

MOUNTAIN ADAPTATION OUTLOOK SERIES

Sustainable mountain development in East Africa in a changing climate



DISCLAIMER

The development of this publication was supported by the United Nations Environment Programme (UNEP) in the context of its inter-regional project “Climate change action in developing countries with fragile mountainous ecosystems from a sub-regional perspective” that is financially co-supported by the Government of Austria (Austria Federal Ministry of Agriculture, Forestry, Environment and Water Management).



This synthesis publication builds on main findings and results available through conducted projects, activities and based on information that is available such as respective national communications by countries to the UNFCCC and peer reviewed literature. It is based on review of existing literature and not based on new scientific results generated through the project.

The contents of this publication do not necessarily reflect the views or policies of UNEP, contributory organizations or any governmental authority or institution with which authors or contributors are affiliated, and neither do they imply any endorsement.

While reasonable efforts have been made to ensure that the contents of this publication are factually correct and properly referenced, UNEP does not accept responsibility for the accuracy or completeness of the contents, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of UNEP concerning the legal status of any country, territory or city or its authorities, or concerning the delimitation of its frontiers or boundaries.

Mention of a commercial company or product in this publication does not imply endorsement by UNEP.

This publication may be reproduced in whole or in part and in any form for educational or non-profit services without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source.

We regret any errors or omissions that may unwittingly have been made.



Editors

Jurek Matthias, UNEP
Kavagi Levis, UNEP
Mafuta Clever, GRID-Arendal
Mwikila Dismass L., EAC
Ntamubano Wivine, EAC
Otiende Brian O., EAC
Schoolmeester Tina, GRID-Arendal
Sebukeera Charles, UNEP
Wabunoha Robert, UNEP

Layout

GRID-Arendal

Cartography

Izquierdo Nieves López

Dedicated to the memory of Dr. Festus Bagoora, who not only contributed significantly to the contents of this report, but was also a renowned mountain policy expert on East Africa.

ISBN: 978-82-7701-154-7

Recommended Citation

EAC, UNEP and GRID-Arendal (2016). *Sustainable Mountain Development in East Africa in a Changing Climate*. East African Community, United Nations Environment Programme and GRID-Arendal. Arusha, Nairobi and Arendal

Front cover photo:
Mubuku Valley in Rwenzori Mountains National Park, Uganda

UNEP promotes environmentally sound practices globally and in its own activities. This publication is printed on fully recycled paper, FSC certified, post-consumer waste and chlorine-free. Inks are vegetable-based and coatings are water-based. UNEP's distribution policy aims to reduce its carbon footprint.

Sustainable mountain development in East Africa in a changing climate

5	Foreword
6	Executive summary
8	Key Messages
11	Introductory overview
13	East Africa
16	Approach and methodology
17	East Africa's Mountain Ecosystems in a Changing Climate
18	Overview of East Africa's mountain areas
20	Climate change trends and scenarios and their effect on mountain ecosystems
24	East Africa's Mountains and Climate Change: The case of Mount Kilimanjaro, Tanzania
28	African Mountains and Climate Change: The case of Mount Elgon
36	Mau Forest Complex: Renewed Efforts to Save Kenya's Water Tower
42	Rwanda: Climate Resilience
46	Transboundary collaboration in the Greater Virunga
48	Burundi's Mountains
49	East Africa's mountain policies
51	Governance of East Africa's mountainous areas
68	Best practice case studies
74	Key messages
75	East Africa Mountain Agenda: Options
76	Background
77	Governance of mountain ecosystem conservation and development
78	Identified gaps and overlaps
80	The Case for an East African mountain agenda
81	The agenda for Eastern African mountains
92	Conclusion
93	Contributors and reviewers
94	Acronyms
95	References



Mount Elgon on the border between Kenya and Uganda

Foreword

Mountains directly contribute to the lives of much of the world's population through the provision of freshwater or irrigation for agriculture; they are the source of rivers, along which human settlements are able to flourish. While acting as the lifeblood for many communities, these fragile landscapes are under threat from changes to our climate, the effects of which are accentuated at high altitudes. A range of ecosystems such as mountain forests, grasslands and lakes are affected, with pollution from mining and agriculture further weakening their ability to cope with changes in rainfall and temperature. Mountain populations dependent on these ecosystems are vulnerable - especially when isolated from markets, services and decision-making institutions. Adaptation to climate change therefore requires a tailored approach if mountain regions are to be sustainably managed.

Recognising the value of mountain regions and the need for climate change adaptation, a joint project is underway led by UN Environment and GRID-Arendal, co-financed by the Government of Austria, to produce a series of mountain adaptation outlooks. The publications gather the latest evidence on adaptation measures while identifying gaps and assessing key risks linked to climate change. A broad participatory assessment process fed into the work, including input from national governments, regional and international experts. Concrete follow-

up recommendations for policymakers are provided that take a regional perspective covering the Balkans, the South Caucasus, Central Asia, the Tropical Andes and the East African mountain ranges. The latter contain some of the highest mountains on the Pan-African continent and are often under severe resource extraction pressures while also acting as a hotbed for biodiversity and boon for tourism.

With the support of this Outlook publication, countries now have a unique opportunity to mainstream work not only on climate adaptation but on a host of environmental protection issues into decisions taken by the East African Community.

The publication contains practical policy recommendations, such as that Mount Kilimanjaro is reforested to protect its water catchment area, that agroecosystem practices be adopted in Rwanda for food security environmental conservation, and that continuous awareness-raising is needed in Burundi. It includes a section on mountain policies - including transboundary ones - and documents best practices for issues such as soil conservation and landscape conservation. While few countries have specific institutions addressing mountains, sufficient momentum can be garnered from existing policies in the region to drive their sustainable management, it finds.

Further collaboration with UN Environment would build on the strong role the organization already has in the region - thanks to publishing the first ever Mountain Atlas for the region issued last year and co-organizing the first African Mountains Forum in 2014 for example. The report's publication could not be better timed to coincide with the World Mountain Forum taking place in Mbale, Uganda in October 2016 to drive this forward.

It is our hope that this Outlook as well as the overall series being coordinated by UN Environment will contribute to build a common understanding of what is needed for a sustainable mountain development in East Africa, as well as to the ongoing discussion on a shared mountain agenda for the region.

The East African Community, UN Environment and the Government of Austria gratefully acknowledge the work carried out by GRID-Arendal, Nature RIDD, the Albertine Rift Conservation Society and others in helping bring about this comprehensive assessment, drawing on best practices in East Africa. We would also like to express our thanks to all those that contributed to the series of regional meetings that fed into these reports on what is a vital issue for all regions of the globe.

Hon. Jesca Eriyo
Deputy Secretary General, East African
Community (EAC)

H.E. Andrä Rupprechter
Austrian Federal Minister of Agriculture, Forestry,
Environment and Water Management

Executive summary

The United Nations Environment Programme and GRID-Arendal partnered and prepared a series of outlook reports on the need for urgent action to protect mountain ecosystems and to mitigate human risk from extreme events. This global project aims at supporting mountainous developing countries to integrate climate change adaptation practices into their development policies, plans and strategies, and was initiated in 2014. The project focuses on the five mountainous regions of East Africa, the tropical Andes, the Balkans, the Southern Caucasus and Central Asia.

The main focus of the current phase of this project is to assess and evaluate approaches for sustainable development and climate change adaptation in mountainous regions, including an assessment of relevant existing national plans, strategies and policies.

This summary focuses on East Africa, primarily the Member States of the East African Community (EAC) – Burundi, Kenya, Rwanda, Tanzania and Uganda - and neighbouring countries with which the Community shares mountain ecosystems.

Overview

Similar to many other mountainous regions, the mountains of East Africa provide a variety of ecosystems such as forests, scrublands and grasslands. These ecosystems are all vulnerable to extreme natural events that can alter the landscape significantly. East Africa's mountains support large populations. The Ugandan side of Mount Elgon, for example, has an average population density of 900 people per square kilometre. This is partly because

the mountainous regions of East Africa have cooler temperatures, more stable rainfall regimes and more fertile soil compared with lowland areas.

The mountains of East Africa are not only highly productive agricultural areas: the rivers also have significant, but largely unexploited, hydropower potential. Other economic opportunities relate to hiking and wildlife-based tourism. These scenic areas, which include snow-covered mountain peaks, glaciers and dense forests, are an important tourist attractions. The famous mountain peaks, which include Mt. Kilimanjaro, account for a large proportion of the region's annual tourism, and the number of tourists is increasing as new ecotourism initiatives are developed.

The favourable conditions – that support a large population, extensive natural ecosystems and national economies – could be threatened by changes to the climate. Changes in climatic conditions have already been observed and the severe impacts of climate change are becoming more common. According to the Intergovernmental Panel for Climate Change (IPCC) Fifth Assessment Report, the average annual temperature for Africa has risen by at least 0.5 °C during the last 50 to 100 years. The Fourth IPCC Assessment notes that the average temperature for East Africa will increase by approximately 3.2 °C by 2080. Such an increase will affect the suitability of certain agricultural crops, creating the need to introduce other crop types. Temperature increases will also dramatically diminish glaciers in East Africa – which have already shown significant decline during the last few decades. Since the 1990s, the surface area of glaciers in the region has decreased by 80 per cent and they are expected to completely disappear within a few decades.

Precipitation trends for East Africa have not been consistent, although a general decrease has been observed in the amount of rain received during the season that runs from March to June. There has also been an increase over the last 30 to 60 years in extreme weather events such as heavy precipitation and droughts. Despite the observed decrease in precipitation, scenarios for the future indicate a wetter climate for East Africa with fewer droughts. The expected increase in precipitation will increase the risk of flooding.

The majority of the population in the mountainous areas live and work on small farms. The increasing risks of disasters, such as floods, will have a devastating impact on livelihoods and cause the destruction of buildings and infrastructure. To date, climate change has been responsible for crop failures and famine, while the increasing incidence of floods and droughts has severely degraded productive agricultural land. In order to address the vulnerability of these areas and the risks to the population there is a need for improved governance systems that take into account the potential effects of climate change.

The mountainous areas of East Africa are generally dealt with through sectoral institutions – particularly those related to tourism, agriculture and rural development. There are no public institutions that focus specifically on mountains as distinct areas. Some countries, including Kenya, Tanzania and Uganda, have policies that relate to issues relevant to these areas but these are often only components of larger policy agendas. There is an urgent need for addressing the impacts of climate change on mountainous areas in national policies across the region.



Kilimanjaro, Tanzania

Key Messages

Climate change already affects East Africa's mountain regions

The mountainous areas of East Africa are densely populated due to the favourable natural conditions for agriculture. The population depends on the mountains for a variety of ecosystem services, including food and water. Climate change and the increase in extreme events such as flooding and droughts have altered the landscape and have had severe social, ecological and economic impacts.

Weak mountain governance systems

East Africa's mountainous regions are hampered by weak governance systems; in particular, a lack of specific policies that target mountains and climate change. In addition, the majority of countries in the region do not have specific institutions that can push forward the regional mountain agenda. As well as being bound by the goals and aspirations of the East Africa Community, these countries are also



Marabou storks, Ethiopia



Ol Doinyo Lengai mountain, Tanzania



members of other regional economic communities such as the Southern Africa Development Community, the Common Market for Southern and East Africa, and the Intergovernmental Authority for Development. Such overlapping membership creates challenges for coordination, while also stretching human and financial resources. Where regional and global climate change policies do exist, these are rarely instituted at the national level and therefore have little legal basis.

Towards an East Africa mountain agenda

In the context of a changing climate, there is a growing recognition of the environmental, social and economic value of mountainous regions in Africa. This is particularly true for East Africa, which has some of the continent's most prominent mountains. This was highlighted at the Fifteenth Session of the African Ministerial Conference of the Environment (AMCEN) held in Cairo from 4–6 March 2015. The



Walia Ibex, Ethiopia

Conference issued a declaration stating that Member States should develop appropriate institutions, policies, laws and programmes, as well as strengthen existing transboundary and regional frameworks for the sustainable management of mountain ecosystems. In addition, the Conference agreed to prepare a regional mountain agenda and to establish and strengthen the Africa Regional Mountains Forum to facilitate knowledge and information exchange, and for policy dialogue in close cooperation with Africa's Mountain Partnership.

Current efforts will mark a major step towards achieving sustainable mountain development in Africa, and will form the basis for discussions on a proposal for East Africa's mountainous regions. This should be in line with the Global Mountain Agenda (from the 1992 United Nations Conference on Environment and Development) and the subsequent Rio+20 outcomes, the 2030 Sustainable Development Goals and the Africa Union's Agenda for 2063.

The proposed components of an East Africa Mountain Agenda include:

- developing and/or strengthening the policy and institutional arrangements and mechanisms for enhanced governance in mountain ecosystems
- increasing investment in mountain development and conservation, and enhancing mountain ecosystems and the participation of mountain communities
- implementing adaptation measures to address the impacts of climate change in mountain areas



AMCEN

The African Ministerial Conference on the Environment is increasingly focused on mountain issues. In March 2015, it committed to the development of initiatives that will strengthen sustainable development in Africa's mountain ecosystems, with a particular emphasis on the importance of transboundary and regional frameworks.

Agenda 21

Mountain areas were, for the first time, recognized and distinctly addressed during the Rio Summit in 1992. Agenda 21, the outcome of the summit, addresses mountain issues in chapter 13: 'Managing Fragile Ecosystems - Sustainable Mountain Development'.

EAST AFRICAN MOUNTAINS

Overview

Snowcapped summit of Mount Rwenzori, Uganda

Introduction

This report – *Sustainable Mountain Development in East Africa in a Changing Climate* – complements the *Africa Mountain Atlas*, a UNEP publication that describes changes to Africa’s mountain ecosystems and the impact of these changes on livelihoods.

In launching the *Africa Mountain Atlas*, the first African Regional Mountains Forum, held in Arusha in 2014, called upon Member States to develop and implement a shared mountain agenda and strategy for Africa. It is on this basis that this report was

conceived – to inform the development of appropriate institutions, policies, laws and programmes, as well as strengthen existing transboundary and regional frameworks for the sustainable management of African mountain ecosystems.

In addition to the 2014 Arusha Mountain Forum, there were several other calls to action – reiterating the need to strengthen mountain governance and to enhance cooperative action in mountain regions at various levels. These include the 2013 African

Ministerial Conference on the Environment (AMCEN) Gaborone Declaration on Climate Change and Africa’s Development, which stressed the need to promote and strengthen sustainable mountain development, including the adoption of transboundary and regional frameworks for the sustainable management of African mountain ecosystems. Building on these mandates, the call for strengthened management and conservation of mountain ecosystems was reinforced at the fifteenth session of AMCEN in Cairo, which called for the strengthening of the Africa Regional Mountains Forum as a centre of knowledge, information exchange and policy dialogue.

This report also responds to UNEP’s global efforts towards supporting sustainable development in mountain regions in developing countries in Africa, the Andes, Central Asia and others. The report examines climate change action in countries within the region of East Africa that have fragile mountainous ecosystems. The core objective of this report and similar UNEP-led initiatives is to foster dialogue and promote a regional understanding of mountain ecosystems with a specific focus on climate change and adaptation, as well as fostering further interregional exchange of experiences and best practice at the global level. This report is therefore one of a set of five reports; the other four focus on the tropical Andes, the Western Balkans, the Southern Caucasus and Central Asia.

Furthermore, as the continent’s most mountainous region, it is hoped that the East African experience will be key to informing Africa’s wider mountain agenda.



Simien community, Ethiopia

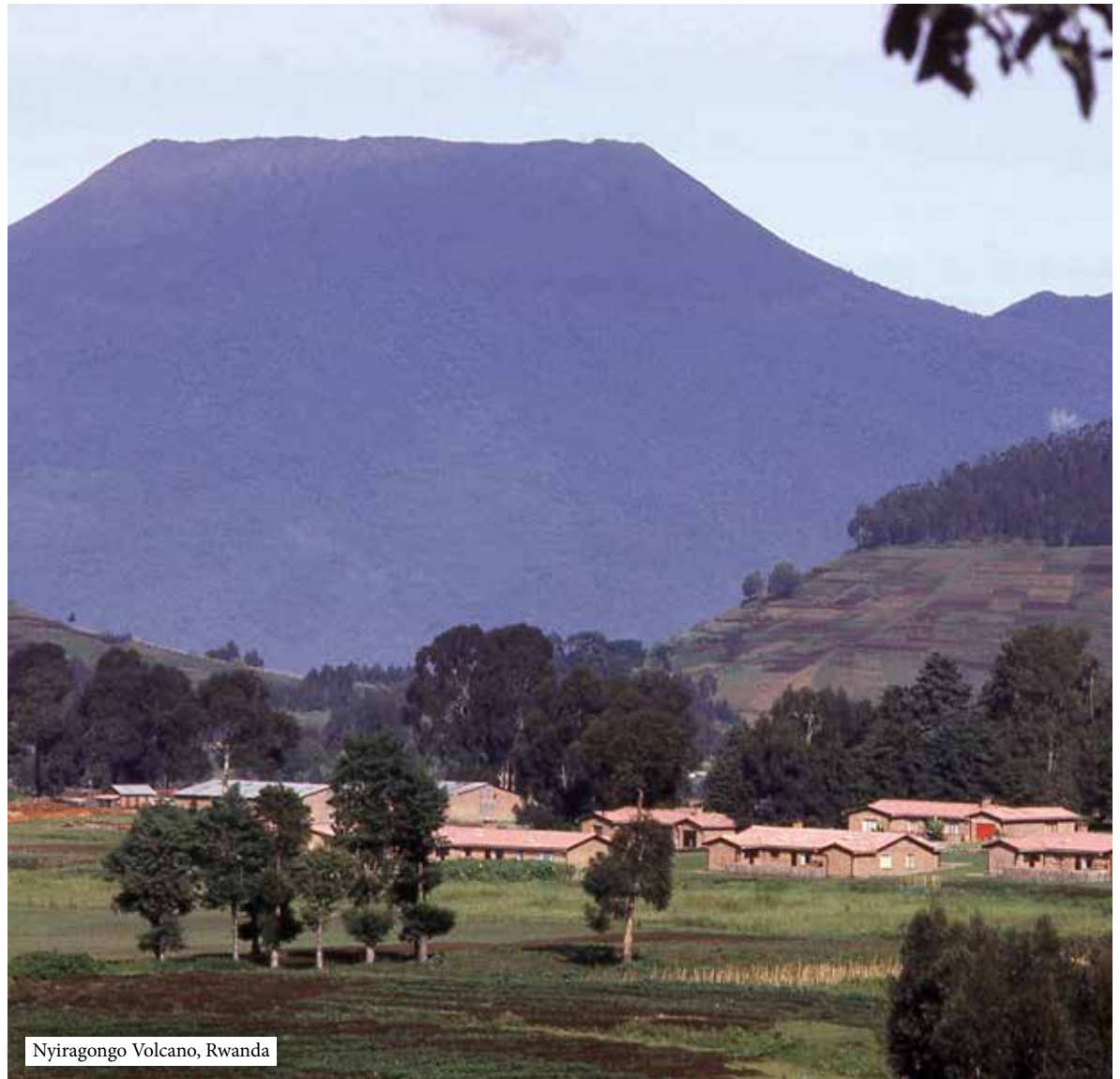
East Africa

The majority of countries in Africa have land that is over 1,500 m above sea level, and therefore classified as mountainous (UNEP 2014). East Africa is home to some of Africa's most prominent mountains, including Mount Kilimanjaro, Rwenzori, Virunga, Kenya and Elgon, as well as highland regions such as the Ethiopian Highlands and the East Africa Arc. The Congo Nile Ridge, which runs from Bujumbura and southwestern Rwanda and stretches to the Northern Volcano Massif. The East Africa Rift Valley is also a major geological feature of East Africa.

These mountains are the source of major rivers such as the Nile, and are rich in biodiversity. Examples include the Albertine Rift, which is famous for its outstanding species diversity and the large number of endemic species, and the critically endangered mountain gorillas in East Africa's Virunga Mountains. The highlands have rich agricultural land, and as a result the region is a major exporter of tea and coffee. East Africa's mountain forests are important for carbon sequestration – the conservation of forests on Mount Elgon and the rehabilitation of forests in the Kibale National Parks are part of the global effort to mitigate global warming. The forests in the Kibale National Parks are estimated to sequester 7.1 Mt of carbon over a 99-year period.

Governance systems

The region is comprised of a number of different, and in places, overlapping governance systems.



Nyiragongo Volcano, Rwanda



The East African Community (EAC)

Most of the region's countries are members of the EAC, a subregional intergovernmental organization made up of Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda. The Protocol on Environment and Natural Resources Management, which is not yet operational, will be critical in the future management of East Africa's mountainous areas. The Protocol seeks to improve collaboration in the management of East Africa's mountain ecosystems, transboundary resources, biodiversity, forests, wildlife and water resources.

Non-EAC Member States

While the EAC is the most prominent intergovernmental body in the subregion, East Africa's mountainous areas extend into non-EAC Member countries such as Ethiopia, Eritrea, Djibouti, Somalia, Sudan and the Democratic Republic of Congo.

Overlapping membership

Multiple membership of regional economic communities is common in East Africa, as it is in the rest of Africa. Besides the EAC, some East Africa countries are also members of the Southern African Development Community (SADC), the Intergovernmental Authority on Development (IGAD) and the Common Market for Eastern and Southern Africa (COMESA). According to the United Nations Economic Commission for Africa (2004), overlapping membership of regional economic communities burdens Member States with multiple financial obligations and a host of different meetings, policy decisions, instruments, procedures and schedules. For example, in dealing with environment and development issues Tanzania has to align its national policies, programmes and institutional arrangements with not only the EAC's Protocol on Environment and Natural Resources Management, but also with the SADC's Protocol on Natural Resources.



Elementaita Lake, Rift Valley, Kenya

Approach and methodology

This report is the outcome of a process that involved the collection and analysis of information and data relevant to mountain-specific climate change policies in East Africa. The purpose of the report is to enable targeted cooperative action at the global level, informed by subregional reports covering East Africa, the tropical Andes, the Western Balkans, the Southern Caucasus and Central Asia.

Building on the findings of the *African Mountain Atlas*, which contains a chapter on East Africa, the *Sustainable Mountain Development in East Africa in a Changing Climate* report is a synthesis of a literature review, case studies of both good and bad practices, and assessments of vulnerability to climate change. The main focus of this report is to identify gaps in approaches to sustainable development and climate change adaptation in mountainous regions. This includes an assessment of relevant national plans, strategies and policies. In addition, it evaluates best practices, and through a gap analysis, identifies priority areas for future collaborative action based on recent AMCEN outcomes.

The report, which was compiled by local experts, benefited from extensive government and peer review. Stakeholder participation was critical, not only for the collection of the information and data, and the analysis, review and validation of the findings, but also in ensuring the buy-in of East African countries and the EAC.

This report will inform the next phase of development: fostering joint dialogue, a common subregional understanding and cooperative action in the context of relevant transboundary institutional



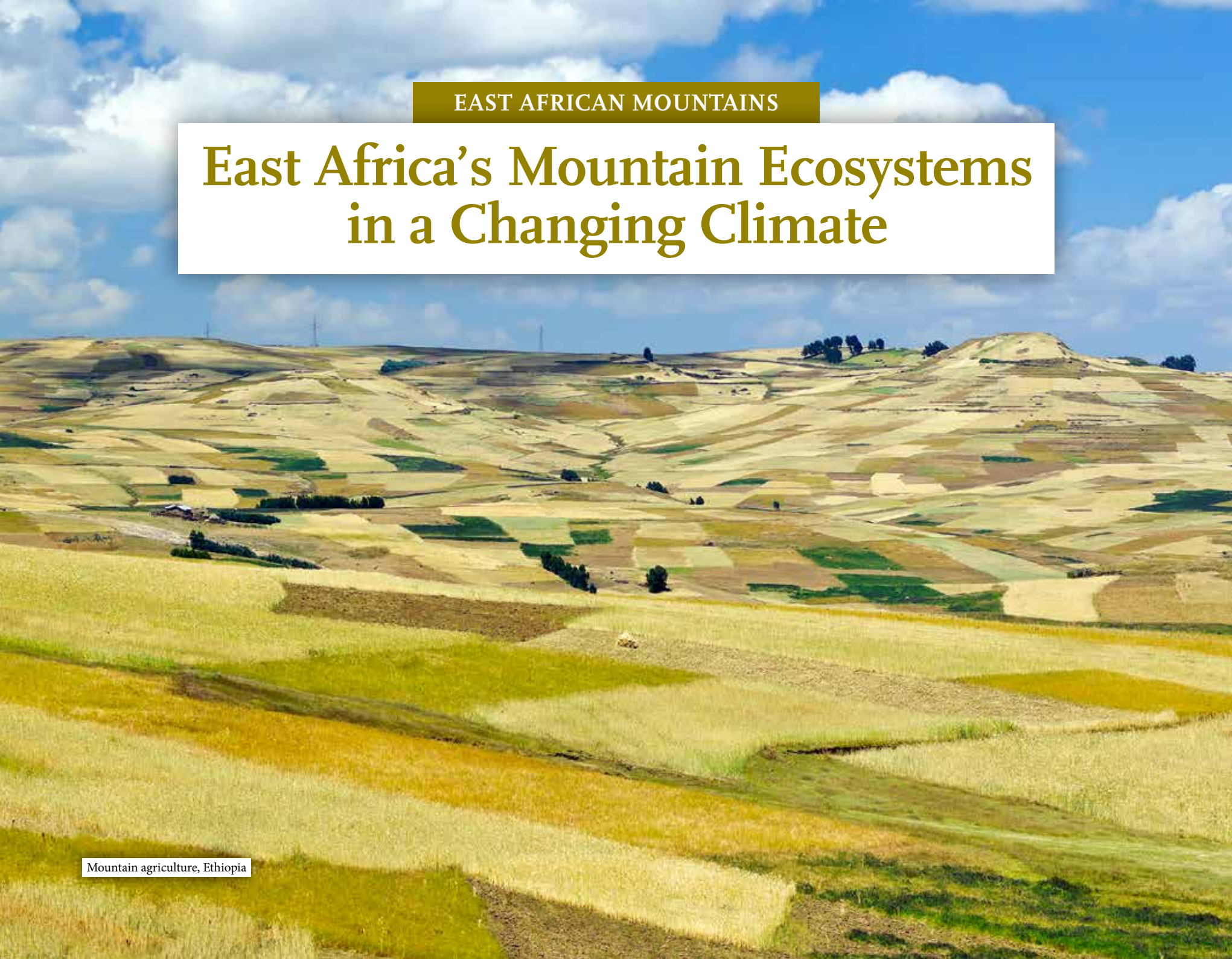
Handful of Fair Trade Coffee, Kenya

frameworks such as the EAC. It is hoped that the response to this report will be coordinated in a consultative manner, involving stakeholders and experts – non-governmental organisations, scientists and governmental experts – who will come together to share information, identify the most relevant key sectors for policy action and analyse institutional and subregional conditions as a step towards transboundary cooperation. Commonly agreed objectives and strategies based on best practice from other mountain regions (such as the Alps, Carpathians, Central Asia and the Andes) will support national efforts to develop mountain-specific legislation/policies and integrate mountain-specific climate change adaptation measures into relevant policies and strategies.

EAST AFRICAN MOUNTAINS

East Africa's Mountain Ecosystems in a Changing Climate

Mountain agriculture, Ethiopia



Overview of East Africa's mountain areas

Mountains cover 20 per cent of Africa's surface area, and over half of the 54 countries in Africa have mountain peaks that rise 2,000 metres above sea level. East Africa is one of the most mountainous areas of Africa with several peaks above 4,500 metres, and is home to the three highest mountains on the continent: Kilimanjaro (5,895 m), Mount Kenya (5,119 m) and the Rwenzori Mountains (5,109) (Alweny and Gatarabirwa, 2014; UNEP, 2014).

Several mountains and mountain ranges in East Africa stretch across borders. The Ethiopian Highlands cross into Djibouti and Eritrea; the Rwenzori Mountains, known as the 'Mountains of the Moon' are shared between Uganda and the Democratic Republic of Congo (DRC); while the Virunga Mountains extend across Uganda, DRC

and Rwanda. Mount Elgon, Africa's oldest volcano is divided between Uganda and Kenya, while the Eastern Arc Mountains extend 600 kilometres from the south of Kenya to the southern part of Tanzania (UNEP, 2014).

The majority of East Africa's mountains are situated along the East African Rift System, stretching 3,000 kilometres from Djibouti in the north to Malawi in the south. The rift began to develop 22-25 million years ago when the Somali plate broke away from the African plate, also known as the Nubian. Today, it is the largest active rift in the world. The rift is divided into two parts: the Eastern Rift Valley (Ethiopia and Tanzania) and the Western Rift Valley (Uganda and Malawi). Two large mountain ranges, the Rwenzori Mountains and Virunga Mountains, are situated

along the Albertine Rift at the northern end of the Western Rift. The Ethiopian Highlands, Mount Kilimanjaro, the Aberdare Mountains, Mount Kenya and Mount Elgon are located along the Eastern Rift (UNEP, 2014).

Volcanic mountains are the most common mountain type along the East African Rift System, where the majority of volcanic mountains in Africa are located (UNEP, 2014). Formed during different time periods, volcanic mountains are all made up of accumulated lava and ash that erupted from below the earth's crust. Volcanoes are organized into three groups depending on their activity status: active, dormant and extinct. An active volcano has either historically or recently erupted or shown signs of unrest (USGS, 2009). Examples of active volcanoes in East Africa include Mount Nyiragongo and Mount Nyamuragira – two of the eight volcanic mountains in the Virunga Mountains (UNEP, 2014). Mount Nyamuragira is Africa's most active volcano with more than 40 eruptions since 1865 (SIGVP, 2015). Dormant volcanoes have not been active for a long time, but may show signs of unrest or may erupt again. Mount Kilimanjaro and the other six volcanoes that make up the Virunga Mountains are examples of dormant volcanoes. Volcanoes that scientists consider unlikely to erupt again are known as extinct volcanoes, such as Mount Kenya and Mount Elgon (USGS, 2009; UNEP, 2014). Other important mountain types in East Africa include massifs and highlands. Massifs form when parts of the central block of the earth's crust cracks and opposing forces push the block upward. Examples include the Rwenzori Mountains and the Eastern Arc Mountains. Volcanic mountains can also be massifs, such as Kilimanjaro, which is the largest



Agriculture and livestock, Kinigi, Rwanda

freestanding massif in the world. Highlands are areas that rise above surrounding land with a relatively flat top; the Kenyan and Ethiopian Highlands are examples of such features, the latter being the most well-known in Africa (UNEP, 2014).

The mountains support a variety of ecosystems, including Afro-alpine moorlands, forests, scrublands and grasslands. The latter three are the most common type of mountain ecosystems, while Afro-alpine moorland ecosystems are only found at elevations above 3,000 metres. Forests cover a vast area of East Africa's mountains and a high proportion are protected due to their importance for biodiversity conservation and as water catchment areas. The mountains are home to some of the most diverse tropical montane forests in the world, located in areas such as the Eastern Arc Mountains, the Mau Escarpment, the Albertine Rift, and the Eastern Highlands (Alweny and Gatarabirwa, 2014; UNEP, 2014). These montane forests are also the most important 'water towers' in East Africa, providing water for millions of people in highland and lowland communities as well as to important transboundary rivers (UNEP, 2010).

Situated near or directly on the equator, East Africa is dominated by a tropical climate, but variations occur between locations and elevations. While vast areas of Kenya and Ethiopia and some areas of Tanzania are semi-arid or arid, most of the mountainous areas have a tropical climate, which are moderated by high elevations and mountain formations (UNEP, 2014). Although it is situated entirely within the equatorial zone, Rwanda, for example, enjoys a cool climate due to its high elevation – nearly all of the country is situated over 1,000 metres above sea level

(REMA, 2011). The combination of cooler and wetter climates in these mountainous areas, coupled with fertile volcanic soil makes the mountain regions very adequate for agriculture. As agriculture is the main source of income for East Africa, the population densities in mountainous areas are generally much higher than in lowland areas (UNEP, 2014).

The majority of the region has two distinct rainy seasons: the 'long rains' from March to May, and the 'short rains', which occur sometime between September and December, depending on the year. The movement of the Inter-Tropical Convergence Zone (ITCZ) over the equator is the main driver of these seasonal rains. Climate variability in the region is mainly caused by changes in the sea-surface temperatures of the tropical eastern Pacific Ocean and

the Indian Ocean. The El Niño–Southern Oscillation (ENSO), caused by changes in the eastern Pacific Ocean, occurs roughly every fifth year resulting in either El Niño or La Niña conditions. During El Niño, ocean temperatures are warmer than normal and lead to wetter conditions in East Africa, while La Niña, which occurs when the ocean becomes cooler than average, brings about drier conditions. Changes in the temperature of the western Indian Ocean, known as the Indian Ocean Dipole (IOD), have similar effects on the region with higher sea-surface temperatures resulting in wetter conditions over eastern and southern Africa (Christensen et al., 2013; Shanahan et al., 2013). The ITCZ is especially sensitive to changes in the temperature of the western Indian Ocean, which affects the onset as well as the duration of rainy periods (McSweeney, New and Lizcano, 2012a).



Simien Mountains National Park, Ethiopia

Climate change trends and scenarios and their effect on mountain ecosystems

Observed climate change

Mountains are one of the most sensitive ecosystems to climate change in the world (Kohler and Maselli, 2012). Globally, mountainous regions have experienced above average warming during the twentieth century, a trend that is likely to continue in the future (IPCC, 2007). Scientists, therefore, often refer to mountains as early warning systems as they may provide an indication of the changes that lowland ecosystems can expect in the future (Kohler and Maselli, 2012). Specific data on climate change observations and trends in East Africa's mountainous areas are, however, limited; the available data is mainly for the region as whole. As noted in the IPCC's Fifth Assessment Report (2013), there is a gap in the research on the long-term climate trends for mountain ecosystems in Africa.

According to the IPCC's Fifth Assessment Report, Africa has seen an increase in temperature by 0.5 °C or more during the last 50 to 100 years. The temperature changes in East Africa are in line with UNDP Climate Change Country Profiles, which indicate that both Tanzania and Kenya have had an increase in temperature of 1.0 °C between 1960 and 2003, while Uganda and Ethiopia have seen an increase of 1.3 °C over the same period (McSweeney et al., 2012 a, b, c, d). Data from weather stations east of the Rwenzori Mountains, located between 960 and 1,869 metres above sea level, indicate an increase in temperature of 0.5 °C per decade since the 1960s (Taylor et al., 2006). Similarly, an increase in

temperature of 0.27 °C per decade has been recorded near Mount Kilimanjaro (Buytaert et al., 2011). In the northern part of the Ethiopian Highlands, the average annual minimum temperature has increased by 0.76 °C between 1954 and 2008, while average annual maximum temperatures have increased by 0.36 °C over the same period. This is significantly higher than the national average of 0.25 °C and 0.10 °C, respectively (Gebrehiwot and van der Veen, 2013).

There is less certainty on the observed trends in rainfall across East Africa due to climate models' difficulties with incorporating the processes affecting the rainfall patterns in the region. Studies presented in the IPCC's Fifth Assessment Report (2013) show a reduction in rainfall over East Africa during the past 30 years during the 'long rains' between March and May/June. Similar findings are reported across the region from Tanzania (Hemp, 2005) and Rwanda (MoNR, 2012) to Ethiopia (William and Funk, 2011). Lower rainfall has also been recorded at Mount Kilimanjaro. Data from three weather stations on the southern slope of Mount Kilimanjaro indicate that precipitation has decreased by up to 39 per cent between 1911 and 2004 (Hemp, 2005). For some areas, the average annual rainfall has remained more or less the same, but records show shifts in the rainy seasons and prolonged dry spells as well as increases in the intensity of rainfall. There is evidence that extreme weather events – both heavy rainfall and droughts – have increased in frequency during the past 30 to 60 years. Based on data from the International Emergency Disaster Database, Shongwe et al. (2010)

noted a significant increase in hydro-meteorological disasters in East Africa, from an average of three events per year in the 1980s to almost 10 per year between 2000 and 2006. The biggest increase was in floods, with an increase from one event per year in the 1980s to seven per year between 2000 and 2006. These disasters affected about 2 million people a year.

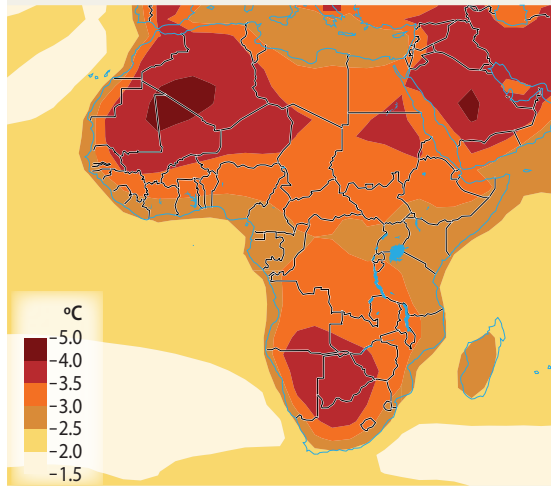
Future climate scenarios

Projections of the future impacts of climate change on East Africa indicate that the current warming trend will continue throughout the twenty-first century. According to the medium-emission scenario of the IPCC's Fourth Assessment Report, East Africa can expect an average increase in annual temperature of 3.2 °C by 2080; ranging between 1.8 °C and 4.3 °C (IPCC, 2007). The highest increase in temperature is expected in June, July and August. Based on the medium-emission scenario, the temperature will increase by as much as 3.4 °C (ranging between 1.6 and 4.7 °C). Data on climate extremes indicate that the region will experience an increase in warm days and nights as well as an increase in the frequency of heat waves and warm spells (IPCC, 2012; CDKN, 2012).

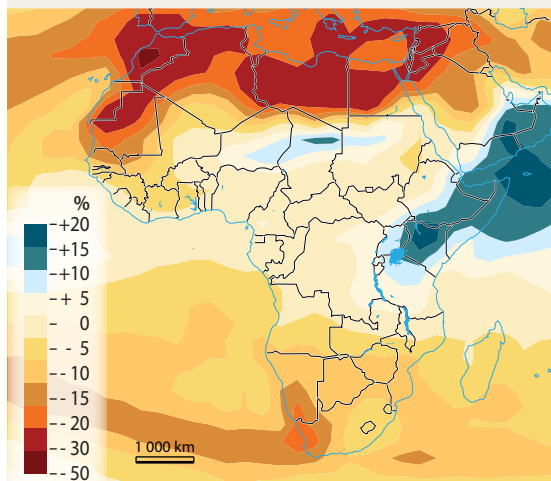
The IPCC (2013) notes that changes in precipitation will greatly affect the climate in Africa. There is a general agreement between the Fourth and Fifth IPCC Assessment Reports (2007; 2013) that East Africa will become wetter, both during the 'long' and 'short' rainy seasons. Future scenarios predict that the current trend towards a drier climate will reverse. As

Climate Change effects

Changes in annual temperature projected for 2080-2099 compare to 1980-1999



Changes in annual precipitation projected for 2080-2099 compare to 1980-1999



Source: IPCC, 2007, "Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change", Cambridge University Press.

Copyright © 2015 GRID-Arendal - Cartografare il presente/ Nieves López Izquierdo



People drawing water from the Mago River in Omo Valley, Ethiopia

a result, it is expected that the region will experience less severe droughts. These scenarios indicate that there is high certainty of an increased intensity in rainfall, which in turn, increases the risk of flooding in the region (Shongwe et al., 2010; IPCC, 2013).

Impacts of climate change on vulnerable sectors

Africa is recognized as one of the most vulnerable continents to climate change and climate variability, due to 'multiple stresses' such as endemic poverty, weak governance and institutional arrangements, ecosystem degradation, complex disasters and conflicts, and limited access to capital, infrastructure and technology

(IPCC, 2007). As a result of these factors, Brooks et al. (2005), rated Burundi, DRC, Ethiopia and Rwanda as some of the most vulnerable countries in the world to climate change, and Kenya and Uganda as moderately to highly vulnerable. The sectors presented below are particularly vulnerable in the mountainous areas of East Africa due to a combination of factors such as high exposure to climate-related hazards or trends, low adaptive capacity and the importance of the sector to the region.

Water availability

The mountains in East Africa receive more rain than lowland areas and play a key role in capturing, storing and purifying water. As such, these mountains are

a crucial source of water for the whole subregion, providing water for domestic, industrial, irrigation and hydropower uses (UNEP, 2014). In Rwanda, for example, annual precipitation varies from less than 700 mm in the lowland areas in the east to over 1,500 mm in the more mountainous areas of the west (MoNR, 2012). Some of the subregion's largest cities depend on mountains for their water supply: Dar es Salaam gets its water from the Uluru Mountains (part of the Eastern Arc Mountains) and Nairobi is supplied by the Aberdare Mountains (Fisher et al., 2011; NEMA, 2011). Mount Kenya alone provides fresh water to about 7 million people (Kohler and Masseli, 2012).

Key 'water towers' in East Africa include the Albertine Rift, the Kenyan Highlands and the Ethiopian Highlands. Some water towers, such as the Albertine Rift and Mount Elgon, are transboundary. Rivers originating from the mountains cross national borders; these include the White and the Blue Nile, which drain into the Nile River. The transboundary nature of East Africa's water resources calls for international cooperation for resource use and protection (UNEP, 2010; UNEP, 2014).

The impact of climate change on East Africa's water resources is not yet fully understood. There are a number of uncertainties around future precipitation trends; findings from scientific studies vary significantly – some forecast an increase in water availability, while others a decline. Nonetheless, the majority of studies project that water availability in the subregion will increase due to climate change (Bates et al., 2008; Niang et al., 2014). A study by Döll (2009), for example, predicts that climate change will have a positive effect on groundwater recharge in East Africa. According to some climate change models, most areas in East Africa can expect an increase in groundwater recharge

Water Towers	Major Rivers	Countries
Southern Highlands	Great Ruaha	Tanzania
Albertine Rift	White Nile Congo	Sudan, South Sudan, Rwanda, Tanzania, Uganda, DR Congo
Kenyan Highlands	Tana Ewaso Ng'iro	Kenya Kenya, Somalia (Juba)
Ethiopian Highlands	Blue Nile Juba Shabelle Omo Atbara	Ethiopia, Sudan Ethiopia, Somalia Ethiopia, Somalia Ethiopia, into Sudan



Murchison Falls, Uganda



Mount Kenya, Kenya

by 30 per cent or more by 2050. Several studies presented in the IPCC's Fifth Assessment Report (Niang et al. 2014) find that Kenyan rivers such as the Mara, the Nyando and the Tana can expect an increase in water flow during the second half of this century. Similarly, a study by Rockström et al (2009), which assesses the impact of climate change on water availability towards 2050, finds that water availability will increase in most of the subregion. Uganda, Burundi and Rwanda, however, may experience a reduction in water availability, to between 500 and 1,000 m³ per capita per annum, but this will largely be due to their rapid population growth. Ethiopia is also likely to experience a decrease in water availability, but this will remain between 1,300 and 1,500 m³ per capita per annum. A study by Williams and Funk (2011) finds that the eastern part of the Ethiopian Highlands will experience reduced precipitation due to climate change and, as a consequence, the river flow of the Blue Nile River will decline towards the end of the century (McCartney and Girma, 2012). Similar findings have been reported by Abdo et al. (2009).

Glacial retreat

Melting glaciers have provided the most compelling evidence of climate change globally. East Africa is the only subregion of Africa where glaciers are found and only on the highest summits. They are scattered across the peaks of Mount Kilimanjaro, Mount Kenya and the Rwenzori Mountains (Mount Stanley, Speke and Baker). It is not without reason that the media and scientists alike are calling this the last chance to see the glaciers of Africa. Since the 1990s, Africa's glaciers have lost 80 per cent of their surface area and, if the current rate of recession continues, it is very likely that they will disappear within a few decades (UNEP, 2014). Six square kilometres of glaciers is all that is left (Kohler and Masseli, 2012).

The glaciers started to retreat at the beginning of the 1880s due to reductions in precipitation and cloud cover – this resulted in lower rates of snow accumulation and higher levels of solar radiation which further increased the rate of melting (Hastenrath, 2010). Scientific studies of current glacial retreat do not agree, however, on the main drivers, which include air

temperature, evaporation, precipitation and humidity (Campell, 2008; Taylor et al., 2009; Mölg et al., 2009; Hastenrath, 2010; UNEP, 2012).

According to Taylor et al. (2006), the glaciers on the Rwenzori Mountains have decreased from a total of 6.5 km² in 1906 to about 1 km² in 2003. From 1987 to 2003, the total area of the glaciers decreased by about 50 per cent. If the current rate of recession continues, these glaciers will disappear within the next two decades. The same study argues that the rapid recession of Rwenzori's glaciers can be attributed to the increase in temperature of 0.5 °C per decade documented since the 1960s in areas close to the mountain range. An increase in temperature is also believed to be the reason for the shrinking of Mount Kenya's glaciers (Campell, 2008). On Mount Kilimanjaro, a reduction in precipitation is seen as the main reason for the shrinking of its glaciers in recent decades (Mölg et al., 2009). Records indicate that precipitation has declined in East Africa and that the higher altitudes, in particular, have become drier. Data from three weather stations on the southern slope of Kilimanjaro show that precipitation decreased by up to 39 per cent between 1911 and 2004 (Hemp, 2005).

Globally, water from melting glaciers provides fresh water to millions of people. However, in East Africa, receding glaciers are of little concern for future water supply. Water from glaciers is relatively insignificant for total river flows in the region. For example, a study by Taylor et al. (2009), found that meltwater from the glaciers on Speke and Elana in the Rwenzori Mountains contributes less than 2 per cent of the discharge of the Mubuku River. Similar findings are likely for the glaciers on Mount Kenya and Kilimanjaro. The main source of fresh water in the Mubuku River is rainwater, which the area receives in abundance – about 2,340-2,600 mm a year (Taylor et al., 2009).

East Africa's Mountains and Climate Change: The case of Mount Kilimanjaro, Tanzania

Mount Kilimanjaro is located in north-eastern Tanzania, near the border with Kenya. It derives its name from the Swahili words Kilima Njaro meaning 'shining mountain', a reference to its legendary ice cap. Mount Kilimanjaro is Africa's highest mountain, standing at 5,895 m (UNEP, 2014) and has three main peaks: Shira, Mawenzi and the tallest, Kibo. Mount Kilimanjaro is also a Biosphere Reserve and a World Heritage site.

High rainfall and extensive forests make Mount Kilimanjaro a critical water catchment for both Kenya and Tanzania. Water from Mount Kilimanjaro feeds into the Pangani River, one of Tanzania's largest rivers. The water supports smallholder irrigation and the provision of food, fuel and building materials for the people of north-central Tanzania and East Africa in general.

The mountain attracts more than 35,000 climbers a year, and 5,000 day-visitors from around the world. It is a major source of foreign exchange earnings for Tanzania. The surrounding area is also home to 1.5 million people, three-quarters of whom depend on its rich natural resources: water, food and medicinal herbs.

Key challenges

Mount Kilimanjaro is threatened by warming climate which has consequently led to the melting of its icecaps. The ice fields atop Mt. Kilimanjaro have lost 80 per cent of their area during the last 100 years and, despite persisting for over 10,000 years, the ice caps are likely to disappear in the coming decades (Combes et. al., undated).

Since 1976, fires instigated by a warming climate have degraded 13,000 ha of forest (mainly Erica forest in the upper parts of Mount Kilimanjaro),



Shrinking ice caps of Mt. Kilimanjaro from 1993 to 2000 (50–80% decrease (TMA, 2005). (Source: VPO NAPA, Tanzania, 2007)

which in turn has severely disturbed the water balance. This is particularly significant given the fact that the forest belt functions as the main water catchment for the surrounding area. As a result of the receding ice cap and deforestation, several rivers are drying up, affecting the forests and farmland below. A stark example of this is the serious water shortage in the town of Moshi, located on the foothills of the mountain. It is also threatening the livelihoods of the Chagga people, who are highly dependent on a steady river discharge for their irrigation systems. During the dry seasons, water shortages are becoming increasingly common, especially on the lower foothills. Women and children bear most of the burden as they have to spend a large part of the day fetching water.

Policy Responses

Mount Kilimanjaro is a UNESCO World Natural Heritage Site, and a biodiversity hotspot. As such, the Tanzanian Government pays special attention to this mountain region and established several protected areas, including the Kilimanjaro National Park (1,668 km²) in 1973, currently under the administration of the Tanzania National Parks Authority. The Kilimanjaro Forest Reserve (107,828 ha) was also gazetted in 1921.

In an attempt to reduce the risk of forest fires, the Tanzanian Government implemented a policy to ban campfires. Unfortunately, this did not have the desired effect because most of the fires were being lit by honey collectors and not by mountaineers.



Mount Kilimanjaro, Tanzania

Environmental concerns for the Mount Kilimanjaro region have also attracted international attention and a number of conservation projects are currently being implemented. The United Nations Development Programme (UNDP) and the United Nations Foundation, for example, jointly provided USD 264,000 to the Tanzanian Government in

support of environmental conservation projects and the promotion of ecotourism on Mt. Kilimanjaro (OECD, 2003).

Other projects and activities that have been implemented include the 'Reducing Land Degradation on the Highlands of Kilimanjaro Region' project which aimed

to support sustainable land management as a basis for economic development, food security and sustainable livelihoods, while restoring the ecological integrity of the Kilimanjaro region's ecosystems. In addition, UNDP implemented the "Community Management of Protected Area Conservation Project" which aimed to promote community-based biodiversity conservation in the Kilimanjaro region (OECD, 2003).

Lessons Learned

It is worth noting that if Mount Kilimanjaro lost its glaciers, the loss may not have a major impact on the hydrology of the mountain. It is also unlikely that the loss of glaciers would have a significant long-term impact on tourism. It is however, important to note that the ice-cores on Mount Kilimanjaro are a repository of paleo-climatic records, and valuable climatic records would be irreplaceably lost.

Mount Kilimanjaro is a water tower of international importance, and therefore needs attention at both local and international levels. There is a need for more concerted efforts in the conservation of the mountain and the glaciers therein.

Recommendations

The following measures are recommended of the ecosystem integrity of Mount Kilimanjaro is to be maintained:

- Constant monitoring and investment in weather and climate early warning systems;
- Reforestation programmes that can possibly protect the mountain water catchment area;
- Inclusion of issues relevant to mountains in national and international policy processes; and
- Mainstream climate change adaptation at all levels, from sectoral strategies and programmes down to the grassroots level.

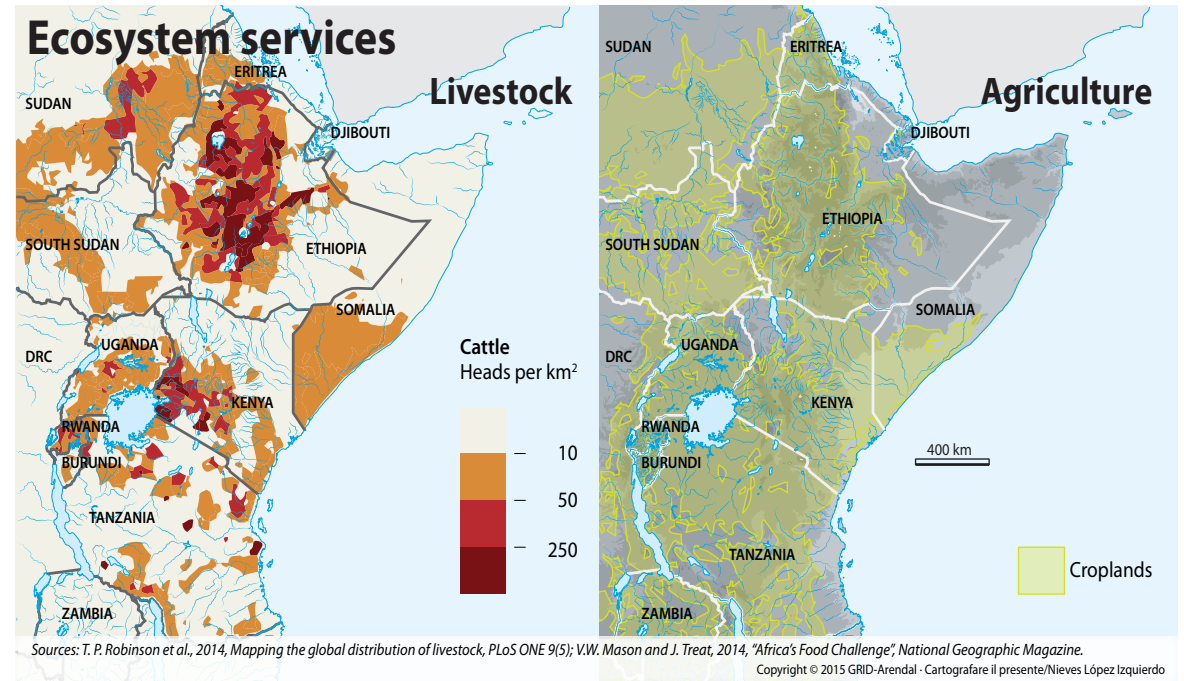


Drying of sorghum to brew beer, Mahoko, Rubavu, Rwanda

Agriculture and food security

Agriculture is the backbone of East Africa's economy, and the most important livelihood strategy for mountain communities is to ensure regional food security. East Africa's mountainous areas are known for their favourable agricultural conditions due to their fertile volcanic soils, cooler temperatures and more stable rainfall patterns (FAO, 2013; FAO, 2014). As a consequence, the population densities in the mountainous areas of East Africa are much higher than in lowland areas. While Africa has an average population density of 35 people per km², the mountain slopes of Mount Elgon in Uganda have a population density of 900 people per km² (UNEP, 2014). Similarly, the majority of Ethiopia's population, nearly 90 per cent, live in the Ethiopian Highlands, which has the country's most productive agricultural land and receives the highest rainfall (Alweny et al., 2014; Josephson et al., 2014). Due to the intense population pressure, farm sizes are small – generally below 2 hectares (FAO, 2013). In Rwanda, 25 per cent of families have less than 0.2 hectares of arable land (UNEP, 2014). As a result of the small size of land holdings, 50 to 60 per cent of the population lives in poverty in East Africa's mountains (FAO, 2013) and food insecurity is widespread (UNEP, 2014). The pressure on limited land leads to deforestation and, as a consequence, land degradation through soil erosion is a common feature on the fertile mountain land (Alweny et al., 2014). Coupled with other risk factors such as remoteness and poor infrastructure, mountain communities and the agricultural sector are extremely vulnerable to climate change.

Although climate change is predicted to lead to wetter conditions, the current trend for East Africa has been towards a warmer and drier climate with less reliable rainfall patterns. Mountain farmers



depending on rain-fed agriculture are especially vulnerable to variable rainfall patterns (Bishaw et al., 2013). Such changes have been reported (FAO, 2013) and are blamed for crop failure and famine during recent decades (Alweny et al., 2014). Extreme events such as floods and drought have increased during the past 30 to 60 years (Niang et al., 2014), destroying crops, infrastructure, agricultural land, homes, livelihoods, as well as exacerbating food insecurity and taking many lives (NEMA, 2010a; MoWE, 2013). The communities cultivating and living on mountainous land are especially vulnerable to landslides during heavy rainfall. Landslides are, to a large extent, a result of clearing forests for cultivation and the removal of the soils' natural protection from erosion. On Mount Elgon, for example, 70 per cent of all landslides in

the twentieth century occurred after 1997 when large areas of forest were cleared. Recent incidents in 2010 and 2012 resulted in 500 deaths, while hundreds of others were displaced (UNEP, 2014). The loss of fertile soil, crops and livestock is putting the population at risk of famine and is further increasing the pressure on limited agricultural land on Mount Elgon (MoWE, 2013).

African Mountains and Climate Change: The case of Mount Elgon

Mount Elgon is shared between Uganda and Kenya and stands at a height of about 4,000 metres above sea level (MoWE, 2013).

In Uganda, Mount Elgon National Park covers nearly 1,121 km² of the mountain's 4,000 km² area (UWA, 2009a). The mountain was listed as a UNESCO Biosphere Reserve in 2005 due to its considerable plant diversity, including several rare species of Afromontane flora, its cultural significance and role as a water catchment area (UWA, 2009a).

Apart from being one of the most important areas of biodiversity and a water tower for both Uganda and Kenya, Mt. Elgon also serves as a catchment area for the drainage systems of three lakes - Victoria, Turkana and Kyoga (MoWE, 2013).

Mount Elgon's Afromontane forests provide a range of foods, fibres and fodder for the people

living around the mountain area, including the Benet Ndorobo people (Ongugo et. al., 2014). The mountain area contains endangered species, some of which are endemic to the Afromontane region, making it one of the major tourist attractions in East Africa (Ongugo et al., 2014).

Key challenges

Mount Elgon's ecosystem is vulnerable to the impacts of climate change largely because of the mountain's high population density (900 people per km² on the Uganda side, with a population growth rate of 3.4 per cent per annum). This puts a lot of pressure on the mountain ecosystem, particularly given the fact that the main source of livelihoods for Mount Elgon communities is agriculture and that hilly areas are being cleared for settlements and farming. The slopes of Mount Elgon are highly prone to landslides that are caused by a combination of unsustainable land-use practices, high population densities, heavy

rainfall, as well as natural features of the area such as soil properties and steep slopes. The result has been flooding of downstream areas, extensive soil erosion and landslides which have destroyed lives and property.

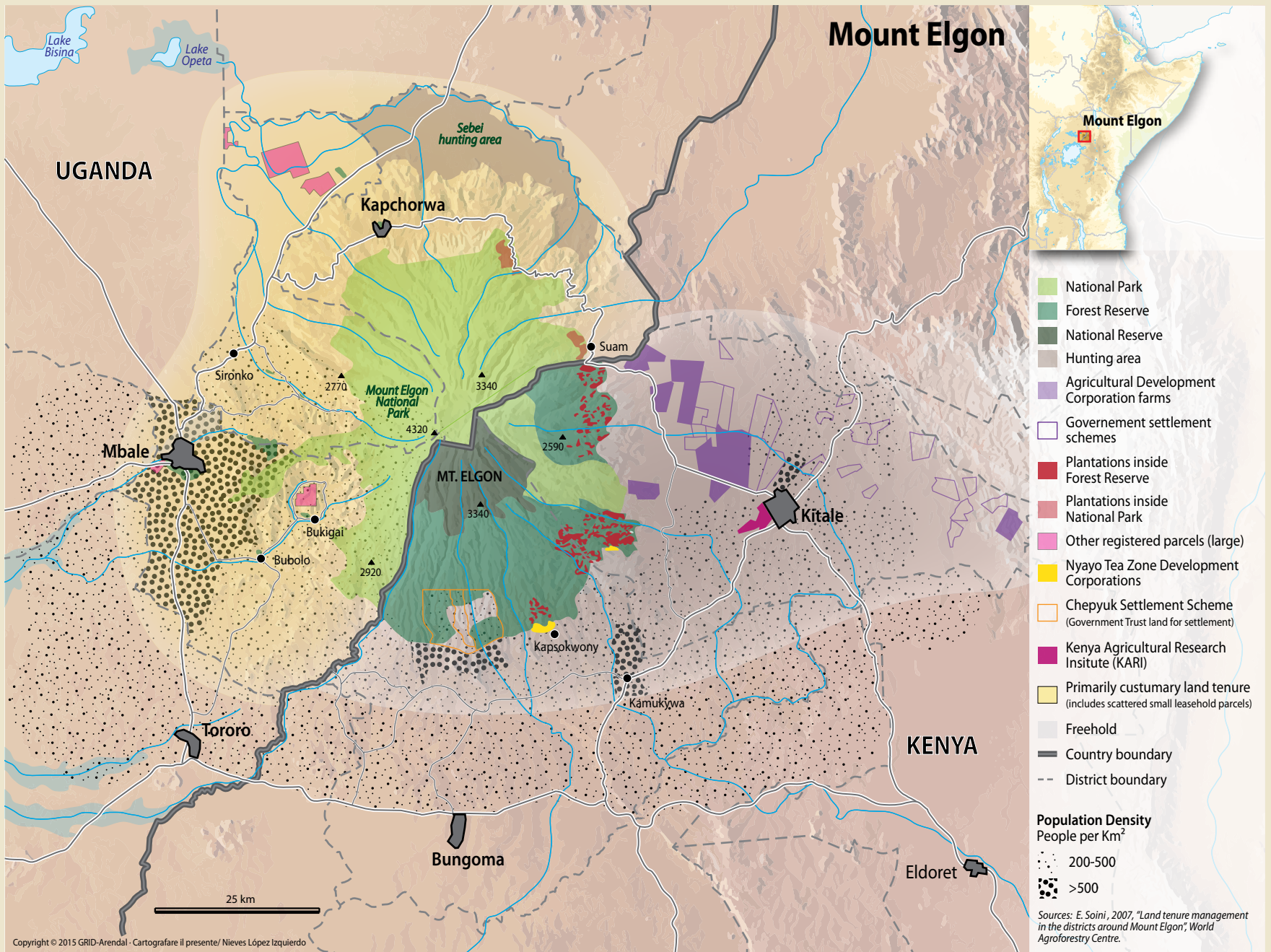
Policy responses

The international community and the Governments of Kenya and Uganda have paid special attention to Mount Elgon because of its importance as a transboundary resource and a UNESCO Biosphere Reserve. The two governments have gazetted landslide and mudslide prone areas, prohibited settlement in high risk areas and are in the process of resettling people living in land/mudslide prone areas. They have also made significant efforts to promote reforestation.

The Ugandan Wildlife Authority, through its Forests Absorbing Carbon Emissions project, has, to date, restored over 6 000 ha of natural forest in an effort to sequester carbon. The United Nations through UNDP and UNEP, the district authorities of Mbale, Manafwa and Bududa, and the Ugandan Ministry of Water and Environment, have implemented the Territorial Approach to Climate Change, whose overall objective is to support local low carbon and climate change-resilient development by helping local decision makers and planners to design integrated climate change (adaptation and mitigation) policies and strategies, and formulate solid action and investment plans that promote long-term sustainability and poverty reduction (UNDP, 2011).

Other initiatives include the Mt. Elgon Regional Ecosystem Conservation Programme whose main aim is to strengthen natural transboundary resource management, with a focus on participatory benefit sharing models.









A deadly landslide in Nametsi village, Bududa district, on the slopes of Mount Elgon National Park, left over 300 people buried, in addition to homes and community health centres.



Lessons learned

Mount Elgon is endowed with unique ecosystems that provide ecosystem goods and services upon which many communities depend. Despite the amount of investment in mountain areas, landslides still occur.

Several activities have been implemented to integrate ecosystem-based adaptation measures into the District Development Plans for Sironko, Bulambuli, Kapchorwa and Kween.

Recommendations

The EAC and the Government of Kenya and Uganda have put in place requisite policies and legal frameworks, but the level of implementation and compliance with these instruments is still very low, especially at the regional level. There is need to mainstream climate change adaptation at all levels, from sectoral strategies and programmes down to the grassroots level.

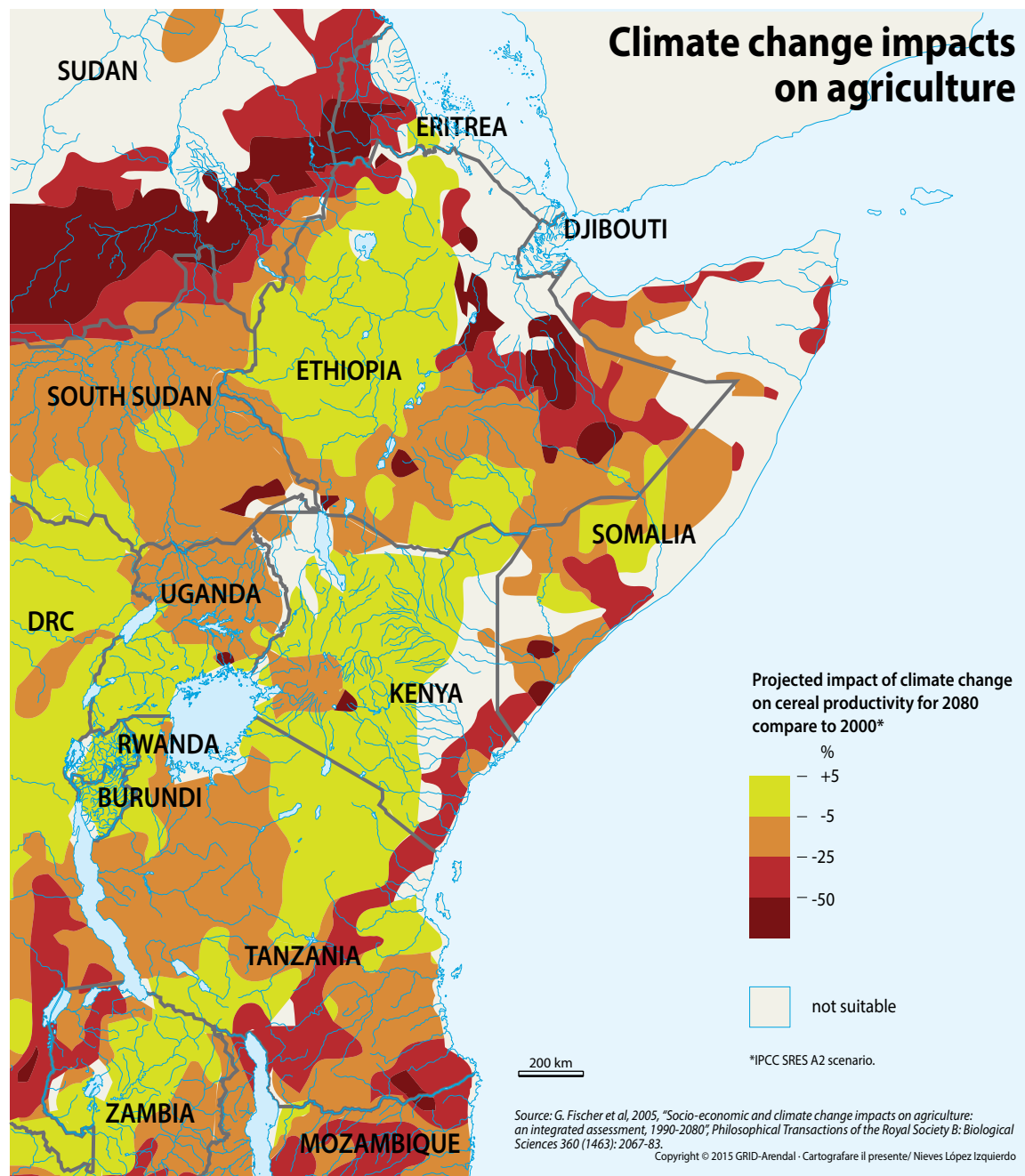
Furthermore, there is a need for an exclusive and comprehensive climate change policy in Kenya and a legislative framework that creates, or sets out a mandate for a leading institution to spearhead the nation's efforts in climate change adaptation and mitigation. In addition, climate change policy should have a clear and comprehensive implementation framework to ensure that funds are channelled into projects that address the most vulnerable social groups and regions.

Both Uganda and Kenya need to harmonize their environmental policies because, at the moment, they are scattered, disjointed and sometimes contradictory, and are therefore failing to address climate change and mitigation issues, particularly in mountain areas.

While projections for future impacts of climate change on agriculture in large parts of Africa are dire, the mountainous areas of East Africa may benefit from warmer temperatures and an increase in precipitation (Niang et al., 2014). For example, farmers in mountain areas may be able to cultivate crops that have previously been unsuited to the area, such as maize, which has been limited by the low temperatures. A study by Thornton et al. (2010), argues that, while maize yields will decrease in lowland Kenya, the highland areas are likely to become more favourable for maize. The study also identified similar results for highland areas in Burundi, Rwanda and DRC. The same is also true for livestock. While livestock farming is common in some parts of East Africa, it has generally been less successful in mountain areas due to the colder temperatures. This may change as temperatures increase (Thornton et al., 2010; Niang et al., 2014).

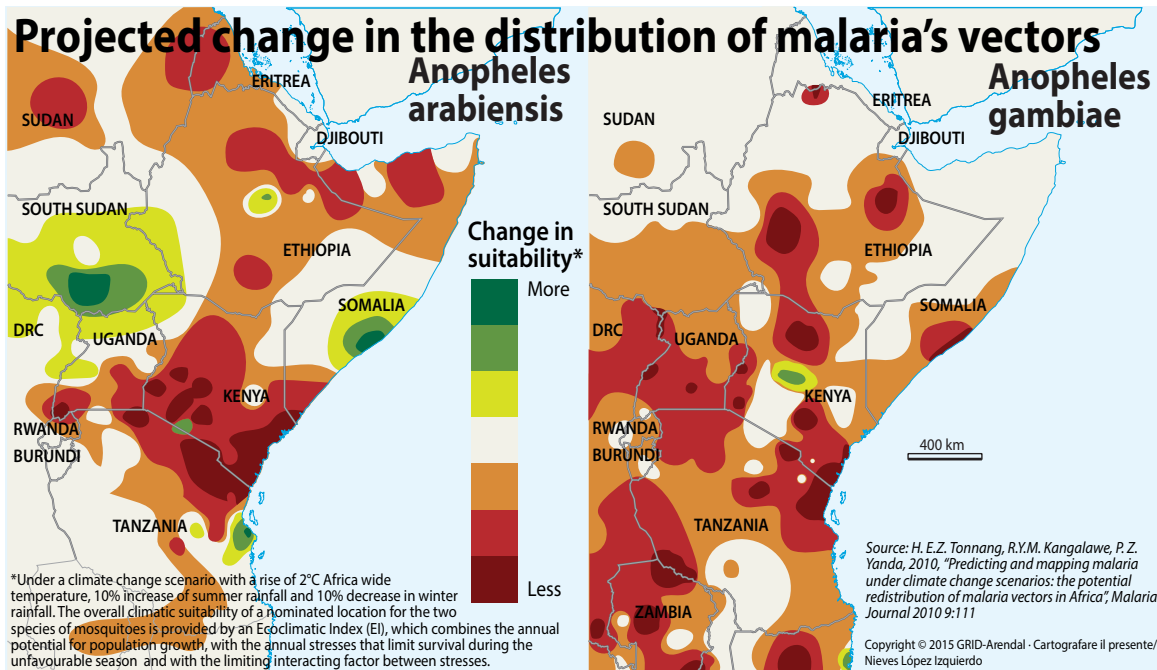
However, the projected increase in precipitation could also have adverse effects, such as increased exposure to diseases for livestock and crops. More rainfall may increase the risk of livestock exposure to respiratory diseases and foot rot (MoNR, 2012). There is also concern that crop pests that have been restricted by cold temperatures could extend into higher altitudes when temperatures increase. Examples include the coffee berry borer (*Hypothenemus hampei*) that attacks arabica coffee and the burrowing nematode (*Radopholus similis*) that affects bananas, both important cash crops in the subregion (Niang et al., 2014; UNEP, 2014). The higher temperatures will also expose the East Africa mountain region to malaria.

There is also concern that the increase in rainfall will not be distributed evenly across the year, but may intensify over short periods of time (IPCC, 2012; World Bank, 2013), and thus further increase the





Pink flamingos in Lake Nakuru National Park, Kenya

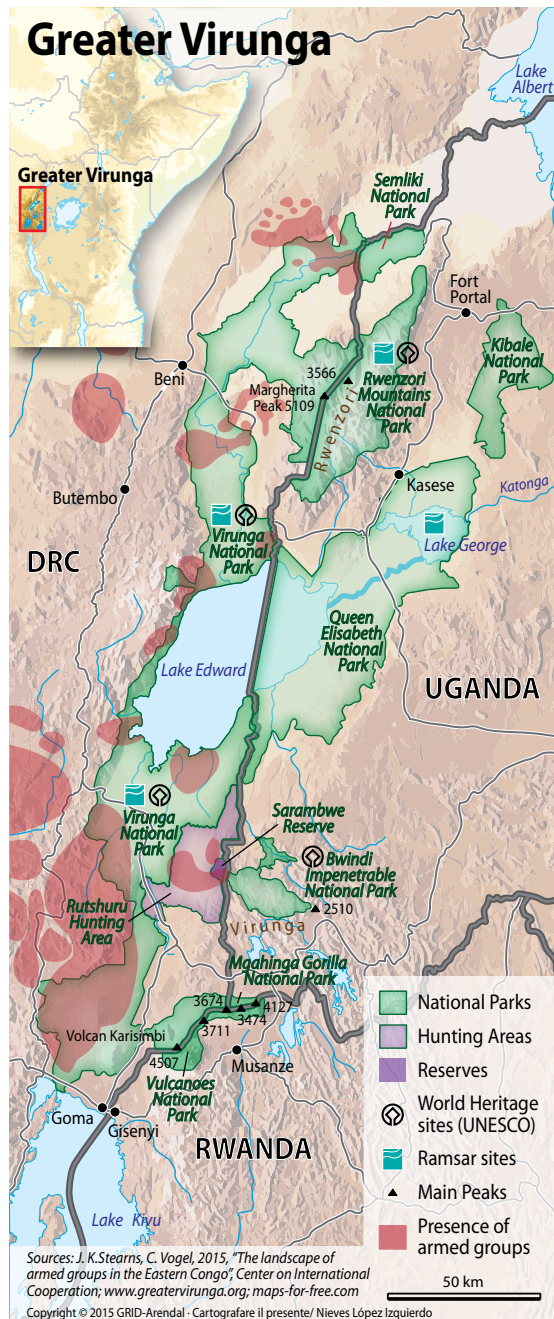


frequency of extreme events such as flooding and landslides. Rainfall variability is also a major problem for rain-fed agriculture, which is the most common form of farming in East Africa (FAO 2014).

Some areas may also receive less rainfall, such as parts of the Ethiopian Highlands (William and Funk 2011). In areas with a large amount of arable land, such a change is likely to have a negative impact on the agricultural sector and exacerbate food insecurity in an already food insecure region (IGAD and ICPAC, 2007; Alweny et al., 2014).

Biodiversity

The mountain ecosystems of East Africa are rich in biodiversity and are an important resource for local communities. They provide food, freshwater, fibre, fuel, shelter, building materials, medicines and other important ecosystem services. As such, biodiversity serves as an important safety net for the rural poor (Boko et al., 2007; Alweny et al., 2014). Understanding how climate change will impact on natural resources is a major concern (Platts et al., 2012). Changes to biodiversity are also likely to adversely affect the tourism industry (UNEP, 2014). Known for their high concentration of plants and animals of which many are endemic, the mountainous areas of East Africa are some of the main tourist attractions in the subregion (UNEP, 2014). Much of the Eastern Afrotropical biodiversity hotspot, which stretches from the mountains of Saudi Arabia in the north to Zimbabwe in the south, is found in East Africa. It includes the Albertine Rift, the Eastern Arc Mountains, the Ethiopian Highlands, Mount Kilimanjaro, Mount Kenya, Mount Elgon and Mount Meru. Of the 10,856 species found in this hotspot, over a third are endemic (BirdLife International, 2012). The Albertine Rift alone – which stretches across Rwanda, Burundi, Uganda and DRC – has over



400 recorded species of mammals and 7,500 species of plants and animals, of which 15 per cent are endemic. The Virunga National Park, in the Albertine Rift, has the largest diversity of vertebrate species of all protected areas in Africa, including the endangered okapi (UNEP, 2014). Furthermore, 14 per cent of Africa's vascular plants are found within the Eastern Arc Mountains, an area that represents only 0.24 per cent of Africa's total land area (Platts et al., 2012).

Due to the climatic and topographic differences, and the diversity of species within the region, as well as differences in climate models, results from studies on the impact of climate change vary considerably. Several studies, however, find that flora and fauna will move towards higher altitudes as temperatures increase. Such results were found by Thuiller et al. (2006), in their assessment of the vulnerability of African mammals to climate change in 11 national parks across Africa. The study found that while 25 to 40 per cent of the 144 assessed mammal species will become critically endangered or extinct by 2080 (assuming that the species cannot spread) in Africa as a whole, Mount Kenya National Park could see an increase in species richness by between 50 to 80 per cent, because of the park's cooler climate at a higher altitude. While the study did not include other mountainous areas, it may be assumed that other national parks in East Africa could see similar results.

However, climate change is likely to have an adverse effect on species already living at higher altitudes as their habitat decreases when they are forced to migrate upwards. A study by BirdLife International (2015), focusing on the Albertine Rift, found that of the 14 endemic bird species assessed, all are at severe risk from the impacts of climate change. By 2085, it is projected that the habitats for these birds

will move upwards and shift slightly northwards. On average, the birds will migrate to altitudes 350 metres higher, which will severely limit their habitat. Similarly, the African Conservation Centre (2012) finds that suitable areas for species dependent on high elevation and moist climates will shrink and move upwards towards the peaks. On the other hand, Platts et al. (2012), studied the impact of climate change on plants in the Eastern Arc Mountains and found that two-thirds of the plants studied will move in different directions (up and down) in different parts of the region, depending on changes in seasonality and water availability in each location. It is therefore, not a given that all species will migrate towards higher altitudes.

The impact of climate change on forests includes a documented increase in forest fires on Mount Kilimanjaro. As a result of a drier climate, the incidence of wildfires in the montane forest belt has increased and the damage is more severe. This has displaced the forest line to a lower altitude and changed the vegetation composition (Hemp, 2005). As a direct consequence, there has been a drastic decline in water flow from the mountain. Hemp (2005) estimates that the loss of forests through fires since 1976 has reduced the annual dew by 25 per cent, an amount equivalent to the annual demand for drinking water for 1 million people living around Mount Kilimanjaro. Furthermore, a study by Krishnaswamy et al. (2014) identified that climate change, mainly through increasing temperatures, has caused a browning of the vegetation in the eastern part of Africa across eight higher elevation national parks since the 1990s, indicating that the land is either degraded or the productivity of the land has decreased.



A firewood market in Lalibela, Ethiopia

Mau Forest Complex: Renewed Efforts to Save Kenya's Water Tower

The Mau Forest complex is the largest closed canopy forest in Kenya and the largest indigenous montane forest in East Africa, located in the Eastern Rift Valley of Kenya (BirdLife International, 2013). The Mau Forest complex is divided into seven blocks: South-West Mau (Tinet), East Mau, Ol'donyo Purro, Transmara, Massai Mau, Western Mau and Southern Mau (Sang, 2001). The original gazetted forest area covered 452,007 ha, but a large part of the area was removed from protection in 2001, reducing the forest land area to approximately 416,542 ha (NEMA, 2013). The Mau Forest is recognized as the most important and critical water catchment in the Rift Valley and western Kenya, and it is the source of numerous rivers. Lake Victoria receives 60 per cent of its water from the Mau forest catchment. The Mau Forest is considered a water catchment of international importance and supports a wealth of biodiversity, some of which is of concern to international conservation bodies. It is also

the main source of livelihoods in the Rift Valley and provides invaluable goods and services to surrounding areas (NEMA, 2013).

Key challenges

Despite its status as the most important water tower of Kenya, the Mau Forest complex has been over-exploited due to a lack of institutional governance and a long-term strategic plan.

The removal from protection of a large part of the forest has resulted in continuous widespread encroachment – the Mau Forest is now a quarter of the size it once was. This has severely disturbed the forest's role in storing and distributing water to outlying areas.

According to investigations by BirdLife International (2014), the Mau Forest has been affected by widespread unplanned settlement development,

irregular forest land allocation and illegal extraction of forest resources. The Mau Forest has served as home to different groups of indigenous people like the Massai and the Ogiek (Sang, 2001) who consider the forest as their ancestral home.

The plan to use tea plantations as a buffer zone may have been well-intentioned but the conversion of forest land into large-scale tea plantations has contributed to the immense loss of forest cover, partly because the designated size for the tea zone was not adhered to in all areas, resulting in excessive deforestation (NEMA, 2013). The establishment of large exotic tree plantations by major timber companies has also led to the replacement of indigenous forest with monoculture species. The strategy to enhance timber production using fast growing exotic species has resulted in a significant loss of biodiversity (NEMA, 2013).

Policy actions

A new understanding of the Mau Forest as a 'water tower' has catalysed resource mobilization and enabled actions to rehabilitate the Mau forest. In recognition of the impact of deforestation on economic activities and livelihoods and on a range of crucial ecosystem goods and services, the Government of Kenya convened a forum in 2009 to find ways to address the threats to the Mau Forest ecosystem, and a plan to rehabilitate the forest was proposed with a budget of USD 81 million (UNEP, 2010).

The Government of Kenya developed a new forest policy with a commitment to manage all indigenous forests (including the Mau Forest complex) to conserve water, soil and biodiversity, and enhance the provision of forest goods and services (GoK, 2015).



Tea harvest in Kericho, Kenya

The Government of Kenya has also committed to a plan to establish a Mau Forest Complex Authority to coordinate and oversee the management of the area (GoK, 2009).

Eviction of illegal settlers: The relocation of people from the forest by the Kenyan Government is highly controversial and has resulted in social and political conflict. On the one hand, indigenous people are very attached to the land, which they consider part of their ancestral legacy, and have fought for ownership rights; on the other hand, the Government's plan to relocate and compensate people living in the area is seen as a means of reducing pressure on the land and restoring the forest.

Lessons learned

There are a number of lessons relating to environmental concerns and policy arrangements for the Mau Forest:

- Ad hoc arrangements and the mismanagement of established plans have led to the loss of a large part of the Mau Forest complex;
- Relocating indigenous communities should be carefully managed to avoid social and political conflict; and
- The Mau Forest is a water tower of international importance that needs attention at both the local and international level.

Recommendations

In recognition of the importance of the Mau Forest complex, the Government of Kenya has introduced a package of policies and rules to support sustainable management of the forest, but more consideration is needed in how these policies are implemented and how the local communities can be involved in rehabilitation activities.



Ostriches in Samburu, Kenya

Recommendations include:

- Improving collaboration between all stakeholders with an interest in the Mau Forest landscape in order to sustain the rehabilitation of the forest;
- Enhancing efforts to institutionalize governance systems by enhancing the Mau Forest Complex Authority and harmonizing strategic plans and actions;
- Carefully involving local communities in restoration activities; and
- All stakeholders in the region should advocate for the protection of the Mau Forest complex in its role as an important water tower for the East Africa region.



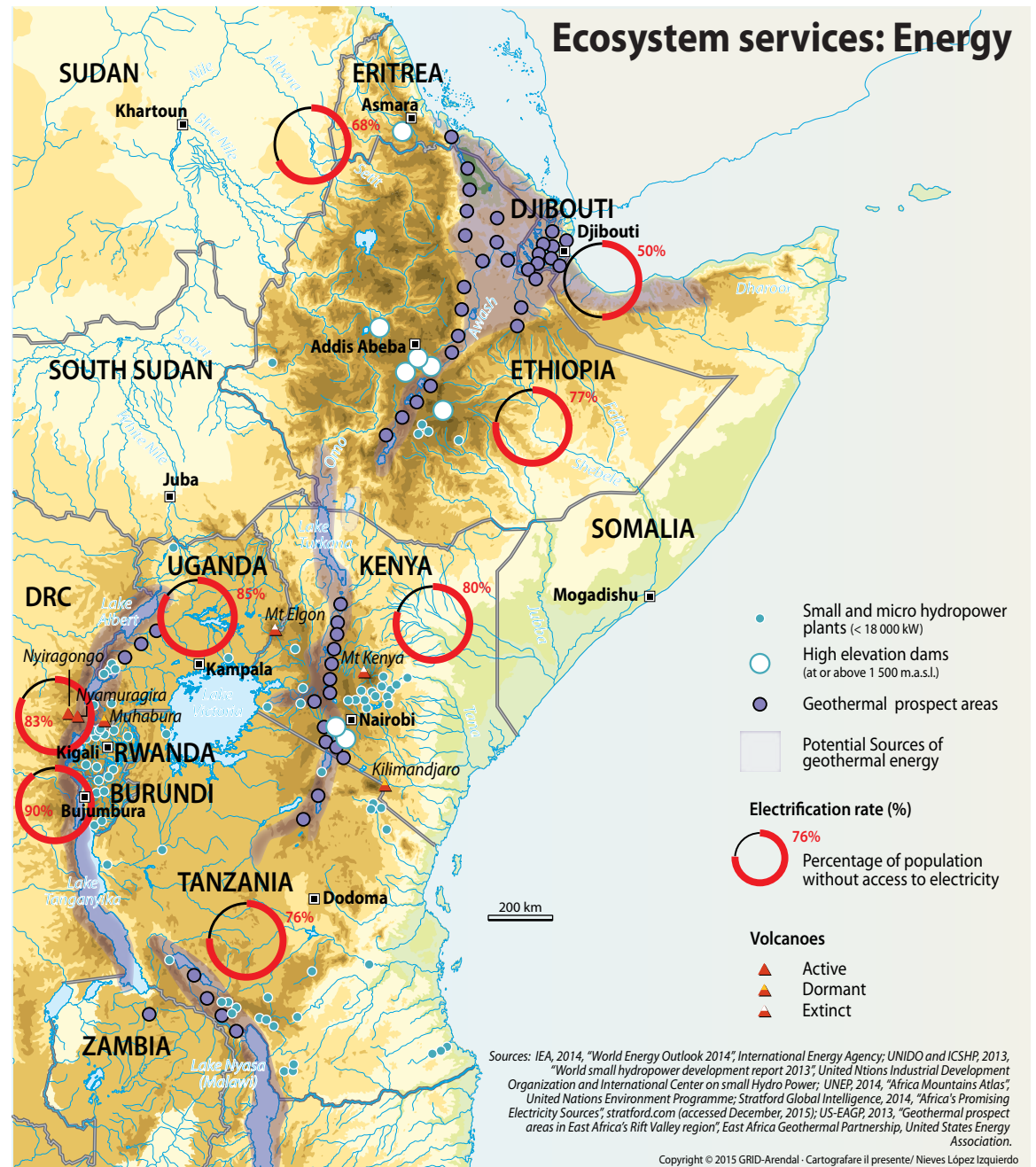
Owen Falls Dam, Uganda

Hydropower

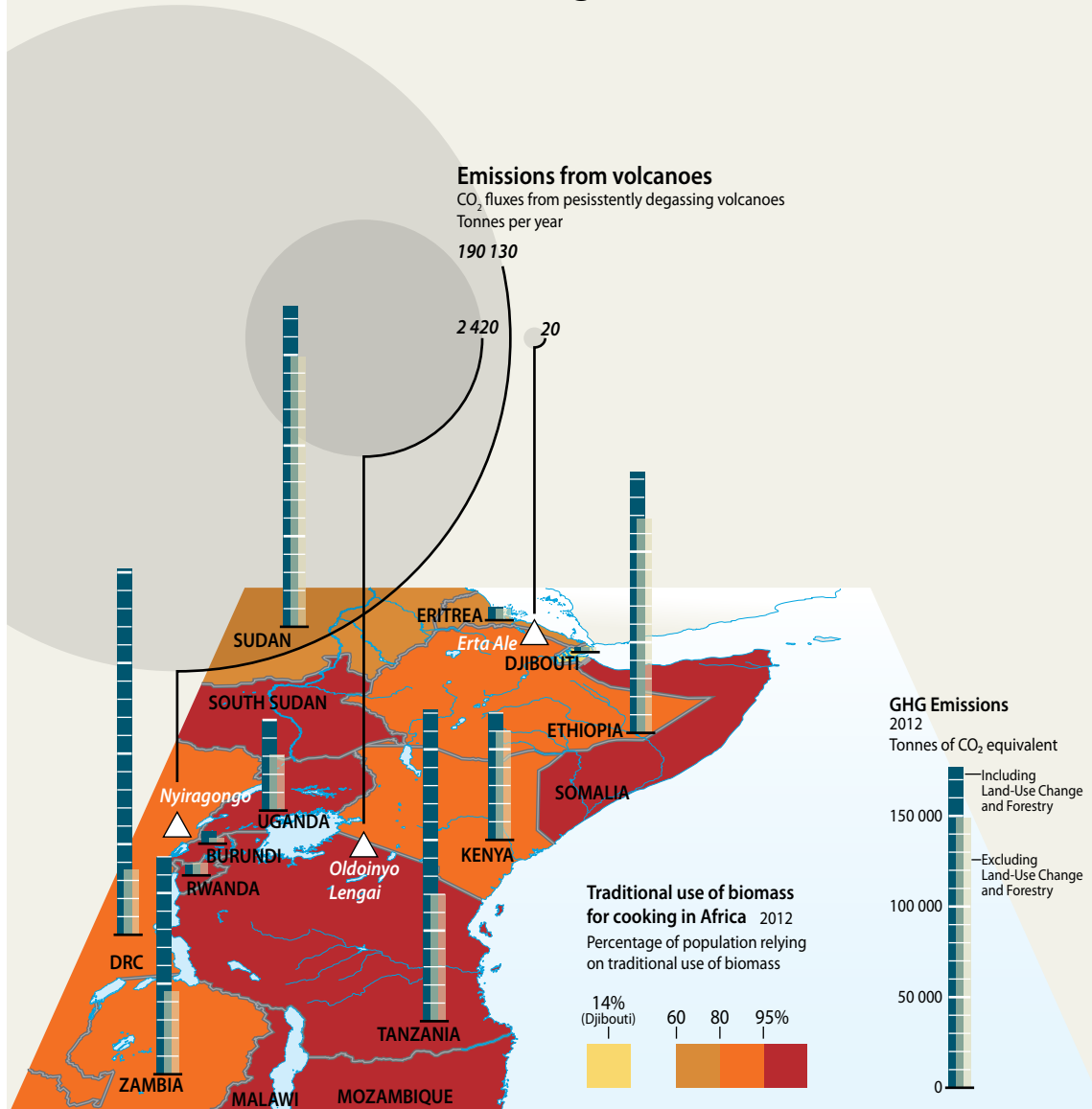
Access to electricity is one of East Africa's key constraints. In the majority of the subregion, less than 20 per cent of the population has access to electricity (UNEP, 2014). Firewood and charcoal remain the most common form of energy for cooking and heating in rural areas. Improved access to electricity would significantly contribute to energy security, poverty alleviation, improved health, increased productivity, enhanced competitiveness and economic growth. Furthermore, it would take pressure off forests and reduce deforestation.

The 'water towers' of East Africa provide opportunities for generating hydropower in the region, which could provide secure access to cleaner electricity and enhance economic development. In Africa as a whole, about 93 per cent of economically viable hydropower potential is unexploited. East Africa has a significant share of the rivers with high hydropower potential. Rivers in the Nile Basin, for example, have the potential to generate 20 gigawatts of electricity. The Blue Nile, which drops 1,300 metres down from Lake Tana to Sudan's border could generate 8,000 megawatts (UNEP, 2014). The Mau Forest complex has the potential to generate an additional 508 megawatts – equivalent to half of Kenya's current capacity (UNEP, 2014).

The region has great potential for developing small, micro and pico-hydropower schemes due to the large number of smaller rivers that are not prone to drought and which can therefore provide a continuous source of power. According to the World Small Hydropower Development Report (UNIDO and ICSPH, 2013), East Africa, excluding DRC, has a total potential of 5,112 MW, of which only 125 MW is being realized. Kenya and Ethiopia have by far the largest potential: 3 000 MW and 1 500 MW, respectively. In addition to being more environmentally friendly, small



Contribution to Climate Change



Sources: IEA, 2014, "World Energy Outlook"; World Resources Institute, 2014, "CAIT - Country Greenhouse Gas Emissions Data"; M.R. Burton, G.M. Sawyer and D. Granieri, 2013, "Deep Carbon Emissions from Volcanoes", *Reviews in Mineralogy & Geochemistry*, Vol.75, pp. 323-354, Mineralogical Society of America.

Copyright © 2015 GRID-Arendal - Cartografare il presente/ Nieves López Izquierdo and Darío Ingiusto

hydropower schemes are also seen as a viable option for providing electricity to remote rural areas, such as mountainous areas where access to the electricity grid is difficult (Quirke, 2012; UNEP, 2014).

A key constraint hindering the development of the energy sector is limited finance. In addition to the economic costs of constructing dams, there is the social and environmental cost to consider. The construction of new dams means the forced relocation of communities and changes to the natural water flow which can place stress on downstream communities and countries as well as ecosystems and biodiversity (UNEP, 2014). It is crucial that new constructions take into account environmental and social sustainability and that the costs and benefits are shared equally (Niang et al., 2014).

Hydropower is a vulnerable sector to climate change due to its reliance on precipitation and water flow. Reductions in rainfall, increased evaporation and droughts have already had significant impacts on hydropower generation in East Africa. During the previous La Niña years of 1991-1992 and 2009, droughts results in a drop in annual hydropower generation to less than 2,500 million kWh, down from an average of over 3,000 million kWh (UNEP, 2014). Similar reductions in hydropower generation occurred in 2011 due to drought (Wahome, 2011). Prolonged droughts in 2004-2005 in Rwanda, coupled with the drainage of the Rugezi marshland, reduced electricity generation from the Ntaruka and the Mukunwa hydropower plants from 23 MW down to 5 MW (MoNR, 2012). Similarly, when Lake Victoria's water level dropped by over a metre in 2006 as a result of dry conditions, the Ugandan hydropower station at Owen Falls Dam was not able to operate at full capacity (NEMA, 2010a). Floods and landslides can also cause significant damage to hydropower plants. The construction of the Tekeze Dam in Ethiopia, for

example, cost an additional USD 42 million due to a massive landslide in 2008 (UNEP, 2014).

While future reductions in rainfall due to climate change pose a threat to hydropower developments

in much of Africa, East Africa's predicted increase in rainfall means that the outlook for hydropower potential in the subregion is good. At the same time, it will be important for East Africa to ensure a diversity of energy sources (CDKN, 2014). According

to a World Bank-sponsored study (Ebinger and Vergara, 2011), East Africa's over-dependency on hydropower for electricity, comprising over 80 per cent of the subregion's electricity generation, makes it particularly vulnerable to climate change.



Blue Nile Falls, Ethiopia

Rwanda: Climate Resilience

Rwanda is a mountainous country in the Great Lakes region of Africa, covering roughly 26,338 km². It is known as the 'land of a thousand hills' as its terrain is characterized by steep slopes and green hills. Its predominantly rural population relies on subsistence agriculture for livelihoods. According to the 2012 population census, Rwanda has a total population of 10,537,222, giving a population density of 416 people per km². About 30.2 per cent of the population lives below the national poverty level; only 16 per cent has access to electricity; and 75 per cent depends on subsistence agriculture which is mostly rain-fed. About 45 per cent of the land in Rwanda is arable, an estimated 22 per cent is forested, while 18 per cent is pastureland.

The significant economic growth, averaging 7.1 per cent per year in recent years, was largely driven by agriculture, which contributed an average of 32 per cent of GDP. Rwanda is taking its future development seriously in view of a rapidly growing population, which is projected to grow to 26 million by 2050 (United Nations, 2011), as well as plan for the impacts of climate change on land, water, food and energy resources.

Current actions for green growth and climate resilience

Rwanda has a Green Growth and Climate Resilience National Strategy for Climate Change and Low Carbon Development. The strategy is one of the initial steps on a pathway leading to a sustainable future; Rwanda is preparing for the risks associated with emerging threats such as climate change and high population density. The strategy sets out a framework for mainstreaming climate change and a green growth approach in national socioeconomic planning, while providing mechanisms to mobilize

funding to finance green growth programmes identified during the process. Some of the issues in reducing vulnerability to climate change include the strong reliance on rain-fed agriculture, the dependency on hydropower for half of the national electricity generation and endeavours to preserve the natural ecosystems.

Initiatives linked to green growth and climate resilience in Rwanda

National Climate and Environment Fund

Rwanda's National Climate and Environment Fund, locally referred to as FONERWA, is ground breaking and envisaged to become the engine for the country's green growth over the next 50 years. Its strategy is to provide technical and financial support to public and private projects that align with Rwanda's commitment to a strong green economy.

FONERWA is an instrument for facilitating direct access to international environment and climate change finance, as well as for streamlining and rationalizing external aid and domestic finance. Access to the fund is open to line ministries and districts, research institutions, non-profit organizations and private entities. Currently, FONERWA has about USD 65 million (RWF 50 billion) in funds and has so far invested over USD 28 million (RWF 22 billion) in projects related to climate change and environmental conservation. Projects are distributed all over the country, particularly in the west and mountainous parts of Rwanda.

Green energy

The Government of Rwanda is striving to find new sources of energy to replace fuelwood that is being used by a large percentage of the Rwandan population and to increase the proportion of the population with

access to electricity. Solar energy is being promoted as an alternative source of energy. A USD 23.7 million solar power plant, located in Rubona, Rwamagana District (Eastern Province), was inaugurated in 2015. The plant is the first utility-scale solar power plant to be built in East Africa and will produce 8.5 megawatts, enough to power 15,000 homes. Currently, the solar plant contributes 5 per cent of Rwanda's current total energy generation capacity of 155 MW. The objective is to increase the country's total generation capacity to 563 MW by 2017/18.

Ecosystem restoration in Rwanda

The Green Growth and Climate Resilience National Strategy highlights that, in order to maintain Rwanda's protected areas as key economic assets supporting a climate-resilient services industry, as well as a haven for biodiversity and a source of key ecosystem services, effective protection and sustainable management measures need to be put in place.

It is under this framework that the Rwanda Environmental Management Authority and Rwanda Development Board are implementing a project funded by the Global Environment Facility through the World Bank. The Landscape Approach to Forest Restoration and Conservation project will provide a model for landscape management for enhanced environmental services and climate resilience. The project will be implemented in the newly-established Gishwati-Mukura National Park, which contains two degraded mountain natural forests located in the western part of Rwanda. Landscape Approach to Forest Restoration and Conservation aims to restore the landscape by improving the management of the Gishwati and Mukura forests and enhancing local livelihoods and climate resilience within the area.



Hilltop village overlooking Lake Ruhondo, Rwanda

Lessons learned

The challenges to sustainable mountain development can sometimes affect a whole country, as is the case in Rwanda. There is therefore a need for national level response rather than mountain-specific approaches. The green growth and climate resilience strategy could focus more on the most vulnerable areas, but it concerns the country as a whole. Mountains provide indispensable services including water for irrigation

and hydropower energy and can contribute significantly to green growth. When mountain ecosystems are well managed, they contribute to climate change mitigation.

Recommendations

It is clear that Rwanda, as a low income and densely populated country, faces many challenges in achieving green growth and full climate change resilience. However, notable steps have been taken, ranging

from policy responses to the implementation of good practices on the ground. For a significant impact, more good practices should be promoted, such as investing more in watershed management to sustain agriculture in mountainous areas. In addition, given the rapid population growth and the high demand for agricultural land, agroecosystem practices should be adopted to simultaneously improve food security and enhance environmental conservation.



Tourism mountain lodge, Arusha, Tanzania

Tourism

Tourism is an important and growing economic sector for East Africa. Economic revenues from tourism for Kenya, Uganda, Ethiopia, Rwanda, Uganda, DRC and Tanzania amount to an annual average of over USD 7 billion (World Bank, 2015). Mountains and mountain ecosystems are popular

destinations for trekkers, mountain climbers, and for experiencing wildlife and spectacular scenery. As an example, tourists visiting Mount Kilimanjaro contribute over a third of Tanzania's total revenues from tourism (UNEP, 2014). In areas where there are few alternative livelihood opportunities besides agriculture, tourism can bring in the much needed

income through selling home-made products, guiding tours, and providing pottering services or employment in hotels and lodges (Alweny and Gatarabirwa, 2014; Debarbieux et al., 2014; UNEP, 2014). In recent years, there has been a growing interest in developing ecotourism in mountainous areas in Africa (Alweny and Gatarabirwa, 2014).

New initiatives are being developed in the Nyungwe National Park in Rwanda to promote tourism while also preserving the park's biodiversity, providing alternative livelihood opportunities for local communities and reducing the threat of illegal poaching and fires (RBD, 2015).

The natural beauty of mountain areas is a major tourist attraction – from high snow-capped and glacier-covered mountain peaks to dense forests teeming with wildlife. Negative impacts on biodiversity and ecosystems may reduce tourism revenues. The montane forests in East Africa have some of the highest concentrations of unique species in the world and are home to one of Africa's most famous and critically endangered species – the mountain gorilla. Found only in the mountain forests in DRC, Rwanda and Uganda, the mountain gorilla attracts thousands of tourists to the Virunga, Volcanoes, Mgahinga and Bwindi Impenetrable National Parks. Collaborative conservation measures between the three countries have been successful in increasing the Virunga mountain gorilla population from 250 in 1981 to 480 in 2011 (UNEP, 2014). While there are few benefits for local people, gorillas contribute significantly to the national economies. Estimates suggest that in Uganda, each gorilla brings in USD 1 million in revenues annually (Debarbieux et al., 2014). As mountain gorillas have a high tolerance for a wide range of temperatures, feed on a variety of plants and have low water requirements, they are not directly threatened by climate change. However, due to their small population and limited geographical range, low reproductive rates and high susceptibility to diseases, mountain gorillas are at risk from the indirect consequences of climate change, such as increased human population pressure and habitat destruction, poaching, civil unrest due to sociopolitical instability as well as increased exposure to diseases (WWF, 2014).



Transboundary collaboration in the Greater Virunga

The Greater Virunga Landscape is one of the most biologically diverse mountainous landscapes in the world containing three World Heritage Sites (the Virunga, Rwenzori Mountain and Bwindi Impenetrable National Parks), one Ramsar Site (Lake George and Lake Edward) and one Biosphere Reserve (Queen Elizabeth National Park). The landscape, which covers an area of 15,155 km², has been recognized as an area of global importance.

The Greater Virunga Landscape (GVL) provides goods and services to local communities, and contributes to the national economies through different sectors such as tourism, agriculture, energy and fisheries. The large and growing human population of the area relies on the rich natural capital. The Greater Virunga Landscape provides millions of people with freshwater for drinking and farming. However, overexploitation due to the high population density (600 individuals per km², one of the highest in the region) (Pavageau et al., 2013) has had a severe effect on ecosystem services. In addition, changes in climatic conditions have led to an increase in extreme events such as floods and landslides, as well as changes in hydrological cycles, which affect ecosystem services and the communities that depend on them. Changes in mountain hydrology also have consequences for downstream communities and are likely to be highly significant to economic activities dependent on this water (Beniston and Fox, n.d.).

Key challenges for Greater Virunga

The vulnerability of Greater Virunga to climate change is related, to a large extent, to the anthropogenic characteristics of the region such as high levels of poverty; rapid population growth and high population density; dependence on, and

overexploitation of, natural resources; as well as the geophysical characteristics of this mountainous landscape. This is exacerbated by the effects of climate change which include water scarcity, falling agricultural yields, erosion and floods. This, in turn, affects food security in the region and could increase poverty levels and dependency on natural resources. Climate change also directly impacts on biodiversity.

Climate change is already a reality in GVL and the effects are being felt by communities experiencing an increase in extreme natural events. This requires a response from neighbouring countries to develop and implement mitigation and adaptation measures. This is hindered by weak coordination and collaboration between the countries (including the lack of harmonized policies, practices, and priorities), inadequate information and information management, the actions of extractive industries and political instability.

Countries sharing the Greater Virunga ecosystems face a number of specific challenges, including:

- A lack of vulnerability data and information. Some research has been conducted but the findings are not available to the public.
- Conflicts between the countries and the insecurity in DRC impede collaboration. The presence of the military camps in some areas of the landscape does not allow access.
- There is a lack of communication between the institutions and organizations operating in the landscape which hampers transboundary cooperation in tackling common issues.
- There is a limited number of local experts in the region with an understanding of the local dynamics.



Agroforestry in the Virunga Mountains, Rwanda



Policy actions

Greater Virunga is a transboundary ecosystem that requires transboundary collaboration. The mismanagement of the ecosystem in one country can affect efforts in the other countries. It is for this reason that the neighbouring countries established a transboundary framework to collaborate efforts in conserving this important ecosystem. The Greater Virunga Transboundary Collaboration is a mechanism for strategic, transboundary, collaborative management of the GVL. This mechanism was set up in 1991 by the Institut Congolais pour la Conservation de la Nature, the Rwanda Development Board and the Ugandan Wildlife Authority, with support from their partners in the region. It started with ranger collaboration to protect mountain gorillas in Mgahinga, Bwindi, Virunga and the Volcanoes National Park. Later, it expanded in scope to include tourism, community conservation, and research and monitoring. It covers an area which now extends to central and northern Virunga (DRC), and the Queen Elizabeth, Rwenzori Mountains and Semuliki National Park (Uganda). The Executive Secretariat is based in Kigali, and coordinates communication between stakeholders on behalf of the Protected Area Authorities.

Although the transboundary initiative is in place, it still has no legal basis. The treaty governing its establishment was expected to be signed by the Heads of State of the DRC, Rwanda and Uganda in 2011, but this is still pending.

Lessons learned from the case study

While the Greater Virunga Transboundary Collaboration is a step in the right direction, it requires a strong mandate if it is to be effective.

Signing up to the treaty is a prerequisite to legalization but the difficult relationship between the countries bordering the GVL has delayed the process. All three countries (DRC, Rwanda and Uganda) recognize the importance of GVL, in particular for its revenues from tourism, but political instability in the region continues to hinder the collaborative sustainable management of this important landscape.

Recommendations

Transboundary collaboration in the management of transboundary ecosystems is crucial. In East Africa, very few transboundary initiatives are in place and therefore new initiatives should be encouraged. Recently, the Albertine Rift Conservation Society signed a Memorandum of Understanding with the EAC to join efforts in enhancing environmental and sustainable natural resource management in the Albertine Rift region and other transboundary ecosystems of East Africa. The parties agreed to collaborate on activities to improve the management of transboundary ecosystems, particularly those relevant to sustainable mountain development.

Burundi's Mountains

Burundi is a mountainous country. Its altitude ranges from about 800 m at Lake Tanganyika to 2,608 m on Mount Teza in the Kibira National Park. Mountain Protection in Burundi is of high priority because the majority of protected areas in Burundi are in the mountains. These protected mountain areas are important water towers – the main rivers feeding the watersheds of the Nile and Congo have their sources inside the forest of Kibira National Park, one of the few mountainous forests in the country.

Key Challenges

- The massive mountains in the country are not classified as protected areas, and these include Inanzerwe Kibimbi, Birime, and Mpungwe.
- Bushfires are common
- Poaching is widespread
- Funds for mountain protection are limited
- Deforestation rates are high in mountain areas



Women harvesting tea leaves in Rwegura, Burundi

Policy responses

Even if there are no policies which focus specifically on mountains, some mountains have been reforested through the national reforestation programme, and receive attention for protection against bushfires and poaching. Each year, the Government of Burundi provides about 10 million seedlings for reforestation. Kibimbi and Inanzerwe mountains are important attractions for hiking, and are also famous for hot springs. These mountains support the livelihoods of many Burundians through grazing, drinking water, construction materials, and land for farming.

Lesson learned

In Burundi, there are projects that deal with climate change adaptation such as TAMP KAGERA which also include the Watershed Management and Climate Resilience Improvement Project (PABVARC), and the Biodiversity Project.

Recommendations

- Funds must be made available to intervene in all the national mountain ecosystems
- Awareness raising needs to be a continuous activity

Policies and institutional Framework

In Burundi, there are no policies which focus specifically on mountains. However, there are a number of projects and policies where mountains and forest ecosystems are taken into consideration, and they include:

- Strategic Framework for growth and fight against poverty, Phase II (CSLP II)
- National Strategy and Action Plan for Adaptation to Climate Change
- National strategy and action plan on Biodiversity
- Policy of the Ministry of Water, Environment, Land management and Urban planning
- National environmental Strategy
- National Forestry policy
- Watershed Management and Climate Resilience Improvement Project in Burundi (PABVARC),
- Reforestation project of a range of mountain Inanzerwe which starts from Bururi province to Ruyigi Province
- Biodiversity Project which will end this year
- TAMP KAGERA project which ended

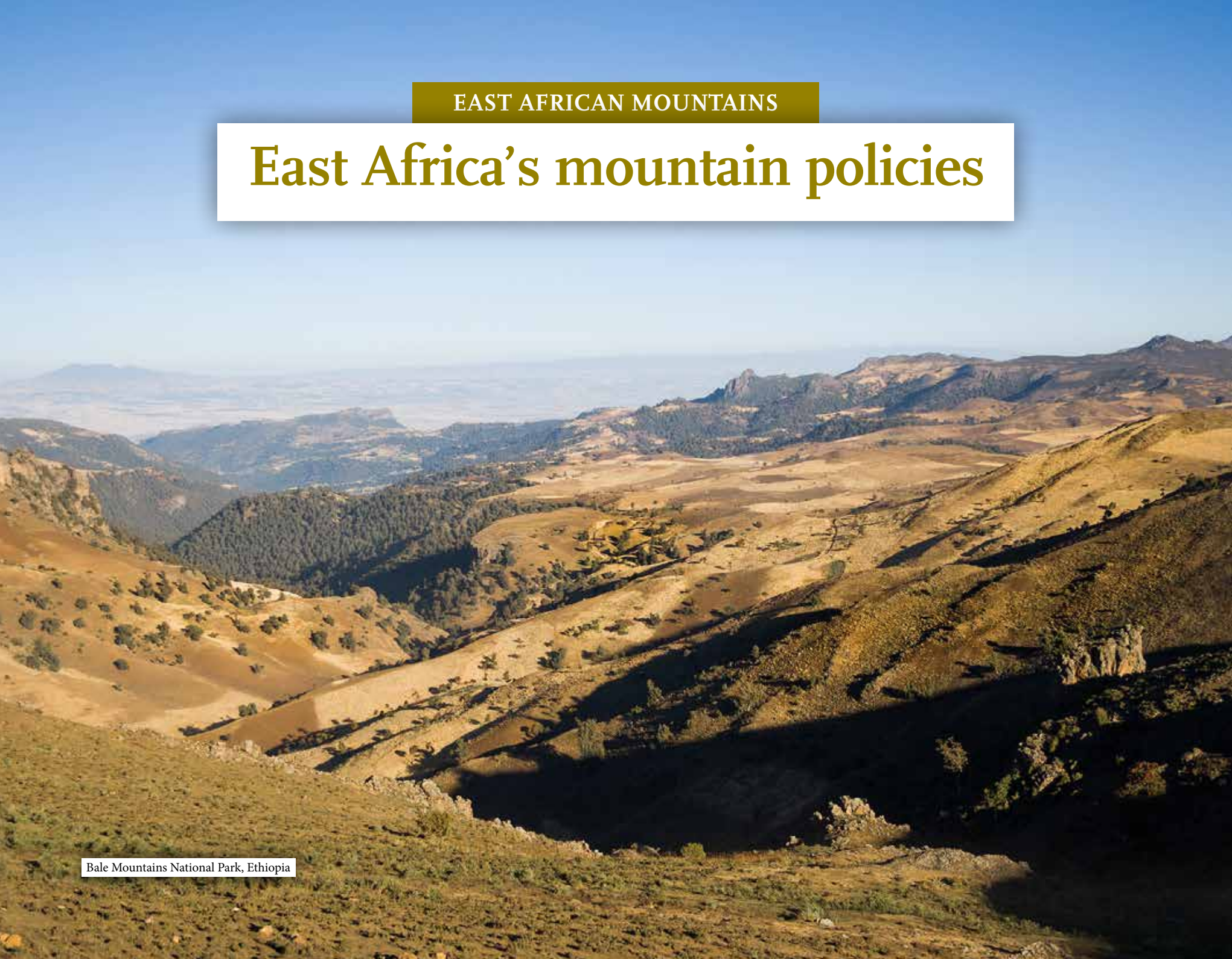
Mountain issues are coordinated by various institutions, including:

- Ministry of Water, Environment, Land Management and Urban Planning through the Burundi Geographical Institute (IGEBU), and the Burundi Office of the Environment Protection (OBPE)
- National Commission on Environment

EAST AFRICAN MOUNTAINS

East Africa's mountain policies

Bale Mountains National Park, Ethiopia



Introduction

Governance of East Africa's mountainous areas covers not only the five countries of the East African Community (EAC), but also other countries in East, Central and Southern Africa, which share transboundary ecosystems with East Africa. In order to effectively address the challenges of climate change in the mountainous areas of East Africa, policy coordination between countries and regional economic communities neighbouring EAC is required.

Policies and institutional arrangements, as well as specific mountain region programmes, implemented in East Africa to address sustainable natural resources management, community livelihoods and development in a changing climate, have the potential to facilitate societal and environmental resilience. The formulation and implementation of such policies and actions take place at different levels including subnational, national and transnational. At the continental level, the New Partnership for Africa's Development (NEPAD) Action Plan for the Environment Initiative, which was developed and is being implemented as an AMCEN initiative, is key in addressing Africa's mountain policy agenda.

Africa's rich indigenous knowledge and practices in mountain resources management are also key to policy formulation. Such knowledge and practices have evolved over a long period of time and sustained resources and livelihoods. While some of these practices may no longer effectively address the current challenges, many are still effective and suited to the local environment and therefore need to be identified and enhanced for replication and up-scaling in order to ensure sustainable development and community resilience to the changing climate of East Africa.



Young mountain gorilla, DRC

Governance of East Africa's mountainous areas

Policies and institutional frameworks

National and subnational policies and institutional arrangements

Most countries in East Africa have institutional frameworks for environmental protection and sustainable development, including those relevant to mountain areas. The exceptions are Burundi where mountain issues are indirectly addressed through the county's constitutional environmental code, and the DRC where mountain-specific arrangements are yet to be formulated (EAC, 2006).

The institutional and policy arrangements vary among countries in terms of the level of comprehensiveness in addressing mountain issues. There are no public institutions in East Africa that deal specifically with mountain areas. Mountain issues are addressed through a variety of sectoral institutions working in agriculture, tourism and rural development (Villeneuve et al., 2002; EAC, 2006; Smith, 2010; GVTC, 2014; UNEP, 2014). Kenya, Tanzania and Uganda, as signatories to the East African Protocol on Natural Resources, have environment policies that contain sections that specifically address mountain issues. For example, the Ugandan National Environment Act Cap. 153 includes three sections (38-40) with specific regulations for the sustainable management of mountainous areas (National Environment Act Cap. 153; NEMR, 2000). These laws were put in place to operationalize relevant sections of environmental policies in these countries indirectly or through more generalized ways, with the exception of the National Environment Policy for Kenya (Government of Kenya, 2013) which also contains a specific section

(section 4.4) that directly addresses conservation and sustainable utilization of mountain ecosystems. Similarly, Uganda's environmental law has specific sections relevant to mountain ecosystems, as well as regulations and guidelines for operationalizing these sections of the law (National Environment Act Cap. 153; NEMR 2000). However, measures to tackle the impacts of climate change are not well integrated.

Other countries in the subregion do not have any policies that specifically address mountains. The absence of specific policies and institutional frameworks for addressing the unique human and biogeographical characteristics of mountain areas can be viewed in the context of the broader failure of nations to recognize the uniqueness and importance of mountain ecosystems and communities (Owen and Maggio, 1997).

In addition, the EAC (2006) also observed inconsistencies in the allocation and implementation of environmental functions, which often leads to poor coordination and/or duplication. These problems are often due to the misinterpretation of laws and regulations by different institutions – for example, different interpretations of the role of local governments and the central forest authority in the management of forest reserves in the Mt. Elgon area (Bazaara, 2003). These differences may not seriously hinder the implementation of mountain programmes, but they could be more effective with greater harmonization.

With regards to institutional frameworks, most of the EAC countries have a lead agency coordinating environmental management: National Environment

Management Authority in Kenya and Uganda; National Environment Management Council in Tanzania; Rwanda Environment Management Authority in Rwanda. These lead agencies are important given that environmental policies and laws address cross-cutting issues that involve a range of agencies and departments which implement different components of the environmental management strategy within their sector. Embedded in such arrangements is the reasonable harmonization of the roles and responsibilities of the different actors.

With or without the lead agency, overlaps and duplication of roles are common in the region, resulting in inconsistencies in the way laws are implemented. An analysis of these inconsistencies indicate that they are largely a result of the misinterpretation of policies and laws regulating institutional mandates, roles and responsibilities, which may be due to either a lack of awareness or institutions deliberately acting in their own self-interest.

Environmental laws relevant to the different EAC Member States are reasonably well harmonized, although further improvement would make the implementation of a mountain agenda more effective. For instance, there should be a uniform court system to handle environmental cases in the region. Many of the countries have regulations governing similar issues – restricted access to fragile conservation areas, the regulated use of river banks and a requirement for Environmental Impact Assessments (EIA) for new developments, for example – but there are notable differences in the standards and guidelines in each of the Partner States. A case in point is the policy on



Drummers and dancers in Gitega, Burundi

allocating revenue from tourism to local communities. This mechanism needs to be harmonized across the subregion. Currently, in Uganda, 20 per cent of the total gate fees from all national parks go towards supporting local communities; except in the Mghahinga Gorilla National Park and the Bwindi Impenetrable National Park which includes an additional supplement of 5 per cent of all gorilla permit fees. In Rwanda 5 per cent of all tourism revenue is allocated to local communities while in the DRC such a policy has not yet been developed due to the political insecurity in the country.

An evaluation of policies and institutional frameworks in the region clearly indicates that, at present, there are adequate policy and institutional frameworks to enable the effective implementation of programmes for sustainable mountain development. However, climate change policies do not specifically

focus on mountains in particular (EAC 2011), even up to the present, and therefore there is need to pragmatically integrate issues of climate change adaptation and resilience. There is an urgent need for review and harmonization of policies and institutional frameworks to make the mountain development agenda more relevant to the changing climatic conditions.

In Ethiopia, both environmental policies and laws exist (EPA, 1997; 2012). However, few policies contain specific sections on mountains. For example, within the environmental policy there are sections that concern the sustainable management of resources in the highlands, particularly soil erosion and general land management. Similarly, Ethiopian environmental laws contain proclamations on environmental management with some sections which can be used to

address mountain issues: Water Resource Management Proclamation (No. 197/2000); Establishment of Environmental Protection Organs Proclamation (no. 295/2002); Biodiversity Conservation Proclamation (No. 381/2004); Environmental Impact Assessment Proclamation (No. 299/2002). In Eritrea, at present there is no formal environmental legislation or legislation specifically relating to mountains. The legislation that directly addresses the environment includes the Eritrea Biosafety Act. It should be noted, however, that in 2001 Eritrea submitted a National Communication to the UNFCCC which provides an indication of ongoing efforts to address climate change and other environmental issues, some of which relate to sustainable development in mountain areas (GOE, 2001).

In many of the countries in East Africa, governance is either decentralized or semi-decentralized (EAC, 2006). Governance of natural resources and sustainable mountain development is normally the responsibility of local government structures.

At the subnational level, elements of national programmes are implemented based on their relevance to each specific region or district. In a few cases, some programmes may be developed and implemented by subnational governance structures themselves. Data and information at these levels, however, remains scarce and can only be obtained through national programmes.

Decentralization is meant to strengthen access to services for local communities. Experiences across East Africa indicate a mixture of success and failure. Approaches to local governance differ among countries. Governance in Tanzania, for example, is based on a regional system, which is further decentralized to the district level; this creates layers of bureaucracy which may delay service delivery. In Uganda, on the other

hand, decentralization is from the central government to the district directly, where district councils are in charge of district level governance. Below the district councils are sub-county and lower level councils, which are supposed to facilitate effective community participation. In Kenya, the management of natural resources is decentralized from provinces to districts, which enables participation of local communities (Kithika, 1999; GoK, 2013).

The implementation of policies and laws on sustainable development in the mountains of East Africa has often been constrained by a lack of human resource capacity, limited financial resources, corruption, a lack of access to information, political meddling and political instability at all levels (Rwakakamba, 2009; NEMA, 2010; GVTC, 2014).

While there is a lack of policies with a direct focus on mountain ecosystem management, many of the East African countries have a number of sectoral policies and laws that address issues relevant to mountains. These will have to be properly integrated into the implementation of a regional mountain agenda. Experience on the ground reveals that there is lack of coordination and collaboration among sectoral institutions and political leaders. This tends to create rivalry and conflict in the implementation and enforcement of the policies (e.g. Wetlands policy, National Policy on Water Resources Management and Development; National Land Policy, National Agricultural policy; Forests Act). However, it should be noted that institutional frameworks are good; it is only distortions and misinterpretations of the roles and responsibilities.

Civil society plays roles in lobbying and awareness-raising on mountain development issues, and their great contribution should not only be recognized, but also built on in further pursuance of mountain development issues and climate change.



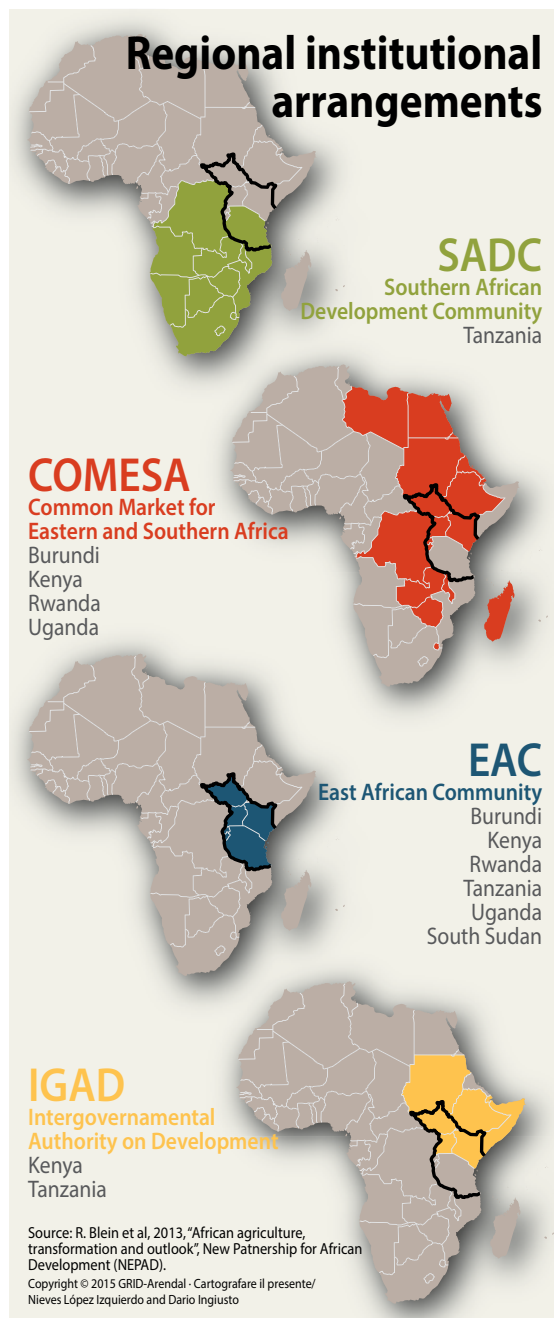
Turmi market, Ethiopia

It is important to note that mountain ecosystems, cultures and economies are usually not contiguous with international frontiers and domestic boundaries created by central governments. Most of the mountain ecosystems in the East Africa countries transcend national borders. To be able to manage such ecosystems as well as provide improved community livelihoods, subregional approaches are required either to complement or feed into national programmes. In this respect, existing or past subregional programmes need to be reviewed to determine whether they fit these requirements. Mountain communities on one side of the border are often part of the communities on the other side. This raises the question of national identity and the affiliation of particular mountain communities to a particular country. This calls for intergovernmental cooperation. Cooperation between neighbouring

states is necessary for promoting the wellbeing of the mountain peoples and ecosystems. This cooperation can also promote peace between states and a recognition of shared values and objectives (Owen and Maggio, 1997).

The impacts of mountain ecosystems also extend beyond mountain boundaries to the surrounding areas. This brings in the concept of highland-lowland interactions. Highland and lowland interactions can be social, ecological, economic or political in nature, and may include flows of resources, trade and people. These linkages also need to be taken into account.

In addition, efforts have to be made to build the capacity and awareness of mountain communities to understand and appreciate the uniqueness and importance of their native habitat. In particular,



there is a need to enable communities to meet the challenges of climate change and the interactions with other people outside the mountains. To address such transboundary issues concerning shared mountain populations and ecosystems, efforts should be made to understand the linkages and develop laws and policies that foster productive interactions.

Transnational policies and institutional arrangements

At the transnational level, a significant number of policies and institutional frameworks exist and are in operation. In East Africa, these arrangements can be used to pursue the agenda for sustainable mountain development. These include, among others, the IGAD, the EAC, the SADC and COMESA. Under these political and economic subregional arrangements, there are institutional frameworks that address a wide range of issues that are relevant to mountain areas. These institutions have a variety of administrative levels particularly the commissions and secretariats, and through these it is possible to address pertinent mountain issues as well as develop and implement programmes of activities to address the challenges facing mountain ecosystems in a changing climate.

At the political level, the EAC operates under a 'Treaty of Cooperation'. The EAC Secretariat is the technical body that carries out Community operations. A number of protocols and policies at the Heads of State level have been put in place to facilitate the operation of these institutions. These include the East African Community Protocol on Environment and Natural Resources Management, the East African Climate Change Policy, and the East African Community Transboundary Ecosystem Management Act of 2010.

The East African Climate Change Policy adopted on April 2011 contains activities and provisions for

addressing climate change adaptation. Steps have been taken to implement the policy, but significant challenges and gaps remain. An East African Community Climate Change Strategy was developed to guide and enhance strategic implementation of the policy. The EAC Secretariat in Arusha has also put in place lower level institutional arrangements. The Lake Victoria Basin Commission, for instance, has a number of programmes and projects relevant to natural resource management including for mountain ecosystems and communities. Similar initiatives have been finalized or are under way and should be encouraged in the subregion. A Memorandum of Understanding was endorsed between Rwanda and Burundi in 2012 for the joint management of natural resources. Another Memorandum of Understanding was signed under the auspices of the EAC for improving the management of wildlife conservation in the Mara-Serengeti region. However, there are still other transboundary mountains in the region (such as the Pare Hills between Kenya and Tanzania) where collaboration is lacking. In general, there is still lack of vision on how the EAC could manage and coordinate efforts on mountains within the region.

The Intergovernmental Authority on Development (IGAD), as amended in 1996, is an intergovernmental institution for the East Africa region that addresses development issues, some of which are relevant to transboundary natural resources and ecosystems. The IGAD, which has its Secretariat in Djibouti, has clear policies and guidelines that govern its various entities. Over the years, the organization, through its Secretariat, has developed and implemented a number of strategies and programmes which address climate change and community livelihoods. While there is no explicit focus on mountain ecosystems and communities, there are strategies and programmes that offer other avenues for addressing mountains issues. For instance, the IGAD (2003) Strategy focuses



Rift valley, Ethiopia

on a number of relevant programmes including agricultural development and food security, natural resource management, environmental protection, conflict prevention/management and transport and communications. All these programmes contain provisions pertaining to sustainable mountain ecosystem-based development, which can be profitably utilized to design and implement a mountain agenda for the region. In addition, IGAD has also carried out a number of assessments – the IGAD Environment Outlook (2007), for example – which provides a wealth of information for addressing climate change and mountain issues, among others.

The Common Market for Eastern and Southern Africa (COMESA) was established in 1993, as a

common market institutional arrangement and has its Secretariat in Lusaka, Zambia. The organization is operating within a variety of policies and institutional frameworks. A number of programmes with components relevant to mountain ecosystems and climate change have been developed under the COMESA framework. These include programmes on climate change, agriculture and livelihoods, which are linked to the New Partnership for Africa's Development (NEPAD). However, none of these programmes directly address mountain issues.

NEPAD, adopted by the African Heads of State and Government in 2001, is a commitment by African leaders to eradicate poverty and promote sustainable growth and development (Rehabeam,

2004). Under this partnership, there are a number of institutional frameworks that guide and support the implementation of policies and programmes geared to realizing the common vision of the Heads of State. It has a Secretariat in Pretoria, South Africa, which provides overall coordination and guidance. Under this institutional arrangement, resources have been allocated and a number of programmes have been implemented, some of which address issues pertinent to sustainable mountain ecosystems. One of the most important and relevant programmes is the NEPAD Action Plan for the Environment Initiative developed and implemented under AMCEN. The Action Plan was finalized and approved in 2003 and contains many components relevant to the environment and development in mountainous areas, including environmental hazards which are common in mountains.

The SADC is an economic organization comprising of 15 states, some of which are located in Eastern and Central Africa. Some of these countries are also part of the East African mountain ecosystem region; namely, Tanzania, Malawi and DRC. The programme offers an opportunity for developing and implementing programmes that could have significant relevance to East African mountain development. The transnational issues affecting areas like Mulanje Highlands in Malawi, and the Virunga Mountains and the Rwenzori Mountains, could be best addressed through such an institutional arrangement, something that has so far been difficult under the EAC, particularly with regard to Malawi and DRC (COMESA/EAC/SADC, 2011).

In summary, the EAC is strategically well positioned to spearhead transboundary mountain ecosystem management, while synergizing with subrelated regional entities.



Programmes and projects

National and subnational level

At the national level, a number of programmes and projects relating to mountain ecosystems and sustainable community development have been implemented. However, information on subnational level programmes and projects is very limited. This is largely because implementation is normally reflected on the national investment programmes and budget frameworks of respective countries. A number of factors may explain this state of affairs. While information and reports on projects may be available, moreover in more detail than national reports on respective districts, accessing this information remains difficult because of a poor information sharing mechanisms, which is hindered by budgetary constraints and a lack of knowledge management capacity. It is for this reason that subnational level information in this report is limited and why the proposed mountain agenda calls for improved knowledge management systems.

The review presented below for projects and programmes in East Africa is organized in four thematic areas: catchment/watershed management, sustainable land management, biodiversity conservation and climate change adaptation.

Catchment/watershed management

There are a few projects addressing problems at the watershed or catchment level in the mountain regions of East Africa. These include the River Catchments Rehabilitation and Alternative Livelihood Development Project and the Koga Irrigation and Watershed Management Project, both in Ethiopia, which are aimed at improving agricultural production in the catchment areas of the Koga river valley. The project created 77 m³ of water reservoirs to irrigate 6,000 ha of land and

helped to increase crop yields and improve farmers' capacity for developing irrigation enterprises. In Kenya, the Mt Elgon Integrated Watershed Management Programme was implemented with the aim of improving livelihood conditions and building resilience to the effects of climate change among communities in the Mt Elgon water catchment areas. The project increased awareness of climate change issues and sustainable farming systems, and built community capacity for managing natural resources, water technologies and the protection of water sources. Another project in Rwanda, the Bugesera Agricultural Development Support Project, aimed to irrigate 800 ha of land and train farming communities on integrated watershed management techniques. Despite these notable achievements, there remains

a lot to be done, particularly considering the high level of environmental degradation and population pressure in water catchment areas under changing climatic conditions.

Sustainable development and land management

A number of projects have been implemented to address issues of sustainable land management in the mountain regions of East Africa. These include the Sustainable Agricultural and Environmental Rehabilitation of Drought Prone Ethiopian Highlands; the Southern Region Agricultural Support Service Project; and the Bale Eco-Region Sustainable Management Programme aimed at addressing deforestation in the Bale Mountains of Ethiopia (UNEP, 2014).



In the Mount Elgon region, a number of projects focusing on conservation (such as the Mount Elgon Conservation and Development Project) were implemented between 1988 and 2002 by the Governments of Kenya and Uganda and the International Union for Conservation of Nature (IUCN). These projects had a significant impact, including the development and implementation of sustainable land management technologies and the capacity building of local communities for the conservation and development-based management of the mountain ecosystem, which helped to reduce pressure on the forest from the surrounding communities.

Phase II of the Rwenzori Mountains Conservation and Development project, was able to build capacity for integrated and ecosystem management, support community restoration of degraded ecosystems and develop improved and sustainable livelihoods for mountain communities. In Rwanda, a number of sustainable land management (SLM) projects and programmes were implemented, including the Special Urgent Soil Conservation Programme, 2007; the Programme for Sustainable Management of Natural Resources and Water and Soil Conservation; the Strategic Plan for Agricultural Transformation; and the Landscape Approach to Forest Restoration and Conservation programme, funded by World Bank.

In Tanzania, several programmes, projects and activities on sustainable ecosystem management and development have been implemented in the key mountain areas of Meru, Kilimanjaro and the Eastern Arc Mountains, in particular, the Uluguru Mountains. Some of the key programmes and projects undertaken in these areas include the Reducing Land Degradation on the Highlands of the Kilimanjaro Region Programme – which uses SLM as a basis for economic development, food

security and sustainable livelihoods, while restoring the ecological integrity of the Kilimanjaro region's ecosystems (UNDP, 2007) – and the Conservation and Management of the Eastern Arc Mountain Forests of Tanzania Project.

The UNDP-Global Environment Facility (GEF) Capacity Building for Sustainable Land Management Project in Burundi aimed to strengthen sustainable land management while ensuring broad-based political and participatory support for SLM implementation from 2008 to 2010 (UNDP, 2008).

Biodiversity conservation

The key biodiversity conservation projects and programmes implemented in the East African mountain areas have mainly focused on protecting the integrity of gazetted areas, while a few others have addressed problems outside conservation areas.

One project involves the use of enclosures to rehabilitate degraded land in Alaba district in Ethiopia (2009-2012). The project involved various actors including women's groups, and adopted multiple measures such as reforestation, planting grass tufts, building soil erosion control structures, constructing micro-catchments and planting a variety of indigenous and exotic species. The national policy in Ethiopia strongly supports the planting of native species in enclosures (Teketay et al., 2010), but mainly exotic trees and shrubs were introduced to the project area because they were considered fast growing and were expected to establish well on harsh sites. The major achievement of this project was the positive attitudes it engendered among local communities towards rehabilitation and livelihood improvement. This was boosted through self-ownership and the direct benefits to the communities. A few challenges included conflicts in demarcating enclosures in resource pool areas and a lack of land tenure rights.

Another example of a biodiversity conservation project was the Sustainable Development of the Protected Area System of Ethiopia supported by GEF (2008-2016). The aim of the project is to conserve biodiversity, ecosystems and ecological processes from adverse human activities by forming an association of protected areas and national parks to enhance systematic cooperation. So far, this project has helped to renew the demarcation of wildlife protected areas, boosted research related to conservation and made improvements to geospatial information management.

In its first phase, the Rwenzori Mountain Conservation and Development project in Uganda made some notable achievements, including strengthening biodiversity conservation through improved management of the Rwenzori Mountain National Park, and increasing the benefits and sharing of such to local communities.

In the extreme south-western mountain and highland region, similar conservation and development projects, based on the Mt Elgon and Mt Rwenzori model, have been implemented since 1989 to secure the integrity of Mgahinga and Bwindi Impenetrable Forest National Parks, which are home to the endangered mountain gorilla. This was followed by the development of the Bwindi Mgahinga Conservation Trust in 1995, which was the first Conservation Trust in Africa funded by GEF. The Trust provides long-term funding for the conservation of the two national parks, which are home to one-third of the world's remaining mountain gorillas. The Trust provides resources for park management to strengthen protection of the gorilla population and for research to better understand the ecology and social behaviour of the gorillas and other native wildlife. The majority of the fund is used to support community development for local people



to provide sustainable livelihoods as an alternative to agricultural encroachment into the park. The Trust is recognized internationally as an example of innovative conservation finance (World Bank, 2002).

Conservation and Management of the Eastern Arc Mountain Forests of Tanzania Project aimed to build consensus among multiple stakeholders around how best to conserve mountain biodiversity; support the implementation of community-based conservation initiatives in priority pilot areas in the Uluguru Mountains; and develop lessons that could be extended to other areas (UNDP, 2010). It also supported a process of institutional reform to strengthen institutional capacity to undertake

participatory forest biodiversity conservation. The UNDP implemented Community Management of Protected Areas for Conservation Project aimed to promoting community-based biodiversity conservation in the Kilimanjaro region (OECD, 2003). Other similar projects include the World Bank-funded Forest Conservation and Management Project, which focused on the development of the forestry sector, and on biodiversity conservation in Tanzania's forests. The latter component, which is supported by the GEF and jointly implemented with UNDP, focused on the Eastern Arc forests, which are recognized as biodiversity hotspots, and are a crucial water catchment area for Tanzania's water supply and hydroelectric power generation.

Climate change adaptation

A few projects relating to climate change adaptation have been implemented in the mountain regions of East Africa. There have been some notable achievements, but also a number of challenges. One of the most recent projects was the Ecosystem Based Adaptation (EBA) programme, which covered eight mountainous districts in Uganda. The project was jointly implemented by the Government of Uganda, UNEP, UNDP and IUCN. The project was implemented by local and central government teams in close collaboration with local communities. The overall objective of the project was to strengthen Uganda's capacity for promoting ecosystem-based adaptation options and to reduce the vulnerability of communities to climate change impacts with particular emphasis on the Mount Elgon ecosystem.

Another project of relevance to the East Africa region is the Strengthening Sustainable Environment and Natural Resource Management, Climate Adaptation and Mitigation project in Uganda. The project was implemented by WWF and focuses on the Rwenzori Mountains. In Burundi, the Enhancing Climate Risk Management and Adaptation project was implemented between 2010 and 2014. The project aimed at integrating relevant information on climate change into national and subnational decision-making processes by raising awareness, developing preparedness and adaptation measures, and enhancing the capacity of the population to adapt to climate change and reduce vulnerability (GEF, 2010).

Generally, reasonable achievements have been made in terms of creating awareness of climate change and building local institutional capacity for climate change adaptation in the mountainous areas. These projects are, however, scattered and rather short-lived and, therefore, unlikely to demonstrate any significant long-term impact.

Table 1: Relevant programmes or projects implemented in different mountain areas of East Africa

Project	Country	Purpose/objectives	Implementation	Results and impacts
<i>Sustainable development and land management</i>				
Sustainable Agricultural and Environmental Rehabilitation of Drought Prone Ethiopian Highlands (Tigray)	Ethiopia	Not available	Not available	The landscape has been rehabilitated through terracing leading to increased investment returns. A range of improved land management technologies and best practices have been developed and adopted.
Small-Scale Irrigation and Conservation	Ethiopia	Combat drought and desertification in Arsi, Bale, North Sidamo and Hararghe. Small-scale irrigation, land conservation, improved production	1987–1996	Not available
Mt Elgon Conservation and Development	Uganda	Restoring the ecological integrity of the mountain ecosystem	1988–1990 (Phase 1) 1990–1994 (Phase 2) 1996–2000 (Phase 3)	Improved resource conservation on farmlands and forest collaborative management; Livelihood improvement of communities in target areas
WFP-Managing Environmental Resources To Enable Transitions	Ethiopia	To improve environmental management for sustainable livelihoods	1974–1980	The Food for Assets and livelihood enhancement operation, known as ‘MERET’, currently reaches an average of 1.3 million beneficiaries in 600 different communities each year
Land Rehabilitation Programme	Ethiopia	To promote land management for food security		Part of the Product Safety Net Programme aiming to improve food security in selected regions (Amhara, Tigray, SPNN).
Ecosystem Based Adaptation in Mt Elgon ecosystem	Uganda	To strengthen the capacities and ecosystem resilience by promoting ecosystem adaptation to reduce the vulnerability of mountain communities	2011–2014	Developed methodologies and tools for EBA decision-making at ecosystem level; Improved institutional capacity through investment in demonstration sites within Mt Elgon ecosystem; Established systems and frameworks for scaling up EBA at national level for climate risk management

Table 1: Relevant programmes or projects implemented in different mountain areas of East Africa (continued)

Project	Country	Purpose/objectives	Implementation	Results and impacts
<i>Sustainable development and land management (continued)</i>				
UNDP-GEF Capacity Building for Sustainable Land Management in Burundi Project 2008 to 2010	Burundi	Strengthening the enabling environment for sustainable land management while ensuring broad-based political and participatory support for the process	Implemented 2008–2010	Capacity in sustainable land management reinforced and mainstreamed into development policies; Implementation of adaptive lessons learned.
Rwenzori Mountain Conservation and environmental Management Project	Uganda	Conservation of Mt Rwenzori ecosystem, including its biodiversity and water catchment values, for the benefit of neighbouring and the international communities	Phase I Implemented 2005–2009 Phase II implemented 2010–2012	Strengthening biodiversity conservation through improved management of the Rwenzori Mountains National Park, increased benefits to local communities and sharing and lessons with stakeholders. Enhancement of capacity for integrated and ecosystem management, community restoration of degraded ecosystem, and improved and sustainable livelihoods of mountain communities.
Mt Elgon Integrated Conservation and Development	Uganda	Enhancement of biodiversity conservation on Mt Elgon through capacity building of partner agencies and local communities	1998–2001	Improved understanding and application of natural resource based knowledge; strengthened local institutional capacities and capabilities in natural resource management; reduced dependency on protected area natural resources
Bale Eco-Region Sustainable Management Programme (BERSMP)-Ethiopia	Ethiopia	To address deforestation in the Bale Mountains of Ethiopia	Ongoing (20 year Reduced Emissions from Deforestation and Forest Degradation (REDD) Project)	Participatory forest management is being implemented to reduce the forest loss through establishing Community Based Organizations and Sustainable Forest Management practices.

Table 1: Relevant programmes or projects implemented in different mountain areas of East Africa

Project	Country	Purpose/objectives	Implementation	Results and impacts
<i>Biodiversity conservation</i>				
National biodiversity strategy and action plan	Ethiopia	Implementation of the strategy has eight objectives addressing different areas of concern including among others: protected area conservation; effective integrated sustainable use natural resource management systems using innovative public private partnerships; adoption of appropriate policies and plans to promote the conservation and sustainable use of biodiversity; building information base and monitoring systems	Partially complete	Although not effectively conserved, changes in some species have been realized, particularly in Simien and Bale mountain national parks.
Better understanding and maintaining the diversity of ecological processes and species across the altitudinal range of the Bale Mountains	Ethiopia	Mitigation and reduction of human threats to the Bale Mountains National Park due to unsustainable natural resource use in partnership with other programmes	2007–2017	Not available
Forests Absorbing Carbon Emissions on Mt Elgon	Uganda	Establishing forests as Carbon sinks to offset emissions of greenhouse gas from power stations in the Netherlands	1994–1998	Improved tree cover in forest degraded areas [25, 000ha]
Improving agricultural extension services for sustainable land-use management in Rwanda	Rwanda	Capacity developed for sustainable land management in central and local government, government agencies for example Rwanda Agriculture Development Authority, and farmers; and sustainable land management Principles mainstreamed into national policies, plans and processes.	Implemented 2007–2010	Development of a participatory field-based training course for extension staff, including regional best practices; and cost-benefit analysis of interventions at household level. Capacity built in soil and water conservation, and degraded agricultural landscapes restored.

Table 1: Relevant programmes or projects implemented in different mountain areas of East Africa (continued)

Project	Country	Purpose/objectives	Implementation	Results and impacts
<i>Biodiversity conservation (continued)</i>				
Reducing Land Degradation on the Highlands of Kilimanjaro Region	Tanzania	To provide enabling environment for sustainable land management as a basis for economic development, food security and sustainable livelihoods while restoring the ecological integrity of the Kilimanjaro region's ecosystems.	Implemented 2010–2014	Capacity Built for Energy mainstreaming; Alternative income generating activities established for income generation; Natural resource governance systems strengthened at local levels.
Landscape Approach to Forest Restoration and Conservation	Rwanda	To promote land management of the Gishwati and Mukura forests. Improve on the environment including local livelihoods and climate resilience	2014–2017	Not available
<i>Catchment/Watershed management</i>				
Mt Elgon Integrated watershed management	Kenya	Improve living conditions and resilience of communities to effects of climate change	2010–2012	Improved sustainability of farming systems; Increased awareness to climate change and its effects
Conservation and Management of the Eastern Arc Mountain Forests of Tanzania Project	Tanzania	Build consensus of multiple stakeholders about how best the biodiversity can be conserved in the mountains; support the implementation of community-based conservation initiatives in priority pilot areas in the Uluguru Mountains and to develop lessons that can be extended to other areas; and support a process of institutional reform that will strengthen institution capacity to undertake participatory forest biodiversity conservation	Scheduled implementation 2004 to 2009, but ended June 2010	Decline in cutting down coastal and Eastern Arch mountain forests due to successful and participatory management systems; Enhanced organization capacity of villagers and increased agricultural production; adoption of sustainable land management practices related to agriculture; a model for long-term financial flows among communities developed.

Table 1: Relevant programmes or projects implemented in different mountain areas of East Africa (continued)

Project	Country	Purpose/objectives	Implementation	Results and impacts
<i>Catchment/Watershed management (continued)</i>				
Koga Irrigation and Watershed Management Project	Ethiopia	The project comprised four main components: (i) Irrigation Development; (ii) Watershed Management; (iii) Capacity Building; and (iv) Project Coordination and Management. The project aimed at harnessing the water resources of the Koga River to irrigate 6 000 ha of the command area, as well as to improve rain-fed agriculture, forestry, livestock, soil conservation, water and sanitation on some 22 000 ha catchment area. The overall sector goal of the project was to contribute towards poverty reduction among smallholders through improvement in food security in the region in particular and the country as a whole, consistent with the government's policies of sustainable environment and agricultural development. The specific objective of the project was to improve agricultural production in the catchment and command areas of the Koga River valley in a sustainable manner	2002–2008	Not available
Project to rehabilitate Dejel watershed in the eastern Gojjal zone of the Ahmara region	Ethiopia	To increase soil and water conservation (land rehabilitation), restore biodiversity and increase food security	2008–2012	Farmers are less vulnerable to climate-related stress and shocks in the watersheds. There is improved food security. 1220 ha of land was rehabilitated for 3044 families. Household safety nets strengthened through on-farm income generating activities

Table 1: Relevant programmes or projects implemented in different mountain areas of East Africa (continued)

Project	Country	Purpose/objectives	Implementation	Results and impacts
<i>Climate change adaptation</i>				
Climate change and development – adapting by reducing vulnerability in Bale Mountain	Ethiopia	Reduce vulnerability to climate change	2008–2012	Improved knowledge, skills and partnership supporting systematic mainstreaming of climate change risks; improved capacity in prioritizing and implementing cost-effective measures
Climate Change Adaptation Programme 2010-2020	Kenya	Enhancing resilience of Mount Kenya’s Outstanding Universal Values to climate change	Ongoing beginning 2013	Climate Change related threats to key attributes of Mt Kenya’s impressive landscape studied and managed including improved integrity and connectivity of the Site and increased capacity to manage the site.
Enhancing Climate Risk Management and Adaptation in Burundi 2010 to 2014	Burundi	Integrating relevant information on climate change, including variability, into national and subnational decision-making processes for better awareness, preparedness and adaptation, through enhanced capacity of the population to adapt to climate change and reduce vulnerability	Implemented 2010–2014	Capacities of local population enhanced, capacities to adapt to climate change and variability, the benefits of which are to continue long after the end of the project; Lessons learned and best practices disseminated and up-scaled.

Transboundary mountain regional programmes

Mountain ecosystems are more often than not transboundary, stretching across the borders of two or more countries. A number of regional programmes have been implemented in East Africa to address transboundary ecosystem management issues and the development of border communities. Some of these programmes also integrate climate change adaptation and community resilience measures.

One of the key programmes in East Africa is the Transboundary Agroecosystem Management Programme for the Kagera River Basin, which covers Burundi, Rwanda, Tanzania and Uganda. The programme is aimed at addressing the causes of land degradation and restoring ecosystem health and functions. The project seeks to generate a range of global environmental benefits across the Kagera Basin through the introduction of adapted agroecosystem

management approaches. It also aims to improve the livelihoods of rural communities in the Kagera Basin through more productive and sustainable resource management practices that are technically and socio-economically viable (FAO, 2013).

Two programmes of the Nile Basin Initiative – the Nile Equatorial Lakes Subsidiary Action Programme and the Eastern Nile Subsidiary Action Programme – are transboundary, involving Ethiopia and Sudan. Within the Nile Equatorial Lakes Subsidiary Action Programme, two transboundary projects have been implemented, namely, the Kagera River Basin Transboundary Integrated Water Resources Development Project, involving Rwanda, Burundi, Tanzania and Uganda; and the Rusumo Hydropower Project, covering Burundi, Rwanda, and Tanzania (EAC, 2006; Nile Basin Initiative, n.d.).

The Greater Virunga Transboundary Collaboration is the largest and most successful transboundary mountain ecosystem collaboration in the EAC, encompassing not only the countries of the subregion, but also the DRC. The initiative has successfully demonstrated how to handle complex policies, practices and development of communities across borders of several countries in the East Africa Rift system. Under the initiative, Burundi and Rwanda are jointly implementing the Nyungwe and Kibira National Parks Transboundary Strategic Plan, which aims to improve cooperation in the conservation of biodiversity, natural resources and associated cultural values, as well as develop research and ecotourism in both parks. The plan also seeks to promote landscape conservation through planning and improved management of the two protected areas (UNEP, 2014).

The Albertine Rift Montane Forests Eco-region Programme 2001–2005, covering a mountain chain within the Albertine Rift straddles the borders of five different nations – DRC, Uganda, Rwanda, Burundi and Tanzania. The programme developed a strategic framework for conservation efforts in the eco-region with a wide variety of stakeholders, and supported national authorities in the planning and management of protected areas and buffer zones. In the case of DRC, one of the key projects is the Albertine Rift Montane Forest Eco-region programme that started in 2004 and ended in 2014 (Arcos Network, n.d.).

The Mount Elgon Regional Ecosystem Conservation Programme was implemented by the EAC through the Lake Victoria Basin Commission. It started in 2006, after which it was redesigned in 2008 and ended in 2011. The project improved community livelihoods through the construction of a 25 km road to Chepkitale, planted 381 ha of forest and helped to support climate change adaptation measures in the Mount Elgon region (EAC, 2015).



Queen Elisabeth National Park, Uganda

Table 2: Relevant transboundary programmes or projects implemented in different mountain countries of Eastern Africa

Project title and countries	Main objectives	Implementation status	Some of the results and impacts
Transboundary Agroecosystem Management Programme for the Kagera River Basin: Burundi, Rwanda, Tanzania and Uganda	To address the causes of land degradation, restore ecosystem health and function and generate a range of global environmental benefits across the Kagera Basin through the introduction of adapted agroecosystem management approaches; improve the livelihoods of rural communities in the Kagera Basin through more productive and sustainable resource management practices that are technically feasible and socio-economically viable	Implemented 2010–2014 with 6 months extension, completed in June 2015	SLM technologies developed and demonstrated including micro-catchment and river bank restoration; construction of soil conservation technologies; participatory Field Farmer Schools established and used to enhance farmers' capacity in sustainable land management; a framework for harmonization of transboundary ecosystem management policies developed.
WWF's Albertine Rift Montane Forests Eco-region Programme: DRC, Uganda, Rwanda, Burundi and Tanzania	Develop a strategic framework for conservation efforts in the eco-region with a wide variety of stakeholders and support national authorities in the planning and management of protected areas and buffer zones	Implemented 2001–2005	Strategic planning undertaken in partnership with other non-governmental organisations and institutions; biodiversity assessment and priority setting for conservation effort completed; new projects developed, both transboundary and regional.
The Mount Elgon Regional Ecosystem Conservation Programme	Ensure the sustainable use of shared natural resources and benefits to local livelihoods; develop mitigation and adaptation measures to anticipated climate change impacts in the Mt. Elgon transboundary ecosystem by 2015	Implemented 2006–2011	Development and demonstration of benefit sharing and co-management models of ecosystem and biodiversity conservation and management around Protected Areas; development of equity and benefit sharing models/revolving funds that create opportunities for generating revenue from ecosystem goods and services for improved livelihoods; strengthened appropriate institutions in support of the transboundary ecosystem approach; demonstrated linkages between livelihoods improvement and climate change mitigation/adaptation

Best practice case studies

Agroforestry

A review of the history of natural resource governance in the mountainous areas of East Africa and the plateau lands reveals that there has been a general marginalization of traditional natural resource management systems, which have evolved through centuries of human-environment interactions, knowledge and experience. These important traditional approaches and practices were abandoned in favour of modern approaches, instead of integrating the two to provide more appropriate and sustainable management systems. Examples of such systems are found in the Kigezi, Mount Rwenzori and Elgon regions in Uganda and on the slopes of Mount Kilimanjaro in Tanzania where traditional agroforestry systems – the traditional blend of crops and trees of different species – have been used throughout the different ecological areas. A mixture of crops is grown to maintain soil fertility, to provide food, to supply shade to crops such as coffee and bananas and to supply materials such as bark, fuel, timber and wood products. The national forest policies in East Africa have been revised to incorporate the promotion of agroforestry practices and to integrate them with modern approaches as a strategy to protect existing natural reserves and improve livelihoods.

The kihamba agroforestry system, practised on 120,000 hectares on the southern slopes of Mount Kilimanjaro in Tanzania, is an example of best practice. It is considered to be one of the most sustainable forms of upland farming and provides livelihoods for an estimated one million people. The kihamba agroforestry system maximizes the use of

limited land. Based on a multi-layered vegetation structure similar to that of a tropical mountain forest, the system provides a large variety of food and substantial environmental services beyond the area where it is practised. With the large quantities of biomass it produces and its capacity to recycle organic matter on farms, the kihamba system also contributes significantly to carbon sequestration. Its trees and dense vegetation ensure that Mount Kilimanjaro can continue to function as a water tower for the surrounding areas. Coffee, an ecologically compatible cash crop, enables the system to adapt successfully to the emerging cash economy in the area. However, there has been a decline in coffee production as a result of unfavourable world market prices. Recently, however, a project to restore the coffee crop was initiated by FAO under the Globally Important Agricultural Heritage System, to pilot a series of climate-smart agricultural activities with 660 households. The project supports conversion to certified organic coffee farming, the adoption of vanilla as a high-value additional cash crop and the introduction of trout aquaculture along irrigation channels (Kohler et al., 2014).

Integrated agroforestry practices can be developed into a hybrid inland resource management system that offers opportunities for the sustainable development of mountain communities in a changing climate. It should be noted, however, that in areas where population pressure is high, these practices are in decline due to a shortage of arable land. Nevertheless, some middle ground can be found whereby integrated practices can be adopted at appropriate scales depending on local circumstances.



Soil conservation technologies and practices

Mountain farming communities have evolved over centuries and have practised a range of soil conservation technologies to safeguard their soil resources. These have improved over time, especially through the integration of modern technologies and government extension



services. This wealth of knowledge and experience will play a key role in enabling communities to be resilient and to adapt to the impacts of climate change in this naturally fragile environment (UNEP, 2001).

Examples of soil conservation technologies include *Konso* terracing practised in Ethiopia; *fanya juu* terracing in Machakos, Kenya; and contour

terracing in Tigray in the Ethiopian Highlands and the Kigezi region in south-western Uganda. In the Kigezi region, for example, farmers have hundreds of years of experience of bunding and terracing systems which enable them to cultivate steep slopes and utilize marginal land without substantially degrading it. Today, the whole highland region is patterned by a myriad of impressive contour bunds

and raised terraces, a practice that has protected the area against soil erosion. The same impressive practices are common in Rwanda, which is part of the same highland region. In the 1940s, the standard of conservation practices was unsurpassed by any other on the African continent (Bagoora, 1989). However, as a result of population pressure and poor agricultural governance, particularly in terms of policy enforcement and extension services, the condition of conservation structures has degenerated and requires urgent restoration in order to significantly boost the resilience and adaptive capacity of farming communities to climate change.

Bench terracing is a well-known soil conservation practice and is one of the oldest practises in Africa. It is practised throughout the Ethiopia highlands. Experience shows that bench terracing provides a multipurpose structure for enhancing agriculture on steep slopes by controlling soil and water loss. It also creates new cultivable land suitable for irrigation by diversion of perennial rivers, spate irrigation and earthen dam farming (Hagos, 2014).

In catchment areas, the terracing of small dams has been used (in Eritrea, for example) to supply water to villages without adversely affecting downstream users. Bunding and terracing, common in most other mountainous communities, have been adapted and modelled for different local conditions. Examples include the *fanya juu* terracing system used in the Kenya Highlands, which is now being up-scaled in other areas such as Mount Elgon. These practices offer a viable option for conserving mountain soil resources and developing community resilience and adaptation to climate change.

Restoration of degraded landscapes

Mountainous areas the world over are under heavy population pressure, both from upland and lowland communities. This has resulted in the widespread clearance of vegetation cover and subsequent land degradation. The African highlands are an example of areas of large-scale deforestation, although efforts have been made to restore the forest cover on many mountain slopes. The desire to restore on-site productivity for the benefit of local communities and the recognition that restored forests provide downstream benefits – improved stream flow and reduced sedimentation – have resulted in some semblance of forest restoration. In areas such as the Kigezi region of Uganda, reforestation has been widely adopted as a means of providing a source of income from the sale of forest products. This has largely been driven by local communities, with little government intervention, which makes the practice more sustainable.

Phase II of the WWF Rwenzori Mountains Conservation and Environmental Management Project (2010-2012) provides an example of best practice for the restoration of degraded landscapes. The impacts of the project included capacity-building for integrated ecosystem management, community restoration of degraded ecosystems, and improved and sustainable livelihoods for mountain communities. Furthermore, the role that the millions of individuals and households play in landscape restoration – planting tree seedlings on their degraded and marginal lands – should not be underestimated. These initiatives often escape attention, as opposed to the large-scale initiatives by governments and other institutions.

The benefits to local communities derived from restoration are undeniable: an increase in the

availability of forest products and improved on-site productivity, as well as improvements in general ecosystem productivity and services.

Conservation trust fund management

Conservation trust fund management is an approach that has been successfully used to protect critical mountain ecosystem and habitats while involving affected communities and ensuring sustainable financial support. It should therefore be considered as one of the best practices or approaches in conservation and development of mountain areas.

There are a number of case studies on conservation trust fund management. In Uganda, the Bwindi Trust, established through the Bwindi Impenetrable National Park and Mgahinga Gorilla National Park Conservation Project is an example. The Trust, established with GEF funding in 1995, provides for long-term funding for the conservation of the two national parks, which are home to one-third of the world's remaining mountain gorillas. The Trust provides resources for park management to strengthen protection of the gorilla population and for research to better understand the ecology and social behaviour of the gorillas and other native wildlife. The bulk of the fund is used to support community development for local people to provide sustainable livelihoods as an alternative to agricultural encroachment into the park. The Trust is recognized internationally as an example of innovative conservation finance.

In Tanzania, the Eastern Arc Forests Conservation and Management Project was implemented in the mountain rainforests of eastern Tanzania stretching from the Pare and Usambara Mountains to the Southern Highlands. This is one of the most important sites for forest biodiversity in continental Africa. The forests lie on hills and are recognized

as a biodiversity hotspot and centre for endemic species, especially for plants, birds, amphibians and primates. The project will develop an integrated conservation strategy for the Eastern Arc Mountain Forests that will be implemented through income generated under the project's endowment fund (World Bank, 2002).

The conservation trust fund approach is a successful means of securing financial resources for sustainable ecosystem conservation and community development in the mountainous areas, which should be replicated in the region wherever possible.

Transhumance

Transhumance is practised in some mountainous areas of Africa by pastoral communities, although the practice is on the decline. It is a good example of the efficient use of land resources practised by mountain people, and is dictated by altitudinal and climatic or seasonal changes and variations. The practice is driven by wet and dry seasonal patterns: animals are moved from the dry, pasture-deficit lowlands to the moist, pasture-rich highlands during the dry season, and in the opposite direction during the wet season when the pastures in the lowlands recover. The practice is still prevalent in the Godantu community in the Bale Mountains of Ethiopia: herders move their livestock to graze on higher grounds while the lowlands recover, while taking advantage of forests higher up the mountain for shade and water (UNEP, 2014). The Maasai community of western Kenya and northern Tanzania also practice transhumance.

There are numerous other communities who practice transhumance either on a small-scale or a semi-transhumance scale; many are not well documented, but are crucial for land resource management systems and livelihood sustenance.

Mixed farming systems

Mixed farming is a traditional practice that has evolved over a long time in farming communities throughout East Africa's mountainous areas. The practice involves a combination of crops and livestock on the same farm unit. It also includes other forms of crop and livestock integration systems such as intercropping management, which are meant to promote diversified farm income and land husbandry, and maximize productivity per unit area, as well as improve soil erosion control and nutrient management. The practice also enhances food security and marketing opportunities, which, in turn, improve household incomes.

Restoration of pasture for communal grazing and fodder management

The restoration of degraded lands in livestock grazing communities, and in crop farming communities, is an important intervention for the sustainability of fragile land resources in mountainous regions. In many areas, communities have abandoned their land due to severe degradation, but after many years these lands have been able to recover. Consequently, many communities are beginning to adopt initiatives to restore degraded land. It is important for the government and other institutions to identify and collaborate with such communities to achieve a faster rate of a landscape recovery and restoration, especially in mountainous areas.

The Humbo community in south-western Ethiopia, for example, obtains restored degraded grazing areas and farmlands by setting aside land for natural regeneration. The community is part of the Natural Regeneration Project, registered with the Clean Development Mechanism, which supports forest regeneration by using a variety of tree species through



the Farmer-Managed Natural Forest Regeneration technique. As a result, more than 90 per cent of the area devoted to the Humbo community has been reforested. The initiative has resulted in the recovery of 2,728 ha of land (UNEP, 2014).

Another example is that of the Kuwalla community in northern Ethiopia's Amhara region. While many communities in the Ethiopian Highlands permit open access pasture grazing, the Kuwalla community uses a rotational grazing system to manage its communal pasture. The community developed the system after recognizing the negative impacts of the open access system, which they had

practised until 1990. Severe soil erosion and gully formation led to a loss of grazing land. The initiative was led by traditional leaders, who mobilized their communities and established rules and procedures for restoration processes, and collaborated with government agencies to secure support for the enforcement of the rules. The intervention helped to reduce grazing pressure and enabled the pastures to regenerate. This case study demonstrates that effective community-based pasture management can enable valuable fodder species to regenerate, ensuring adequate species of feed for livestock, particularly during critical times of the year (Kohler et al., 2014).

High-quality mountain agricultural products

Local and regional marketing of agricultural products is expanding in many mountain areas, encouraged by a growth in potential markets in the surrounding lowlands. This opens up development opportunities for the largely isolated and marginalized mountain economies.

In the Uluguru Mountains in Tanzania, the communities grow crops throughout the year, including temperate vegetables, which fetch a high price in urban lowland centres. Likewise, communities in the Usambara Mountains have started growing tomatoes, which they sell to urban communities in the lowlands (UNEP, [AEO-2] 2006). There are many such cases of mountain communities taking advantage of growing and selling products that are unique to the mountain environment and therefore sell at a higher price. This includes Arabica coffee, a product of mountain areas such as the Ethiopian Highlands, the Kenya Highlands, Mount Kilimanjaro, Mount Kenya and Rwenzori. In some areas, such as on the slopes of Mount Kilimanjaro, farmers have gone a step further and are now growing certified organic products to tap into the growing demand from developed countries where a growing number of consumers are becoming increasingly conscious of the negative effects of consuming food products containing pesticides.

Therefore, high-quality mountain products are becoming an increasingly important means of improving the livelihoods of mountain communities around the world. In Africa, the FAO Mountains Products Programme, developed in the context of the Mountain Partnership, is working to improve the production and marketing of quality local products by providing mountain communities with



Tea plantation, Rwanda

the necessary organizational skills, market linkages, technology and expertise. Efforts to promote the initiative are ongoing in mountain countries of the region. Examples include the Dean's Beans Organic Coffee Company, which works in collaboration with Ethiopian coffee to ensure high-quality production that is sold at fair trade prices. Similar efforts are being made in Uganda to introduce high-value crops in highland and mountain regions – areas facing high population pressures, land shortages and environmental degradation.

Water harvesting and irrigation for land restoration

Water harvesting is a very important means of accessing water in water deficient areas, while at the

same time averting hazards common to mountains and their surrounding areas such as excessive run-off, soil erosion and flooding. Many mountain communities practice rainwater harvesting, ranging from rooftop collection for domestic use to collecting run-off from impervious surfaces such as rocks and roads for gardens and crop irrigation. This has many benefits including increased land productivity, the restoration of unproductive land and the control of environmental hazards. These practices are common all over East Africa.

Laikipia District in Kenya, provides an example of water harvesting for irrigation and land restoration. The district lies on the leeward side of Mount Kenya and has an annual average rainfall of approximately 700 mm; the area is categorized as semi-arid. The communities

comprise of subsistence crop farmers and livestock farmers. There is a high incidence of drought, resulting in frequent crop failures and the decimation of livestock herds. A rainwater harvesting project was initiated to overcome water scarcity and other related problems. Before the project, most people did not have access to clean water. There was also considerable soil erosion due to inappropriate farming practices, which, in turn, resulted in high rates of sedimentation in downstream dams. To address these problems, local communities in Laikipia initiated a community-based resource mobilization project. Rainwater harvesting was identified as a viable option which could not only address water shortages but also support other areas of social and economic development. The water augmentation programme began by introducing 200 litre drums and 2,500 litre water tanks for collecting water from rooftops. These small containers demonstrated the potential for rainwater harvesting, so the communities decided to develop large systems – by the end of the project, they had constructed several 10,000 litre ferro-cement tanks to capture and store rainwater. Maize production increased as a result of improved land use and run-off farming techniques. These also resulted in an increase in vegetable production – to meet the demand for household consumption and to provide surpluses for sale to augment household incomes. In addition, farmers diversified their traditional crops of maize and beans to include potatoes, carrots, onions, soya beans, millet, bananas and fruit. This diversity has contributed greatly to food security and a more balanced diet (UNEP, 2001).

Collaborative management of conservation ecosystems

Conservation should also address the needs of local communities if it is to succeed. This approach views people as an integral part of mountain ecosystems rather than focusing on their exclusion from

protected areas. Conventional approaches do not always recognize the reliance of local populations on protected areas, either for forest products or grazing. A good example of a collaborative approach is the recently introduced biosphere reserves management system, which has been adopted in the Rwenzori Mountains. The approach recognizes the key role of local communities in areas of high biodiversity. The biosphere reserves consist of core, buffer and transition zones that offer different levels of protection and human activity. Effective mountain ecosystem conservation ensures that communities do not have to make difficult choices between their own survival and that of mountain ecosystems. In this regard, conservation must be materially beneficial to local communities. Benefits may include rights and royalties, revenue from tourism and trophy hunting, crop cultivation and access to medicinal plants.

The Ethiopian Wildlife Conservation Authority is working in collaboration with the Austrian Government in the *woredas* (districts) to reduce grazing pressure through on-farm fodder production, the introduction of zero-grazing (cut-and-carry system) livestock management techniques and the introduction of improved livestock breeds. Furthermore, patrolling has been intensified to restrict livestock grazing in core wildlife areas of the park (EWCA, 2014).

There are, however, also examples of the poor collaborative management of conservation ecosystems. The Mount Elgon Conservation Area in Kenya has been severely affected by widespread encroachment from surrounding communities in recent times. A decision was taken in June 2000 to evict all the encroachers and secure the integrity of the conservation area. This affected 6,000 Ogiek people. The resettlement programme only succeeded in relocating a small proportion and, as a result, many were left homeless and the majority remained in the area, leading to conflict.

The Kenya Wildlife Service, through its Community Conservation Programme, supports social and economic projects such as bee keeping, health centres and education projects for the indigenous people and local communities living next to protected areas. Funding is limited, however, and not all projects are implemented. In the case of Mount Elgon, a health centre was funded and medical staff deployed, but the Ogiek were not involved in the selection and implementation of the project. In Uganda, the Mt Elgon Ecosystem Management Plan (2002-2007) was developed, with specific activities and tasks to be undertaken each year. This included plans for local communities to develop income generating activities and projects such as bee keeping and agroforestry, to reduce overdependence on forest resources. The joint initiative was constructive in regards to the sustainable use of forest resources, but has been undermined by conflicts in the area as a result of the failed resettlement programme.

Another case study in successful collaborative management involves preventing mountain fires. As a result of both climate change impacts and human activities, the incidence of fires is on the increase in the mountain ecosystems of East Africa. The number of fires has increased on the upper slopes of Mount Kilimanjaro, for example, as a result of climate change and human activities such as honey gathering and illicit logging. This has led to the destruction of 50 km² of forests during the last three decades. The loss of forests has affected the capacity of mountain forests to trap water from the clouds. A collaborative management initiative was initiated by environmental groups and the private sector and a special firefighting fund was established. This initiative has helped to significantly reduce the threat of fires to mountain ecosystems.

Key messages

Policy and institutional frameworks

In most of the countries in the sub-region, the foundation elements for policy and institutional arrangements are in place which can be exploited to drive forward a sustainable mountain ecosystem conservation and development agenda, even though there are no institutions that specifically address mountain issues (with the exception of Kenya and Uganda).

- The implementation of policies is still limited by poor institutional coordination, funding and political meddling.

- The implementation of climate-smart agriculture policies tailored to national and regional contexts is gaining momentum in East Africa.
- The absence of a mountain-focused convention is partly blamed for the slow and largely ineffective implementation of initiatives on sustainable development in the mountainous areas of Africa. However, use has been made of relevant sections of other international and regional conventions and protocols such as the Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD) and the UNFCCC.
- Policymakers should recognize users of mountain

ecosystems as key partners when designing adaptation strategies.

- Mountain ranges are mostly transboundary and issues relating to them require cooperation and appropriate institutional mechanisms at a transnational level.
- Mountain Partnership Member countries need to establish national sustainable mountain development committees to handle mountain issues at the national level and strengthen partnerships at the transnational level.
- Mountain landscapes have valuable natural capital whose benefits in terms of economic value should be publicized to influence policy and decision-making in the involvement of mountain communities for sustainable development.

Programmes and implementation

- The development and implementation of mountain and climate change specific programmes will significantly improve both mountain ecosystem conservation and the livelihoods of local communities.
- A wide range of projects and programmes relevant to mountain ecosystems do not pay specific attention to climate change.
- Information on programmes, projects and activities implemented in East Africa is normally available only in aggregate form, making it difficult to identify the particular components and investments that are dedicated to, or focus on, mountain areas and communities. Even where information is available on project implementation in mountain regions, the proportion of investment that directly benefits the community is either difficult to determine or relatively small.



Young man with a heavy load of bananas, DRC

EAST AFRICAN MOUNTAINS

Towards an East Africa Mountain Agenda

Lalibela, Ethiopia

Background

Mountain ecosystems first received global attention during the United Nations Conference on the Environment and Development (UNCED) in 1992 (the Rio Summit). Mountains are addressed in Chapter 13 of Agenda 21 – Managing Fragile Ecosystems: Sustainable Mountain Development – and are recognized as having unique and fragile ecosystems in need of urgent intervention attention.

Ten years later, the World Summit on Sustainable Development was held in Johannesburg in 2002 to review progress of Agenda 21 implementation. As a result of a lack of progress towards the implementation of chapter 13, the ‘Mountain Partnership’, a voluntary alliance of partners dedicated to improving the lives of mountain people and protecting mountain environments around the world, was launched along with the United Nations General Assembly’s Declaration of 2002 as the ‘International Year of Mountains’.

Twenty years later, in June 2012, UNCED and the world community gathered once again in Rio de Janeiro (Rio+20) to further review progress on Agenda 21 implementation and to come up with an agenda to enhance implementation. The final document of the Rio+20 Summit – the Future We Want – contained 283 paragraphs including a specific section on mountains (paragraphs 210-212), which provides a comprehensive coverage of priority areas for sustainable mountain ecosystem development and actions to further implementation. Subsequently, seventeen ‘Sustainable Development Goals’ (SDGs) were developed, with targets set for 2030. Although the SDGs do not make any direct reference to sustainable mountain ecosystems, goals aimed at addressing water and sanitation, poverty



eradication and the promotion of agriculture could be used to develop national and local plans to address issues relevant to mountainous regions.

The African Union/AMCEN has increasingly prioritized mountain ecosystems, and has included sustainable mountain ecosystems management among its priority programmes. During its

fourteenth session (12 September 2012) in Arusha, AMCEN made a Declaration on Africa’s post Rio+20 strategy for sustainable development with a reference to mountains in Africa – a strong indication of the continued recognition of the importance of sustainable mountain ecosystem management.

This was reiterated at the fifteenth Session of AMCEN held in Cairo from 4-6 March 2015. The Conference committed itself to the development of appropriate institutions, policies, laws and programmes, as well as the strengthening of existing transboundary and regional frameworks on the sustainable management of African mountain ecosystems. In addition, AMCEN agreed to establish and strengthen institutional arrangements for sustainable mountain development, including centres of excellence. Furthermore, AMCEN agreed to strengthen the Africa Regional Mountains Forum to facilitate research, information exchange and policy dialogue. This was in response to the recommendation of the Africa Regional Mountains Forum organized by the African Mountain Partnership in collaboration with the EAC in Arusha, Tanzania, from 22–24 October 2014.

This marked a great step towards achieving sustainable ecosystems and the development of mountain regions in Africa and forms a solid basis for the proposed Agenda for the East African Mountains. The East Africa Mountain Agenda is, therefore, the culmination of a long process starting with the Global Mountain Agenda from UNCED 1992 through to Rio+20 and its outcomes, with AMCEN/UNEP and EAC continuing to lead in the implementation of the Agenda on the African continent.

Governance of mountain ecosystem conservation and development



Hummingbird in Virunga National Park, DRC



Geladas in Simien National Park, Ethiopia

Governance plays a central role in achieving effective, sustainable mountain ecosystem development. The term 'governance' refers to the action or manner of governing a state, organization, etc. and is exercised through institutions: laws, property rights systems and forms of social organization (UNEP, 2012). Governance involves not only formal means of control and authority most commonly associated with governments, through the enforcement of established policies and laws, but also a variety of informal approaches through influence or setting standards and principles for a course of action.

Experience from both historical and current practices point to the fact that effective natural resource governance must recognize and integrate the

principle of 'environmental or natural resource justice', which refers to the fair treatment and meaningful involvement of all people regardless of race, nationality, culture, gender, education or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Remedies for environmental deterioration recognize the intrinsic value of, nature and viewing humans as part of, owners of the natural resources thereof (Mayhew, 2009). This highlights the need for focusing, not only on the relationship between states and civil society, but also on all other stakeholders, including the private sector and individuals, regardless of their status. This requires consideration of both traditional and formal systems of natural resource governance. The former comprises mainly of unwritten traditional

systems and customs that wield influence and control, such as rules, behavioural standards, rituals and taboos, aimed at ensuring stewardship of various environmental resources (NEMA, 2008).

It is of paramount importance to recognize that the conservation and development of East African mountain ecosystems requires effective natural resource governance and that the sustainable use of resources is a prerequisite for the conservation of mountain ecosystems and the socioeconomic development of mountain communities. Both traditional and formal systems of governance have to be considered to overcome the problems and challenges of conservation, development and the impacts of climate change in mountain regions.

Identified gaps and overlaps

Before presenting the case for the East African mountain agenda, it is important to note the important gaps and overlaps that exist (as highlighted in chapter 3).

Gaps

- Policymakers do not always consider users of mountain ecosystems as key partners when designing adaptation strategies.
- The integration of climate change issues into the design of national projects and programmes of relevance to mountain ecosystems is often inadequate. This makes it difficult to determine the overall impact of projects/programmes in addressing the impacts of climate change.
- Partnerships are often weak, including those between national governments, non-governmental actors (non-governmental organisations, civil society organisations and the private sector), regional organizations and international agencies.
- The benefits of resources and mountain services need to be presented in terms of their monetary value as a means of encouraging planners, policy and decision makers and governments to commit resources.
- There is a lack of replication and up-scaling of the many best practices and technologies that have been developed and used by communities throughout the mountain regions of East Africa.
- Political instability in some mountain areas is not conducive to the fostering of community innovations and the practices of sustainable mountain ecosystem development.
- The lack of mountain-specific programmes and projects in public investment programmes exacerbate the marginalization of mountain ecosystems and communities.
- The integration of community livelihoods and development issues into mountain-specific projects and programmes is limited. These tend to focus on protecting conservation areas and only allocate a small proportion of their budget to livelihood and community development in the surrounding areas.
- Policies specific to mountains are lacking, except in Uganda and Kenya – but even in these two countries implementation of these policies needs strengthening.
- Throughout the region there are no specific institutional frameworks directly responsible for sustainable mountain ecosystems and development.
- There is a lack of appropriate regional institutional framework to coordinate mountain-specific issues across the region.
- There is a lack of legislative frameworks or arrangements for protocols and agreements on transnational mountain ecosystem management – such as those developed for European mountains, which include the Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) and the Alpine Convention. Experience from these could, in the future, act as a guide for a possible East African Protocol on mountains.
- There is a lack of knowledge and understanding of upland-lowland interactions and the linkages between these communities – particularly in terms of the flows of people, trade and resources.
- There is little understanding and appreciation of the importance and role of indigenous people, and indigenous knowledge and practices in ensuring sustainable mountain ecosystem development, climate change resilience and adaptation.
- Collaborative management and benefit sharing schemes are weak for mountain protected ecosystems. Governance is still heavily top-down and largely in the hands of conservation institutions. This leads to significant levels of dissatisfaction among local communities. Likewise, the benefit sharing schemes are grossly in favour of conservation management institutions.
- The profile of mountain ecosystems at the national level in most of the region remains low.
- There is a lack of harmonized monitoring systems for projects and programmes. Monitoring systems and frameworks are fragmented not only at the project level, but also at the national level, where each sector develops and implements its own monitoring framework without reference to other sectors working in the same area or field.
- Research and monitoring of ecosystem processes, climate change and community resilience and adaptation in the mountain areas of East Africa remains a low priority.
- There is a lack of development and integration of land-use planning for both agricultural and marginal landscapes – a prerequisite for sustainable management of landscape ecosystems.
- Documentation, access to information, knowledge dissemination and awareness of mountain issues in the region, is limited.

Overlaps

Many existing projects and programmes involve several sectoral actors. Projects need to be more streamlined to avoid overlaps and duplication, particularly if two or more sectors implement sectoral programmes relating to mountain issues (e.g. water, agriculture, environment and community development sectors) in the same region.



Bonga forest reserve, Ethiopia

Making the Case for an East African mountain agenda

The Global Mountain Agenda (Agenda 21, Chapter 13) comprises of two programme areas:

- Generating and strengthening knowledge of the ecology and sustainable development of mountain ecosystems; and
- Promoting integrated watershed development and alternative livelihood opportunities.

The two areas are often addressed together under the framework of an integrated ecosystems approach to sustainable mountain development (Sène and MacGuire, 1997). A review of progress made in the implementation of the Agenda indicated that, over the 20 years of implementation, significant achievements have been made. This progress forms

an important basis upon which an Agenda for East Africa can be developed and executed.

Within the framework of the Mountain Agenda, global implementation efforts have focused on the following specific objectives:

- Raising awareness of, and improving understanding of, sustainable mountain development issues from global to national levels;
- Protecting natural resources and developing technical and institutional arrangements for natural disaster reduction;
- Strengthening information networks and databases for organizations, governments and individuals concerned with mountain issues;
- Strengthening countries' capacity to improve planning, implementation and monitoring of sustainable mountain development programmes and activities;
- Combating poverty through the promotion of sustainable income-generation activities, particularly among local communities and indigenous people; and
- Formulating and negotiating regional or subregional mountain conventions; and the possibility of developing a global mountain charter.

Following the review of progress towards the implementation of the Mountain Agenda in East Africa, new priority and focus areas emerge; these require urgent action to further enhance the objectives of the Mountain Agenda. Proposals for these emerging priority areas for action are based on gaps and overlaps identified in the review of policies and institutional frameworks, and programmes and projects implemented in the mountain areas of the subregion.



African fish eagle, Kenya

The agenda for Eastern African mountains

It should be noted that, despite all the notable efforts, progress towards implementing East Africa's Mountain Agenda remains only modest. This calls for the identification of emerging priorities based on a review of progress made so far. A continued recognition of the special status of mountain areas is paramount, not only because of their fragility, remoteness and marginality, but also because of their unique and rich natural and cultural resources that in many cases offer distinct comparative advantages for development both for the mountain areas themselves and nations or the region as a whole.

In line with global sustainable development efforts – in particular the SDGs – the following section proposes a number of elements for a possible shared mountain agenda, based on a time frame of 15 years (2015-2030); it includes specific priority action areas (and the justification for their inclusion), principle objectives and an estimated implementation time frame.

Development and/or strengthening of policy and institutional arrangements, and mechanisms for enhanced governance of mountain ecosystems

There is a wide variety of governance structures – policies and institutional frameworks – for sustainable development in mountain ecosystems in East Africa's mountainous countries.

With the exception of Uganda and Kenya, there are no mountain-specific policies in the rest of the countries. Policies are scattered across sectoral institutions and are inadequate for addressing mountain issues or in some cases are non-existent.

At the subnational level, most countries do not have specific policies that deal with mountain issues; subnational governance structures are geared towards implementing national policies. However, developing and implementing subnational level policies, harmonized with appropriate national policies, would allow for more effective, locally-appropriate policies and the participation of local institutions in the development process.

Furthermore, at the national and subnational level, the emphasis is on formal governance, which largely ignores the invaluable role that informal governance systems and traditional norms have played in sustaining natural resources in the mountains.

In terms of institutional frameworks, it is clear that there is no institution/mountain centre of excellence specifically set up to address or coordinate mountain-related issues, although in some countries like Kenya and Uganda it is possible to identify institutions that tend to take the lead in addressing mountain issues. Similarly, at a subnational level, there is no institutional structure set up specifically to address mountain issues.

At the transnational level, there have been some efforts to develop and implement policies that address mountain issues, but these remain limited. These include the East African Protocol on Environment and Natural Resource Management, The East African Community Transboundary Ecosystem Management Act and The Nile Basin Initiative. There is a need for further development of similar policies to effectively address issues affecting transboundary mountain ecosystems in the region. There is also a need to develop and implement more

robust arrangements – such as conventions and protocols similar to those in the Carpathian region and the Alps – to effectively gain the commitment of countries and other stakeholders in the region to implement interventions for the sustainable development of mountain ecosystems.

There are a range of institutional frameworks that exist at the transnational level: EAC, COMESA, IGAD, SADC, and African Union's African Ministerial Conference on the Environment (AU-AMCEN). However, these institutional frameworks could be used to address mountain issues – which currently, are a low priority.

The first intervention is to address and strengthen legislative and institutional arrangements for mountains. These must seek to promote and facilitate policy reforms and harmonization on sustainable mountain development at all levels, through actions that may include:

- Identifying and assessing existing institutional linkages and collaboration so as to determine strengths and weaknesses in addressing sustainable mountain development;
- Developing a policy framework for strengthening existing policies to more directly and effectively address mountain issues, and where necessary, develop new ones where they do not exist;
- Mobilizing stakeholders and resources for the implementation of policies at all levels, including the monitoring and evaluation of benchmarks for implementation; and
- Developing and implementing a mechanism for harmonization and dispute resolution for policy implementation at all levels.

The second objective should seek to promote and facilitate the formation or strengthening of institutional arrangements directly addressing sustainable mountain ecosystem development at all levels of governance, including the establishment of coordination centres and the designation of focal points, through actions that may include:

- Reviewing existing institutional arrangements and governance mechanisms and identifying weaknesses or gaps requiring action for establishing institutions and/or strengthening their operations to more effectively address sustainable mountain ecosystem development;
- Developing frameworks and guidelines for strengthening institutional governance systems including establishing new ones where necessary;
- Facilitating and coordinating the development

and strengthening of institutional arrangements both within countries and at the transnational level; and

- Establishing and operationalizing a regional framework for monitoring and evaluation of institutional coordination and collaboration on mountain issues.

The third objective should seek to integrate both formal and informal systems and norms of governance at subnational, national and transnational levels, through actions such as:

- Formulating policy frameworks, guidelines and mechanisms to enable the integration of formal and informal systems and norms; and
- Mobilizing resources to operationalize and facilitate policy harmonization and integration processes.

Increased investment in mountain development and conservation, and an end to the consistent marginalization of the mountain ecosystems and communities

Levels of investment in the remote mountainous areas of East Africa remain low; preference tends to be given to more accessible lowland areas. In adherence to the principle of social equity and given the potential for resource development in mountain areas, there is need to reverse this trend and bring an end to the neglect and marginalization of mountain areas and communities.

This calls for increased investment in mountain development and conservation, including the mobilization of resources for mountain-specific programmes. In order to clearly determine how much mountain areas have benefited from overall national investment, disaggregation of country level investment from public private partnerships and Public Investment Programmes is required, to avoid further marginalization.

Proposed interventions relating to investment should firstly seek to promote increased investment in mountain areas through developing an appreciation of the importance, uniqueness and potential of mountain ecosystems, resources and communities; and increased investment in the development and implementation of relevant programmes and projects, through actions that may include:

- Assessments to evaluate and determine the potential of mountain ecosystems for conservation and development investments;
- Development of mechanisms for lobbying high-level political leaders and policymakers on the importance of mountain issues and the need to designate mountain regions as areas for priority investment; and



Kikuyu couple, Thomson Falls, Kenya

- Development and implementation of comprehensive publicity programmes for all stakeholders to raise awareness of the importance of mountain areas.

Subsequent interventions could include the development and operationalization of guidelines for resource mobilization to facilitate increased investment in mountain areas, through actions that may include:

- Carrying out comprehensive reviews of Public Investment Programmes in order to determine the proportions of investments that go to mountainous areas, both directly and indirectly;
- Developing budgetary frameworks for Public Investment Programmes that endeavour to disaggregate investments destined for mountain areas, given the fact that there is a tendency to allocate more investments to lowland areas; and
- Monitoring approaches at all levels to ensure that mountainous areas receive due attention in terms of investment allocations and programme implementation.

Comprehensive assessment of the impacts of climate change in mountainous areas, and the vulnerability and adaptive capacity of mountain communities

Mountain areas are among the most sensitive and vulnerable ecosystems to the impacts of climate change. The impacts of climate change on mountain ecosystems and communities may have far-reaching consequences including an increase in the incidence of disasters such as erosion and landslides, which in turn adversely affect the welfare of local communities. In some cases, the scale of these events may be beyond the resilience and adaptive capacity of the affected communities. A comprehensive assessment of such impacts and the abilities of communities

to effectively respond can help develop policy frameworks and guidelines, as well as determining the requirements for building the capacity of these communities to respond.

Proposed intervention areas may initially seek to assess and determine the extent to which mountain ecosystems will be affected by climate change, on the basis of which appropriate mitigation and adaptation measures can be designed, through actions that include the following:

- Identification of experts to undertake assessments including, and where possible, enhancing their capacity through training;
- Identification of specific areas of study or assessment covering both ecosystems and development initiatives;

- Mobilization of resources for studies or assessments from different potential sources including the public and private sectors; and
- Application of the results of the study or assessment to develop a comprehensive mitigation and adaptation framework in mountain regions.

Secondly, intervention may seek to undertake a comprehensive study of the vulnerability and adaptive capacity of mountain communities to the impacts of climate change through:

- Identifying resource persons to undertake the study and enhancing their capacity through training;
- Identifying specific representative communities and activities for the study or assessment covering a range of social and cultural characteristics, ecosystems and development initiatives;



Rwenzori Mountains, Uganda



Maasai herder, Kenya

- Mobilizing resources for the study or assessment from different potential sources including the public and private sectors; and
- Applying the results to develop appropriate strategies and practices to address vulnerability and adaptation issues.

Enhanced recognition of, and respect for, indigenous and cultural rights and the integrity of mountain communities including an appreciation of indigenous knowledge, technologies and practices

This action area adheres to the principle of social equity and the increasing appreciation that mountainous areas are home to some indigenous communities. It recognizes: the value of mountains in preserving cultural integrity and conserving biological diversity; the importance of mountain cultures and the role they play in maintaining mountain ecosystems; and the variety of endemic plants and animal species native to mountain ecosystems.

There is a need for promoting programmes that hinge on traditional beliefs that help preserve biodiversity, landscapes, heritage sites and other important resources in mountain areas. Traditional beliefs, including sacred sites – The Kikuyu and Masai people hold the traditional belief that their God, *Ngai*, resides on Mount Kenya, the ‘mountain of brightness’.

Interventions should involve harnessing the rich indigenous knowledge and cultural practices that promote the sustainable use and development of mountain ecosystems through:

- Compiling an inventory of existing indigenous knowledge and practices of selected, but representative, mountain communities;

- Raising awareness of the importance of the rich and varied indigenous knowledge and practices of mountain communities and the potential for applying these to development programmes;
- Assessing and selecting the most suitable knowledge and practices for possible applications to further develop and implement appropriate measures for mountain ecosystem development;
- Promoting fair and equitable sharing of benefits arising from the use of indigenous knowledge and practices; and
- Developing and implementing frameworks, guidelines and policy reforms for institutions and communities which value indigenous belief systems and practices.

It is also important to promote the integrity and rights of indigenous mountain communities. As well as ensuring more equitable development, this is also a means of promoting the sustainable use of ecosystem. This could be done through:

- Raising awareness among all stakeholders at all levels of the rights and integrity of indigenous mountain communities; their long interaction with, and understanding of, mountain ecosystems; and the valuable role they play (in partnership with formal governance structures) in securing the integrity of mountain landscapes;
- Promoting the formulation of policies and policy reforms that comprehensively address the rights and integrity of mountain communities including a respect for cultural sites, land tenure and use and their rights to remain in their indigenous environment; and
- Ensuring legal recognition of community-based property rights and devolution of management authority to mountain communities, with governments retaining a monitoring and advisory role.

Increased research and knowledge to gain a better understanding of mountain ecosystems and processes; capacity building for research-based innovations and development; and the replication and/or up-scaling of best practices and technologies for the protection of mountain ecosystems and communities.

In order to undertake research on mountain ecosystems and communities, the following actions are proposed:

- Carry out a preliminary assessment to determine priority research areas;
- Mobilize research resources to support existing mountain research institutions (such as Makerere University) and strengthen multidisciplinary teams;
- Undertake a comprehensive study of mountain ecosystem dynamics and processes and the interactions with local communities; and
- Develop key policy messages and engage both political leaders and policymakers in understanding and appreciating mountain ecosystems and communities – as a strategy for gaining political buy-in for increased prioritization at both national and subnational levels.

In order to maximize the application of research-based innovations and best practices best suited to mountain ecosystem development, the following actions are proposed:

- Compile an inventory of existing research-based innovations and best practices currently being applied in mountain ecosystems and select the most suitable for replication and up-scaling;
- Publicize selected innovations and best practices among all stakeholders, including mountain communities, undertaking cross exchange visits to centres of excellence;

- Develop guidelines for implementation of selected innovations and best practices, at all levels of governance; and
- Build capacity and mobilize resources for the implementation of innovations and best practices; and monitor implementation progress.

Global and regional coordinated programmes to detect and monitor climate change in mountain ecosystems

Mountains are known to be early detectors of climate change. It is, therefore, important to develop and implement well-targeted research to detect climate change and how this relates to mountain ecosystems and development – including trends in climate change and ecosystem responses. Results of ongoing research and monitoring programmes are vital, not only for the East African mountainous region, but also on a global scale.

Interventions may seek to develop climate and ecosystem research for East Africa's mountains as an early indicator of climate change through the following actions:

- Develop research ideas and identify key actors, including research institutions at the national, transnational and global levels; and
- Identify priority areas for research and develop research protocols.

Other intervention areas will involve operationalizing platforms for sharing research results at both regional and global levels through:

- Publicizing planned research programmes and raising awareness of the importance of the research and the need to participate;
- Mobilizing resources and setting up research teams according to priority areas and available resources;

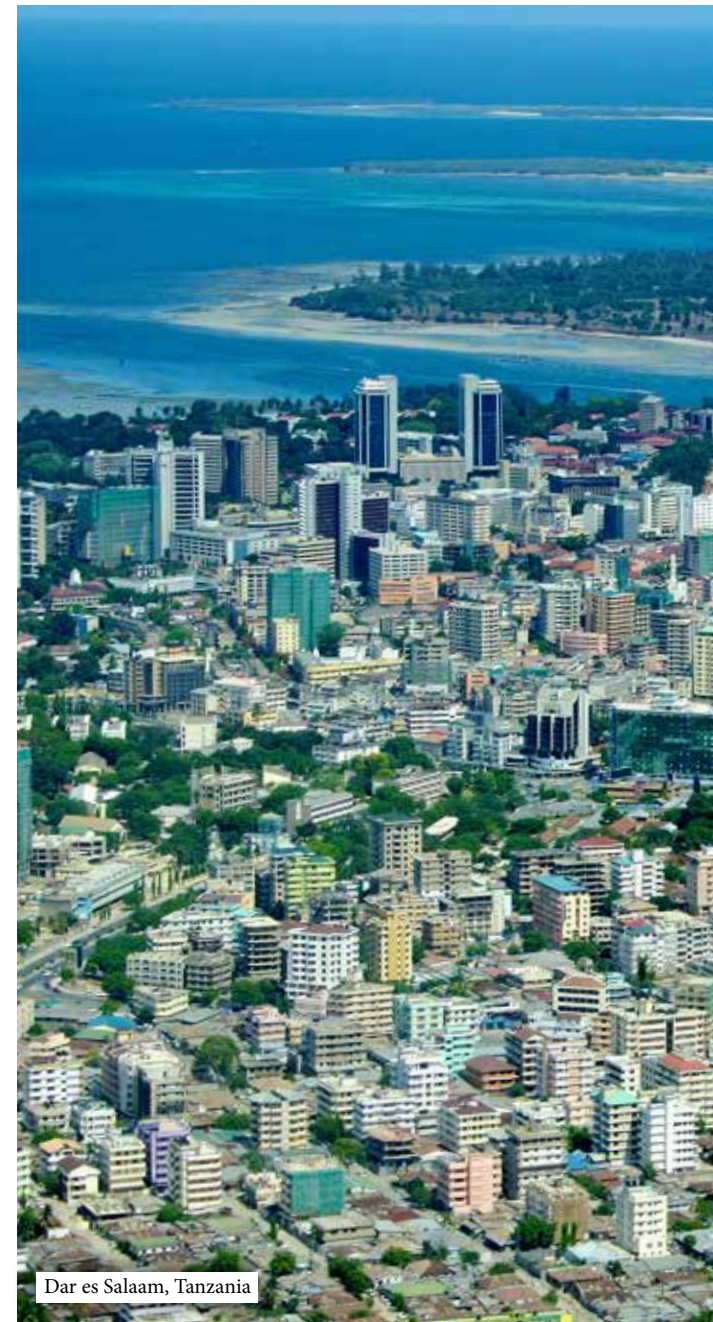
- Developing mechanisms for research and information sharing between teams and the public at large; and
- Continuously monitoring research progress and feeding results into regional and global information networks for the prediction of climate change in mountain regions.

Determination, evaluation and management of highland-lowland interactions and continuous monitoring of resource flows in order to avoid mountain resource depletion, and to realize increased financial benefits for mountain communities

As a result of population growth and economic pressures, movement of both people and resources has increased. This includes both the movement of people from the lowlands into mountain areas in search of economic opportunities; and the flow of people and resources from the mountain areas to the lowlands to exchange products and services with lowland communities and to take advantage of more developed infrastructure and services. The dynamics of highland-lowland interactions, therefore, have important implications for mountain communities and resources.

Understanding and continuously monitoring resource flows to and from mountain areas is crucial, particularly for ensuring that mountain resources are used sustainably. It is also important for a fairer distribution of earnings from natural resource exploitation and more equitable service provision in both mountains and lowlands. There is a need to establish a benefit sharing mechanism.

Proposed interventions will seek to assess the nature and magnitude of highland-lowland resource flows



Dar es Salaam, Tanzania



in different mountain communities in order to develop strategies for ensuring sustainable highland-lowland interactions. This may be facilitated through the following actions:

- Carrying out an assessment of existing highland-lowland interactions and determining the type and magnitude of these interactions;
- Documenting, publicizing and conducting consultations on how such interactions should be enhanced; and
- Developing and implementing policies and strategies for enhancement of interactions that are important for development and the sustainable management of mountain resources.

It is worthwhile assessing the socioeconomic benefits of mountain resource exploitation for mountain communities and identifying causes of poverty in

mountainous areas. This could be used to develop policy reforms for empowering vulnerable groups by increasing their resilience and ability to adapt to the challenges of mountain environments, including the impacts of climate change. Possible actions include:

- Undertaking socioeconomic benefit analyses of resource exploitation and export out of the mountain areas;
- Identifying the causes of poverty in mountain communities, particularly in relation to the exploitation of mountain resources;
- Identifying vulnerable groups among mountain communities, especially women and children, in order to develop measures to address their vulnerabilities; and
- Implementing policy reforms for empowering vulnerable groups to increase their resilience and adaptive capacity.



Street market in Addis Ababa, Ethiopia



Promotion of land-use planning, land management and sustainable agriculture practices; and promotion of high-quality mountain agricultural products

While mountainous areas in Africa are generally perceived as harsh areas for human livelihood, the favourable climatic and ecological conditions (in contrast to the surrounding lowland areas) means they are highly productive and able to support large populations, largely dependent on agriculture. The high population densities, coupled with limited or no land-use planning and poor land management practices, pose a series threat to the sustainability of agriculture in these fragile mountain environments.

With the mounting population pressure and the increase in environmental disasters related to poor land use and climate change, proper land-use planning and sustainable land management practices are required to ensure sustainable agriculture and development in mountain areas.

The environmental conditions found in many mountain areas favour the production of high-quality products, which are becoming an increasingly important means of improving the livelihoods of mountain communities around the world. To exploit the comparative advantages that these conditions provide, requires the selection of high-quality crops and the provision of organizational skills, market

linkages, technology and the necessary expertise. In particular, there has been a rise in consumer demand for organically produced crops such as coffee and vegetables and fruit that fetch high prices in western markets. These have the potential to significantly enhance the welfare and development of mountain communities.

Interventions must seek to promote land-use planning and sustainable land management practices in the mountainous regions, through actions that may include:

- Compiling resource inventories in East African mountain areas including potentials and sensitivities of the physical landscapes by both national and transnational authorities;
- Developing land-use plans at different scales of management (at least up to district or regional levels) within countries to guide users on appropriate ways of managing the land for sustainability; and
- Publicizing and implementing the use of land-use plans and monitoring progress in their implementation.

Another possible intervention area involves promoting the production of high-quality mountain agricultural products as a means of improving the economic welfare of mountain communities. This may include the following actions:

- Carrying out an assessment (environmental and socio-economic) of a range of high-quality mountain agricultural products;
- Identifying the most suitable products for promotion, and potential markets and linkages where the products can be sold;
- Promoting the production of high-quality mountain products among politicians, policymakers, technocrats and mountain communities;

- Developing policies and guidelines on the production and marketing of these products; and
- Building the capacity of farmers to produce quality products that meet prescribed standards and assist them in marketing their produce.

Open up mountain areas for development through well planned infrastructure, industry and settlements

Although mountain areas remain remote and sensitive to development, their growing populations and rich natural resources mean that they should not be left behind in the process of national development. There is a need for including programmes in the Agenda that focus on opening up some of the mountain areas for development, wherever possible and appropriate. This could include: infrastructure development to open up remote and inaccessible areas with potential for development; establishing small-scale to medium-scale industries, including cottage industries, based on existing mountain resources; upgrading rural settlements to provide minimum standards including developing townships with public services such as water, electricity, education and health facilities. While supplying power to remote and isolated settlement areas may be a challenge, possible solutions include the development of innovative mini-hydropower generating dams on the numerous rapids and waterfalls found along mountain streams and the harnessing of solar power from photo voltaic modules.

The construction of infrastructure such as roads may present another big challenge on highly unstable mountain slopes. However, well designed and environmentally-sensitive road construction and maintenance can go a long way to reducing the risk of environmental degradation associated with road construction.



Nyabugogo river valley in Kigali, Rwanda

The mining industry also provides opportunities for development since many mountains contain valuable mineral deposits with the potential for extraction; in areas such as the Rwenzori Mountains, mining of minerals such as copper and cobalt has been taking place for a long time. Exploitation of these resources for development is inevitable; however, mining activities are very disruptive to mountain ecosystems and may have a number of adverse environmental impacts. It is essential, therefore, that carefully designed and executed mining activities, adhere to the principles of the 'green economy' approach: the use of Environmental Impact Assessments (EIA), and the restoration of disturbed landscapes.

Interventions should seek to promote and monitor programmes aimed at opening up mountains for development, including the development of industries, infrastructure and settlements through the following actions:

- Mobilizing and sensitizing political leaders, policymakers, investors and other key stakeholders to the importance of developing and implementing development programmes in mountain areas; and
- Holding consultations with key actors on how to move forward in pursuing infrastructure development, with a view to facilitating future resource mobilization for new developments.

It is also important to identify the potential for development in different mountain areas, which should include an environmental impact assessment to determine the most viable, environmentally friendly development strategies. Possible actions for this intervention area include:

- Undertaking a comprehensive assessment of the development potential of mountain areas;
- Identifying suitable areas of infrastructural development investments;
- Developing policies and guidelines for establishing and operating industries in highly sensitive mountain ecosystems; and
- Monitoring infrastructural development establishments to ensure that operations comply with environmental sensitivities of mountain ecosystems.

Promotion of mountain tourism for sustainable development

Mountain regions are among the major tourist destinations, mainly due to the attractive landscapes that provide great opportunities for recreation and adventure. Sacred and spiritual sites are also an attraction for those seeking spiritual renewal and rich cultural experiences (Messerli and Ives, 1997).

As in the rest of the world, tourism in the mountains of East Africa is a potential long-term source of income and, if well managed, can have a positive effect on both conservation and income generation for local communities. East Africa countries are already implementing initiatives to promote sustainable tourism in mountain areas.

The economic, social and cultural impacts of mountain tourism are important issues, considering the role of the tourism industry in sustainable development. It is important to note, however, that large numbers of tourists who lack respect for religious and local traditions can have an extremely negative impact. To avoid this,

tourism needs to be adapted to the needs of sacred sites; and the number of tourists and their behaviour need to be managed. This includes implementing environmental management guidelines and regulations for tourists.

Possible interventions include promoting the potential for developing tourism in mountain areas, which include: areas of outstanding beauty; cultural and religious sites and mountain communities themselves. This could involve the following actions:

- Carrying out a comprehensive assessment of the potential for tourism in different mountain areas, including existing and potential tourism activities;
- Undertaking awareness campaigns, publicity and lobbying for enhancement of the tourism industry in the mountain areas of Eastern Africa; and
- Developing policies for enhanced and sustainable tourism in the mountain regions.

It is also important to establish guidelines and mechanisms for ensuring sustainable tourism in the mountains and securing a fair share of the benefits for local communities. This could be done through:

- Development and implementation of strategies and guidelines on enhanced and sustainable tourism for use by all actors in the industry;
- Education and sensitization of all stakeholders on the established strategies and guidelines to prepare them for tourism development initiatives;
- Development and implementation of monitoring mechanisms to ensure sustainable tourism development; and
- Evaluations of benefit sharing in the industry, especially in regard to mountain communities.

Promotion of national and regional collaboration and partnerships

Due to the transboundary nature of mountain ecosystems, it is essential to develop and implement

policy frameworks, strategies and programmes to foster collaboration and partnerships in mountain conservation development. There are already a number of regional and transnational policy and institutional frameworks in existence that promote collaboration and partnerships – these may need enhancement where appropriate. Where necessary, new transnational policy and institutional frameworks for cooperation between and among nations should be established and operationalized. These should address issues relating to sustainable development in mountain ecosystems and should, as far as possible, build on existing regional organizations such as IGAD, EAC and Nile Basin Initiative. Partnerships should not only be between policymakers, but should also involve non-governmental organisations and private sector organizations.

A good example of this is the recently established Africa Regional Mountains Forum – a forum for information exchange and policy dialogue, which was initiated by the fifteenth session of AMCEN held in Cairo in March 2015. There are also a number of collaborations and partnerships between non-governmental organisations, civil society organisations and the private sector which should be enhanced as an effective means of realizing sustainable mountain ecosystem development. A case in point is the Albertine Rift Conservation Society (ARCOS Network) which has entered into partnership with governments to enhance efforts for promoting sustainable mountain development.

Possible interventions may include promoting partnership and collaboration at all levels of governance in order to harness knowledge and experience from and between different partners on the management of mountain ecosystems, especially those of a transboundary nature. This can be done through the following actions:

- Assessment and determination of existing (sub) regional partnerships, collaborations and linkages between institutions at different levels and evaluations of opportunities for adoption in the new arrangements;
- Development or enhancement of policy frameworks and other mechanisms to achieve the desired levels of collaboration and partnerships; and
- Raising awareness among all actors of the importance of new partnerships and collaborations.

It is also important to operationalize collaboration and partnership arrangements to foster effective implementation through:

- Consultations with stakeholders to reach consensus on the most important approaches for collaboration and partnership strategies;
- Developing guidelines for the implementation of collaboration and partnership arrangements; and
- Creating or promoting an enabling environment to facilitate the implementation of these arrangements, including platforms, information exchange and networking arrangements, as well as regular dialogue and meetings to harmonize positions in the implementation process.

Restoration of degraded landscapes

Many mountainous areas are under heavy pressure from their large population densities, which has resulted in excessive clearance of vegetation cover and subsequent land degradation. The African highlands are one of the key examples of large-scale deforestation. However, efforts have been made to restore the forest cover on many mountain slopes. This has been driven by the desire to restore on-site productivity for the benefit of local communities and a recognition that restored forests will provide downstream benefits – improved stream flow and reduced sedimentation. Recently, reforestation has also been recognized as an

important adaptation measure against the impacts of climate change. The benefits derived from restoration to local communities are undeniable, through an increase in the availability of forest products and improved on-site productivity.

Interventions should seek to promote the restoration of degraded landscapes in the mountain areas of East Africa at the community, subnational, national and transnational level, to enhance land and ecosystem productivity. Possible actions include:

- A comprehensive assessment of both degraded and restored land in order to determine priority areas for restoration while learning from the experiences of the restored landscapes; and

- Developing policies, strategies and guidelines on restoration initiatives.

It is also important to build the capacity of all actors or stakeholders to enable them to undertake restoration initiatives, with possible actions as follows:

- Publicizing and popularizing the need for landscape restoration initiatives in mountain areas;
- Building the capacity of all actors for identifying priority areas for restoration and methods to be used, with an emphasis on collaboration and partnership arrangements; and
- Promoting mobilization of resources for the implementation of restoration activities.



Mount Elgon afforestation, Uganda

Conclusion

East Africa provides a good case on which the framework for an Africa Mountain Agenda can be developed. East Africa has some of Africa's most prominent mountains, and also home to large mountain communities.

Over the years, several assessments have been conducted on Africa's mountain regions, including the Africa Mountain Atlas, which has a chapter on East Africa. As such, the current state and trends of mountain ecosystems is generally known. Several political pronouncements have also been made on mountain regions, including by the African Ministerial Conference on the Environment at its 15th session.

In this report, an East Africa mountain agenda is proposed, and will benchmark an Africa-wide mountain agenda. The proposed East Africa mountain agenda provides priority areas of action following the identification of gaps in on-going efforts to protect mountain ecosystems and to achieve sustainable development of mountain regions. In line with the Sustainable Development Goals, Africa's Agenda 2063 and various on-going programme in the region, the proposed timeframe for East Africa's mountain agenda is 15 years, from 2015–2030.

A total of 12 priority areas of action are identified and proposed, and their objectives and activities provided. The priority areas are comparable with developmental plans for other mountain regions of the world. Therefore, East Africa's mountain agenda will provide useful inputs into the global mountain agenda should this come into being.



Bigo Bog at Mount Rwenzori, Uganda

Contributors and reviewers

Contributors

Alfthan Bjorn, GRID-Arendal
Bagoora Festus, Nature – RIDD
Jurek Matthias, UNEP
Jørstad Hanne, GRID-Arendal
Kavagi Levis, UNEP
Kirkfeldt, Trine, GRID-Arendal
Kieft Koen GRID-Arendal
Mafuta Clever, GRID-Arendal
Mugisha William, Nature – RIDD
Mumba Musonda, UNEP
Munang Richard, ROA
Mwikila L. Dismass, EAC
Nakileza Bob, Makerere University
Ntamubano Wivine, EAC
Opedes Hosea, Nature – RIDD
Otiende Brian O., EAC
Schoolmeester Tina, GRID-Arendal
Sebukeera Charles, UNEP
Swagga Arnold, Nature – RIDD
Tayebwa William, Uganda
Wabunoha Robert, UNEP

Case Studies

Alweny Salome, ARCOS
Bigengimana Yvonne, ARCOS
Daniel Essey, UNEP
Muvunankiko Gilbert, ARCOS
Nsengiyumva Philbert, ARCOS
Nteza Paul, UNDP
Refisch Johannes, UNEP GRASP

Reviewers

Banamwana Marshall, Ministry of Natural Resources,
Rwanda
Bukeyenzea Deo, Burundi

Hakizimana Carine, Burundi
Havugimana Jean Baptiste, EAC
Kanyamibwa Sam, ARCOS
Natai Shakwaanande, Ministry of Agriculture, Food
Security and Cooperatives, Tanzania
Nganga Lucy, Ministry of Agriculture, Livestock and
Fisheries, Kenya
Nyamgeroh Beryl, EAC
Semernya Larisa, UN Vienna
Sikoyo George, Lake Victoria Basin Commission

Review Workshop (Sustainable mountain development in East Africa – sub-regional stakeholders meeting)

Alweny Salome, Albertine Rift Conservation Society
Bbaale Josephine, Ministry of Water and
Environment, Uganda
Bigengimana Yvenne, Albertine Rift Conservation
Society
Bosco Keri Justin, Community Empowerment for
Progress Organisation, South Sudan
Byamana Kizungu Robert, Centre de Recherche en
Science Naturelle, DR Congo
Byamukama James, Greater Virunga Transboundary
Collaboration, Rwanda
Daniel Essey, UNEP
Egaru Moses, IUCN-ESARO
Eshetu Zwedu Climate Science Centre, Addis Ababa
University
Fazili Mukuba Fabien, DR Congo
Gahungu Richard, Ministry of Agriculture and
Livestock, Burundi
Ibony Namanya Beria, WWF Eastern and Southern
African Regional Programme
Jurek Matthias, UNEP

Kanyamibwa Sam, Albertine Rift Conservation Society
Kanyamugenge Brigitte, Albertine Rift Conservation
Society
Kavagi Levis, UNEP
Lero Peter Minasona, Ministry of Wildlife
Conservation and Tourism, South Sudan
Mafuta Clever, GRID-Arendal
Makau Joseph, National Environment Management
Authority, Kenya
Mugabi David Stephen, Ministry of Water and
Environment, Uganda
Mukama Revocat, Office Burundais pour la
Protection de l'Environnement
Munishi Pantaleo, Sokoine University of Agriculture
Musamali Paul Buyera, National Forestry Authority,
Uganda
Nagujja Nuriat, East African Community
Nakileza Bob, Nature RIDD
Ngoga Telesphore, Rwanda Development Board
Ngoru Bernard, Kenya Wildlife Service
Nsengiyumva Philbert, Albertine Rift Conservation
Society
Ntamubano Wivine, East African Community
Nteza Paul, UNDP, Uganda
Oloya Collins, Ministry of Water and Environment,
Uganda
Opedes Hosea, Makerere University, Uganda
Refisch Johannes, UNEP GRASP
Salehe John, Tanzania Forest Conservation Group
Sebukeera Charles, UNEP
Swagga Arnold, Nature RIDD
Wabunoha Robert, UNEP
William Mugisha, Makerere University, Uganda
Wondafrash Mengistu, Ethiopian Wildlife and
Natural History Society

Acronyms

AMCEN	African Ministerial Conference of the Environment
CBD	Convention on Biological Diversity
COMESA	Common Market for Eastern and Southern Africa
DRC	Democratic Republic of Congo
EAC	East African Community
EBA	Ecosystem-Based Adaptation
EIA	Environmental Impact Assessments
ENSO	El Niño–Southern Oscillation
FAO	Food and Agricultural Organization
GEF	Global Environment Facility
GVL	Greater Virunga Landscape
IGAD	Inter-Governmental Authority on Development
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel for Climate Change
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
NEPAD	New Partnership for Africa's Development
SADC	Southern African Development Community
SDG	Sustainable Development Goals
SLM	Sustainable Land Management
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on the Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Fund

Photo credits

1	iStock/ApuuliWorld	75	iStock/Ondrej111
4	Mountain EbA Project/Ed Barrows	76	iStock/Robert Ford
7	iStock/WLDavies	77	iStock/Kirsten Dohmeier
8	iStock/Klaas Lingbeek van Kranen	77	iStock/Rob Naw
8-9	iStock/Guenter Guni	79	iStock/miroslav_1
9	iStock/Guenter Guni	80	iStock/master1305
10	Mountain EbA Project	82	iStock/Fernando Quevedo
11	iStock/Guenter Guni	83	iStock/Guenter Guni
12	iStock/Davor Lovincic	84	iStock/Davor Lovincic
13	iStock/Robert Ford	86-87	iStock/MHGallery
15	Peter Prokosch	87	iStock/mustafa6noz
16	iStock/ranplett	88	Silvia Giada
17	iStock/Davor Lovincic	89	iStock/Sloot
18	iStock/Sloot	91	Mountain EbA Project/Monica Kyeyune
19	iStock/Fabio Lamanna	92	iStock/Guenter Guni
21	iStock/itpow	98	iStock/WLDavies
22	iStock/Liz Leyden	100	iStock/Guenter Guni
23	iStock/Alexander Fortelny		
25	iStock/VaP		
26	iStock/Sloot		
28	iStock/Byelikova Oksana		
30-31	Rannveig Formo/Bernardas Padegimas		
33	iStock/Meinzahn		
35	iStock/Meinzahn		
36	iStock/Tim De Boeck		
37	iStock/Britta Kasholm-Tengve		
38	iStock/Klaas Lingbeek van Kranen		
41	iStock/geneward2		
43	iStock/Robert Ford		
44	iStock/Achim Prill		
46-47	iStock/Robert Ford		
48	iStock/Jose Carlos Alexandre		
49	iStock/Michele Alfieri		
50	iStock/Christoffer Vorm		
52	iStock/Guenter Guni		
53	iStock/Davor Lovincic		
55	iStock/LuCaAr		
56	iStock/Guenter Guni		
57	iStock/SimplyCreativePhotography		
59	iStock/Davor Lovincic		
66	iStock/Klaas Lingbeek van Kranen		
68-69	iStock/AL-Travelpicture		
71	iStock/Suzi McGregor		
72	iStock/mtcurado		
74	iStock/Guenter Guni		

References

- Abdo, K.S., B.M. Fiseha., T.H.M. Rientjes., A.S.M. Gieske. and A.T. Haile (2009). Assessment of climate change impacts on the hydrology of Gilgel Abay catchment in Lake Tana basin, Ethiopia. *Hydrological Processes*, 23(26), 3661-3669.
- African Conservation Centre (2012). *SERVIR Africa Biodiversity Project: Assessing the Vulnerability of Biodiversity to Climate Change: Report on Assessing Impacts of Future Climate Change on vegetation in East Africa and Kenya-Tanzania Borderlands*. African Conservation Centre, National Museums of Kenya, University of York, Missouri Botanical Gardens, 5East African Herbarium, Tanzania Commission for Science and Technology.
- African Wildlife Foundation., the International Gorilla Conservation Programme., and EcoAdapt (no date). *The Implications of Global Climate Change for Mountain Gorilla Conservation in the Albertine Rift*.
- Agriculture Sector Development Strategy and Investment Plan (DSIP) 2010/11-2014/15; *Agriculture for Food and Income Security*; Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) July 2010, The Republic of Uganda.
- Agroforestry Centre (ICRAF); and International Development Research Centre, Nairobi Earth scan, London.
- Alweny, S., Nsengiyumva, P., and Gatarabirwa, W. (2014). *African Mountains Status Report Technical Report No. 1. Albertine Rift Conservation Society*.
- AMCEN Secretariat (2006). *History of the African Ministerial Conference on the Environment 1985-2005*. AMCEN Secretariat, Nairobi 2006.
- ARCOS Network. (n.d.). Accessed on 14 July 2015, 10:59am: www.arcosnetwork.org.
- Bagoora, F. D. K. (1989). A preliminary investigation into the consequences of inadequate conservation policies on steep slopes of Rukiga Highlands, south-western Uganda. In D. B. Thomas et. al. (Eds), *Soil and Water Conservation in Kenya*; Dept. Agric. Engr.; University of Nairobi Kenya.
- Bale Mountains National Park (2007). *General Management Plan (BMNP) 2007 – 2017*. Bale Mountains National Park, Ethiopia.
- Banana, A.Y., Byakagaba. P., Russell, A.J.M., Waiswa, D., and Bomuhangi, A. (2014). A review of Uganda's national policies relevant to climate change adaptation and mitigation: Insights from Mount Elgon. Working Paper 157. Bogor, Indonesia: CIFOR.
- Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. (2008). *Climate Change and Water*. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.
- Bazaara, N. (2003). *Environmental Governance in Africa: Decentralisation, Politics and Environment in Uganda*.
- Beniston, M. and Fox, D.G. (no date). *Impacts of Climate Change on Mountain Regions*. Chapter 5.
- BirdLife International (2012). *Ecosystem Profile: Eastern Afromontane Biodiversity Hotspot*. Critical Ecosystem Partnership Fund.
- BirdLife International (2013). *Deforestation in the Mau Forest, Kenya, is impacting wildlife and people*. Presented as part of the BirdLife State of the world's birds website. Available from: <http://www.birdlife.org/datazone/sowb/casestudy/566>. Accessed: 17/08/2015.
- BirdLife International (2015). *Focus on the Albertine Rift*. Online. Available from: <http://www.africa-climate-exchange.org/albertine-rift/>.
- Bishaw, B., Neufeldt, H., Mowo, J., Abdelkadir, A., Muriuki, J., Dalle, G., Assefa, T., Guillozet, K., Kassa, H., Dawson, I.K., Luedeling, E., and Mbow, C (2013). *Farmers' Strategies for Adapting to and Mitigating Climate Variability and Change through Agroforestry in Ethiopia and Kenya*, edited by Caryn M. Davis, Bryan Bernart, and Aleksandra Dmitriev. Forestry Communications Group, Oregon State University, Corvallis, Oregon.
- 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.
- Brooks, N., Adger, W. N., and Kelly, P. M. (2005). *The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation*. *Global Environmental Change*. No. 15. Pp. 151-163.
- Buytaert, W., Cuesta-Camacho, F. and Tóbon, C. (2011). *Potential impacts of climate change on the environmental services of humid tropical alpine regions*. *Global Ecology and Biogeography*, No. Pp. 19-33.
- Campell, R. (2008). *Mount Kilimanjaro, Tanzania: 1976, 2000*. U.S. Geological Survey. 2008. <http://earthshots.usgs.gov> (accessed on April 30, 2015).
- CDKN (2012). *Managing climate extremes and disasters in Africa: Lessons from the SREX report*. Climate and Development Knowledge Network.
- CDKN (2014). *The IPCC's Fifth Assessment Report: What's in it for Africa?* Climate and Development Knowledge Network.
- Christensen, J.H., K. Krishna Kumar, E. Aldrian, S.-I. An, I.F.A. Cavalcanti, M. de Castro, W. Dong, P. Goswami, A.Hall, J.K. Kanyanga, A. Kitoh, J. Kossin, N.-C. Lau, J. Renwick, D.B. Stephenson, S.-P. Xie and T. Zhou, (2013). *Climate Phenomena and their Relevance for Future Regional Climate Change*. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Combes, S., Prentice, M.L., Hansen, L. and Rosentrater, L. (No date). *Going Going Gone: Climate Change and Global Glacier Decline*. World Wide Fund, Germany.
- COMESA/EAC/SADC Climate change programme, 2011.
- Debarbieux B, Oiry Varacca M, Rudaz G, Maselli D, Kohler T, Jurek M (eds.). (2014). *Tourism in Mountain Regions: Hopes, Fears and Realities*. Sustainable Mountain Development Series. Geneva, Switzerland: UNIGE, CDE, SDC, pp. 108.
- Desanker, P.V. (2002). *Impact of Climate Change on Life in Africa*. World Wildlife Fund.
- Döll, P. (2009). *Vulnerability to the impact of climate change on renewable groundwater resources: a global-scale assessment*. *Environmental Research Letters*, 4(3), 035006. doi:10.1088/1748-9326/4/3/035006.
- EAC (2006). *Harmonisation of environmental policies, laws and regulations*. Bureau for industrial cooperation. Working Paper 2.1. EAC Secretariat Arusha Tanzania.
- EAC (2011). *East African Community Climate Change Policy 2011*. East African Community, Arusha Tanzania.
- Ebinger, J. and Vergara, W. (2011). *Climate Impacts on Energy Systems: Key Issues for Energy Sector Adaptation*. A World Bank Study. The World Bank, Washington, DC.
- EPA (1997). *Environmental Policy of Ethiopia (EPE)*. The Republic of Ethiopia.
- EPA (2012). *Environmental Laws of Ethiopia (ELE)*. The Republic of Ethiopia.
- EWCA (2014). *State of Conservation Report on Simien Mountains National Park, World Natural Heritage Site (Ethiopia)*. Addis Ababa, Ethiopia.
- FAO (2013). *Mid-Term Evaluation of the FAO-GEF Project: Transboundary Agro-Ecosystem Management Programme for the Kagera River Basin (Kagera TAMP)*. FAO, Rome.
- FAO (2013). *Mountain farming is family farming*. Food and

- Agriculture Organization of the United Nations, Rome.
- FAO (2014). Adapting to climate change through land and water management in Easter Africa: Results of pilot projects in Ethiopia, Kenya and Tanzania. Food and Agriculture Organization of the United Nations, Rome.
- Fisher, B. et al. (2011). Measuring, modeling and mapping ecosystem services in the Eastern Arc Mountains of Tanzania. *Progress in Physical Geography*. No 35. Vol. 5. Pp. 596-611. DOI: 10.1177/0309133311422968.
- Funder, M., & Marani, M. (2013). Implementing national environmental frameworks at the local level: a case study from Taita Taveta County, Kenya. DIIS Working Paper 2013:06. DIIS, Copenhagen.
- Gebrehiwot, T. and van der Veen, A. (2013). Assessing the evidence of climate variability in the northern parts of Ethiopia. *Journal of Development and Agricultural Economics* Vol. 5(3), pp. 104-119.
- GEF (2010). PROJECT IDENTIFICATION FORM: Enhancing Climate Risk Management and Adaptation in Burundi.
- GOE [Government of Eritrea] (2001). Eritrea's initial national communication under the United Nations Framework Convention on Climate Change (UNFCCC). Department of Environment in the Ministry of Land, Water and Environment, Asmara-Eritrea.
- Government of Kenya (2009). Rehabilitation of Mau Forest. A project prepared by Interim coordinating secretariat, Office of the Prime Minister, on behalf of the Government of Kenya.
- Government of Kenya, Ministry of Environment, Water and Natural Resources (2015). Draft National Forest Policy, 2015.
- Great Virunga Transboundary Collaboration (2014). Context analysis of GVTC-TSP theory of change. Available from: www.greatervirunga.org
- Hagos, G. (2014). Opportunities of bench terracing in Tigray. Department of Natural Resources Management, Adigrat University, Ethiopia.
- Hastenrath, S. (2010). Climatic forcing of glacier thinning on the mountains of East Africa. *International Journal of Climatology* 30: 146–152, doi: 10.1002/joc.1866.
- Hemp, A. (2005). Climate change-driven forest fires marginalize the impact of ice cap wasting on Kilimanjaro. *Glob. Change Biol.*, 11, 1013-1023.
- IGAD (2007). IGAD Environment Outlook: Our environment, Our wealth; Intergovernmental Authority on Development (IGAD), Djibouti.
- IGAD and ICPAC (2007). Climate Change and Human Development in Africa: Assessing the Risks and Vulnerability of Climate Change in Kenya, Malawi and Ethiopia. Intergovernmental Authority on Development (IGAD) and Climate Prediction and Applications Centre (ICPAC).
- IGAD Strategy, 2003: Inter-Governmental Authority on Development (IGAD), Djibouti.
- IPCC (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.
- IPCC (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 582 pp.
- IPCC (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.
- Josephson, A.L., Ricker-Gilbert, J. and Florax, R.J.G.M. (2014). How does population density influence agricultural intensification and productivity? Evidence from Ethiopia. *Food Policy*. Vol. 48. pp. 142-152.
- Kithika, J. (1999). Environmental laws in Kenya.
- Kohler, T. and Maselli, D. (eds) (2012). Mountains and Climate Change - From Understanding to Action. 3rd edition. Published by Geographica Bernensia with the support of the Swiss Agency for Development and Cooperation (SDC), and an international team of contributors. Bern.
- Kohler, T., Wehrli, A. & Jurek, M., eds. (2014). Mountains and climate change: A global concern. Sustainable Mountain Development Series. Bern, Switzerland, Centre for Development and Environment (CDE), Swiss Agency for Development and Cooperation (SDC) and Geographica Bernensia. 136 pp.
- Krishnaswamy, J., John, R. and Jospeh, S. (2014). Consistent response of vegetation dynamics to recent climate change in tropical mountain regions. *Global Change Biology*. 20. pp. 203–215, doi: 10.1111/gcb.12362.
- McCartney, M.P. and Girma, M.M. (2012). Evaluating the downstream implications of planned water resource development in the Ethiopian portion of the Blue Nile River. *Water International*, 37(4), 362-379.
- McSweeney, C., New, M. and Lizcano, G. (2012a). UNDP Climate Change Country Profiles: Tanzania. Available from: <http://country-profiles.geog.ox.ac.uk/>
- McSweeney, C., New, M. and Lizcano, G. (2012b). UNDP Climate Change Country Profiles: Kenya. Available from: <http://country-profiles.geog.ox.ac.uk/>
- McSweeney, C., New, M. and Lizcano, G. (2012c). UNDP Climate Change Country Profiles: Uganda. Available from: <http://country-profiles.geog.ox.ac.uk/>
- McSweeney, C., New, M. and Lizcano, G. (2012d). UNDP Climate Change Country Profiles: Ethiopia. Available from: <http://country-profiles.geog.ox.ac.uk/>
- Messerli, B., and Ives, J.D. (Eds.) (1997) Mountains of the World- A Global Priority. The Parthenon Publishing Group, U.K.
- Mölg, T., Cullen, N., Hardy, D.R., Winkler, M. and Kaser, G. (2009). Quantifying Climate Change in the Tropical Midtroposphere over East Africa from Glacier Shrinkage on Kilimanjaro. *Journal of Climate*. Vol 22. pp. 4162-4181.
- MoNR (2012). Second National Communication under the United Nations Framework Convention on Climate Change. Ministry of Natural Resources, Kigali.
- MoWE (2013). Ecosystem based adaptation in mountain Elgon ecosystems: Vulnerability Impact Assessment (VIA) for the Mt Elgon Ecosystem. Ministry of Water and Environment, Uganda.
- National Environment Management Authority (NEMA) Kenya (2013). NEMA-Report, January 2013.
- National Environment (Management of Mountains and Hilly areas) Regulations (NEMR) (2000)
- NEMA (2008). State of Environment Report for Uganda 2008. National Environment Management Authority (NEMA), Kampala.
- NEMA (2010). State of Environment Report for Uganda 2010. National Environment Management Authority (NEMA), Kampala.
- NEMA (2010a). Landslides in Bududa District: Their causes and consequences. National Environment Management Authority. Available from: http://www.nemaug.org/reports/Current_reports/Bududa_report.pdf
- NEMA Kenya (2011). Kenya State of the Environment and Outlook 2010: Supporting the Delivery of Vision 2010. National Environment Management Authority, Kenya, Nairobi.
- Niang, I., O.C. Ruppel, M.A. Abdrabo, A. Essel, C. Lennard, J. Padgham, and P. Urquhart, (2014). Africa. In: Climate Change 2014: Impacts, Adaptation and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1199-1265.
- Nile Basin Initiative. (n.d.). Accessed on 3 August 2015, www.nilebasin.org.
- OECD (2003). Development and Climate Change in Tanzania:

- Focus on Mount Kilimanjaro. OECD, Paris.
- Ongugo, P.O., Langat, D., Oeba, V.O., Kimondo, J.M., Owuor, B., Njuguna, J., Okwaro, G. and Russell, A.J.M. (2014). A review of Kenya's national policies relevant to climate change adaptation and mitigation: Insights from Mount Elgon. Working Paper 155. Bogor, Indonesia: CIFOR.
- Owen, J. L. and Maggio, G.F. (1997). Mountain laws and peoples: Moving towards sustainable development and recognition of community-based property rights: a general overview of mountain laws and policies with insights from the mountain forum's electronic conference on mountain policy and law. The mountain institute, Washington, DC, USA.
- Pavageau, C., Butterfield, R. and Tiani, A.M. (2013). Current vulnerability in the Virunga landscape, Rwanda.
- Platts, P.J., Gereau, R.E., Burgess, N.D. and Marchant, R. (2012). Spatial heterogeneity of climate change in an Afrotropical centre of endemism. *Ecography*. 36. pp. 518-530. doi: 10.1111/j.1600-0587.2012.07805.x.
- Quirke, P. (2012). The river wild: Harnessing East Africa's hydropower potential. Consultancy Africa Intelligence. Online. Available from: http://www.consultancyafrica.com/index.php?option=com_content&view=article&id=1098:the-river-wild-harnessing-east-africas-hydropower-potential&catid=57:africa-watch-discussion-papers&Itemid=263
- RBD (2015). Rwanda's Nyungwe Nziza Project scoops top Globe Award from the British Guild of Travel Writers. Rwanda Development Bank. Online. Available from: <http://www.rdb.rw/news-pages/news-details/article/rwandas-nyungwe-nziza-project-scoops-top-globe-award-from-the-british-guild-of-travel-writers.html>
- Rehabeam, S. (2004). NEPAD and the African Civil Society; Namibian Economic Policy Research Unit working paper No. 94.
- REMA (2011). "Atlas of Rwanda's changing environment: Implications for Climate Change Resilience". Rwanda Environment Management Authority, Kigali.
- Rockström, J., M. Falkenmark, L. Karlberg, H. Hoff, S. Rost, and D. Gerten (2009). Future water availability for global food production: The potential of green water for increasing resilience to global change. *Water Resour. Res.*, 45, W00A12, doi:10.1029/2007WR006767.
- Rwakakamba, T.M. (2009). How Effective are Uganda's Environmental Policies. *Mountain Research and Development*, 29(2):121-127.
- Sang Joseph K. (2001). The Ogiek in Mau Forest: Case study 3 - Kenya.
- Sène, E.H. and McGuire, D. (1997). in B. Messerli and J.D. Ives (Eds). *Mountains of the World - A Global Priority*. The Parthenon Publishing Group, New York, USA.
- Shanahan, M., Shubert, W., Scherer, C. and Corcoran, T. (2013). *Climate Change in Africa: A Guidebook for Journalists*. UNESCO Series on Journalism Education. United Nations Educational, Scientific and Cultural Organization, Paris.
- Shongwe, M.E., van Oldenborgh, G.J., van den Hurk, B. (2010). Projected Changes in Mean and Extreme Precipitation in Africa under Global Warming. Part II: East Africa. *Journal of Climate*. Vol. 24. pp. 3718-3733.
- SIGVP (2015). Nyamuragira. Smithsonian Institution Global Volcanism Programme. Online. Available from: <http://volcano.si.edu/volcano.cfm?vn=223020>
- Smith, H. (2010). The overlap between conservation and development organisation in the Albertine Rift, western Uganda. International institute for sustainable development, Winnipeg, Manitoba, Canada.
- Taylor, R.G., Mileham, L., Tindimugaya, C., Majuga, A., Muwanga, A., and Nakileza, B. (2006). Recent glacial recession in the Rwenzori Mountains of East Africa due to rising air temperature. *Hydrology and Land Surface Studies*. Vol. 33. Issue 10. Doi: 10.1029/2006GL025962.
- Taylor, R.G., Mileham, L., Tindimugaya, C., Mwebembezi, L., (2009). Recent glacial recession and its impact on alpine riverflow in the Rwenzori Mountains of Uganda. *Journal of African Earth Sciences* 55 (2009) 205–213.
- Teketay, D., Lemenih, M., Bekele, T., Yemshaw, Y., Feleke, S., Tadesse, W., Moges, Y., Hunde, T. & Nigusie, D. 2010. Forest resources and challenges of sustainable forest management and conservation in Ethiopia. In: Bongers, F. & Tenggik, T. (eds.). *Degraded forests in Eastern Africa: Management and restoration*. Earthscan Ltd., London, UK. p. 19–63
- Thornton, P.K., P.G. Jones, G. Alagarswamy, J. Andresen, and M. Herrero (2010). Adapting to climate change: agricultural system and household impacts in East Africa. *Agricultural Systems*, 103(2), 73-82.
- Thuiller, W., Broennimann, O., Hughes, G., Alkemade, J.R.M., Midgley, G.F., and Coris, F. (2006). Vulnerability of African mammals to anthropogenic climate change under conservative land transformation assumptions. *Global Change Biology*. 12. pp. 424-440. doi: 10.1111/j.1365-2486.2006.01115.x.
- United Nations (2011). *World Population Prospects: The 2010 Revision*. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat.
- UNDP (2008). *Capacity Building for Sustainable Land Management in Burundi*. Ministry of Land Management, Tourism and Environment, Republic of Burundi.
- UNDP. (2010). *Independent Terminal Evaluation of the UNDP Component of the Conservation & Management of the Eastern Arc Mountain Forests of Tanzania (CMEAMF) Project*.
- UNDP (2011). *Down to Earth: Territorial Approach to Climate Change - Green, Low-Emission and Climate-Resilient Development Strategies at the Subnational Level*.
- UNEP (2001). *Source Book of alternative technologies for fresh water augmentation in Africa*. UNEP, Nairobi.
- UNEP (2006). *Africa Environment Outlook 2, Our Environment, Our Wealth*. United Nations Environment Programmes (UNEP), Nairobi.
- UNEP (2010). "Africa Water Atlas". Division of Early Warning and Assessment (DEWA). United Nations Environment Programme (UNEP). Nairobi, Kenya.
- UNEP (2012). *Climate Change and Ecosystem Management: Africa without Glaciers*. Online. Available from: http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=90
- UNEP (2014). *Africa Mountains Atlas*. United Nations Environment Programme (UNEP), Nairobi, Kenya.
- UNIDO and ICSHP (2013). *World Small Hydropower Development Report 2013: Eastern Africa*. United Nations Industrial Development Organization (UNIDO) and International Centre on Small Hydropower (ICSHP).
- United Nations Economic Commission for Africa (2004). *Assessing Regional Integration in Africa*. UNECA, Addis Ababa.
- USGS (2009). *VHP Photo Glossary: Volcano*. U.S Geological Survey (USGS). Online. Available from: <http://volcanoes.usgs.gov/images/pglossary/volcano.php>
- UWA (2009a). *Mount Elgon National Park General Management Plan, 2009-2019*. UWA, Kampala.
- Villeneuve, A., Castelein, A. and Mekouar, M.A. (2002). *Mountains and the law - emerging trends; Food and Agricultural Organization (FAO) Legislative study 75*. FAO, Rome.
- Wahome, M. (2011). Kenya: Blackouts, rising bills as drought bites. *Daily Nation*. July 25, 2011. Online. Available from: <http://www.nation.co.ke/News/Blackouts+and+rising+bills+as+drought+bites+/-/1056/1207728/-/8i7eax/-/index.html>
- Williams, A.P. and C. Funk (2011). A westward extension of the warm pool leads to a westward extension of the Walker circulation, drying eastern Africa. *Climate Dynamics*, 37(11-12), 2417-2435.
- World Bank (2002). *Conservation of Biodiversity in Mountain Ecosystems - At a Glance*.
- World Bank (2013). *Turn Down the Heat: Climate Extremes, Regional Impacts and the Case for Resilience*. A report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics. Washington, DC: World Bank.
- World Bank (2015). *Databank. Population density (people per sq. km of land area) in Uganda*. Online. Available from: <http://data.worldbank.org/indicator/EN.POP.DNST/countries/IW-BI-RW-TZ-UG-ET-KE?display=graph>
- WWF (2014). *Mountain Gorilla: WWF Wildlife and Climate Change Series*. World Wildlife Fund. Available from: http://assets.worldwildlife.org/publications/731/files/original/WWF_Climate_Assessment_Mountain_Gorilla_web.pdf?1413379205



Masaai in front of Mount Kilimanjaro, Tanzania

Back cover photo:
Mubuku Valley in Rwenzori Mountains National Park, Uganda



G·R·I·D
ARENDAL

A Centre Collaborating with UNEP



www.unep.org

United Nations Environment Programme

P.O. Box 30552 - 00100 Nairobi, Kenya

Tel.: +254 20 762 1234

Fax: +254 20 762 3927

e-mail: unepubb@unep.org

www.unep.org

