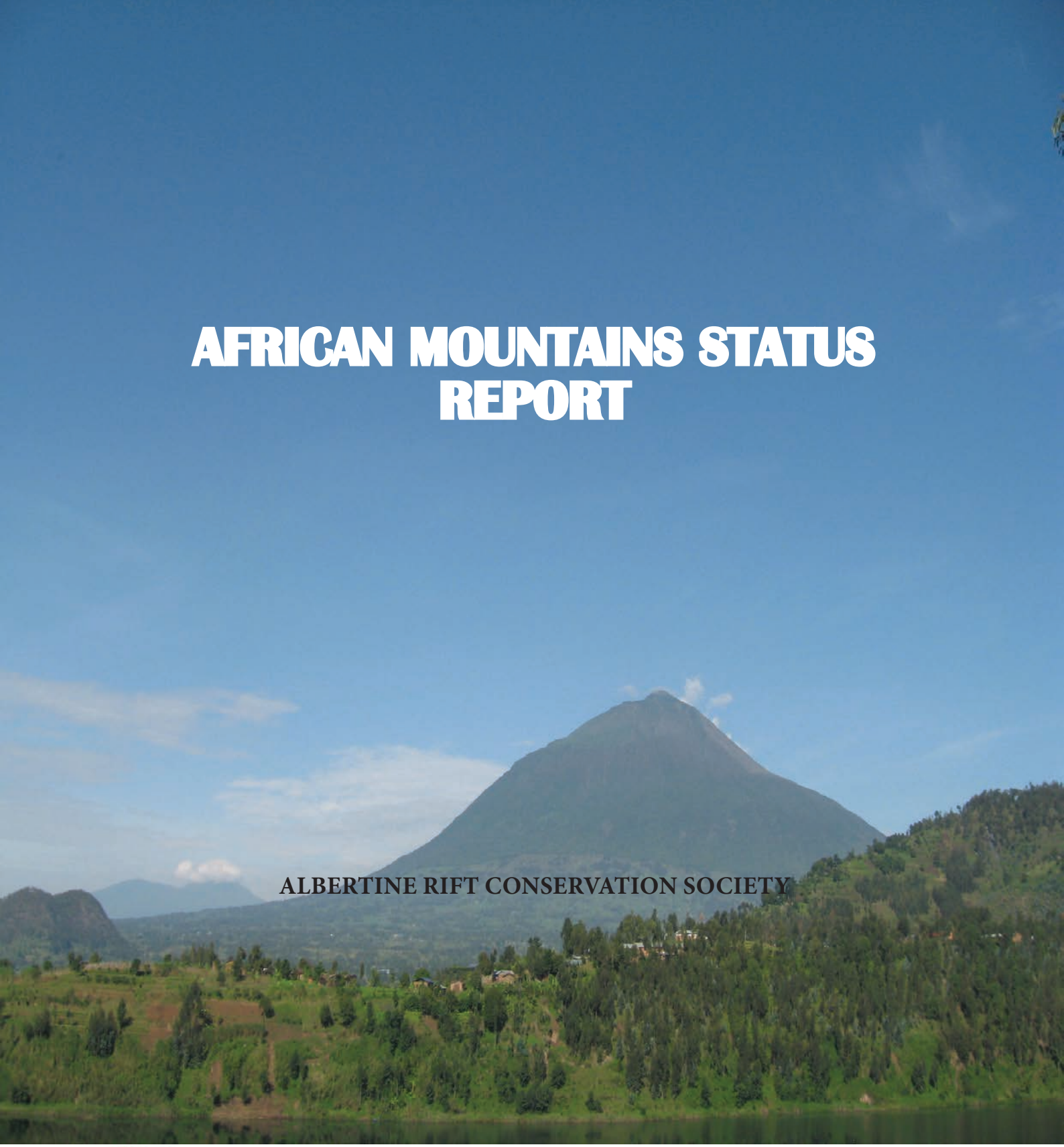

AFRICAN MOUNTAINS STATUS REPORT

ALBERTINE RIFT CONSERVATION SOCIETY

ARCOS NETWORK

Mountain Partnership

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Albertine Rift Conservation Society (ARCOS)

Africa Mountains Status Report

Produced by the Albertine Rift Conservation Society (ARCOS) with financial support from the Swiss Agency for Development and Cooperation (SDC).

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Preface

Dr. Sam Kanyamibwa
Executive Director, ARCOS

In 1992, heads of government of most of the world's nations at the UN Conference on Environment and Development (UNCED or 'Rio Earth Summit') signed a plan of action known as 'Agenda 21' and Chapter 13 which focusses on 'Managing Fragile Ecosystems: Sustainable Mountain Development'.

Twenty years later at the UN Conference on Sustainable Development (UNCSD) known as Rio+20 was held in the same Brazilian city-Rio de Janeiro, Brazil in June 2012 and mountains and their communities received renewed global attention, culminating to the inclusion of three paragraphs (210, 211, 212) of the UNCSD's Outcome Document entitled the "Future We Want", entirely dedicated to mountains.

Other Multilateral Environmental Agreements such as the Convention on Biological Diversity and the Convention on Wetlands (Ramsar, Iran, 1971) recognize the biological, hydrological, cultural and socio-economic importance of mountain ecosystems and call for appropriate and timely actions to improving the awareness, understanding and management of their functions and values.

At the Africa level, many countries, organizations, institutions and individuals are members of the global partnership on sustainable development in mountains, the Partnership and are engaged in various initiatives to promote the cause of sustainability of mountain ecosystems and communities.

Connected to this, in September 2012, at its 14th session, the African Ministerial Conference on the Environment came up with "the Arusha Declaration on Africa's post Rio+20 Strategy for Sustainable Development" which made clear reference to the sustainability of mountains in Africa. The AMCEN then asked the United Nations Environment Programme (UNEP) to support the implementation of the agreed decision under the Rio+20 Conference regarding mountains in Africa.

At national and the sub - regional level, management of mountain ecosystems is also provided for by some policies and instruments, putting emphasise on the need to protect mountain ecosystems such as critical water catchments, conservation, heritage areas and other areas of common strategic interest at local, national, regional and international levels.

Despite the very evident policy framework in place not only at the international, regional and national levels, African countries are doing very little to support the cause for Sustainable Mountain Development. For example at national level, most African countries do not have specific policies or laws presumably because mountains have not been recognised as unique ecosystems that might require special attention.

During the Africa Mountains Partnership (AMP) members meeting organized by ARCOS in collaboration with the Mountain Partnership Secretariat, IUCN and UNEP in Kigali in February 2013, AMP members called for more effort in mainstreaming mountains in countries development agenda. To take this initiative forward, the Swiss Agency for Development and Cooperation (SDC) consequently, provided financial support to ARCOS for implementing a pilot project "Sustainable African Mountains. Exploratory Phase: Building Bridges between Policy and Science for Sustainable Mountain Development" which developed to form part of a global programme "Sustainable Mountain Development for Global Change (SMD4GC)", implemented by ARCOS and other SDC Partners around the world. One of the key objectives of the SMD4GC programme is to ¬launch instruments for Sustainable Mountain Development (e.g. initiatives, actions, legislation).

Despite their abundance in ecosystem goods and services, mountains remain among the ecosystems poorest documented. There is need for monitoring and documentation, for enhancement of knowledge of mountain processes and for improved capacities. These critical gaps need to be closed in order to have better informed stakeholders and policy-makers that intend to shape global sustainable development.

The African Mountains Status Report provides information on the status, trends and levels of threats affecting mountain ecosystems and communities (including climate change, extractive industries, natural disaster, water resources, land use changes and food security) in Africa. The process of compiling this report, started in August 2013 and benefited input from various experts, Mountain Partnership members and specialised institutions that we take the opportunity to thank for their contribution in the development and production of this report. Special thanks go to SDC for the financial support without which, this report would not have been compiled.

Dr. Sam Kanyamibwa
Executive Director, ARCOS
October 2014

Executive Summary

This report is divided into five chapters with each under a different and unique theme.

Chapter one presents a general overview of African mountains, their real coverage, regional distribution and a general overview of the origin and description of Africa's major mountains including Mt Kenya in Kenya, Mount Kilimanjaro, the Drakensberg Mountain Range in South Africa, the Fouta Djallon Mountains and the Madagascar highlands.

Chapter two provides a description of some of the goods and services provided by African mountains including fresh water, energy, support to agriculture, biodiversity, non-timber forest products, ecological services and tourism.

Chapter three focuses on direct and indirect anthropogenic drivers of changes in African mountains while chapter four provides low cost strategies for meeting the challenges in African mountains. Among the strategies discussed in this chapter are: Ecosystem Based Adaptation to climate change and poverty reduction, Integrated Water Resource Management, Ecotourism and Payment for Ecosystem Services.

Chapter 5 presents policy questions in light of sustainable mountain development in Africa with a general concern of low representation, mention and attention to mountains in sectoral policies and laws in most African countries. It also provides policy recommendations including the adoption of mountain-specific policies, trans-boundary frameworks on mountains ecosystems and the development of integrated mountain policies in African countries.

A range of methods including literature review of existing documents (scientific articles, case studies, technical reports and legal documents) on mountains were used in the compilation of the information in this report. Other methods used include direct contact with experts and specialised institutions.

Compilation of cases presented here was limited by factors including data availability on mountains. At the moment, there is inadequate data on mountains in Africa probably owing to the fact that mountains are not looked at as important for national development hence no studies and data collected for them. The financial resources were also inadequate, partly explaining the reason why the team mainly relied on desk and internet research.

Acknowledgements

We would like to thank all the AMP members and institutions that participated for their tremendous insight, information and support at the beginning of this compilation exercise.

Special thanks to the SDC without whose financial support, this report would not have been compiled.

Special thanks also go to all the people who reviewed and provided comments during the writing of this Africa Mountains Status Report. They include; Mr Thomas Kohler, the Associate Director at the Centre for Development and Environment, Dr. Frank Mugagga, Senior Lecturer at the Department of Geography, GeoInformatics and Climatic Sciences, School of Forestry, Environmental and Geographical Sciences, College of Agricultural and Environmental Sciences Makerere University, Dr. Bob Nakileza, Coordinator, Mountain Resource Centre, Makerere University, Kampala, Uganda, Dr. Festus Bagoora, Natural Resources Management Specialist at the National Environment Management Authority, Uganda and Mr Robert Wabunoha, the Legal Officer at the Regional Office for Africa, Division of Environmental Law and Conventions, United Nations Environment Programme, Kenya.

CHAPTER 1
GENERAL OVERVIEW OF AFRICAN MOUNTAINS

Mountains cover an estimated 3,000,000 km2 of Africa's surface area. Approximately half of African countries have mountains higher than 2000m above sea level. The highest mountains, with peaks above 4, 500m are concentrated on the north-western, central and eastern parts of Africa (Bagoora, 2012 and UNEP, 2012).

More than 20 per cent of Africa has an elevation above 1,000m and nearly 5 percent rises above 1,500m. These mountainous regions account for almost 1.5 million km2 of land (Maselli, et al., 1988); GIS Analysis UNEP/GRID).

African mountains are not only good for their beautiful scenery but also for the life-supporting goods and services including provision of water, food and energy security for millions of people at the local, national, and regional levels (UNEP, 2012).

Mountain ranges, massifs and mountains of Africa are scattered throughout the continent. Lesotho, Rwanda and Swaziland are among the top 20 countries in the world, with the highest percentage of mountainous areas. They include the Drakensberg Mountains that cross South Africa and Lesotho, Rwanda's mount Karisimbi in the Virunga chain and the Lebombo mountains in Swaziland. The continent's three highest peaks are found in East Africa and all of them are world heritage sites. Mount Kilimanjaro is the world's tallest free-standing massif, and one of the world's largest volcanoes, covering a total surface area of almost 4,000 km2.

The well-known mountain ranges include those in North of Africa, particularly the Atlas Mountains, Saharan highlands, the Eastern and Southern African highlands and the Albertine Rift Mountains. The prominent ones in West Africa are the Fouta Djallon highlands, Mount Nimba in the Republic of Guinea, the Adamawa highlands in Nigeria and the Mountains of Cape Verde. In the Central African region are Mount Cameroon, Mount Febe and the Angolan highlands to the south. In Southern Africa, the Cape folded mountains of Drakensberg, the Table Mountains, the Soutpansberg mountains, Thabanan and Ntlenyana (Lesotho Mountains) are the most prominent.

In eastern Africa, Ethiopian highlands include Mount RasDaschan, Mount Abune Yosef, Mount Choke and Mount Guge. Mountains in the Central and Western highlands of Kenya include Mount Kenya, Mount Nyambene, Aberdare and Cherangani Hills; while mountains in Central and Northern highlands of Tanzania include Mount Kilimanjaro, Mount Meru and Usambara mountains. Mount Elgon, Muhabura mountain volcanoes (Muhabura, Mugahinga and Sabinio) and the Rwenzori mountains are found in Uganda. Apart from these, there are many other smaller ranges and highlands in all African countries.

1.1 ORIGIN AND DESCRIPTION OF SOME OF AFRICA'S MAJOR MOUNTAINS

The origin of African mountains and highlands is diverse. While the Eastern Africa highlands and mountains are largely a result of the uplift and volcanicity associated with tectonic action around the Great East African Rift valley (which traverses Africa from Ethiopia to central Zambia, and then to west through Lakes Tanganyika and the Kivu region, and further north-eastwards to the Great Albertine Rift lakes of Edward and Albert), other mountains found their origin through tectonic activity.

1.1.1 Mount Kenya in Kenya

Mount Kenya is an ancient extinct volcano with the highest summit Batian ranging at 5,199 meters above sea level. It is Africa's second highest mountain covering a total area of 3,000 Km2, a World Heritage Site since 1997 and a Man and Biosphere Reserve since 1978. It straddles the Eastern and Central regions, south of the equator.

Mt Kenya is an important water reservoir for a population of about seven million people (UNEP, 2010) who live on its foothills and adjacent areas. It is a water catchment area for the Tana and Ewaso Nyiro rivers and is globally recognised for its richness in Afro-alpine flora resulting from ecological processes and a wide range of rare and endemic species. The area above the mount Kenya timberline plus some sections of the forest are protected as a National Park while areas below the forest belt are used for farming, dominated by small-scale farms of both commercial (coffee, tea, horticulture) and subsistence crops (maize, potatoes). The area forms part of Kenya's high potential agricultural land owing to its volcanic soils and sufficient rainfall, partly the reason why it is very densely populated. The main ethnic groups living around mount Kenya are the Kikuyu, Ameru, Embu (related by the fact that they all see the mountain as an important aspect of their cultures) and Maasai who are are semi-nomadic people, who use the land to the north of the mountain for grazing their cattle. Mount Kenya is one of the three tropical African mountains (along with Kilimanjaro and the Rwenzoris) which have permanent glaciers. On Mt. Kenya, 7 of the 18 glaciers present in 1900 had disappeared by 1993, and four glaciers (Lewis, Tyndall, Gregory and Cesar) had lost between 60% and 92% of their area (http://wwf.panda.org/about_our_earth/aboutcc/problems/impacts/glaciers/

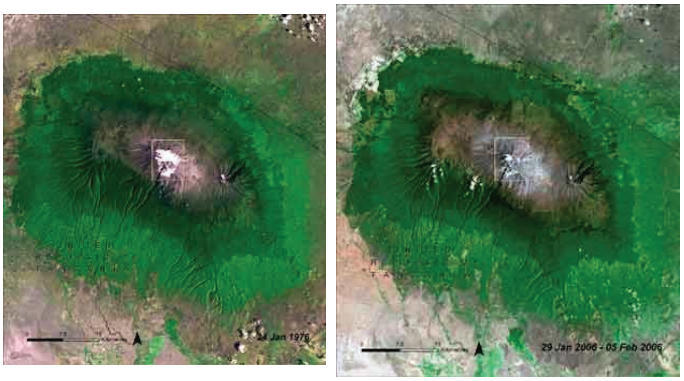
Sunrise over Mt Kenya:
Photo credit: Wikipedia

1.1.2 Mount Kilimanjaro

Mount Kilimanjaro.
Photo credit : Dr. Sam Kanyamibwa

Mount Kilimanjaro is a dormant volcanic mountain located in north Tanzania. It is the highest mountain in Africa and the highest free standing mountain in the world at 5,895 metres or 19,341 feet above sea level.

It was formed thousands of years ago when lava spilled from the East African Rift Zone and piled around the vent in the shape of the present day three distinct volcanic cones: Kibo the highest peak in Africa at 5,891.8 metres, Mawenzi at 5,149 m and Shira, the shortest cone at 3,962 m. As (Misana et al., 2012) notes, some 1.5 million people live around Mount Kilimanjaro of which nearly three quarters depend on its rich natural resources for their livelihoods, including farming the fertile volcanic soils and many are employed in the mountain's busy tourism industry that sees more than 35 000 climbers a year, plus 5, 000 day visitors (Mitchell et al., 2009) and is one of Tanzania's most



Satellite images from 1976 and 2006 showing the decline of Kilimanjaro's glaciers (UNEP n.d.)
Source: http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=90)

important economic sectors (Frömming, 2009). However, despite all these, projections by UNEP (2007) points to the fact that if glacial recession continues at the present rate, the majority of the remaining glaciers on Kilimanjaro could vanish.

1.1.3 The Drakensberg Mountain Range in Southern Africa

Drakensberg Mountains.
Photo credit : www.drakensbergaccommodation.org.za

The Drakensberg is the main mountain range of Southern Africa rising to more than 3,475m and runs from the northeast to southwest (1,125 km) parallel to the south eastern coast of South Africa.

The highest peak is Thabana Ntlenyana, at 3,482 meters. Other notable peaks include Mafadi (3,450 m, Makoaneng at 3,416 m, Njesuthi at 3,408 m, Champagne Castle at 3,377 m, Giant's Castle at 3,315 m, Ben Macdhui at 3,001 m, and Popple Peak at 3331 m, found at the area bordering Lesotho.

The Drakensberg Park was designated a UNESCO World Heritage site in 2000 and is home to a variety of ecosystems with rich and diverse flora and fauna, including numerous endangered plants and an array of antelope species, as well as the rare Southern White Rhino and the roaming Chacma baboon. It supports more than 37% of all South Africa's non-marine avian species (around 300 species in total) and the critically-endangered bearded vultures.

The Drakensberg is also an area of significant anthropological interest, well known for the many ancient San rock paintings that can be found in some 500 caves throughout the region; some of these paintings are possibly as much as 3,000 years old. The Drakensberg is the main watershed of South Africa and is the source of the Orange River.

1.1.4 The Fouta Djallon mountain range

The Fouta Djallon mountain range in west-central Guinea covers an area of 77,000 km2 and averages 3,000 feet (914 m) in elevation with Mount Tamgué near the town of Mali being its highest point at 1,538 m above sea level. It consists of a series of stepped sandstone plateau landscape. The region contains many picturesque trenches and gorges and serves as the watershed for some of western Africa's greatest rivers. The headwaters of the Gambia, Bafing (Sénégal), Koliba, Kolenté (Great Scarcies), Kaba (Little Scarcies), and Konkouré rivers originate from the Fouta Djallon's central plateau.

View of Fouta Djallon mountain range.
Photo credit : FAO

The Fouta's eastern slopes feed various tributaries of the Niger River; and its extension to the extreme southeast, known as the Guinea Highlands, contains the Niger's source. Modern Fouta Djallon is mainly inhabited by the Muslim Fulani people who keep tsetse fly-resistant Ndama cattle.

1.1.5 Madagascar highlands

The Madagascar highlands boast of three massifs: The Maromokotro summit of Tsaratanana Massif in the north that reaches 2,876m above sea level, the Ankaratra Massif whose summit, Tsiafajavona, towers to 2,643m high and the South Andringitra granite massif that rises to as high as 2,658m at Boby Peak.

Generally, African mountains often have favourable climatic and ecological conditions, in contrast to the surrounding lowlands that are generally much drier. As a consequence, the total average population density in all African mountains is more than double the density of the lowlands. African Mountains are also a source of goods (including food, medicine, raw materials for making crafts and construction) in addition to being water towers and food baskets. Apart from providing important goods to up and downstream communities, mountain ecosystems also play an important role in water purification and carbon sequestration, among others however despite of these positive attributes, mountain communities especially in Africa are grappling with issues including water stress or water scarcity or both, poverty, land degradation and climate change, already seen through recurrent landslides, floods, storms, increased temperature and consequent loss of glacial cover in most African mountains. Also, at national level, most African countries do not have mountain-specific policies, laws or institutions simply because mountains have not been recognised as unique ecosystems that require special attention. If nothing is done, climate change for example will lead to the disappearance of tropical mountain glaciers, increasing variation in water flows and changes in disturbance regimes in mountain flora and fauna, with detrimental impacts on local communities.

Mountains in Midongy-Atsimo, Madagascar
Photo credit : Valerie Benjamin Ramahavalisoa

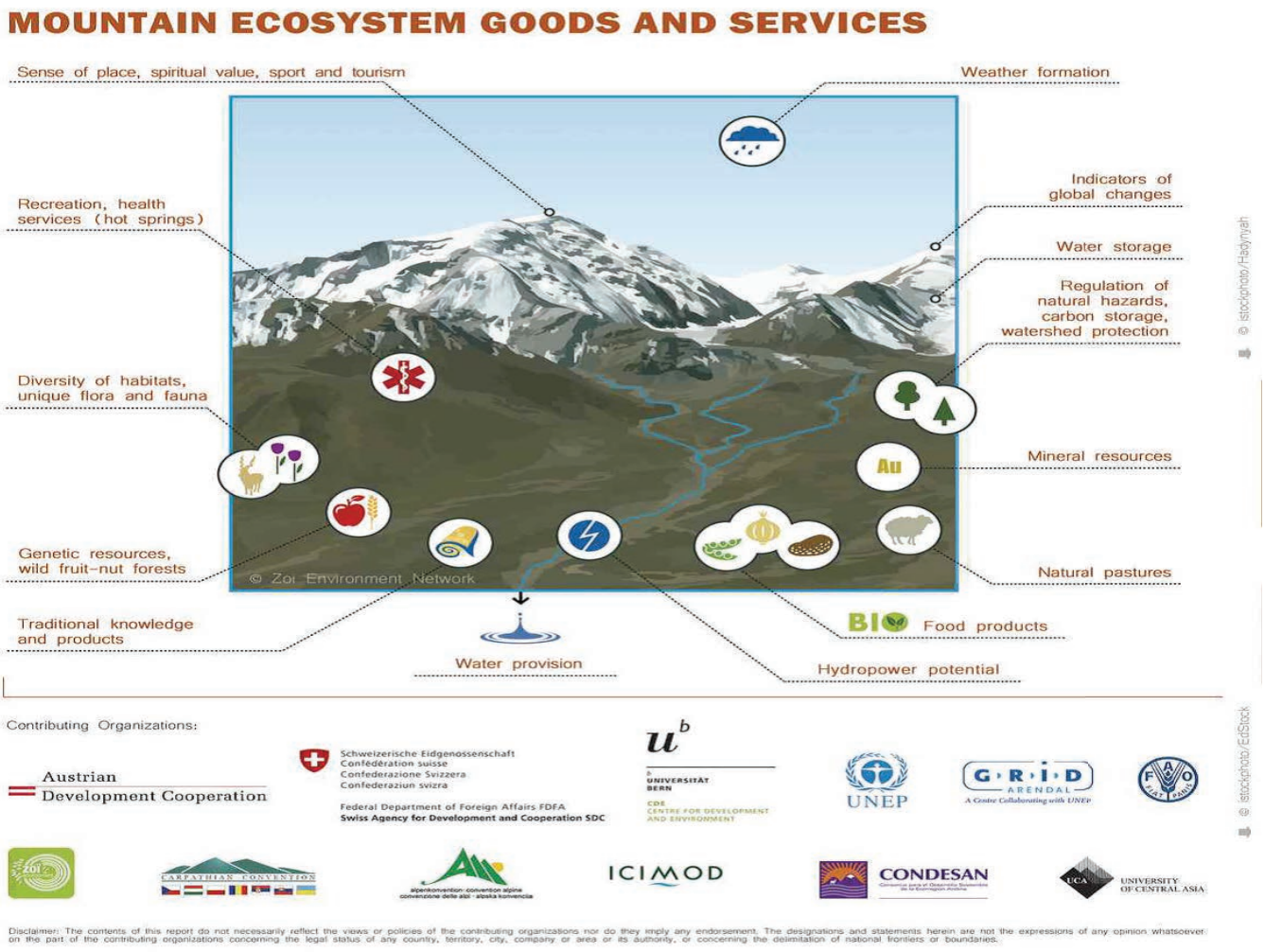
AMBALAVAO FIANARANTSOA, Madagascar.
Photo credit : Valerie Benjamin Ramahavalisoa

CHAPTER 2

AFRICAN MOUNTAIN ECOSYSTEM GOODS AND SERVICES

Mountains provide a vast array of goods and services for people living in and adjacent to mountains as summarised in Figure 1.

Figure 1 Mountain Ecosystem Goods and Services



Source: Mountain Partnership: Why Mountains matter for Climate Change Adaptation and Disaster Risk Reduction

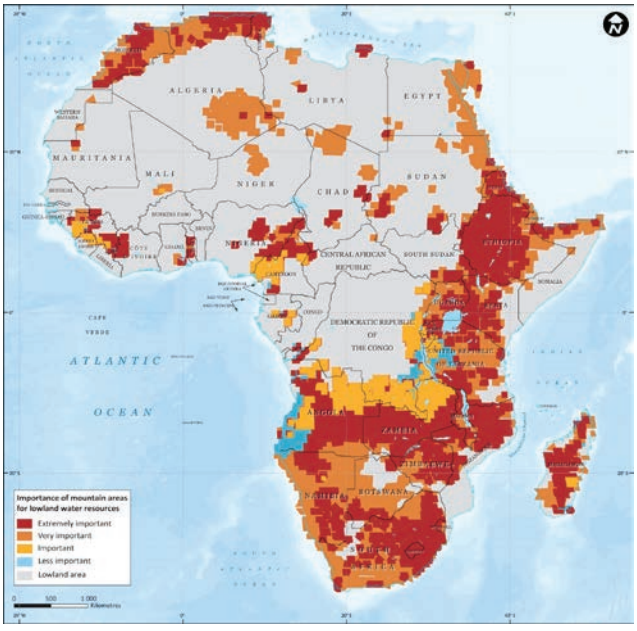
2.1. Fresh Water

African mountains store a vast amount of water in form of, wetlands and forest belts hence are a source of water for more than half of the population in Africa who depend it's freshwater supply for drinking, domestic use, irrigation and industrial use. In a continent dominated by arid and semi-arid areas, water supply greatly depends on the rivers originating in mountain areas.

All of Africa's major rivers originate from mountains that supply water to both up and downstream communities. Low-lying arid areas in countries such as Sudan, Egypt and Namibia receive water from the mountainous sources of large rivers including the Nile, Niger, Senegal, Congo, Tana, Zambezi and Orange. Rivers such as the Nile, the Niger, the Senegal and the Orange flow from relatively rain-abundant areas to areas that would otherwise be too arid to support much life and have been referred to as "the water towers of Africa" for the role they play in supplying millions with life-giving water; and in many cases, these "water towers" are within multi-national watersheds (UNEP, 2010).

Several countries in West Africa depend on water resources from the Fouta Djallon Highlands. In East Africa, Mount Kenya is the only source of freshwater for about seven million people and in Southern Africa, the Drakensberg supplies the majority of water to the entire sub-continent (UNEP, 2012).

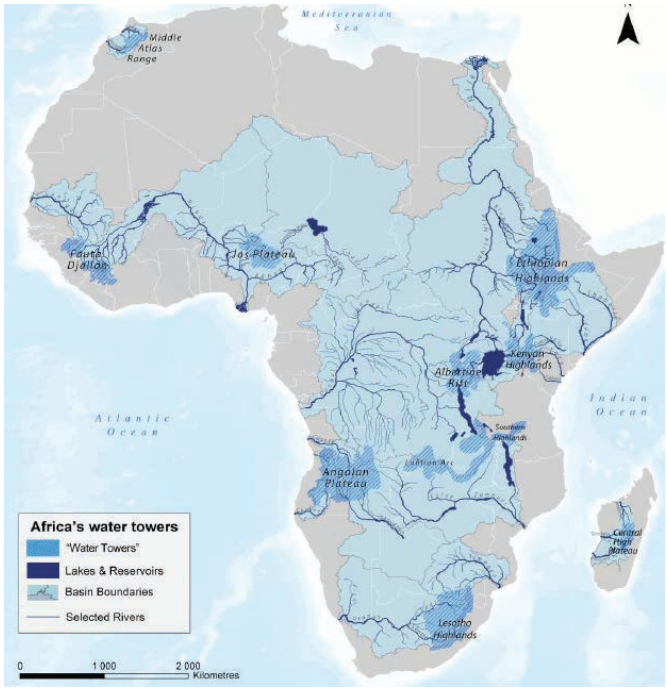
Figure 2: Some of the most important mountain areas for lowland water resources



Source: Adapted from (Viviroli et, 2007 in: Ariza, Maselli, and Kohler, 2013)

River Nyabarongo Landscape, taking its source in the Congo-Nile Divide Mountains and flowing to Kagera River and Nile River.
Photo credit: REMA

Figure 3 Water Towers in Africa



Source: UNEP, 2010.

2.2. Energy

Water from mountains is a source of green renewable energy for many developing cities and settlement centres especially in and around mountainous regions. Hydropower is the main source of clean energy in East Africa and is also important in East, West and Southern Africa.

2.3. Support to Agriculture

African mountains are high-potential farming areas – owing mostly to their good rainfall, and often excellent volcanic soils. They are less affected by tropical diseases, thanks to altitude, cool climate and by ensuring higher and better quality yields, African mountains are important breadbaskets contributing to regional and lowland food security. High Mountains such as Mount Kenya, Mount Elgon and Mount Kilimanjaro have very fertile and productive soils and that partly explains why they are densely populated. They support highly intense agricultural practices based both on cash crops such as coffee and tea and subsistence farming of food crops mainly for domestic consumption, complemented by some cash crops (Mugagga et al., 2010).

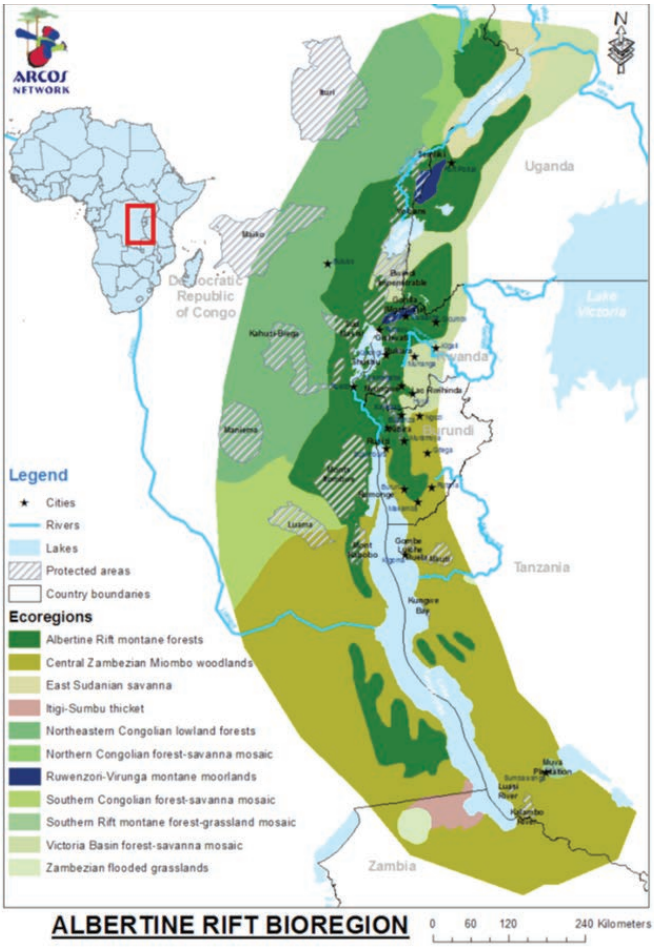
2.4. Biodiversity

The slopes of mountains contain a variety of different types of ecosystems (forests, grasslands, drylands, rivers and wetlands) responding to the changes in weather, soils and terrain. An example of one of the most biologically diverse mountainous areas in Africa is the Albertine Rift region- a home to more than 7, 500 plant and animal species, of which 1 175 are endemic (Plumptre, et al., 2003).

The Albertine Rift region stretches from the northern end of Lake Albert to the southern end of Lake Tanganyika and traverses six countries: Burundi, Democratic Republic of Congo, Rwanda, Tanzania, Uganda and extends to northern Zambia (Plumptre, et al., 2003).

The Fynbos Biome in South Africa is a home to 6,200 endemic plant species. Mt Rwenzori, Mulanje, Cameroon, the Fouta Djjalon and Ethiopian highlands also contain centers of high endemism. The biodiversity therein is a source of timber, food, agro-diversity, medicine and the majestic massifs offer attractive landscapes with true potential for tourism.

Figure 4 The Albertine Rift Bioregion



2.5. Non-Timber Forest Products

Mountain Ecosystems such as forests also provide non-timber forest products like wild food-stuffs and medicines that can be harvested from trees and the undergrowth, such as fruit, vegetables, nuts, native spices, medicinal plants and fodder for livestock (Mugagga et al., 2010); Prunus africana for example is one of the most important medicinal plants found in Africa's montane forests as it's bark is used internationally to treat prostate diseases.

Other non-timber forest products include raw materials for construction, household articles for cash (roots, sap, cane, resins, gums, fibres, ornamental plants, chemicals and dyes), all from the vital mountain ecosystems. On a per-hectare basis, these products can often support a regular household income and through sales, even contribute more to the national or international economy than timber.

2.6 Ecological Services

Mountain ecosystems play an important role in hazard prevention, climate modulation and carbon sequestration. Natural hazards are natural events that threaten lives, property, and other

assets. They usually occur repeatedly in the same geographical locations because of their relationship with weather patterns or the physical characteristics of an area. Natural hazards such as floods, fire and earthquakes affect thousands of people every year however mountain ecosystems such as forests act as buffers for such hazards.

2.7 Formation of local area weather and rainfall

Mountains contribute to the formation of local area rainfall-the reason why many mountain areas are always found to have cooler temperatures than the sourroundings areas.

2.8 Carbon Sequestration

As mountain forests grow, they take up carbon dioxide as a raw material during photosynthesis and give off oxygen which is used by all human beings and other animals. Plants thus clean the air of carbon dioxide, a Greenhouse Gas notorious for causing climate change.

2.9 Tourism

African mountains are tourist attractions because of the pristine landscapes, high biological diversity and unique protected areas which serve as important tourist destinations. The spectacular cliff formations and deep gorges found in the Maloti and Drakensberg mountain ranges in the south of Lesotho are for example, a major tourist attraction for the country. The Maloti/ Drakensberg, a world heritage site and habitat for about 2,500 species of plants also has the world's richest concentration of Stone Age rock art, with more than 30,000 individual paintings recorded. Landmarks in Lesotho that are also major tourist attractions include Mount Qilone, and ThabaBosio, a fortress stronghold where the kings of Lesotho are traditionally buried. The Table Mountain on the other hand, is one of South Africa's most famous landmarks, attracting thousands of visitors each year, a great benefit to the local economy as well as neighbouring communities.

In East and Central Africa (Uganda, Rwanda and DRC), the mountains are the only home to the threatened species of Mountain Gorilla, with only 650 species estimated to be remaining. Together with the physical landscape, the animals are of a great tourist attraction; but at the same time, present conservation challenges.

Mountain Gorillas in the Bwindi Virunga Region, East Africa. Photo Credit: Patrick Magirirane

Canopy walk in Nyungwe National Park. Photo credit : ARCOS

A chimpanzee in Nyungwe National Park. Photo credit : ARCOS

CHAPTER 3
CHALLENGES AND DRIVERS OF CHANGES IN AFRICAN MOUNTAINS

Killer landslide at Nametsi Village, Bududa District on the slopes of Mount Elgon, Eastern Uganda. Over 300 people, homes and a community health centre were buried by the debris. The cause of this landslide was among other factors attributed to deforestation and agricultural encroachment on critically steep slopes. Photo credit : Mugagga et al., 2011

This chapter focuses on direct and indirect anthropogenic drivers of changes in African Mountains. The rich montane biodiversity and the sustainability of ecosystem services in Sub-Sahara African Mountains are at a great risk from drivers of change including encroachment and over exploitation.

The result is environmental degradation that threatens the integrity of mountain ecosystems and the livelihoods of the communities who live in and around mountains. Primary causes can be traced back to population growth, land-use conflicts and political instability in many of these developing mountain countries.

Moreover the effects of climate change and variability are predicted to be most severe and rapid in mountains requiring fast adaptation responses. These drivers of changes, though many of them are inextricably linked, have been grouped in "direct" and "indirect" based on the immediacy of anthropogenic interventions at the origin of the changes being observed or predicted.

3.1. DIRECT DRIVERS

3.1.1 Water conflicts

Mountain streams and rivers are important habitats for fishery and many invertebrate biodiversity. Traditionally they have been used over centuries by mountain communities and lowland communities near and far alike.

According to the Millennium Assessment report, water is becoming a limiting constraint to development in many parts of the world, and in some cases to life itself (Körner and Ohsawa, 2006). The critical importance of mountain ecosystems in regulating water quality and quantity cannot be overstated. In addition, the specific economic value of hydropower depends largely on mountain water, which in turn depends on conserving mountain watersheds.

Therefore, mountain communities and downstream beneficiaries share a common interest in protecting upstream watersheds to assure continued productivity of both hydropower sites and upland production systems, as well as maintaining water levels in long rivers which get most of their water from

Speke Glacier in the Rwenzori Mountain. Photo credit : Richard Taylor

mountains. This has proved to be one avenue to joint stewardship arrangements from local levels to sub-continental regional levels (e.g. Nile Basin Initiative, Fouta Djallon Highlands Integrated Natural Resources Management Project (FDH-INRM)).

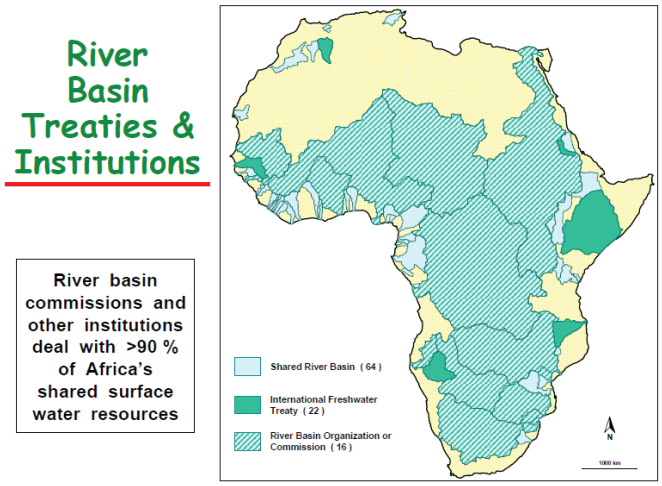
Therefore mountain communities and downstream beneficiaries share a common interest in protecting upstream watersheds to assure continued productivity of both hydropower sites and upland production systems, as well as maintaining water levels in long rivers which get most of their water from mountains. While there have been tension around water, there have also been considerable efforts that resulted in treaties prepared to accommodate the conflicting interests of nations sharing common water resources. For instance, there are international agreements in effect for 20 of Africa's 63 river basins, and in 16 river basins there are institutionalized forums that have the task of coordinating national initiatives (Ashton & Turton 2009; Scheumann & Herrfahrdt-Pähle 2008).

These have proved to be one avenue to joint stewardship arrangements from transboundary to sub-continental regional levels (e.g. Nile Basin Initiative, Fouta Djallon Highlands Integrated Natural Resources Management Project (FDH-INRM) to manage and share services of shared watersheds.

Properly managed water supply and hydropower can be a sustainable use of mountain resources but extra effort is needed to ensure that mountain people get a fair share of benefits and in the case of hydropower projects, a connection to the power grid, whilst guaranteeing adequate water supply to meet local water needs. In South Africa and Lesotho, more than 50% of surface water comes from 8% of the land surface made up of the mountain. However the availability of freshwater is one of the major limiting factors to South Africa's development.

South Africa is a water-scarce country with rainfall distributed unevenly across the landscape, inconveniently away from the centres of mining and industry and tied to seasonal cycles that drive us repeatedly from feast to famine, between floods and droughts (WWF-SA, 2013).

Figure 5. River Basin Treaties and Institutions



3.1.2 Deforestation

Mountains and near-by lowland communities have lived and used forest natural resources sustainably for centuries. Forests on the sides of many mountains have however been cleared to extend agricultural land as population pressures mount and productivity per unit area declines.

Charcoal Making leading to deforestation in mountain areas. Photo Credit: ARCOS

In recent decades, African mountain forests have faced a new pressure - immigration, as population increases in the lowlands, forcing poorer people into the mountains, where they cultivate marginal land for subsistence (Körner and Ohsawa, 2006; Mugagga et al., 2012).

Forests are cleared for commercial timber and charcoal making. Such loss of vegetative cover regardless of the cause can have a significant adverse impact on water quality and quantity both in mountain regions and below. The construction of access roads usually increases soil erosion and heightens the risk of landslides in mountain areas, and cleared areas are usually taken up by different forms of land-use such as agriculture. For example the Fouta Djallon Highlands continue to be under serious threat of degradation, resulting in accelerated reduction of vegetative cover; acceleration of soil erosion and reduction of soil fertility; loss of biodiversity; increase in water run-off, siltation and sedimentation of watercourses as well as drying up of springs (FAO, 2013). The loss of vegetation cover inevitably alters mountain hydrology, and has implications for local and regional climate variability (Beniston, 2003; IPCC, 2007a; 2007b).

There is also unchecked exploitation of resources by outsiders. Natural habitats outside protected areas are vulnerable and easily lost. Often inadequate and poorly targeted fiscal interventions don't benefit indigenous local communities and these are used as loophole for better informed outsiders.

The Millennium Assessment also recognised forests as the second most important economic resource provided by mountains, although this varies across mountain regions. Since most logging is done in pristine forests, little or nothing is paid for production costs. However, standing timber also provides valuable services – stabilization of water flow, protection of biodiversity, carbon sequestration, provision of amenities, and many non-timber products. Several studies have calculated that the economic value for such services exceeds that of the timber extracted. Harvesting primary forests therefore, is like mining a resource without compensatory reinvestment. And as with hydropower and mining, many of the economic benefits do not remain in the region that provides the resource, but rather are consumed by distant communities and development infrastructures.

The site rainforests of the Atsinanana.
Photo credit: Wikipedia

The construction of roads in mountain areas often leads to slope instability, landslides, and erosion. The construction of road and railroads for the transport of heavy goods is often in response to extractive industry needs (transport of ore or timber for processing). Threats to the Site Rainforests of the Atsinanana in Madagascar, were added on the list of endangered World Heritage Sites because of:
a)Illegal logging of precious wood species especially ebony and rosewood;
b)Secondary impacts of the illegal logging;
c)Poaching of endangered lemurs.

3.1.3 Mining in Mountain Areas

The forces that shaped the world's mountains also made them rich in minerals and metals, including gold, copper, iron, silver and zinc. Due to increasing world demand, mines are now being opened even in remote mountain areas. Large-scale mining can massively overburden steep terrain and often pollute streams and damages aquatic and other wildlife. A glaring example is the mount Nimba Reserve.

Old Nimba mine.
Photo credit : Fauna and Flora International

Due to mining, it was inscribed on the list of the World Heritage in Danger (UNESCO WHC, 2014) as a result of two factors: 1)A proposed iron-ore mining concession to an international consortium; 2) The arrival of a large number of refugees to areas in and around the Guinean part of the site.

Although mining can bring large benefits especially at national level, it can also be devastating to fragile mountain ecosystems and local cultures, destroying the livelihood base of mountain communities. Mining also leads to atmospheric pollution, the loss of biodiversity and vegetation cover, which in turn destabilizes mountain slopes. Water contamination is especially serious because mountains supply most drinking and irrigation water.

In some mountain regions where mines are located, arsenic levels in water are several times over WHO (World Health Organisation) accepted standards (Van Halem et al. 2009). Mining also, often has serious social consequences as local communities are deprived of their land. Short-term investments and the presence of immigrant workers can lead to social disintegration and disruption; mine workers can also suffer from hazardous working conditions and, eventually, poor health (FAO, 2011).

The challenge is to balance mining opportunities with environmental and social responsibility, and to ensure that traditional mountain cultures are protected. Policies and legislation should be reflective of this challenge and oblige mining companies to respect environmental and social standards. Mines are nearly always highly destructive to the local environment and displace people living in the immediate area. More threatening still are the pollution and toxic wastes produced or accidentally released by mine operations. Toxic pollution from mines has often been recorded leaching out and contaminating large areas downstream (Pratt & Shilling, 2002).

Artisanal Mining

This activity also presents serious threat to mountain streams and montane forests. Gold prospecting and panning are the most practiced artisanal manning in Sub-Saharan Mountains. Most of the mining usually takes place in mountain streams and usually damages the habitat, water supply to wildlife and depending on chemical use, the quality and quantity of water received by communities downstream.

More recently the demand for coltan by the mobile phone industry has led to a boom in artisanal mining within the Albertine Rift Mountain forests, for example in the Kahuzi-Biega National Park -the main area where Coltan is mined. Being a home to Mountain Gorillas, the gorilla population of this park has been cut nearly to half, from 258 to 130 as the ground is cleared to make mining easier. The poverty caused by the displacement of the local

Gold panning in Amani Nature Reserve, Tanzania. Photo credit : Neil Burgess

populations by the miners has led to increased poaching and trade in bush meat to the miners and rebel armies that control the area. Grave concern that portions of the Kahuzi-Biega National Park had been deforested and that hunting had been reported there, as well as war and civil strife ravaging the country, led the World Heritage Committee to inscribe the property on the List of World Heritage in Danger since 1997 (UNESCO WHC, 2014).

Subterranean copper mining in Rwenzori Mountains

The Kilembe mine used to operate an extensive network of deep mine shafts extracting copper ore from strata in the Kilembe River Valley within the area now designated as the Rwenzori Mountains World Heritage Site. The mine was closed as a result of the economic difficulties which afflicted Uganda during the 1970s and 1980s and has never been re-opened. However, significant reserves of copper ore remain, and the Uganda Investment Authority has secured an investor for resuming the activities of Kilembe Mines Ltd and plans are underway to re-open the mines (People's Daily Online, 2014). This may have serious implications both in terms of mountain slopes stability and control of pollution arising from the mining activities.

3.1.4 Mass Mountain Tourism

The increase in number of tourists in mountains with limited facilities to accommodate the increased number of visitors can lead to anthropogenic pollution. The development of tourism industry in mountain areas can put pressure on natural resources when it increases consumption in areas where resources are already scarce. Greater extraction of these resources and the strain on the often basic transport infrastructure exacerbates the physical impacts associated with their exploitation.

Mountain tourism has a very minor impact on local and regional tourism–firstly because there are not many tourist and secondly, in comparison to the huge populations surrounding mountains, only a few hundred households benefit (pottering, guides).

In mountain areas, trekking tourists generates a great deal of waste, whilst tourists on expedition often leave behind their garbage and even some camping equipment.

Where tourists use the same trail and this has not been properly adapted to such large footfall, there is an increased risk of trampling the vegetation and soil, causing damage that can lead to loss of biodiversity and soil erosion. Such damage can be unavoidable when visitors are allowed stray off established trails.

3.1.5 Livestock and Agriculture Production

Mountain communities have traditionally herd their livestock (mostly cattle) sustainably in mountain areas. The stocking levels were absorbed by the high productivity of the grass on mountains and hillsides. The increase demand in dairy and meat products has led to the need to increase livestock, usually by non-resident owners in mountains. Although the use of fire in traditional pasture practices has been outlawed in many African mountains, increased livestock production can lead to habitat degradation and lack of proper regeneration for mountain grassland habitats. The resulting trampling leads to soil degradation, biodiversity loss and erosion.

This driver of change is particularly important because of the high level of dependence on subsistence agriculture. There are clear links and snowball effect in environmental degradation stemming from agriculture: Inadequate agricultural practices lead to low yields and rapid decline in soil fertility to soil erosion.

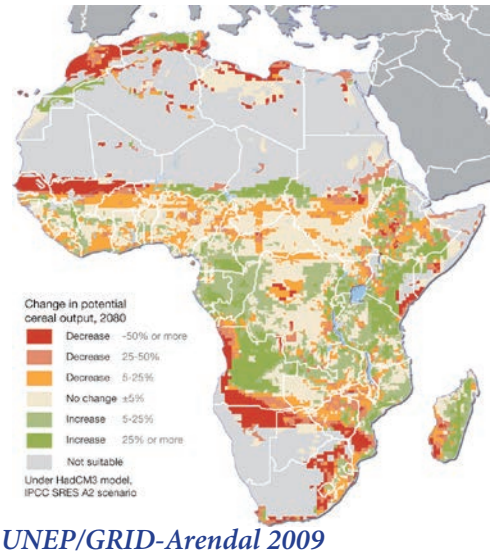
Soil Erosion caused by unsustainable land use. Photo Credit: REMA

In return to feed a growing population size there is increased demand for agricultural land which is often achieved through encroachment and clearing of nearby natural habitats and the resulting loss in biodiversity.

3.1.6 Climate Change

Africa is divided in two halves by the equator, making its climate typically tropical with very low temperature variation nearer to the equator. Furthermore, the altitudinal factors create specially balanced conditions on mountains in these regions, which partly explains, why these mountain ranges have served as biodiversity refugia during the past glacial periods. African mountains are particularly vulnerable to climate change and as such are unique hotspots for the detection of climatic change and the assessment of climate-related impacts, because when the climate changes rapidly with height, over relatively short horizontal distances, so does vegetation and hydrology (Whiteman, 2000; Mugagga et al., 2012).

Figure 6: Projected climate change Impacts for Agriculture in Africa, in potential cereal output for 2080



Source: UNEP/GRID-Arendal 2009

The mountains in Africa whose ice is said to be at risk of disappearing are concentrated in tropical mountains and the southernmost regions closest to the South Pole. They include the African Rift Mountains, the Zambian and Angolan highlands and the Cape Province of South Africa (Schaeffer et al., 2013).

The other factor that is likely to be impacted by climate change is the amount of rainfall and its geographical distribution. Although most areas are predicted to receive more increased precipitation, the shift in the seasonality and regional distribution is likely to have unknown impacts in the sub-continent already dominated by arid and semi-arid rain conditions. While over 95% or crop production in Sub-Saharan Africa is rain-fed, change in rainfall patterns has already caused crop failure and famine in eastern and central regions of African in recent decades.

In terms of biodiversity, although under some climate change scenarios the amounts of rain is predicted to increase, the fine eco-geographical patterns in Mountains may not have enough time to adapt. According to (Mawdsley et al., 2009), some of the effects of climate change on ecosystems and species include:

- Shifts in species distributions, often along elevation gradients;
- Changes in the timing of life-history events, or phenology, for particular species;
- Decoupling of coevolved interactions, such as plant–pollinator relationships;
- Reductions in population size (especially for boreal or montane species);
- Extinction or extirpation of range-restricted or isolated species and populations;
- Direct loss of habitat due to increased fire frequency, altered weather patterns, glacial recession, and direct warming of habitats – such as mountain streams;
- Increased spread of wildlife diseases and parasites
- Increased populations of species that are direct competitors of focal species for conservation efforts;
- Increased spread of invasive or non-native species, including plants, animals, and pathogens.

There is no single answer to respond to the challenge of mitigating the predicted impacts of climate change. A whole host of approaches will need to be deployed, in light of the uncertainties to close climate preparedness gap for climate change in Sub-Saharan Africa.

3.2. INDIRECT DRIVERS

Indirect drivers affecting mountains can be complex and; in addition there are many linkages between them and the direct land-use drivers of change in Sub-Saharan Africa mountains.

3.2.1 Population Growth and High Population Densities

The highlands, particularly in eastern and central Africa, are densely populated areas. For example, the average size of land per person in the Albertine Rift is as low as 0.2 ha. People are attracted to the highlands because of the mild climate, fertile soil and the wide range of crops that can be grown there (including cash crops such as tea and coffee).

Contrary to out-migration observed elsewhere in the world where mountain communities are decreasing as people move to towns and cities in lowlands, Sub-Sahara African experience shows significant population growth in mountain areas fuelled the higher agricultural potential of mountain environment. Mountain areas are, therefore, as a result, the most densely populated compared to neighbouring arid or semi-arid lowlands in many regions of Africa.

Walia ibex/ Photo Credit: Plant Action

Birth-driven and in-migration growth, both lead to increased demand for resources at all levels, especially arable land. Nearly 90% of Ethiopia's population lives in the highlands, which include the critical Blue Nile (Abay) Highlands – a region that holds special importance due to its role in domestic agricultural production and international water resources.

Poverty and high population pressure have resulted in extremely small landholdings for households, very low or no access to investment in improved land management is, leading to high susceptibility to adverse effects of climate variability and change. The natural resources base (land, water and biodiversity) is under intense pressure from population growth and unsuitable traditional farming and management practices.

The World Heritage Committee (UNESCO WHC, 2014) decided to inscribe the Simien National Park (Ethiopia) on the List of World Heritage in Danger due to the deterioration of the population of the Walia ibex, which have moved out of the park due to human presence and to cultivation of considerable areas of the park. Other large mammals characteristic of the site, such as the bushbuck and the bush pig have become extremely rare. Road construction and human population increase within the site represent further threats to the values of the Simien National Park, which was among the first sites to be inscribed on the World Heritage List in 1978.

3.2.2 Poor and Weak Management System

Fragmentary, incoherent and poorly planned development efforts coupled with weak or non-existent management mechanisms at local level render natural resources in mountain areas of Sub-Saharan Africa outside protected areas particularly vulnerable.

Short-termism and lack of continuity in intervention activities (often inspired by top-down planning) to sustainable use of natural resources, often due to lack of resources or conflicting policy priorities on the part of the decision makers. Apparent lack of co-ordination among different stakeholders means that landscape issues, especially in remote mountainous areas, are not properly considered and included in local and national environmental and development policies. For instance, political patronage and lack of collaboration between local resource users/communities, local authorities and Park Authorities have been identified as key deterrents to the successful implementation of Collaborative Forest Management initiatives around Mount Elgon (Mugagga, et al 2010).

Corruption, where it exists, gives privileged access to outsiders at the expense of the cost to local communities. Conversely, economic development in mountain communities has been associated with the weakening of traditional cultures and religions that have provided the underpinnings for local sustainability (Körner and Ohsawa, 2006).

Little opportunity to change environmentally damaging lifestyles such as traditional agricultural and livestock farming that remains land intensive, and without a corresponding economic rewards.

3.2.3 Poverty and Lack of Alternative Livelihood

Poverty is the main driver that that leads many communities to varying levels of dependence on the "freely available" natural resources provided by mountain ecosystems. According to recent research by ARCOS on Total Economic Valuation of some mountain ecosystems in the Albertine Rift, these resources have been sufficient and may be considered to be sufficient in light of the single purpose of meeting local communities' immediate livelihood needs. Indeed customary law that has guaranteed the sustainability of these resources are inherently based on the principle of common pool resource management.

Although mountain communities in different regions of Africa have used these services sustainably in the past to meet their livelihoods needs, such dependence can now be assessed as symptomatic of the apparent lack of capacity to develop financially without risking to overexploit these resources to supply far-off markets. Support is needed to overcome the barriers to achieving integration and participation in increasingly global economies that lowland communities benefit from with development interventions put in place by governments.

In mountain areas such as the Pangani River Basin of NE Tanzania, forests are destroyed as population increases in the lowlands, forcing poorer people into the mountains, where they cultivate marginal land for subsistence. The same is

true around Mount Elgon where encroachment for cultivation is continuously extending into critically steep slopes (> 30°) (Mugagga et al., 2012). Little opportunity to change environmentally damaging lifestyles such as traditional agricultural and livestock farming that remains land intensive without a corresponding economic rewards.

3.2.4 Lack of Environmental Awareness amongst Local Communities

There is an inadequate environmental awareness among local mountain communities as seen in their low representation in decision making and natural resources management processes. As a result damage to the environment often is overlooked by individual users at the expense of the many. This of course not withstanding land tenure insecurity for some communities surrounding protected mountain ecosystems which have severe implications for investment in long term soil conservation (Mugagga & Buyinza, 2013).

CHAPTER 4

MEETING THE CHALLENGES FOR AFRICAN MOUNTAIN COMMUNITIES

The apparent lack of structural mechanisms that can deal holistically with mountain areas, make it difficult to mitigate adverse impacts of key drivers of change. The command-and-control, top-down models of resource management are limited and often ineffective in a complex and fast changing world. Strategies that promote collaboration and learning to build trust and viable networks of researchers, communities, and policy makers need to be put in place. These would potentially lead not only to ecological sustainability but also socio-economic development and sustainability for all stakeholders, whilst helping to establish strong but adaptive management structures responsive to current and future to local communities' needs.

The traditional systems of natural resources management such as protected areas need to be improved into the new management framework, bringing more ownership and value to local beneficiaries as well as promoting connectivity to allow biodiversity to have corridors for under the changing climate.

Whereas communities living and neighbouring mountains (highlands) have traditionally conserved and reserved them for many years, rapid population increases, conflicting conservation policies, liberalization and globalization of economies have triggered the changes being witnessed today in these regions. Over the world, research studies are still continuing in ways to mitigate and reduce the impacts of key drivers of change. However, for all complex challenges, there are no one-size-fit-all solutions to mitigating drivers of change in Sub-Sahara African Mountains. Indeed local or locally owned solutions are called for to increase the chance of success of any strategies and approaches.

4.1. Ecosystem-Based Adaptation to Climate Change and Poverty Reduction

Ecosystem-based Adaptation is recognized by many Least Developed Countries in Sub-Saharan Africa as a cost-effective, accessible way of reducing poverty and climate risk (Devisscher, 2010).

Many Sub-Saharan African Countries qualified under the Least Developed Countries (LDCs) for financial and technical support to prepare Climate Change National Adaptation Programmes for Action – NAPAs (UNFCCC, 2013). The aim of the programme under the Marrakesh Accord, is for countries to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage. A number of African countries took part in the programme and NAPAs documents are among the useful source of actions identified (such as community-based natural resource management programmes) to and some of these are being trailed at country level.

As part of the National Adaptation Programme of Action (NAPAs) process, priority adaptation projects are identified using multi-criteria analysis

to assess their poverty and climate risk reduction potential; synergy with national and sectoral plans and Multilateral Environmental Agreements (MEAs); and cost-effectiveness. For example, out of the 37 potential adaptation options shortlisted by Ethiopian NAPA, 19 were ecosystem-based activities. Three of the final eleven priority projects recommended for implementation in Ethiopia's NAPA are ecosystem-based adaptation activities:

- Improving and enhancing rangeland resource management practices in the pastoral areas
- Community based sustainable utilization and management of wetlands
- Promotion of on farm and homestead forestry and agroforestry practices in arid, semi-arid and dry, sub-humid parts of Ethiopia.

NAPAs are centred on community participation to planning and implementation of resource management as well as the use of scientific and technological tools and advances to improve and sustain livelihoods.

Ecosystem-based approaches to adaptation are widely applicable at different spatial and temporal scales. They have the potential to reduce vulnerability to a broad range of climate and non-climate stresses. Such approaches have been shown to be effective for adaptation across sectors, contributing to livelihood sustenance and food security, sustainable water management, disaster risk reduction and biodiversity conservation.

Ecosystem-based approaches to adaptation may be more cost-effective and accessible by rural or poor communities who are often the most directly dependent on the ecosystem services.

In addition to providing support for societal adaptation to climate change, ecosystem-based approaches to adaptation also provide for the possibility of multiple economic, social, environmental and cultural co-benefits. Approaches such as forest conservation or restoration of degraded wetlands can also contribute to climate change mitigation measures. Such win–win outcomes could also help to avoid mal-adaptation.

4.2. Integrated Water Resource Management

The commercialization of natural resources such as water and forests in often non-transparent way overlooks customary laws that have led to sustainable use of these resources over several centuries. In addition, often there are no clear benefits to local mountain communities who are often forced to the margins of their traditional lands to access the same resources –increasing their labour cost.

Several countries in West Africa depend on water resources from the Fouta Djallon Highlands and Mount Nimba. The Ethiopian Highlands are the source of water for the Blue Nile which supplies more than 70% of the Nile River. The other 30% of the White Nile originate from the equatorial highlands of Uganda (chiefly the Rwenzori range, the Volcanoes ranges of south Uganda and Northern Rwanda, and the eastern side of Nile/Congo divide that constitute the major sources for Lake Victoria and Lake Albert respectively). Local mountain communities need water for domestic consumption as well as for their livestock. Irrigated agriculture is very minimal or simply non-existent.

Hydropower production is an important land/water use that is relatively recent. Large scheme hydropower projects requiring dams may require uprooting entire mountain communities to lowlands. Also, changes in access to water, for instance for livestock is an important factor to be considered as the Integrated Water Resource Management is put in place. Change in water level renders this particularly vulnerable to changes. Small scale hydropower to meet current and near-future energy needs in mountain is to be encouraged.

Caution is called for by some authorities regarding the strict implementation of IWRM who warn that, despite all the good intentions, there remains a danger that IWRM tools may be applied in a such a way that they allow a level of degradation beyond that from which the ecosystem is able to recover i.e. beyond the level of its resilience (Jewitt, 2002).

Box 1 Integrated Water Resource Management in Pangani River Basin, Tanzania

The Pangani River Basin drains a large area in the northeastern part of the Tanzania along the border with Kenya, extending from Mount Meru and Mount Kilimanjaro down through the Pare and Usambara ranges. The major sources of water in the basin, which has a total catchment area of about 42,000 sq. km is endangered by environmental degradation, climate change, and increased use. By 2003 several studies showed that the Pangani basin was already water-stressed - the river's flow had decreased dramatically in recent years and the water demand was expected to double by 2015 (IUCN, 2009). Many conditions that may trigger conflicts were predicted, including jurisdictional ambiguities, miscommunication, and competition between sectors and users such as communities vs. conservationists, upstream vs. downstream users, hydroelectricity production vs. other uses, farmers vs. pastoralists, rural vs. urban areas; and communities vs. river basin authorities. Resolving these conflicts required understanding the socio-cultural context of the local communities and increasing stakeholder involvement in water management.

A range of rights of access have to evolve within and between communities and helping local people secure their rights and livelihoods is of vital importance for the success of this approach (Barchiesi et al. 2011)

4.3 Ecotourism as a complement to Traditional Tourism

Defined by The International Ecotourism Society (TIES) as "responsible travel to natural areas that conserves the environment and sustains the well-being of local people", this is a relatively new approach to tourism and, it embodies many benefits associated with Ecosystem-based Adaptation (EbA) and Community-based Adaptation (CbA) in managing natural resources.

In Kenya, the ecotourism industry is among the most advanced in the whole of Sub-Saharan Africa and a number of factors may have contributed to its development. A combination of being a popular holiday destination, property rights system and increasing environmental awareness seems to have aided this rapid growth (Ecotourism Society of Kenya, 2004, World Bank, 2009). Conservation benefits to nature and biodiversity include reduced levels of damage to the environment – including carefully controlled visitors ration per area and most importantly generating more income for local communities than traditional tourism or other forms of land-use.

Box 2. The evolution and impacts of community-based ecotourism in northern Tanzania

The evolution and impacts of community-based ecotourism in northern Tanzania [Nelson F., 2004].

The income from tourism has grown from US$65 million in 1990 to US$725 million in 2001, and now represents roughly 10 per cent of Tanzania's GDP (World Bank/MIGA, 2002).

The rapid growth of tourism in northern Tanzania over the last 10 years has been accompanied by a proliferation of commercial ventures on community lands located outside the traditional national park destinations. Community-based ecotourism in northern Tanzania contributes to both conservation and rural development. Growing financial opportunities from tourism, institutional challenges relating to the control of natural resources, and variable local capacity for managing ecotourism ventures are three themes which illustrate both the potential of and the challenges to community-based ecotourism in Tanzania.

4.4. Payment for Ecosystem Services

Mountains in tropical Africa are water towers, supplying surface water to mountain communities, near-by lowland communities and even human settlements of all sizes (from villages to large cities) far off, as they serve as the main water catchments for the major regional and international rivers on the continent. Mountains fulfilling this function are found in all regions: Mt Kenya, the Arc Mountains and Kilimanjaro, the Drakensberg Range, Mount Nimba and Fouta djallon are all for the provision of water in the east, central, south and western part of the continent. The Payment for Ecosystem Services (PES) can help in the protection of mountain resources

as well as generate incomes for local mountain communities who have and still act as stewards.

Water source areas can be protected by strategic planning to prioritise water and prevent incompatible land-uses, including them in nature protection structures such as (reserves or conservancies), and implementing water stewardship, restoration and land-care initiatives in these areas. Restoration and compatible land-uses can stimulate the rural economy in water source areas and provide jobs for mountain communities.

The water industry has great opportunity to promote the preservation of water quality whilst sharing benefits with local communities who act as stewards and in exchange for reduced production costs for the water. Tied with this strategic approach, is the urgent need for increased investment in sustainable development of mountain regions, to provide alternative source of livelihoods, and increased incomes of the people, which would in a way be a just reward to the people for staying in and conserving the most difficult and sensitive landscape ecosystems.

4.5 Adaptable Protected Areas Network

Many mountain protected areas were established to protect the scenic high peaks of local or national value as cultural icons or for mountaineering and tourism. Biodiversity considerations such as viable habitat size for wide-ranging mammals were not integrated, and the protected areas were aimed to protect particular features such glaciers on mountain summits, rock faces or upper montane forests and alpine meadows.

Current sizes are too small to accommodate serious natural or human disturbance or to embrace much mountain biodiversity. In the face of predicted impacts of climate change, mountain protected areas appear to be like "islands in the sky" (Price et al., 2011), disconnected and isolated in a sea of surrounding land-use. The new developments in sustainable management of wildlife population calls for the increase in size to include the arguably richest diversity potential represented by the mountain forest strata but also for the establishment of conservation corridors between these protected areas, even across international boundaries. This requires a higher level integration of policies at national level and a greater collaboration scale at sub-regional and regional level.

In their literature review of strategies recommended to help species cope with impacts of climate change (Heller and Zavaleta (2009), and Ayebare et al. (2013)) found that improving landscape elevation connectivity so that species can move is the most frequent recommendation for climate change adaptation. Top-down approach may not be the best approach in creating connectivity. Instead, facilitation of land rights use, local community participation in the required land-use change can benefit local communities especially through ecotourism schemes between current protected areas. Empowered and well informed local communities have proved to be key to managing changes imposed from outside; in the case of biodiversity, a functional network of protected areas is an essential starting point for genetic reservoirs and monitoring stations.

The involvement of local users in conservation has facilitated conservation activities and increases the economy of people living around protected areas in Uganda. Through the process of consultation, local residents increased awareness of conservation issue and disputes between conservation authorities and local users has been reduced. People discuss their local environment issues (water shortage and forest conservation).

4.6 Community Involvement in Sustainable Forest Management

Effective community involvement relies on a strong relationship between state, private sector and community on privately owned land. The involvement of private sector on private land has caused problems in some countries (land degradation and deforestation in Uganda), but in some countries it has led to better management for example in Zimbabwe and Namibia, and some conservancies in Kenya have started to demonstrate that it can work and generate lasting benefits for all.

Formal or informal interest or user groups emerged to use and manage resources, often with accompanying rules and regulations and in some instances such community based practices have helped to inform policy changes. Actively supporting and strengthening local management capacity to support community and resource user needs will be important to enhancing community and user group livelihood security. Empowered and

well informed local communities have proved to be key to managing changes imposed from outside.

Millennium Assessment review (Körner and Ohsawa 2006) concluded that mountain farming systems involve multiple land use activities and diversified production systems that adapt/amend the natural resources (such as through water harvesting or terracing). This has resulted in diversified and context-specific farming systems characterized by positive social system–ecosystem links. In nearly all mountain regions, non-timber forest products are an important adjunct to traditional agriculture.

4.7 Science and Technology

Science and technological innovations have the potential to provide solutions to a number of critical problems, reduce negative impacts of drivers of change and improve lives of communities even in remote mountain areas in developing countries such as those in Sub-Sahara Africa.

Solar, wind energy and small-scale hydropower have brought enormous benefits in regions where costs prevent power line extension projects. The Millennium Ecosystem Assessment recognised information technology as the single most promising technology for mountain communities, with potential to overcome access barriers that currently limit educational opportunities for tens of millions of mountain families. Scientific studies in modelling the severity and impacts of drivers of changes such as climate change or population growth are helping better plans for adaptation however the lack of knowledge capacity means that adaptation gaps remain not only in understanding of the impacts in many mountains but also in the development of the required solutions.

4.8 Creation of jobs

Creation of jobs in industry (small and large), and services in general could provide real alternatives to agricultural resource overuse. One of the biggest weaknesses in natural resource use is that local communities gain little or no benefits from external exploitation of these resources whilst they bare the brunt of the resulting impacts. Solutions being tried or recommended at different scales of the continent is to bring back local communities to be primary beneficiaries among all stakeholders. This ideal is not easy to achieve particularly when there are commercial interests involved however governments, as regulatory authorities can oversee and facilitate the awareness and capacity building which is urgently required for the local community and give them adequate representation in management structure to defend their rightful share of the benefits.

Table 1: National Adaptation Programme of Action – top 3 priorities for some mountainous countries

Country	Three top ranking priorities (all sectors)
Angola (2011)	1.Promote alternative renewable energies for avoided deforestation 2. Promote SLM for increased agricultural yields 3. Ensure basis access to health services and health monitoring
Burundi (2007)	1. Improve seasonal early warning climate forecasts 2. Safeguard existing woodlots and reforest stripped areas 3. Enhance the management of existing protected areas
Eritrea (2007)	2. Community-based rangeland improvement and management in selected agro-ecological areas 3. Community-based projects to intensify existing livestock production models
Ethiopia (2008)	1. Promote drought/crop insurance program in Ethiopia 2. Strengthen/enhance drought and flood early warning systems in Ethiopia 3. Develop small scale irrigation and water harvesting schemes in arid, semi-arid and dry sub-humid areas in Ethiopia
Guinea (2007)	1. Strengthen wildfires control and restricted forest reserves management 2. Promote agroforestry 3. Promote installation and integrated management of small hydropower projects
Madagascar (2006)	1. Renovate or put in place new sea defences 2. Establish/restore local water management associations 3. Support the intensification of agriculture and livestock production
Malawi (2006)	2. Enhance food security and developing community based storage systems for seed and food 3. Improving crop production through the use of appropriate technologies
Uganda (2007)	1. Promote community best practices of collaborative natural resource management 2. Promote tree growing in farmland 3. Promote community best practices of collaborative water resource management / Enhance water supply to communities adjacent to Protected Areas

Source: Extracted from NAPAs submitted to UNFCCC (UNFFC, 2013b)

CHAPTER 5
KEY POLICY QUESTIONS AND RECOMMENDATIONS FOR ACTION

African Mountain Partnership members during a meeting in Kigali, Rwanda. Photo credit: ARCOS

5.1 Key Policy Issues in Mountains

Africa has many mountain ecosystems that cross political borders-shared by two or more neighbouring countries- but most of them are managed using administrative boundary and risk losing some of their areas due to the unbalanced efforts between riparian countries. Mount Nimba Strict Reserve for example is a trans boundary protected area shared by Guinea, Côte d'Ivoire and UNESCO World Heritage site (STEWARD, 2013) however while parts of guinea and Cote d'Ivoire are well managed, the part of Mount Nimba massif which extends into Liberia is not protected and is vulnerable to mining activities (UNEP, 2014).

Mountains need policy attention at all levels not only because of their unique ecological, social and economic importance to both upland and lowland communities but also because of the increasing vulnerability of mountain ecosystems and people to various threats including unsustainable overuse of natural resources, mostly exacerbated by climate change. Mountains have a global importance but are fragile ecosystems. People living in mountain regions are among the world's poorest; around 40-60 % of the mountain population in Africa are estimated to be vulnerable to food insecurity (FAO, 2003).

The current legal/policy frameworks and institutions involved in sustainable mountain development for healthy mountain ecosystems and communities are relatively weak in most of African countries (Owen J, and Gregory F., 1997).

There are very few countries with mountain specific laws. Uganda in 2000 enacted the Hilly and Mountainous Area Regulations and South Africa has the Mountain Catchment Areas Act of 1970 (Table 2).

There is still lack of awareness of the mountain agenda and in some cases, national policies and strategies are too broad and less specific to address mountain issues.

Also, some national policies (If they exist) lack the consideration of some emerging issues such as climate change adaptation strategies in mountains.

The other challenge is that most regional and national policies and strategies do not address trans-boundary mountain matters. Developing specific policies for mountains or otherwise mainstreaming the mountain agenda in spectral

Transboundary Volcanoes Landscape. Photo credit: Uganda Mountain Club

policies in Africa is still a challenge as mountains are managed under legislations related to lowlands environment yet mountains have unique characteristics quite different to lowland areas.

Consequently there is inadequate policy and institutional framework to guide sustainable management of mountain ecosystems and communities otherwise mountain issues remain unplanned and unbudgeted for. There is therefore a need to formulate and implement strategies, programmes, policies and laws that specifically address mountain issues at ecosystem, transboundary, regional and national levels and respond adequately to current challenges for mountains ecosystems and communities such as climate change, food security, water scarcity, energy problems.

Table 2. Main Examples of Domestic Legislation Specific to Mountains in Sub Saharan Africa

Country	Mountain law/policy
Burundi	Forest Act of 1985.
Equatorial Guinea	Law No. 1/1997 - Use and management of forests.
Namibia	Mountain Catchment Areas Act, 1970.
Nigeria	National Environmental Regulations (Watershed, Mountainous, Hilly and Catchments Areas) 2009.
South Africa	1. Mountain Catchment Areas Act (MCAA) of 1970. 2. Assignment to provinces under the Mountain Catchment Areas Act in accordance with section 235(8) of the Constitution of South Africa (GN. R. 28 of 1995). 3. Regulations made under the Mountain Catchment Areas Act, 1971.
Tanzania	Environmental Management Act, 2004 (No. 20 of 2004).
Uganda	1. National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001 (S.I. No. 59 of 2001). 2. Guidelines on the management of hilly and mountainous areas. 3. National Environment (Mountainous and Hilly Areas Management) Regulations, 2000 (No. 3 of 2000).

5.2 Mountain Agenda in International and National Policies

Globally, mountains are relatively recognised compared to regional and national levels in Africa. Among the international considerations of mountains include the United Nations Conference on Environment and Development (UNCED) in 1992 whose outcome document "Agenda 21" highlighted the need to manage mountain resources in chapter 13 "Managing Fragile Ecosystems: Sustainable Mountain Development".

Other international agreements that call for the protection of mountains include: the Convention on Biological Diversity (CBD), the UN Framework Convention on Climate Change (UNFCCC), the UN Convention to Combat Desertification (UNCCD) and the United Nations Conference on Environment and Development held in Rio commonly called RIO+ 20; whose outcome document" The future we want recognised mountains by incorporating 3 paragraph (210,211,212) on mountains.

5.3. Recommendations for Actions

Sustainable mountain development requires holistic approaches that integrate various aspects, multi-stakeholder cooperation, forward-looking institutions and political will from mountain countries. As such, there is a need to formulate and implement strategies, programmes and policies that specifically address mountain issues at ecosystem, landscape, national and regional (Transboundary) levels and respond adequately to current challenges for mountains ecosystems and communities.

To achieve sustainable mountain development, both international, regional and national policy processes may wish to consider the following recommendations.

- **Strengthen existing, establish new and innovative national, regional and international institutions and mechanisms on mountains.**
- **Develop holistic/integrated, specific policy and institutional frameworks that deal specifically with mountain issues and ensure intersectional collaboration.**
- **To support forward-looking political decisions that safeguard the natural resources in mountain areas for future generations.**
- **Promote initiatives for transboundary cooperation with particular attention to upstream–downstream linkages and for trans-boundary mountain terrestrial ecosystems.**
- **Policies should consider the importance of mountains (in terms of goods and services provided) to lowland areas and propose strategies to conserve mountain ecosystem for sustainable provision of the services. The adequate compensation for the use of these resources should be granted to mountain areas as part of a comprehensive arrangement between highland and lowland systems.**
- **To create mechanisms for investing in mountains and for sustainable funding for mountain development such as REDD and REDD-plus programmes and through better integration of the private sector.**
- **Through mountain people's active engagement in decision-making processes, ensure that indigenous cultures, traditions and knowledge are fully recognized and included in development policy and planning in mountain regions and that access and agreed-to rights to land and natural resources are respected.**

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