the forefront of international climate and biodiversity policy and the financing of those policies, it stands to reason that the European Space Agency (ESA) will be employed to provide the needed satellite imagery.

2. Natural Resources and conflict

Competition over access to natural resources can catalyze violent conflicts in the Horn of Africa. Evidence-based policy development is needed to enhance environmental security. Research programmes, such as the Dutch CoCoon programme, should therefore be set up, and focus on the dynamics of conflict and cooperation around natural resources in the Horn.

B. Diplomacy and governance

3. Nile River cooperation

Water makes or breaks relationships. Given the relationship between water security, peace and development in the region, the importance of finding a peaceful solution to the existing tensions regarding the Agreement on the Nile River Basin Cooperative Framework cannot be overestimated. The President of the EU, the European Commission and political representatives of the EU member states should intensify their support for the Nile Basin Initiative and the Nile Basin countries in the Horn to find peaceful and fair solutions for the rising tensions over the distribution of the waters of the Nile River.

4. Transboundary cooperation

Social and political instability in border regions are largely caused by conflicts between pastoralist communities, moving across boundaries. The gravity of these conflicts, largely related to cattle raids, is intensified by the proliferation of small arms in the region. Many of these border areas are among the least developed regions of the Horn. Long term stability of the borders is essential to promote trade, investment and environmental development between bordering countries. Therefore, national and regional governments are encouraged to cooperate with international institutions (such as UNDP, UNMIS, IGAD, and the AU) to develop regional strategies on transboundary control of small arms and prevention of (and responses to) cattle raiding.

In regions with high conservation value, governments of different countries are advised to set up transboundary protected areas. A good example is the border region between Gambella National Park in Ethiopia and Boma National Park in (Southern) Sudan, where a transboundary approach to conservation is likely to contribute to knowledge sharing, tourism development and nature protection. Other potential transboundary protected areas include the spectacular Kidepo Valley National Park, Uganda, and the Kidepo Game Reserve in (Southern) Sudan, located on the border with Kenya. Organisations to assist the respective governments in developing the financial basis and management approach of such a transboundary system include HoA-REC, Wildlife Conservation Society, WWF and the African Parks Foundation. Wildlife authorities of Uganda, DR Congo and Rwanda can provide useful advice, based on their experiences and lessons learned from the Virunga Volcanoes transboundary protected area.

5. Environmental security strategy

To promote regional stability, poverty alleviation and sustainable management of natural resources, the Intergovernmental Authority for Development (IGAD) and national governments are encouraged to draft an environmental security strategy for the Horn of Africa. This strategy should include significant commitments by each of the respective governments to actively promote environmental security, and should ideally be adopted by each of the countries. It could serve as a fundamental document for the region outlining common policy initiatives in the fields of sustainable natural resource management, fair access to resources and biodiversity protection.

6. Land use planning

By creating corridors to facilitate the movement of pastoralists and their herds and securing access to water and grazing lands, land use planning can be a vital peacebuilding tool. This should be arranged through participatory land use planning processes that help to ensure that resource related changes are managed in a rational and fair way. Considering the impacts of climate change and population growth in time, the international donor community should assist national and local authorities to develop long-term regional outlooks, identifying the values, strengths and strategic opportunities of a region. Local land use plans should be based on these integrated regional visions, in which unique ecosystem values should be pivotal elements.

7. Disaster Risk Reduction Revolution

Strengthening food security in the Horn of Africa requires a new mindset. Rather than relying on food aid, preparing for recurrent hazards like drought, floods and disease outbreaks is essential to feed the region's growing population. National governments are advised to take the lead in drafting and implementing strategies to boost communities' resilience to disasters in line with the 'Africa Regional Strategy for Disaster Risk Reduction'. Donor organizations should support such strategies and invest in local and regional production capacity.

Decentralization of disaster risk reduction interventions should be strengthened, for instance. There is an important role for the African Union (AU) and its New Partnership for Africa's Development (NEPAD) to ensure that such an approach towards disaster management materializes. The World Food Programme (WFP) should focus on making its emergency food aid contribute to sustainable development, e.g. by providing food in exchange for work on water conservation, thereby enhancing rural productivity.[302] Urban farming should also be promoted[303].

8. Build up local social institutions

Environmental degradation can lead to forced migration, which has the potential to spur conflicts between migrants and host communities. Such conflicts are accelerated by the breakdown of social institutions that traditionally served to mitigate resource disputes. National governments and the international community should provide (host) communities with support and legal space to build up better dispute settlement mechanisms.

C. Law

9. Land tenure security

Land tenure insecurity is a common problem for millions of people in the Horn of Africa. Significant structural changes are needed to improve land access and ownership for millions of people who risk losing land through competing claims or eviction plans. The international programme of the Dutch Land Registry Office (Kadaster) is encouraged to extend its services also to assist the governments of the Horn (in particular Kenya, Ethiopia and Eritrea) to improve handling of records and update cadastres as soon as possible, while developing transparent land registration procedures.

10. Environmental Assessments

Institutional capacity for carrying out Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs) should be strengthened. Popular participation should become an integral part of the EIA processes. NGOs are encouraged to start campaigns

[302] Based on recommendations by Oxfam Novib (2009), *Band Aids and Beyond; tackling disasters in Ethiopia 25 years after the famine*. Oxfam Briefing Paper 22 October 2009. Available at: http://www.oxfam.org/sites/www.oxfam.org/files/bp133-band-aids-beyond.pdf

[303] Karanja, N., D. Nierenberg, M. Njenga (2010), "Kenya: Urban women grow food in sacks". *All Africa, 18 February 2010*. Available at: http://allafrica.com/stories/201002180809.html

among citizens and decision-makers in the private and public sector to strengthen awareness on the importance of good EIAs and SEAs. Furthermore, it is crucial to develop 'follow-up' mechanisms, ensuring better implementation of recommendations. National governments are advised to cooperate with the Capacity Development and Linkages for Environmental Assessment in Africa (CLEAA) Network, with possible support from the Netherlands Commission for Environmental Assessment (NCEA).

11. Piracy, illegal fishing and illegal waste dumping

Careful consideration should be given to the implementation of Security Council Resolution no. 10092, adopted on 23 November 2010, to fight piracy off the coast of Somalia, while also stressing the importance of preventing illegal fishing and illegal dumping of toxic waste. The EU through its Common Fisheries Policy should ensure that European vessels involved in illegal fishing will not receive any support from the EU. The International Maritime Organisation (IMO) and INTERPOL should step up their efforts to track down and prosecute illegal waste dumping. Piracy, illegal fishing and illegal waste dumping are interrelated problems. As they are all very serious acts of crime, they all should receive a similar level of concern and action.

12. Overfishing

The national governments of Uganda and Kenya are advised to take the lead in combating overfishing in Lake Victoria and other vulnerable lakes, by stopping illegal fishing and by developing criteria to reduce the numbers of operational fishermen.

13. Binding legal framework for biodiversity conservation

Corporate investments in the region, e.g. for commercial farming, can have major impacts on biodiversity. As part of the Convention on Biological Diversity, the EU could help set up an instrument through which (corporate) actors are obliged to compensate the detrimental effects of their activities on biodiversity through investments in biodiversity conservation in the same region or elsewhere, as has been done by the Business Biodiversity Offset Program (BBOP). The framework should also include the possibility to block any (corporate) investments when they threaten areas of exceptional biodiversity value.

14. Land grabbing

There is a rapid increase in foreign investment in agricultural development for large-scale food production and biomass development, directed at export. If requested, the international community should assist the national governments, and in particular the new government of Southern Sudan, in preparing for the influx of large scale land investors, supporting them to develop policies and laws to regulate this development[304].

15. Illegal trade

In September 2010 ministers from many African countries, including Sudan, Kenya and Uganda, drafted a plan to combat the illicit trade of minerals. It is strongly recommended to give high priority to the implementation of the plans to harmonize laws, formalize the

[304] AWEPA (2010), *No Time To Waste: Sustainable Environmental Management in a Changing Southern Sudan.*

mining sector, increase transparency and create a database to trace the origin of minerals bound for export. Not only the national governments, but also importing countries have a responsibility to ban illegally obtained natural resources such as timber and gold. A first step for the EU and its member states is to develop general legislation to forbid the import of any illegally extracted natural resources. Options are discussed in the IES report 'good deal, bad deal', describing what measures European institutions and member states can take to ensure the legality of their imported mining products and natural resources[305].

D. Finance and Economics

16. Payment for biodiversity conservation

All countries of the Horn are Parties to the major Multilateral Environmental Agreements (MEAs) such as the Convention on Biological Diversity (CBD), the UN Framework Convention on Climate Change (UNFCCC) and the Convention to Combat Desertification (CCD), under which they have obligations to conserve and sustainably use the biodiversity in their territories and to contribute to prevent further climate destabilization and desertification.

Ethiopia, as one of the eight so-called Vavilov Centers of Crop Origin, has of course a special responsibility to protect the sites of these wild original crops as they contain vital genetic material to help their productive relatives elsewhere in the world to cope with changing circumstances such as rising temperatures and increasing droughts resulting from climate change. Protecting these sites is an essential service to the rest of the world, which should be adequately compensated by the global community. It is recommended to design contractual arrangements between the Global Environment Facility (GEF) as financial mechanism for the MEAs and the authorities responsible for managing the protection and sustainable use of the sites in which performance indicators, levels of compensation, monitoring mechanisms and dispute settlement procedures are defined. (A model of such a contractual arrangement can be found in the Guiana Shield Initiative's contract between UNDP, one of the GEF's Implementing Agencies, and the Iwokrama International Center in Guyana, which protects and promotes sustainable use of unique, endemic biodiversity[306].)

17. Sustainable energy

Building peace and prosperity in the Horn of Africa requires the development of sustainable ways to meet increasing energy demands in the region, both for electricity generation and for household purposes (cooking, heating). Developing new and innovative energy solutions with large potential, such as micro-hydro, solar power and geothermal power, will stimulate sustainable economic development. Given the large investments, broad applicability and significant profits, public-private partnerships are likely to be suitable institutional arrangements for developing such sustainable energy solutions.

---

[305] De Ville, G. (2010), *Good deal, bad deal: Report of the Conference "Illegal Trade in Natural Resources - What can Brussels do?"* Institute for Environmental Security, November 2010. Available at: http://www.envirosecurity.org/pathfinder/conference/Report_Final_med.pdf

[306] Guiana Shield Initiative website, available at: http://www.guianashield.org

18. Green Climate Fund

The region is vulnerable to the impacts of climate change - to which it hardly contributes. The Horn countries therefore qualify for financing adaptation measures out of the Green Climate Fund, as decided in the UNFCCC COP16 in Cancún in December 2010.

19. Re-Greening the Horn

The international community and national governments are advised to invest in re-greening the Horn, through agro-forestry and reforestation projects. Large-scale tree planting to prevent erosion, regulate the local water cycle and precipitation and the restoration of coastal mangroves to protect against sea level rise and other threats of the communities living on the coast, also sequester CO_2 from the atmosphere. This form of "Global Cooling" is eligible for financial compensation through the selling of carbon credits (Certified Emission Reductions) under the Clean Development Mechanism of the Kyoto Protocol. The remaining forest estates in the Horn may benefit from the REDD+ financial provisions now being developed under the UNFCCC.

Governments are also advised to strengthen their forest protection mechanisms. In particular, church forests in Northern Ethiopia offer great opportunities for the conservation of biodiversity. The government of Ethiopia is advised to actively promote the establishment of corridors for the protection of (church) forests' genetic diversity. Remaining forest estates in the Horn may benefit from the REDD+ financial provisions currently being developed. As the global community wants to ensure that it gets what it pays for, a reliable and transparent monitoring system has to be put in place (see recommendation 1).

The Horn of Africa Regional Environment Programme has set up the Horn Re-Greening Initiative, to prevent further deforestation, to restore damaged forest ecosystems and to develop or strengthen natural resources based value chains in the Horn of Africa. Donor organisations, the private sector and national governments in the Horn of Africa are strongly advised to support this initiative.

20. Water and soil conservation

One of the main measures to combat food and water insecurity is to make better use of existing precipitation and water flows. All national governments are advised to invest in developing and implementing water conservation, rainwater harvesting and irrigation techniques, in collaboration with local and international experts. The techniques are often already developed and existing, such as the sand dams in the Kitui district in Kenya, providing the population with drinking water and water for agriculture in dry seasons.

At the same time, it is crucial to apply large scale reforestation and soil conservation measures, such as terracing, altering existing water courses, and planting of crops on hillsides. The work of the Ethiopian Organisation for Rehabilitation and Development in Amhara (ORDA) is a very impressive example in that respect. Some development organizations have also experimented with encouraging communities to diversify crops and livestock, such as shifting from cattle to more drought-resistant camels. Adapting water

management and agricultural systems to the changing environments and build resilience in the region should be highly eligible for donor support.

21. Funding nature conservation
A multi-donor Horn of Africa Trust Fund should be set up, to finance activities aimed at promoting natural resource management and nature conservation in the region. This could include a *revolving fund*, to provide credit to local environment-related development initiatives, such as on waste management or renewable energy.

22. Waste management
To lower the health risks of millions of citizens, private and public organizations are advised to invest heavily in improving the handling of waste on household level, and in strengthening waste management infrastructure (collection, transport and treatment) in all countries of the Horn. Moreover, national governments are encouraged to ensure that systems are put in place based on the "polluter-pays"-principle. These systems should hold companies and individuals accountable for preventing and restoring damage to the environment and affected populations.

Private, governmental and non-governmental organizations are also encouraged to set up a large education and awareness raising programme, to significantly lower the use of unnecessary pesticides and other agrochemicals.

E. Education and Empowerment

23. Grassroots
For effective and fair results, development assistance should primarily be provided at the local level through non-political organisations. Recent evaluations and reports have shown that funds channelled through Ethiopian local governments (district governments) are not always reaching the target groups and may even effectively support certain political parties and repress others. The World Bank and donor nations, which provide direct support to district governments in Ethiopia for basic services such as health, education, agriculture, and water, should take this criticism seriously and reconsider their support to district governments[307]. In order to spend development assistance - including climate funds - properly in the Horn of Africa (including fragile states like Sudan and Somalia), large parts should be spent through humanitarian organizations, grassroots organizations as well as through churches or religious groups. These are often the only functioning institutional

[307] Human Rights Watch (2010). *Development without Freedom. How Aid Underwrites Repression in Ethiopia.* Available at: http://www.hrw.org/sites/default/files/reports/ethiopia1010webwcover.pdf.
This report demonstrates that criticasters and members of opposition parties are systematically discriminated against and excluded from access to those basic services. The European Union, the United States, the United Kingdom, and Germany are the largest bilateral donors. According to Human Rights Watch, that bases its findings on interviews with citizens, donor officials and other country experts, their aid supports political repression.

channels in these fragile states[308]. This is not only more effective, but also allows the donors to ensure that support to the poorest people is provided equitably.

For sustainable development, the voice of a strong civil society is indispensable. Successful campaigns in Uganda (for protection of national forest reserves, in response to plans to establish palm oil and sugarcane plantations) have shown the strength of the check and balance function of civil society. In particular, the EU is encouraged to support environmental NGOs, in order to maintain and strengthen the important controlling and balancing functions these organizations perform. The Horn of Africa Regional Environment Network (HoA-REN) brings together about 50 NGOs from the region, to share ideas and information and support small scale projects in the region (Environmental Partnership Programmes). In particular, these NGOs, local communities and grassroots organizations should be encouraged to develop the capacity to monitor natural resource based conflicts and to develop early-warning systems for the prevention of conflicts[309].

24. Combat invasive species

Invasive species such as 'prosopis' and parthenium weed pose a serious environmental security threat by endangering the indigenous flora and fauna population and existing ecosystems. Eradication of the invasive species may require a massive operation, for which the involvement of the military, following the example of Djibouti, should be considered.

25. Integrate environment in emergency aid and recovery.

It is crucial to integrate environmental considerations in emergency aid and recovery programmes and budgets, to minimize their negative impacts on the natural environment around refugee and IDP camps. Humanitarian aid organizations are advised to better distribute existing environmental and energy-related guidelines and manuals, such as the Green Recovery and Reconstruction Toolkit recently published by WWF and the Red Cross, and integrate this information in the training programmes of their personnel.

On the HOTSPOTS

A. Gilgel Gibe dams

Lives and livelihoods of the communities living around Omo River and Lake Turkana may be severely threatened by the current construction of the Gilgel Gibe III Dam. While recognizing the energy needs of Ethiopia and Kenya, the international community should be encouraged to take a critical stance in the Gilgel Gibe dam project. In line with the "EU Consensus on Development[310]" the European Union should request all actors involved in building the Gilgel Gibe dams *(EEPCo, Governments of Kenya and Ethiopia, Salini Costruttori S.p.A)* to halt

[308] Van Dorp, M. and Van de Giessen, E. (2010) *Climate and Conflict: a Double Disaster for the Poorest People*. Available at: http://www.envirosecurity.org/news/ClimateAndConflict.pdf

[309] AWEPA (2010), *No Time To Waste: Sustainable Environmental Management in a Changing Southern Sudan*

[310] In 2005, the European Union has adopted the "EU Consensus on Development", stressing the importance of sustainable management and preservation of natural resources, as a source of income and as a means to safeguard and develop jobs, rural livelihoods and environmental goods and services.

further dam construction until a proper Environment and Social Impact Assessment (ESIA) is carried out to look into the potential impacts on downstream and lake communities in Ethiopia and Kenya.

Moreover, it is recommended that the African Development Bank (AfDB) withdraws support to the project, as it does not promote the Millennium Development Goals, including MDG 7 on ensuring environmental sustainability. The AfDB is further advised to adopt the Equator Principles (a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing). The Italian-based Salini Costruttori S.p.A. is advised to adopt the OECD Guidelines on Multinational Enterprises in all its policies and practices.

B. Bale Mountains

For the Bale Mountains, a holistic set of solutions is needed, recognizing the problems in the eco-region as a whole, including the ecosystem services to the population further downstream. Current settlers in the National Park need to be assisted in developing alternative livelihoods. Meanwhile, the Federal and Oromia state governments, with real participation from other stakeholders, need to develop a vision on the region in which conservation of crucial ecosystem services of the Bale ecoregion is a central element. It is advised to adapt current and planned activities, such as road construction and the expansion of agriculture, in such a way that vital ecosystem services of the Bale Mountains are well-maintained.

ANNEX A. ORGANISATIONS & INITIATIVES

Many international organisations have initiated or supported projects aimed at enhancing the ability of communities to manage natural resources in a sustainable way, to adapt to climate change, to prevent resource disputes or to settle these disputes peacefully. Others have been set up to raise awareness and advocate environmental protection. In this annex, a modest but interesting selection of organisations and initiatives is presented.

Advocates Coalition for Development and Environment

This Ugandan public policy think tank carries out research and advocacy activities to support national and regional development policies. Among the latest publications are reviews of the Ugandan oil and gas policy and legal framework, the fish product chain in Lake George. A major area of work also includes advocacy and capacity building to empower people to shape public policies. Its activities are financed by various international development organizations. http://www.acode-u.org

Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)

ASARECA is a non-political cooperative organization, of which the National Agricultural Research Institutes (NARIs) of ten African countries are members: Burundi, DR Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda. It aims at increasing the efficiency of agricultural research in the region so as to facilitate economic growth, food security and export competitiveness through productive and sustainable agriculture. ASARECA promotes environmental security by providing a forum where strategies and ideas for sustainable agricultural research are conceived and exchanged. http://www.asareca.org

African Centre for Technology Studies (ACTS)

The Kenya-based African Centre for Technology Studies is an international intergovernmental policy research and outreach institution. Its main areas of work are research and capacity building in the fields of environmental technologies and sustainable development. With its vision “knowledge for better livelihoods” ACTS works on three programmes: Biodiversity and Natural Resource Management; Energy and Water Security; and Agriculture and Food Security. Many of ACTS’ publications and activities are strongly related to environmental security in the Horn of Africa, such as policy briefs on biofuels regulations in Kenya, as well as mainstreaming adaptation to climate change in the Ugandan development process. http://www.acts.or.ke/

African Conservation Foundation

The African Conservation Foundation is working towards the protection and conservation of Africa's endangered wildlife and their habitats. Founded in 1999, ACF has created an Africa-wide network for information exchange and capacity building of conservation efforts in Africa. ACF works mainly in Kenya, Tanzania and Cameroon. The organisation strengthens

environmental security in the Horn through its efforts to protect and restore the highland forests of the Mau Forest in Kenya.
http://www.africanconservation.org/

African Wildlife Foundation (AWF)
The organization operates in many African countries, including Kenya and Uganda in the Horn. Its main area of focus is community based conservation of nature. Empowering Africans to be Africa's stewards is at the core of AWF's strategy. Capacities of local organizations are strengthened to foster sustainable conservation of wildlife, including in the Samburu Heartlands (Kenya), where AWF has helped to create the Kenya Land Conservation Trust (KLCT) – a community land trust that aims to benefit the country's wildlife, its people and its economy. http://www.awf.org

Bale Eco-Region Sustainable Management Programme
Building on the experiences of the Participatory Forest Management Programme, FARM-Africa and SOS Sahel are currently running a program in the Bale Mountains of Ethiopia on sustainable natural resource management: the Bale Eco-Region Sustainable Management Programme. The programme has been operating in the Bale Massif since the end of 2006 and brings local communities into a central role in sustainable natural resources management supported by government services, across the whole Bale Massif. The programme aims to develop an eco-regional plan, strengthen institutional capacity for natural resource management, promote diversification of resource based livelihoods, set up sustainable financial mechanisms and put in place legal, policy and regulatory frameworks for eco-region planning, resource management and protected areas management.
http://www.pfmp-farmsos.org/Programme.html

CARE projects
In the Horn of Africa, CARE has programmes in Sudan, Uganda, Kenya, Ethiopia, Eritrea and Somalia, Somaliland and Puntland. Many activities specifically relate to environmental security, including in:
• Sudan, by natural resource management as a tool for conflict mitigation; agricultural support to returnees and vulnerable households (North and South Kordofan); disaster mitigation through water management and increasing food production (Darfur);
• Uganda: empowering civil society for participatory forest management (in various areas close to protected areas; assisting IDPs on water and sanitation, livelihood support and peace building (Northern Uganda);
• Eritrea: providing water for livestock and drought and war-affected pastoralists through the construction of micro-dams, and reducing firewood consumption through improved household stoves and planting trees;
• Kenya: improving access to clean water for pastoralists and their animals.
http://www.care-in-africa.org/

FARM-Africa
This organization, with a regional office in Nairobi and a country office in Addis Ababa, aims to assist communities to increase productivity by creating a bridge between agricultural

researchers and farmers. Bringing them together could help solve problems faced by poor rural communities. The organization contributes to environmental security and poverty alleviation in its effort to integrate sustainable natural resource management with farming practices. http://www.farmafrica.org.uk

Forum for Environment

The main objective of this Ethiopian organization is to promote environmental protection in Ethiopia. Located in Addis Ababa, Forum for Environment mainly carries out advocacy and awareness raising activities related to forests, protected areas, fresh water, the flower industry, energy, pollution and climate change. For instance, FfE has in place a "Green award" program, which should encourage environmental awareness and practical actions of citizens. FfE is also the secretariat of the Ethiopian Civil Society Network on Climate Change. http://www.ffe-ethiopia.org

GEF Small Grant Program is funded by the Global Environment Facility (GEF) and implemented by UNDP. The mission is to support communities financially, enabling them to combat critical environmental problems. With more than 12,000 grants awarded worldwide, the Small Grants Program supports projects of non-governmental and community-based organizations in over 120 developing countries. The main focal areas of the programme are climate change mitigation and adaptation, biodiversity conservation, protection of international waters, reduction of the impact of persistent organic pollutants and prevention of land degradation. http://sgp.undp.org

Green Belt Movement (GBM)

The Green Belt Movement has two divisions: Green Belt Movement Kenya and Green Belt Movement International. Nobel Peace Prize Winner Prof. Wangari Maathai founded the Kenyan organization in 1977, under the auspices of the National Council of Women of Kenya. The mission of this initiative is to mobilize community consciousness for self-determination, equity, improved livelihoods, security and environmental conservation. It mainly works in the fields of reforestation, advocacy and networking and environmental education. http://www.greenbeltmovement.org/

Greener Ethiopia

Greener Ethiopia is a non-profit, non-political local organization dedicated primarily to bringing trees back to Ethiopia. A country that was once 38 percent forested in recent years was reduced to less than 3 per cent with serious consequences for the health and wealth of its people. In the last decade Greener Ethiopia and others have worked hard to reverse this critical situation and today 15 per cent of Ethiopia is once more forested. This has been achieved by a well-researched programme firmly focused on encouraging and supporting sustainable economic growth in rural communities.

Tree planting, seed distribution, and specialist training are at the heart of Greener Ethiopia's initiative. Working in partnership with individual volunteers, local communities, farming co-operatives, women's associations and authorities at both regional and national level, Greener Ethiopia has planted and distributed around 20 million trees. It aims to achieve a

further 100 million in the next five years, in order to change the rural face of Ethiopia for the better. www.greenerethiopia.org

German Technical Cooperation (GTZ)
GTZ operates in most of the Horn of African countries. It mainly focuses on promoting cooperation and sustainable development. Main objective of the organization is to provide viable, forward-looking solutions for political, economic, ecological and social development in a globalised world. It promotes environmental security through its program to support ecological projects and capacity development. http://www.gtz.de/en/689.htm

Horn of Africa Regional Environmental Network (HoAREN)
HoA-REN is a network of members and partners consisting of environmental CBOs, NGOs and higher learning institutes from six countries in the Horn of Africa. The network promotes intensive cooperation among and exchange of information and experiences between the member organizations. Annual network meetings are organized and small scale environmental partnership programmes are set up to advance environmental governance. Main focus areas of the Network include adaptation to climate change, renewable energy solutions (solar cookers, small scale jatropha plantations) and biodiversity conservation.

Horn of Africa Regional Environmental Centre (HoAREC)
The Centre serves as the secretariat for the Network and is located at the Science Faculty of the Addis Ababa University, Ethiopia. It supports cooperation between network members and other environmental actors, to carry out activities "on the ground". The Centre also stimulates demand driven action research, by assisting students to carry out practical research in field situations. Students are e.g. currently involved in a participatory research project in different eco-regions in Ethiopia, to assess the impacts of climate change for people, and the way people adapt to these changes.
The Horn of Africa Regional Environment Centre is involved in the assessment of the transfrontier Gambella-Boma region, aimed at promoting a more conservation and tourism-oriented policy approach towards the region. With respect to biodiversity conservation, strong emphasis is further placed on the protection of church forests, and trying to establish corridors for the protection of (church) forests' genetic diversity. The Centre is also involved in establishing Gullele Botanic Garden. This 700 hectares green area will serve both as a conservation, education and recreation area for residents of Addis Ababa and tourists.
www.hoarec.org

Horn Relief
This is an African-led humanitarian and development organization. Its main goal is to improve the living conditions of communities living in marginalized areas in the Horn of Africa. Its programs include strengthening rural livelihoods through environmental, training, technology transfer and innovative humanitarian projects in pursuit of a peaceful, self-reliant, and greener future.
http://www.hornrelief.org

International Livestock Research Institute (ILRI)

Part of the Consultative Group on International Agricultural Research (CGIAR), the International Livestock Research Institute (ILRI) works to improve livelihoods through livestock. Although its offices are located in Eastern Africa (Kenya and Ethiopia), the organisation also carries out research in Southern and Western Africa, as well as in Asia. ILRI aims at bringing high-quality science and capacity-building to bring about poverty alleviation and sustainable development for poor livestock keeping communities. ILRI is one of 15 Future Harvest Centers, which conduct food and environmental research to help alleviate poverty and increase food security while protecting the natural resource base. http://www.ilri.org

Institute for Security Studies (ISS)

The ISS is a regional research institute operating across sub-Saharan Africa. As a leading African human security research institution, the Institute is guided by a broad approach to security reflective of the changing nature and origin of threats to human development. The Institute runs a research programme on Environmental Security. http://www.iss.co.za

IGAD Climate Prediction and Applications Centre (ICPAC)

The IGAD Climate Prediction and Applications Centre (ICPAC), formerly known as the Drought Monitoring Centre, Nairobi, is a specialized regional centre of the Inter-Governmental Authority on Development (IGAD) charged with the responsibility of climate monitoring, prediction, early warning and applications for the reduction of climate related risks including those associated with climate variability and change. It is a specialized institution providing climate information, prediction and early warning for applications in support of environmental management. It is also responsible for the management of a recently set up programme, the African Monitoring of the Environment for Sustainable Development (AMESD) Programme, funded by the European Development Fund from 2010-2013. Objective of this programme is to enhance monitoring for sustainable management of the environment thereby contributing to poverty alleviation. The activities in the Horn of Africa will focus on the assessment and monitoring of land degradation and natural habitats for sustainable land management. http://www.icpac.net/

Institute of Biodiversity Conservation (IBC)

Because of Ethiopia's dependence on biological resources, biodiversity conservation is important for the country. The mandate of the Institute of Biodiversity Conservation
is to foster the conservation and sustainable utilization of biological resources in Ethiopia, including plants, animals and microbial genetic resources. On the basis of national legislation, the IBC has the responsibility to implement international conventions, agreements and obligations on biodiversity to which Ethiopia is a party.

In addition to seed storage and development of a gene bank, the Institute aims to make a major effort to increase in situ conservation in relevant ecosystems. The IBC further carries out research that helps to protect and manage wildlife and endangered species. http://www.ibc-et.org

Kenya Organization for Environmental Education

The Kenya Organization for Environmental Education aims to promote and re-orient environmental education towards sustainable development, and encourages people to actively participate in solving environmental problems. The organisation focuses on improving environmental governance and natural resource management through environmental education. http://www.koee.org

Kenya Green Energy Foundation

This organization aims to combat climate change and to develop and deploy renewable energy, based on wind, sun and biofuels. The foundation connects rural communities with international organizations committed to reducing carbon emissions. It facilitates and initiates reforestation and environmental restoration projects in partnership with local communities, NGOs and relevant ministries. In addition, it develops renewable and sustainable technologies appropriate to the ecological, social and economic environment of communities impacted by climate change.
http://www.kengef.org

National Association of Professional Environmentalists in Uganda (NAPE)

This Ugandan environmental organization was set up in 1997 to promote sustainable and equitable resource management. The association undertakes lobbying and advocacy activities with a specific focus on water management, energy governance, forest and wetlands management, environmental justice and chemicals management. Among many other activities, NAPE was involved in the Mabira forest campaigns, in campaigns against mining in Queen Elizabeth National Park, in establishing the Uganda Dams Dialogue and in promoting geothermal energy in western Uganda. http://www.nape.or.ug

Nature Kenya

The aim of Nature Kenya is to promote the study and conservation of the natural environment in Eastern Africa. The organisation is the Kenyan branch of the East Africa Natural History Society, the oldest conservation institute in Africa. The Nature Kenya conservation programme promotes sound management and sustainable utilisation of natural resources at important biodiversity sites, with a special focus on birds. Furthermore, the organisation is highly active in various advocacy activities, and tries to raise public awareness, e.g. on the impacts of commercial biofuel production and large-scale irrigated rice or sugar production in the Tana Delta. Nature Kenya also manages various local initiatives in and around Nairobi, such as the Nairobi Arboretum and the “Friends of City Park”. http://www.naturekenya.org

Participatory Ecological Land Use Management (PELUM)

With the slogan “Networking for a Greener Africa”, this association works to improve the livelihoods of small-scale farmers and rural communities. PELUM Association is a network of more than 200 civil society organizations from 10 different countries in eastern, central and southern Africa, including Kenya and Uganda in the Horn. Through networking, research and advocacy, the association aims to teach and inspire farmers about production and

management techniques, in order to achieve greater food security. http://www.pelumrd.org/, http://www.pelum.net (Kenya)

Participatory Forest Management Programme (PFMP)
FARM-Africa and SOS Sahel Ethiopia run a program called "Participatory Forest Management Programme" in the forests of Bongo, Bomana, Chi limo (Ethiopia) as well as in the Tanzanian Nou forest. The programme ran from 2002 to 2007 and aimed to achieve environmental sustainability and biodiversity conservation by supporting the development of innovative participatory forest management plans that secure the rights, revenues and responsibilities of forest users. Outputs of the project include the establishment of sustainable forest management systems, the development of new forest policies and the adoption of non-timber forest product technologies by local communities.
http://www.pfmp-farmsos.org/pfmphome.htm

Pastoral and Environmental Network in the Horn of Africa (PENHA)
PENHA is an international NGO operating in Uganda, Sudan, Ethiopia, Eritrea, and Somalia/Somaliland. Its mission is to reduce poverty among pastoralists in the Horn of Africa through the empowerment of communities and to promote sustainable livestock-based and non-livestock-based livelihoods. Activities include capacity building, research, training, education and establishing fora for pastoralist communities, creating small-income generating and micro-credit opportunities, and facilitating market links for pastoralists.
Together with Oxfam Novib, PENHA is highly involved in mitigating resource based conflicts in the region. http://www.penhanetwork.org

SERVIR-Africa
SERVIR integrates satellite observations and predictive models with other geographic information (sensor and field-based) to monitor and forecast ecological changes and respond to natural disasters. SERVIR-Africa was established in 2008 as a joint initiative by the Regional Centre for Mapping of Resources for Development (RCMRD) in Kenya, the US Agency for International Development (USAID), the National Aeronautics and Space Administration (NASA) and the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC).This evolving regional visualization and monitoring platform is being established in Africa to improve scientific knowledge and decision-making in a range of application areas (e.g., biodiversity conservation, disaster management, agricultural development, climate change adaptation, etc.). http://www.servir.net/africa/

SNV Netherlands Development Organization
With the objective of "connecting people's capacities", SNV plays a facilitating role as advisors to NGOs, and local governments. In that role, SNV aims to enable poor people to access basic services. In East and Southern Africa, particular emphasis is given to the access to basic education, water, sanitation and hygiene, and renewable energy. Among the Horn countries, SNV is active in Sudan, Kenya, Uganda and Ethiopia. In Ethiopia the focus is on tourism, honey, milk, oil seeds and fruit (apples, mango and pineapple). SNV also promotes the access to renewable energy, e.g. through biogas projects. SNV further facilitates knowledge dissemination, networking and advocacy at national and international levels in

various environmental development and natural resource programmes. http://www.snvworld.org/en/aboutus/Pages/Introduction.aspx

SOS Sahel

The organization mainly embarks on capacity building of local communities. The objective of the organization is to find innovative ways to help groups in the Sahel secure their rights. SOS Sahel further brings the facts about poverty in the region to the attention of policy-makers. It facilitates environmental security through its program to support pro-environment decision making and encourages collaboration and experience-sharing of African institutions. http://www.sahel.org.uk/mission.html

UNDP

UNDP is active in most countries in the Horn, on a variety of resource-related topics including resource based conflicts among pastoralists and farmers. In Sudan, UNDP implemented the Reduction of Resource Based Conflicts project, from 2004 to September 2009. Supported by the Netherlands and the Canadian International Development Agency (CIDA), this project focused on participatory route demarcation, conflict prevention, empowering pastoralists and community development, among other things.

In Eritrea, UNDP has worked with the Eritrean government, on various topics including Environment and Energy. In order to promote and use renewable and other energy sources, a wind power project has been set up. Also much work has been done to enhance sustainable management of Eritrea's coastal, marine and island biodiversity. The current support of UNDP to the Eritrean government includes a component on food security, natural resources and sustainable environmental development. http://www.undp.org

Wildlife for Sustainable Development

Wildlife for Sustainable Development (WSD) is an Ethiopian non-governmental organization founded in 2008 to conserve the country's rich biodiversity through promoting the sustainable utilization and scientific study of wildlife and their habitats. WSD has worked with the Ethiopian Wildlife Conservation Authority (EWCA) to develop a management plan and encourage community-based wildlife conservation and ecotourism development in and around Babille Elephant Sanctuary, Ethiopia. The project was financially supported by the Horn of Africa Regional Environment Center through the Forum for Environment as fund holding institution. Major activities of the project included the re-defining of the boundaries of the sanctuary, producing a comprehensive sanctuary management plan, and developing ecotourism through community participation, monitoring elephants' home range through GPS satellite telemetry, and reducing the rate of loss of wildlife habitats and minimizing the illegal killing of elephants. http://www.wsd.org.et

Wildlife Clubs of Uganda

The purpose of the Wildlife Clubs of Uganda is to educate the population so as to ensure the sustainable use of Uganda's natural resources and to conserve the country's wildlife heritage for the present and future generations The Wildlife Clubs of Uganda aim to enhance the realization of the economic, recreational, cultural and aesthetic values of the country's

natural resources, thereby cultivating the desire for wildlife conservation and study. http://www.wildlifeclubs.org/programs.html

World Agroforestry Center (ICRAF)

The World Agroforestry Centre (formerly known as ICRAF) is an international research organisation. It is supported by the Consultative Group on International Agricultural Research (CGIAR), which is dedicated to generating and applying the best available knowledge to stimulate sustainable agricultural development. The mission of the World Agroforestry Center is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes, and to use its research to advance policies and practices that benefit the poor and the environment. http://www.worldagroforestrycentre.org/

World Food Program (WFP)

The mission of the organization is to strengthen capacities of countries to reduce hunger. In the Horn of Africa the World Food Program strongly focuses on responding to food emergencies while also strengthening the capacity of the region to become self-sustaining in food production. The World Food Program runs various programmes on land and water management (e.g. the MERET program in Ethiopia) and on enhancing farmers' access to agricultural markets (e.g. in Sudan). Through its activities aimed at increasing productivity and alleviating food insecurity, WFP contributes to environmental security in the Horn of Africa. http://www.wfp.org

ANNEX B. REFERENCES

- Abubakr M. Idris (2008), "Combining multivariate analysis and geochemical approaches for assessing heavy metal level in sediments from Sudanese harbors along the Red Sea coast." *Microchemical Journal*, 90, pp 159-163
- Abebe, W.B., M. McCartney, W.J.A.M. Douven, J. Leentvaar (2006), *Environmental impact assessment follow-up in the Koga Irrigation Project, Ethiopia.* Available at: www.ifwf2.org/addons/download_presentation.php?fid=1038
- AFP (2008), "South Sudan villagers, environment suffer from oil boom." *Sudan Tribune, 5 March 2008*. Available at: http://www.sudantribune.com/spip.php?article26231
- African Economic Outlook (2010), *Basic indicators 2009*. Available at: http://www.africaneconomicoutlook.org/en/data-statistics/table-1-basic-indicators-2009/
- African Press Agency (2008) "Ethiopia can earn $100 million from khat export, minister said." *Ethiopian Review, 26 August 2008.* Available at: http://www.ethiopianreview.com/content/3595
- African Union, Website. Available at: http://www.africa-union.org/root/au/index/index.htm
- African Union (2004), *Strategic Plan Of The African Union Commission, Volume 1: Vision and Mission of the African Union*, May 2004.
- Alemayehu, T. (2001), "The impact of uncontrolled waste disposal on surface water quality in the city of Addis Ababa, Ethiopia." *SINET Ethiopian Journal of Science* , volume 24, pp. 93 – 104
- All Africa (2010), "New Policy to Tackle Disaster Risk in Ethiopia." *All Africa, 27 September 2010.* Available at: http://allafrica.com/view/group/main/main/id/00011809.html
- Amum, P. (2008), *An Assessment Report on Illegal Bushmeat Trade and Consumption in and around Boma National Park in Southern Sudan, Draft Report.* College of African Wildlife Management, Mweka, Tanzania, 2007.
- Angelei, I. (2009), "Ethiopia's Omo River dam to cause environmental disaster." *Ethiopian Review, 5 March 2009*. Available at: http://www.ethiopianreview.com/content/8785
- Animal Info (2009), *Threatened ecosystems.* Available at: http://www.animalinfo.org/
- Animal Info (2009), *Uganda.* Available at: http://www.animalinfo.org/country/uganda.htm
- Anderson, T. et al. (1999), *Rural Energy Services: A Handbook for Sustainable Energy Development*. IT Publications, 1999.
- Arnell, N.W. (2006). "Global impacts of abrupt climate change: an initial assessment." Working Paper 99, Tyndall Centre for Climate Change Research, University of East Anglia, Norwich, 37 pp
- Asmarino (2009), "Chronic food insecurity threatens lives of children in the horn of Africa." *Asmarino Independent, 9 May 2009*. Available at: http://asmarino.com/en/news/167-chronic-food-insecurity-threaten-lives-of-children-in-the-horn-of-africa
- AWEPA (2010), *No Time To Waste: Sustainable Environmental Management in a Changing Southern Sudan*
- Baland, J.M., and J.P. Platteau (1996). *Halting Degradation of Natural Resources: Is there a Role for Local Communities?* Oxford University Press, Oxford.
- Baxter, Z. (2007), *Somalia's Coal Industry*, ICE Case Studies, 201, May 2007. Available at: http://www.american.edu/ted/ice/somalia-coal.htm
- BBC (2009), *Profile: African Union*. Available at: http://news.bbc.co.uk/2/hi/country_profiles/3870303.stm
- BBC News (2009), "The dam that divides Ethiopians", *BBC News,* 26 March 2009. Available at: http://news.bbc.co.uk/2/hi/africa/7959444.stm
- BBC News (2009), "Kenya's heart stops pumping", *BBC News, 29 September 2009.* Available at: http://news.bbc.co.uk/2/hi/8057316.stm

- Berhanu, Y.M. (2008), *The distribution and impacts of parthenium weed around Modjo area, East Shewa Zone*. Abstract available at: http://www.hoarec.org/index.php/programmes/demand-driven-action-research/researches/91
- BirdLife International (2009), *Important Bird Area factsheet: Gambella National Park, Ethiopia.* Retrieved at 1 July 2010 from http://www.birdlife.org
- Black Marlin Energy (year unknown), *Ethiopia.* Available at: http://www.blackmarlinenergy.com/Kenya-Oil-Exploration/ethiopia.aspx
- Blaikie, P. and Brookfield, H. (1987), *Land Degradation and Society*. Methuen and Co. Ltd., London.
- Brander, K. (2006), *Assessments of possible impacts of climate change on fisheries.* Berlin, 2006. Available at: http://www.wbgu.de/wbgu_sn2006_ex02.pdf
- Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda (2007). *Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, pp. 433-467.
- Butterfield, R. (2009). *Extreme rainfall seasons in East Africa.* Available at: http://www.weadapt.org/wiki/Extreme_rainfall_seasons_in_East_Africa. Retrieved at 3 March 2010.
- Balirwa, J.S., A. Colin, L. Chapman, I.G. Cowx, K. Geheb, L. Kaufman, R. H. Lowe-McConnell, O. Seehausen, J.H. Wanink, R.L. Welcomme, and F. Witte (2003), "Biodiversity and Fishery Sustainability in the Lake Victoria Basin: An Unexpected Marriage?" *Bio Science, August 2003, Vol. 53 No. 8, pp. 703-716.*
- Caleb, M., et al. (2007), "Environmental risks of urban agriculture in the Lake Victoria drainage basin: A case of Kisumu municipality, Kenya." *Habitat International*, 31, Issues 3-4, September-December 2007, pp 375-386.
- Central Statistics Agency (2004). *The Federal Democratic Republic of Ethiopia Statistical abstract for 2003.* CSA, Addis Ababa, 2004.
- Christy, J.R. W.B. Norris, and R.T. McNider (2009). "Surface Temperature Variations in East Africa and Possible Causes." *J. Climate,* in press
- CIA (2009), *The World Factbook*. Available at: https://www.cia.gov/library/publications/the-world-factbook
- Conservation International (2007), *Biodiversity hotspots, Horn of Africa*. Available at: http://www.biodiversityhotspots.org/xp/hotspots/horn_africa/Pages/default.aspx
- Conservation International (2007) *Eastern Afromontanes.* Available at: http://www.biodiversityhotspots.org/xp/hotspots/afromontane/Pages/impacts.aspx
- Cotula, L., S. Vermeulen, R. Leonard, J. Keeley (2009), *Land grab or development opportunity? Agricultural investment and international land deals in Africa.* IIED/FAO/IFAD, London/
- Cotula, L. (2007). *Changes in customary land tenure systems in Africa.* Published by IIED and FAO, 2007.
- Dalelo, A. (2002), *Rural electrification in Ethiopia: opportunities and bottlenecks*. Addis Ababa University.
- Daniel, F., F. Itana & M. Olsson (2007), "Total Contents and Sequential Extraction of Heavy Metals in Soils Irrigated with Wastewater, Akaki, Ethiopia". *Environmental Management*, volume 39, 2007, pp. 178-193.
- Damtie, M. and M. Bayou (2008), *Overview of Environmental Impact Assessment in Ethiopia*, published by MELCA, 2008.
- Darkoh, M. B. K. (2003), "Regional perspectives on agriculture and biodiversity in the dry lands of Africa." *Journal of Arid Environments,* Volume 54, Issue 2, June 2003, pp. 261-279
- Dasgupta, S., B. Laplante, S. Murray, D. Wheeler (2009). Sea-Level Rise and Storm Surges: A Comparative Analysis of Impacts in Developing Countries. Policy Research Working Paper 4901, The World Bank Development Research Group, Environment and Energy Team, April 2009.
- Davies, D. (2009), "Somali pirates increase the stakes." *Africa prospects*, October 2009, pp. 12-15.
- De Ville, G. (2010), *Good deal, bad deal: Report of the Conference "Illegal Trade in Natural Resources - What can Brussels do?"* Institute for Environmental Security, November 2010. Available at: http://www.envirosecurity.org/pathfinder/conference/Report_Final_med.pdf

- Demlie, M. and S. Wohnlich (2006), "Soil and groundwater pollution of an urban catchment by trace metals: case study of the Addis Ababa region, central Ethiopia." *Environmental geology, 2006, pp. 421-431.*
- Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.
- Douglas, E.M., S. Wood, K. Sebastian, C. J. Vörösmarty, K. M. Chomitz and T. P. Tomich (2007), "Policy implications of a pan-tropic assessment of the simultaneous hydrological and biodiversity impacts of deforestation". *Water Resources Management,* 21, pp. 211-232.
- Earth trends (2003), *Agriculture and food, Eritrea.* Available at: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_232.pdf
- Earth trends (2003), *Agriculture and food, Ethiopia.* Available at: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_231.pdf
- Earth trends (2003), *Agriculture and food, Kenya.* Available at: http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_404.pdf.
- Earth Trends (2006). Available at: http://earthtrends.wri.org/text/forests-grasslands-drylands/datatable-42.html
- East African Community (2005), *Protocol on Environment & Natural Resource Management*, Draft 5, June 2005.
- Economic Commission for Africa (2008), *Africa Review Report on Drought and Desertification*. United Nations Economic Commission for Africa, Addis Ababa, Ethiopia
- Eden, D. (2008), *Somali pirates: the other side of the story.* Available at: http://viewzone2.com/piratesx.html
- Edwards, S. (2008) "Social breakdown in Darfur", *Forced Migration Review 31*, October 2008, pp. 23-24.
- Ejigu, M. (2009), "Environmental dimensions of the IGAD Peace and Security Strategy", Foundation for Environmental Security and Sustainability, Available at: http://www.fess-global.org/Publications/Other/IGAD-FESS%20May%202009%20Workshop%20Report.pdf
- Encyclopedia of Earth (2008), *Eastern Africa and coastal and marine environments*. Available at: http://www.eoearth.org/article/Eastern_Africa_and_coastal_and_marine_environments
- Environmental Analysis and Remote Sensing. *Monitoring and Early Warning.* Available at:
- http://www.earlywarning.nl/frames/Frame_links.htm
- Eshetu, B. (2010), "Orthodox Church Conservation Efforts Appreciated." In: *Addis Ababa Highlights, Vol.7, No.5.* Available at: http://www.unep.org/roa/addis_ababa_site/Documents/Highlights/highlight2010/May10.pdf
- ESI-Africa (2010), *Electrifying African interest in renewable energy*. Available at:
- http://www.esi-africa.com/Electrifying/African/interest/renewable/energy
- ESI-Africa (2010), *WB approves $330 million for Kenya*. Available at: http://www.esi-africa.com/node/11262
- Ethiopian Electric Power Corporation (2009), *Gibe III EIA – Additional Study on Downstream Impacts*, 2009, pp. 3-4.
- Ethiopian Environmental Protection Authority (2006), *Soil degradation and pollution*.
- Farah, Q.H. (2005). *Natural Resources and Environmental Development Agency – Somalia (NERDA)*. Available at: http://www.angelfire.com/ne/NEDRA/NEDRA.html
- FAO (2000): http://www.fao.org/docrep/006/y5359e/y5359e0f.htm
- FAO (2004), *Livestock sector brief, Ethiopia.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_ETH.pdf
- FAO (2005), *Livestock sector brief, Kenya.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_KEN.pdf.

- FAO (2005), *Livestock sector brief Sudan.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_SDN.pdf
- FAO (2005), *Livestock sector brief, Uganda.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_UGA.pdf
- FAO (2005), *Livestock sector brief, Djibouti.* Retrieved at 13 April 2010 from: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_DJI.pdf
- FAO (2005), *Livestock sector brief, Eritrea.* Available at: http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lsb_ERI.pdf
- FAO (2007), *Export and import commodities.* Available at: http://faostat.fao.org/site/342/default.aspx
- FAO (2008), *Challenges for Sustainable Land Management (SLM) for Food Security in Africa*. Available at: ftp://ftp.fao.org/docrep/fao/meeting/012/k1820e.pdf
- FAO (2009), *State of the World's Forests*, Rome, 2009.
- FAO, Land and water development division. Website. Available at: www.fao.org/nr/land/information-resources/terrastat/en/
- FAO (2005), *Report of the First Lake Victoria Fisheries Organization and FAO Regional Technical Workshop on Fishing Effort and Capacity on Lake Victoria*. Workshop held in Dar es Salaam, Tanzania, 12-14 December 2005, p.10.
- FAO (year unknown), *Management of fish stocks and fisheries of deep and shallow lakes of Eastern, Central and Southern Africa.* Available at: http://www.fao.org/docrep/005/AC751E/AC751E01.htm
- FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action; summary report*. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm
- FAO (2006), *Food security.* Available at: ftp://ftp.fao.org/es/ESA/policybriefs/pb_02.pdf
- FAO (2002), *Implementation of the International Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated.* FAO Technical Guidelines for Responsible Fisheries. Available at: http://www.imcsnet.org/imcs/docs/implementation_for_ipoa.pdf
- FAO (1995), Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. Available at: http://www.fao.org/docrep/meeting/003/x3130m/X3130E00.htm
- FAO (1989). "Forests, trees and people." *Forestry Topics Report*, 2. Rome.
- FAO (2000), *Elimination of food insecurity in the Horn of Africa; a strategy for concerted government and UN agency action.* Summary report. Available at: http://www.fao.org/docrep/003/x8530e/x8530e00.htm
- FAO (2005), Report of the First Lake Victoria Fisheries Organization and FAO Regional Technical Workshop on Fishing Effort and Capacity on Lake Victoria. Dar es Salaam, Tanzania, 12-14 December 2005, pp.8-10
- Federico, C., G. Accordi (2000), "The Indian Ocean Coast of Somalia." *Marine Pollution Bulletin, volume 41, pp. 141-159.*
- FESS (2009), *Lake Tana Watershed, Ethiopia.* Summary available at: http://www.fess-global.org/Lake_Tana.cfm
- Finfacts Ireland (2009). *Study warns of impact of "land grab" deals in Africa and other continents by foreign countries and private groups*. Available at: http://finfacts.ie/irishfinancenews/article_1016761.shtml
- Flintan, F. and I. Tamrat (2009), "Spilling Blood over Water? The Case of Ethiopia", In: *Scarcity and Surfeit*; *the ecology of Africa's conflicts, Lind, J. and K. Sturman (eds), Institute for Security Studies, chapter 6, p.244.*
- Food Security and Nutrition Analysis Unit - Somalia (2010), Available at: http://www.fsnau.org
- Frankfurt Zoological Society (2007), *Bale Mountains General Management Plan: 2007 to 2017.* Available at: http://zgf.de/download/166/BMNP_GMP_2007.pdf
- Gadaa.com (2009), "Ethiopia: UN Study Confirms the Land Grab in Oromia and Elsewhere Poses Risk to Farmers." *Gadaa.com*, 27 May 2009. Available at: http://www.gadaa.com/oduu/?p=646
- Getahun, T. (year unknown), "Climate Change poses danger to pastoralist: How to manage excess of its adversity". Available at: http://www.pfe-ethiopia.org/pub_files/Climate%20changes%20posing%20danger%20on%20pastoralist.pdf

- Gettleman, J (2010), "Future Kenya port could Mar Pristine Land". *New York Times, 11 January 2010.* Available at: http://www.nytimes.com/2010/01/12/world/africa/12lamu.html
- Global Forest Coalition (2010), *Getting to the Roots: Underlying Causes of Deforestation and Forest Degradation, and Drivers of Forest Restoration*, December 2010
- GRAIN (2007), *Seedling: agrofuels special issue,* GRAIN, Barcelona, Spain.
- Guardian, The (2009), *How food and water are driving the 21st land grab in Africa*. The Guardian, 7 March 2009, Available at: http://www.guardian.co.uk/environment/2010/mar/07/food-water-africa-land-grab
- Graetz, R. (2008), *Environmental and Social Impacts of the Proposed Gibe III Hydroelectric Project in Ethiopia's Lower Omo River Basin*, African Resources Working Group, University of Montana, 2008, p.6., Available at: http://d.yimg.com/kq/groups/3764128/1939144819/name/Gibe
- Grigsby, W.J. (2002), "Subsistence and land tenure in the Sahel." *Agriculture and Human Values* 19 (2), 2002, pp. 1-14.
- Guardian, The (2010), *Uganda oil contracts give little cause for optimism.* The Guardian, 18 January 2010. Available at: http://www.guardian.co.uk/katine/katine-chronicles-blog/2010/jan/18/uganda-oil-profits
- Galcano C. M. and L. W. Kariuki (2001), *Mapping and analysis of air pollution in Nairobi.* Available at: http://www.fig.net/pub/proceedings/nairobi/mulaku-kariuki-TS3-2.pdf
- Global Humanitarian Forum (2009).*The Anatomy of a Silent Crisis.* Human Impact Report Climate Change.
- Gough, D. (2000), "Pollution blamed for the death of thousands of flamingos". *The Guardian, 6 March 2000.* Available at: http://www.guardian.co.uk/world/2000/mar/06/1
- Gräfen, C., B. Debele (1996). *Land Tenure and Resource Management in the IGAD region: Summary of Findings and Major Conclusions of the sub-regional Workshop for East African Land Tenure Issues in Natural Resources Management*. Workshop held in Addis Ababa 11 - 15 March 1996.
- Haileselassie, A. (2004). "Ethiopia's struggle over land reform." *World Press Review* 51 (4), 2004, pp. 51–55
- Hartley, A.J., A. Nelson, P. Mayaux and J-M. Grégoire (2007), *The Assessment of African Protected Areas. A characterisation of biodiversity value, ecosystems and threats to inform the effective allocation of conservation funding.* Joint Research Centre and Institute for Environment and Sustainability, 2007.
- Healy, S. (2008), *Lost Opportunities in the Horn of Africa: How Conflicts Connect and Peace Agreements Unravel.* Published by Chatham House - Royal Institute of International Affairs, London, United Kingdom, 2008.
- Helldén, U. (2008), "A Coupled Human-Environment Model for Desertification Simulation and Impact Studies". *Global and Planetary Change* - accepted September 2008
- High Seas Task Force (2006), *Closing the net: Stopping illegal fishing on the high seas*. Governments of Australia, Canada, Chile, Namibia, New Zealand, and the United Kingdom, WWF, IUCN and the Earth Institute at Columbia University.
- Hua Liu, et al (2006), "A Geographically Explicit Genetic Model of Worldwide Human-Settlement History. " *The American Journal of Human Genetics*, 79 (2006), pp. 230–237.
- Human Rights Watch (2010). *Development without Freedom. How Aid Underwrites Repression in Ethiopia.* Available at: http://www.hrw.org/sites/default/files/reports/ethiopia1010webwcover.pdf.
- Huysmans R., (2009). *Land security and livelihoods,* research report Institute for Environmental Security. Available on request.
- Hyde Hecker, J. (2011) *Peace and Sustainable Development through Environmental Security: a Methodology for Environmental Security Assessments*, Institute for Environmental Security, The Hague, January 2011.
- IFRC (2009), *Horn of Africa: Exceptional Food Security Crisis - Appeal and Budget revision*. Emergency appeal MDR64003, 23 June 2009.
- IGAD (2010), *Agriculture and Environment.* Available at: http://igad.int/index.php?option=com_content&view=category&layout=blog&id=43&Itemid=126
- Independent, The (2009), *Wish you weren't here: the devastating effects of the new colonialists*. Available at: http://www.independent.co.uk/environment/nature/wish-you-werent-here-the-devastating-effects-of-the-new-colonialists-1767725.html

- International Rivers (2009). *Lake Turkana People's Declaration*. Available at: http://www.internationalrivers.org/en/node/3891
- Institute for Biodiversity Conservation (2005), *National Biodiversity Conservation and Action Plan, Ethiopia.* Available at: http://ibc-et.org/ibc/pubn/files/NBSAP.zip
- Institute for Biodiversity Conservation (2008), *The impacts of Prosopis Juliflora on Biodiversity in the Desert and Semidesert Ecosystem, Northeast Ethiopia.* Available at: http://ibc-et.org/ibc/pubn/files/Prosopis_juliflora_Biodiversity.pdf
- International Crisis Group (2009), *Jonglei's tribal conflicts: countering insecurity in South Sudan.* Africa Report N°154, 23 December 2009.
- International Institute for Rural Reconstruction (2009), *Facilitating Community Managed Disaster Risk Reduction Course.* Available at: http://www.unisdr.org/preventionweb/files/7881_DRR20Flier.pdf
- Intergovernmental Panel on Climate Change (2000), *Land Use, Land-Use Change and Forestry,* Available at: http://www.grida.no/publications/other/ipcc_sr/?src=/Climate/ipcc/land_use/124.htm
- Intergovernmental Panel on Climate Change (2001). Third Assessment Report of Working Group II on Climate Change Impacts, Adaptation and Vulnerability, Summary for Policy Makers, 2001.
- ITOPF (2001), *A summary of oil spill response arrangements and resources worldwide*. Available at: http://www.itopf.com/_assets/country/djibouti.pdf
- IUCN Red List (2008), Available at: http://cmsdata.iucn.org/downloads/2008rl_stats_tables_all.xls
- International Crisis Group (2009), *Jonglei's tribal conflicts: countering insecurity in South Sudan.* Africa Report N°154, 23 December 2009.
- IRIN News (2006), "Ethiopia: malaria a major threat as flood emergency continues". *IRIN News,* 24 August 2006. Available at: http://www.irinnews.org/Report.aspx?ReportId=60446
- Jacobs, M.J. and C.A. Schloeder (2001). *Impacts of Conflict on Biodiversity and Protected Areas in Ethiopia.* Washington, D.C.: Biodiversity Support Program.
- Jimma Times (2009). "Oromia-Ethiopia: Industrial pollution of Akaki, Modjo and Sebeta rivers", *Jimma Times,* 5 January 2009. Available at: http://www.jimmatimes.com/article/Latest_News/Latest_News/OromiaEthiopia_Industrial_pollution_of_Akaki_Modjo_and_Sebeta_rivers/32201
- Jones, S. P.G. and P.K. Thornton (2003). "The potential impacts of climate change in tropical agriculture: the case of maize in Africa and Latin America in 2055". *Global Environmental Change* 13, 2003, pp. 51–59.
- Kabubo-Mariara, J. (2007). "Land conservation and tenure security in Kenya: Boserup's hypothesis revisited" *Ecological Economics* 64, 2007, pp. 25-35.
- Karekezi, S. and W. Kithyoma (2003), *Renewable Energy in Africa: Prospects and Limits*. Available at: http://www.un.org/esa/sustdev/sdissues/energy/op/nepadkarekezi.pdf
- Kamau, C. (2009), *Human activities and nature conservation conflicts at the Kenyan coastline*. Available at: http://www.marbef.org/wiki/Human_activities_and_nature_conservation_conflicts_at_the_Kenyan_coastline
- Kameri-Mbote (2008), "Water, Conflict, and Cooperation: Lessons From the Nile River Basin", Environmental Change and Security Program Report 13, 2008-2009. Available at: http://www.wilsoncenter.org/topics/pubs/ECSPReport13_NavigatingPeace.pdf
- Karanja, N., D. Nierenberg, M. Njenga (2010), "Kenya: Urban women grow food in sacks". *All Africa, 18 February 2010*. Available at: http://allafrica.com/stories/201002180809.html
- Kenya Environmental & Political News Weblog (2010), "Mau Forest Appeal Brings Multimillion Dollar Pledges And Hope To Kenya". *Kenya Environmental & Political News Weblog*, 6 May 2010, Available at: http://kenvironews.wordpress.com/2010/05/06/mau-forest-appeal-brings-multimillion-dollar-pledges-and-hope-to-kenya/
- Kenyatta, C. and A. Henderson (2001), The Impact of Conflict on the Boma National Park: The Status of Food Security, Wildlife and Livestock. Available at: http://cafnr.missouri.edu/iap/sudan/doc/impact-boma.pdf
- KNMI (2006). *Changes in extreme weather in Africa under global warming.* Available at: http://www.knmi.nl/africa_scenarios/brochure_Afrika.pdf

- Lanly, J.P. (1982), *Tropical forestry resources*. FAO Study: Forests 30. Rome.
- Leroy, M. (ed.) (2009), *Environment and Conflict in Africa, reflections on Darfur*. University for Peace, Africa Programme, 2009.
- Maha Abd Alghaffar Abd Alraheem (2000), "Pollution in the water supply wells of Khartoum, Sudan." *Engineering Geology and the Environment,* volume 58, no.4, pp. 257 – 264.
- Mahgoub, G. Z. (2000), *Country pasture forage resource profile, Sudan.* Available at: http://www.fao.org/ag/AGp/agpc/doc/Counprof/Sudan/sudan.htm
- Markakis, J. (2009), "Conflict in the Horn of Africa", In: Leroy, M. (ed.) (2009), *Environment and Conflict in Africa, reflections on Darfur.* University for Peace, Africa Programme, 2009, pp. 54-59.
- Mbendi (year unknown), *Electrical Power in Kenya.* Available at: http://www.mbendi.com/indy/powr/af/ke/p0005.htm
- Mbendi (year unknown), *Oil and gas in Ethiopia.* Available at: http://www.mbendi.com/indy/oilg/af/et/p0005.htm
- Merchant, B. (2009), *How Overfishing Almost Got Capt. Phillips Killed by Pirates.* Available at: http://www.treehugger.com/files/2009/04/overfishing-pirates-phillips-somali.php?dcitc=TH_rotator
- Menghestab, H. (2005), *Weather patterns, food security and humanitarian response in Sub-Saharan Africa.* Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1569582/#bib41
- Millennium Ecosystem Assessment (2005), *Ecosystems and Human Well-being: Synthesis.* Island Press, Washington, DC.
- Ministry of Water Resources Development (2001), "Water and Development Bulletin" , no. 20, 2001, Ministry of Water Resources Development, Addis Ababa, Ethiopia. In: UNEP, 2006. *Africa Environment Outlook 2 – Our Environment, Our Wealth*.
- Misra, V., S. Pandey (2005), "Hazardous waste, impact on health and environment for development of better waste management strategies in future in India." *Environment International*, volume 31, 2005, pp. 417-431.
- Mohamed, A.E. (2001), *Somalia's degrading environment: causes and effects of deforestation and hazardous waste dumping in Somalia*. Available at: http://www.mbali.info/doc331.htm
- Morrissey, J. (2008), "Rural-urban migration in Ethiopia", *Forced Migration Review 31*, October 2008, pp. 28-29.
- Muchira, N. (2010), "Ethiopia prepares case for mega-hydropower project funding." *Engineering News*, 5 February 2010. Available at: http://www.engineeringnews.co.za/article/ethiopia-prepares-case-for-mega-hydropower-project-funding-2010-02-05.
- Mwendera, E. and S.M. Mohamed (1997), "Infiltration rates, surface runoff, and soil loss as influenced by grazing pressure in the Ethiopian highlands". *Soil Use and Management* volume 13-1,1997, pp. 29–35.
- National Drought Mitigation Center (2006), *What is drought?* Available at: http://www.drought.unl.edu/whatis/what.htm
- Nationmaster: http://www.nationmaster.com/graph/geo_sur_are_sq_km-geography-surface-area-sq-km
- Netherlands Ministry of Foreign Affairs (2004), *Hoorn van Afrika notitie.*
- New Security Beat, The (2010), *Land grab sacrificing the environment for food security.* Available at: http://newsecuritybeat.blogspot.com/2010/01/land-grab-sacrificing-environment-for.html
- Nkomo, J.C., A. O. Nyong, K. Kulindwa (2006), *The impacts of climate change in Africa.* Available at: http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/media/8AD/9E/Chapter_5_The_Impacts_of_Climate_Change_in_Africa-5.pdf
- Norwegian Council for Africa (2007), *Uganda: Curb overfishing on Lake Victoria (editorial)*. Available at: http://www.afrika.no/Detailed/15055.html
- Nyssen, J., H. Mitiku, J. Moeyersons, J. Poesen and J. Deckers (2003), "The environmental policy in Ethiopia." *Journal of Modern African Studies*, 2003.

- Odaguiri, F. (2009), *Possible violations of international human rights law in the region possibly affected by the construction of the hydroelectric dam Gilgel Gibe III in Ethiopia.* Research paper, Institute for Environmental Security, September 2009. Available on request.
- Olsson, L., L. Eklundh, J. Ardo (2005), "A recent greening of the Sahel—trends, patterns and potential causes." *Journal of Arid Environments*, volume 63, 2005, pp. 556–566.
- Oromia Authority for Research and Conservation of Cultural Heritage (2008), *The Bale Mountains National Park.* Available at: http://whc.unesco.org/en/tentativelists/5315
- Osterreichische Bundesforste (2009), *Assessment of the Value of the Protected Area System of Ethiopia, "Making the Economic Case", Volume II: Main report*, September 2009.
- Øystein Nedrebø / Royal Norwegian Embassy in Addis Ababa. *Combating Prosopis in Afar*. Available at: http://www.norway.org.et/News_and_events/DevelopmentCooperation/Development-Cooperation/Combating-Prosopis-in-Afar/
- Oxfam (2009), *East African food crisis*. Available at: http://www.oxfam.org.uk/oxfam_in_action/emergencies/east_africa.html
- Oxfam Novib (2009), *Band Aids and Beyond; tackling disasters in Ethiopia 25 years after the famine*. Oxfam Briefing Paper 22 October 2009. Available at: http://www.oxfam.org/sites/www.oxfam.org/files/bp133-band-aids-beyond.pdf
- Paul T. et al. (2008), "The effect of in-stream activities on the Njoro River, Kenya. Part II: Microbial water quality", *Physics and Chemistry of the Earth*, Parts A/B/C, Volume 33, pp. 729-737.
- PENHA Network. *Horn of Africa.* Retrieved at 13 April 2010 from: http://www.penhanetwork.org/pages/Horn-of-Africa-general.html
- Pham, J.P. (2009), "Strategic Interests: Climate Change and Security in Africa". In: *World Defense Review, 3 November 2009.*
- Population Division of the Department of Economic and Social Affairs of the UN Secretariat (2009). *World Population Prospects: The 2008 Revision and World Urbanization Prospects: The 2009 Revision.* Available at: http://esa.un.org/wup2009/unup/
- Public Broadcasting Service (2010), *Ethiopia abundant farming leaves many still hungry*. Public Broadcasting Service, April 22, 2010. Available at: http://farmlandgrab.org/12321
- Pampazuka News (2009), *Land grabbing in Africa; the why and the how.* Available at: http://www.pambazuka.org/en/category/features/59291
- Picman, A.K. and G.H.N. Towers (1982), "Sesquiterpene lactones in various populations of Parthenium hysterophorus." *Biochemical Systematics and Ecology, Volume 10, Issue 2, 1982, pp. 145-153*
- Reiter, P. (2001), "Climate change and mosquito-borne disease". Environ Health Perspect 109: 141–161. In: J. Yasuoka and R. Levins 2007. Impact of Deforestation and Agricultural Development on Anopheline Ecology and Malaria Epidemiology. *American Journal of Tropical Medicine and Hygiene, 76(3), 2007, pp. 450-460.*
- Randall, D.A, S.D. Williams, I.V. Kuzmin, C.E. Rupprecht, L.A. Tallents, Z. Tefera, et al. (2004), "Rabies in endangered Ethiopian wolves." *Emerging Infectious Diseases,* December 2004.
- Red Cross (2008), *Report on the Horn of Africa Food Crises*. Available at: http://www.ifrc.org/Docs/pubs/disasters/Horn-of-Africa/Report-Horn-Africa.pdf
- Red Cross (2009). *Horn of Africa: Exceptional Food Security Crisis Appeal and Budget revision*. Available at: http://www.ifrc.org/docs/appeals/08/MDR64003REA.pdf
- Red Cross Red Crescent Climate Centre (year unknown), *Health risk management in a changing climate: a global approach to building local capacity.* Available at: http://www.climatecentre.org/downloads/File/programs/Rockefeller%20short%20project%20description%20for%20website.pdf
- Republic of Kenya (2010), *Rehabilitation of the Mau Forest Ecosystem - Executive Summary*, Interim Coordinating Secretariat, Office of the Prime Minister, on behalf of the Government of Kenya, support from UNEP. Available at: http://www.unep.org/roa/kcp/Mau/Docs/MAU_Executive_Summary.pdf
- Reuters (2009), "Ethiopian rebel group threatens foreign oil companies." *Ethiopian Review, 3 June 2009.* Available at: http://www.ethiopianreview.com/content/9943

- Reuters (2010). "Somalia charcoal exports fuel war – minister." *Relief Web, 15 March 2010.* Available at: http://www2.reliefweb.int/rw/rwb.nsf/db900sid/SNAA-83L9CU?OpenDocument
- Rugene, N. (2009), "Endless feuding over Mau likely to stir ethnic tension." *Daily Nation, 20 June 2009*. Available at: http://www.nation.co.ke/News/politics/-/1064/613364/-/view/printVersion/-/rbqljm/-/index.html
- Sanchez, P.A., Shephered, K.D., Soule, M.J., Place, F.M., Buresh, R.J., Izac, N.A.-M., Mokwunyu, A.U., Kwesiga, F.R., Ndiritu, C.G., Tamene, L. and P. L. G. Vlek (2008), Soil Erosion Studies in Northern Ethiopia. In: *Land Use and Soil Resources,* 2008, pp. 73-100.
- Safriel, U. (2009), Deserts and Desertification: Challenges but also Opportunities. *Land degradation & development*, *20, 2009, pp. 353–366.*
- Schreck, C.J. and F.H.M Semazzi (2004). "Variability of the recent climate of eastern Africa". *International Journal of Climatology*, 24 (6), pp. 681-701.
- Secretariat of the Convention on Biological Diversity (2006), *Global Biodiversity Outlook 2*. Montreal, 2006.
- Shongwe, M.E., Van Oldenborgh and Van Aalst (2009). *Projected changes in mean and extreme precipitation in Africa under global warming, Part II: East Africa.* Nairobi, 2009
- Slingo, J.M., A.J. Challinor, B.J. Hiskins and T.R. Wheeler (2005). "Introduction: food crops in a changing climate" *Philosophical Transactions of the Royal Society,* Series B 360, 2005, pp. 1983–1989.
- Sillero-Zubiri, C., and J. Marino (2003), *Ethiopian Wolf; Canis simensis.* Available at: http://www.canids.org/species/Ethiopian_wolf.pdf
- Solomon, A.H. (2004). "A reality check on the quest for tenure security and land administration in Ethiopia." Paper presented at the Expert Group Meeting on Secure Land Tenure: New Legal Frameworks and Tools, 10–12 November, 2004, Nairobi
- Somalia Watch (2000), *Firefight over fish in Somalia waters.* Available at: http://www.somaliawatch.org/archive/000114101.htm
- Soromessa, T. (2007), *Mountain resources and conflict instigating issues*, Addis Ababa University, Ethiopia.
- Stock, R. (2004), *Africa South of the Sahara, 2nd edition: A Geographical Interpretation*, The Guilford Press, 2004
- Taipe times (2010), *Food shortages drive new foreign land grab in Africa*. Taipe Times, 12 March 2010. Available at: http://www.taipeitimes.com/News/editorials/archives/2010/03/12/2003467789
- Tenywa, G. (2007), "Uganda: Bidco Drops Bid for Bugala Forests", New Vision,Uganda, 24 May 2007,. In: Cotula, L., N. Dyer, and S. Vermeulen, 2008. *Fuelling exclusion? The biofuels boom and poor people's access to land*, IIED, London.
- Teketay, D., Fetene, M., Abate, A. (2003), "The state of the environment in Ethiopia: Past, present, and future prospects." In: Sahlu, H. 2004. Population, Development and Environment in Ethiopia. *Environmental Change and Security Project report, volume 10, 2004.*
- Times Online (2005), *Somalia's secret dumps of toxic waste washed ashore by tsunami.* Available at: http://www.timesonline.co.uk/tol/news/world/article418665.ece
- Trowbridge, J. (2001), *The Significance of Biodiversity: Why We Should Protect the Natural Environment*. Available at: http://serendip.brynmawr.edu/exchange/node/1692
- UN (2010), *Overview – Convention of the Law of the Seas & Related Agreements.* Available at: http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm
- UN Department of Economic and Social Affairs (DESA) Available at: http://esa.un.org/unpp/
- UNDP (2009), *Reduction of Resource Based Conflicts among Pastoralists and Farmers*. Available at: http://www.sd.undp.org/projects/cp3.htm
- UNEP (2002). *Africa Environment Outlook.* Nairobi, 2002.
- UNEP (2005), *National Rapid Environmental Desk Assessment – Somalia*. Available at: http://ocha-gwapps1.unog. ch/rw/RWFiles2006.nsf/FilesByRWDocUNIDFileName/TKAE-6TV94M-unep-som-2005.pdf/$File/unep-som-2005.pdf

- UNEP (2005), *Somalia*. Available at: http://www.unep.org.bh/Publications/Somalia/Tsunami_Somalia_Layout.pdf
- UNEP (2006). *Africa Environment Outlook 2 – Our Environment, Our Wealth*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.
- UNEP (2006), *Assessment of ground water vulnerability in African cities*. UNEP, Nairobi.
- UNEP (2007), *Sudan Post-Conflict Environmental Assessment*, Nairobi.
- UNEP (2008), "Africa: Atlas of Our Changing Environment." Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Available at: http://www.unep.org/dewa/africa/AfricaAtlas/
- UNEP (year unknown), *Basic environmental problems in Djibouti City*. Available at: http://www.unep.or.jp/ietc/publications/TechPublications/TechPub-17/djibouti2.asp
- UNEP (2010), *Africa Water Atlas*. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya.
- UNEP (2007). *Sudan Post-Conflict Environmental Assessment*, Nairobi.
- UNHCR (2010). *Regional Operations Profile - East and Horn of Africa.* Available at: http://www.unhcr.org/pages/49e45a846.html
- UN News Service (2010). "Somali refugees strain resources of neighbouring countries, UN official warns". *UN Daily News*, 3 May 2010. Available at: http://www.un.org/news/dh/pdf/english/2010/03052010.pdf
- University of Texas Libraries, The University of Texas at Austin. Available at: http://www.lib.utexas.edu/maps/africa.html
- United Nations Population Division (2010). *World Population Prospects: the 2008 Revision Population Database.* Available at: http://esa.un.org/unpp/
- USAID (2008), *Evaluation of the USAID/Sudan Sudan Transitional Environment Program (Step) implemented by International Resources Group (IRG)*. Available at: http://pdf.usaid.gov/pdf_docs/PDACM088.pdf
- USDA Foreign Agricultural Service (2002), *Crop Characteristics Ethiopia.* Available at: http://www.fas.usda.gov/pecad2/highlights/2002/10/ethiopia/baseline/Eth_Crop_Production.htm
- US Energy Information Administration (2010), *Country Analysis Brief Sudan.* Available at: http://www.eia.doe.gov/cabs/Sudan/Background.html
- Vallely, P. (2009), *A new trend: Industrialized nations lease fertile land in Africa to meet food demands*. The Independent, 10 August, 2009. http://sanhati.com/articles/1734/
- Van Dorp, M. (2009). *"Dealing with energy needs in humanitarian crisis response situations"*. Institute for Environmental Security, The Hague, 2009.
- Van Dorp, M. and Van de Giessen, E. (2010) *Climate and Conflict: a Double Disaster for the Poorest People*. Available at: http://www.envirosecurity.org/news/ClimateAndConflict.pdf
- VOA News (2009), "Environmentalists Ask Bank to Stop Funding Gil Gel Gibe III". *VOA News, 8 May 2009.* Available at: http://www.voanews.com/horn/Environmentalists-Ask-Bank-to-Stop-Funding-Gil-Gel-Gibe-III.cfm
- VOA News (2009), *Group warns drought worsening in East Africa as more rains fail*. Available at: http://www1.voanews.com/english/news/africa/Group-Warns-Drought-Worsening-in-East-Africa-as-More-Rains-Fail-79443377.html
- Volkskrant, De (2009), "Experts worry over land grab by foreigners in Ethiopia". Available at: http://www.vkblog.nl/bericht/273580/Experts_worry_over_land_grab_by_foreigners_in_Ethiopia
- Waldo, M.A. (2009), "Somali Piracy: the other side of the coin." *Africa prospects*, October 2009, pp. 8-11.
- WCS (2007), *Boma-Jonglei , Southern Sudan.* Available at: http://www.wcs.org/saving-wild-places/africa/boma-jonglei.aspx
- WCS (2007), *Southern Sudan.* Available at: http://www.wcs.org/where-we-work/africa/southern-sudan.aspx
- Wikipedia (2009), *Atbarah River.* Available at: http://en.wikipedia.org/wiki/Atbarah_River

- Williams, S. (2005), *Review of activities and achievements, 2000-2004 and future work.* Ethiopian Wildlife Conservation Programme. Available at: http://www.carnivoreconservation.org/files/issues/wolf_ethiopian_conservation_achievements.pdf
- Wood, A., Stedman-Edwards, P. and Mang, J. (2000), *The Root Causes of Biodiversity Loss; Macroeconomicsfor Sustainable Development, WWF-International, Earth scan, London, p. 399*.
- Woomer, P.L. (1997), "Soil fertility replenishment in Africa: an investment in natural resource capital". In: Buresh RJ, Sanchez PA and Calhoun FG (eds), *Replenishing Soil Fertility in Africa, pp 1–46. SSSA Special Publication Number 51. Soil Science Society of America, Madison, WI, USA*
- World Bank (2000), *Map of the Nile River Basin.* Available at: http://go.worldbank.org/4DF3FD8CY0
- World Food Programme (2009), *Hunger Lingers In Horn Of Africa Despite Rains.* Available at: http://www.wfp.org/stories/hunger-lingers-horn-africa-despite-rains
- World Food Programme (2009), *Sudan.* Available at: http://www.wfp.org/countries/sudan
- World Food Programme (2009). *Djibouti.* Available at: http://www.wfp.org/countries/djibouti
- World Food Programme (2009). *Somalia.* Available at: http://www.wfp.org/countries/somalia

Institute for Environmental Security

"Water makes or breaks relationships. The linkages between water security, peace and development are exceptionally obvious in the countries of the Nile River Basin"

"Many areas of high conservation value are not adequately protected against the threats faced by increasing demands for land and wood (...) By protecting forest ecosystems and sites of wild original crops, Ethiopia would provide an essential service to the rest of the world, which should be adequately compensated by the global community. Church forests in northern Ethiopia offer great opportunities for the conservation of biodiversity."

Eric van de Giessen

Project Coordinator East Africa
Institute for Environmental Security

Institute for Environmental Security

Anna Paulownastraat 103
2518 BC The Hague
The Netherlands
Tel +31 70 365 2299 - Fax +31 70 365 1948
Email: info@envirosecurity.org
www.envirosecurity.org