

Scaling Up Mountain Ecosystem-based Adaptation

Building Evidence, Replicating Success, and
Informing Policy



Spring Workshop 2018 | Columbia University's MPA in Environmental Science and Policy

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Cover Photo: Kelsey Wooddell / Cordillera Huayhuash

Executive Summary

This report, written by students in the Master of Public Administration in Environmental Science and Policy Program at Columbia University's School of International and Public Affairs for the 2018 Spring Workshop in Applied Earth Systems Management, contains the collected deliverables of the Scaling Up Mountain Ecosystem-based Adaptation project. These documents were produced for the International Union for Conservation of Nature (IUCN) in support of their efforts to scale up their implementation of Ecosystem-based Adaptation (EbA) in vulnerable mountain communities of six countries around the world.

Ecosystem-based Adaptation is an approach that leverages biodiversity and ecosystem services as a part of strategies to help people adapt to the adverse effects of climate change. The three pillars of EbA are biodiversity conservation, climate change adaptation, and socio-economic development; any measure that contains or contributes to all three of these facets can be considered EbA.

Mountain ecosystems are well suited to the inclusion of EbA in adaptation planning. Mountains all over the world provide indispensable ecosystem services, such as the capture and storage of fresh water not only for the communities living on the mountain, but also the millions living downstream. Delicate mountain ecosystems are particularly vulnerable to the damaging effects of climate change, as climatic patterns such as temperature and seasonal rainfall are altered. Finally, many mountain communities are socio-economically marginalized, offering a unique opportunity for adaptation measures to help these communities leverage their local ecosystems to diversify and enhance their livelihoods.

IUCN began its mountain EbA program in Uganda, Nepal, and Peru. Today, the organization plans to scale-up EbA initiatives in these “flagship” countries, as well as expand the program to Kenya, Bhutan, and Colombia.

In support of this scaling-up process, the team produced a Situation Analysis and a Policy Brief for each country. The Situation Analyses are comprehensive outlines of each country's political and economic background, climate-related threats, mountain ecosystems, climate adaptation policies, and recommendations for the inclusion and implementation of EbA. The Policy Briefs condense this information into two-page summaries focused on the recommendations for each country, in order to act as an EbA-focused resource directed specifically at policy- and decision-makers.

In order to produce these documents, the team utilized scholarly journals, policy documents, and interviewed on-the-ground contacts to conduct research into each country's economics, governance, policies, and environment in each project region. While conducting this research, the team also compiled a database of other worldwide EbA initiatives to be used by IUCN and TMI in the further implementation of this project.

Policy Briefs

Scaling up Ecosystem-based Adaptation in Mountains - Uganda

Ecosystem-based Adaptation



Source: Adyeri / Flickr

Recommendations

Incorporate mountain specific Ecosystem-based Adaptation (EbA) in the district development plans. District plans are more effectively implemented and they provide the appropriate legislative scale for ecosystem management, accounting for the unique nature of each mountain ecosystem. The lack of implementation of national policies, including those that address EbA measures, suggests that there is a lack of capacity and funding to support initiatives at the national level. District level policies driven by communities, as well as inclusive, gender equitable participation, can increase the likelihood of implementation success for EbA initiatives.

Introduction

The mountains of Uganda are among the most biologically diverse zones in Eastern Africa. Water, forests, wildlife, and biodiversity originating from these ecosystems form the basis for much of the country's socioeconomic development in the agricultural, tourism and health sectors.¹

Agriculture remains the backbone of Uganda's economy. In 2017, the sector accounted for 24.5% of the country's GDP and it employs about 60% of the total labor force (formal and informal). The vast majority of the rural population engaged in agriculture are women and youth.² Lower education levels among women in rural areas affect their ability to access information, agricultural extension services, and improved technologies. Consequently, female-managed farms are 60% smaller and 11% less productive on average than their male counterparts'.

With approximately 54% of the population still dependent on subsistence farming, it becomes apparent that sustainable development and natural resource conservation are integral to poverty reduction.^{3 4} EbA approaches can provide holistic solutions to issues such as food insecurity, freshwater availability, and poverty while conserving natural resources.

Background

Agriculture in the Mt Elgon region is primarily rainfed and even though the soils are volcanic and thus fertile, the increased occurrence of erratic weather events, the use of unsustainable agricultural practices and rapid population growth have strained the ecosystem and exposed the population to food

insecurity. Mt Elgon is also an important water tower and a catchment area for Lake Victoria.⁷ As a result, the state of the ecosystem and the services that it provides affect not only the surrounding populations but also the people living downstream. Major effects of climate change are already evident and include soil fertility loss due to droughts and floods, deadly landslides and disease emergence such as malaria in highland zones because of increasing temperatures.

Uganda has made significant efforts to reduce poverty levels driven by Vision 2040, the overarching national strategy that aims to transform Uganda into a competitive upper-middle income country.⁵ Recognizing that these efforts can be reversed by the impacts of climate change, Uganda has prioritized adaptation by incorporating climate change related provisions in the domestic legislation and policies.⁶ EbA measures are explicitly mentioned in Uganda's Second National Development Plan (NDC II) and National Climate Change Policy. EbA-type approaches, although not always explicitly identified as such, are also proposed in several national policies such as the National Biodiversity Strategies and Action Plan (NBSAP II) and the National Adaptation Programme of Action (NAPA).

The Uganda National Development Plan and Vision 2040 recognize that the climate of Uganda is its most valuable natural resource and a major determinant of the health of its soils, water, forests and wildlife, and consequently of the human activities dependent on them. However, the impacts of climate change (droughts, floods, storms, heat waves) and Uganda's rapidly growing population, pose a significant threat to the country's food security, water supply, livelihoods, and sustainable development.

insecurity. Mt Elgon is also an important water tower and a catchment area for Lake Victoria.⁷ As a result, the state of the ecosystem and the services that it provides affect not only the surrounding populations but also the people living downstream. Major effects of climate change are already evident and include soil fertility loss due to droughts and floods, deadly landslides and disease emergence such as malaria in highland zones because of increasing temperatures.

Analysis

The unsung heroes of ecosystem services, mountains, were given a place in the spotlight through the global EbA in Mountains Programme, implemented by UNEP, UNDP and IUCN. The program was successfully implemented in the Mt Elgon region, where rapid population growth has stimulated the expansion of unsustainable agricultural activity and encroachment in the mountain's fragile forest ecosystem.⁸

The pilot program addressed two of the major concerns in the Mount Elgon ecosystem: water insecurity and stalled development of mountain livelihoods. The implementation of a gravity flow scheme in Sanzara, an area in the rain shadow of Mt. Elgon, created an effective catchment management system to restore and manage the Mt. Elgon water tower. Community involvement was harnessed in both upstream and downstream communities to restore river banks, implement soil and water conservation measures, and plant drought tolerant species to reduce erosion.

The combination of these measures decreased sedimentation by 20% within one year.⁹ The initial gravity flow scheme, allowed for more water to be extracted for agricultural practices which in turn increased the quantity and variety of food produced. This program enhanced self-sufficiency, food security, and secured stable income for community members.



Villagers assisting the construction of the gravity flow scheme in Sanzara, Uganda Photo credit: IUCN

Conclusion

Stakeholders from governmental, inter-government, and the private sectors should come together to promote a landscape approach to meet the need of the local population while protecting environmental integrity. EbA measures can be utilized to enhance Uganda's existing Vision 2040 goals through community-driven action at the ecosystem scale. In the case of Mt. Elgon, transboundary ecosystem management will be integral for the successful implementation of EbA. For this reason, the creation of a forum that will facilitate inter-district collaboration for the implementation of EbA initiatives in the Mt. Elgon ecosystem is encouraged.

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¹ Uganda Climate Adaptation Policy Analysis, IUCN

²[The World Factbook, CIA, 2012](#)

³ [Farm Africa, 2018](#)

⁴ [Ministry of Finance, Planning and Economic Development, Poverty Status Report, 2014](#)

⁵ [Vision 2040, GoU, 2007](#)

⁶[INDC, Ministry of Water and Environment, 2015](#)

⁷ [Protected Areas in Kenya – The case of Mt Elgon, Indigenous Information Network, 2008](#)

⁸ [Mountain Ecosystem-based Adaptation in Uganda, UNDP, 2018](#)

⁹ [Making the case for ecosystem-based Adaptation: the Global Mountain EbA Programme in Nepal, Peru and Uganda, UNEP, IUCN, UNDP, 2015](#)

Scaling up Ecosystem-based Adaptation in Mountains - Kenya

Ecosystem-based Adaptation



Source: Tholo / Wikipedia Commons

Recommendations

Mountain ecosystems provide a variety of ecosystem services that are essential to Kenya's economic growth, water and food security and Vision 2030 targets. Thus, it is recommended that mountain specific Ecosystem-based Adaptation (EbA) strategies be included in the Vision 2030 fourth Medium Term Plan (MTP) as a climate change adaptation strategy to address water and food security and promote sustainable development. EbA helps people adapt to the effects of climate change through the conservation, sustainable management and restoration of natural ecosystems. A focus on regional and intercounty collaboration for policy implementation is essential for managing shared resources and transboundary ecosystems. Additionally, engaging female stakeholders in any proposed land-use change will become critical as the gender gap in Kenya continues to narrow.

Introduction

Mountain ecosystems, including the Aberdare Mountains, the Cherangani Hills, Mt. Elgon, and Mt. Kenya, represent four of Kenya's five water towers. These regions are vital national assets in terms of climate regulation, flood and erosion control, groundwater recharge, and carbon storage and sequestration.¹ Kenya's water security is thus determined by the health of its mountains.

Kenya's economy is highly dependent on rain-fed agriculture, ecotourism, and the services industry. The natural beauty of Kenya's mountains lures many visitors, supporting a booming ecotourism industry. Economic growth over the past decade has been driven by the service industry, yet the base economy is still largely dependent on agriculture. The agricultural sector accounts for about 26% of the country's GDP and 50% of the country's revenue from exports.² However, this excludes more than 70% of the rural population who depend on subsistence farming.³

Considering 23% of the country is classified as mountainous, the provisioning and regulating services provided by mountain ecosystems are integral to the well-being and prosperity of the rural populations.⁴ In fact, millions of farmers live on the slopes of mountain forest ecosystems and depend on their rich volcanic soils and micro-climatic conditions for the production of high-value crops, such as banana, tea and coffee.⁵ However, the fact that agricultural production in the

mountains is primarily rainfed, renders the local populations defenseless against the variation in weather patterns. The ongoing biodiversity conservation efforts in many of the country's mountainous forests have excluded the locals from utilizing the mountain's natural resources, thus, increasing their exposure to food insecurity and poverty. EbA approaches have great potential to reduce the population's vulnerability to climate change induced water and food insecurity and provide significant co-benefits for biodiversity and the environment.⁶

Climate change is expected to exacerbate existing stressors on the country's natural resources and potentially compromise the Vision 2030 target of transforming Kenya into a newly industrialized, middle-income country.⁷ The goal of this national long-term development policy is to achieve a 10% growth in GDP by 2030. However, the impacts of climate change as well as the country's rapid population growth, will inevitably result in heavy demand for water, food, and other limited natural resources.

Justifiably, Kenya's Vision 2030 has identified key goals to include: rehabilitation of indigenous forests in Kenya's five water towers; build water conservation structures along major rivers; increase forest cover by 10%. It is therefore clear that the preservation of Kenya's natural resources is key for the sustainable development of the country for which EbA can present an effective method.

Background

Cognizant of the vulnerabilities induced by these changes, Kenya has incorporated climate change mitigation and adaptation commitments into the country's national policies. EbA type approaches have already been proposed in Kenya's National Climate Change Response Strategy (NCCRS), National Climate Change Action Plan (NCCAP), National Adaptation Plan

(NAP) and Intended Nationally Determined Contribution (INDC). EbA-type approaches are also included in sector specific policies.

For example, Kenya's National Water Master Plan 2030 prioritizes the evaluation and management of the country's water resources to address their vulnerability against climate change impacts and

human driven degradation.⁸ Respectively, Kenya Climate Smart Agriculture (CSA) Strategy recognizes the importance of promoting food and nutritional security while adapting to climate change and building resilient agricultural systems.⁹ However, to harness the full potential of ecosystem based strategies, it is

important to explicitly include EbA in the existing policies. Such measures can contribute to both the Kenya Vision 2030 goals for socioeconomic development, as well as several UN Sustainable Development Goals.

Analysis

EbA measures, while not directly indicated as such, have already begun to influence adaptation methods in Kenya. One such example is the Greening Project in Mount Elgon Ecosystem conducted by the Green Belt Movement (GBM).¹⁰ GBM was formed to meet the demands of rural Kenya women who were concerned about drying river beds, inconsistency with food supply, and accessibility to firewood. The Greening Project in the Mount Elgon Ecosystem was chosen for its importance as a water tower for the country. In 2015, the local GBM community in Bungoma County planted 124,000 indigenous seedlings to regulate floodwater, drought, soil erosion, water quality, groundwater recharge, and micro-climate in the region.

GBM empowers local women by having them plant trees, which gives them the customary right to have a say in how the trees and areas around them are managed. This provided them economic incentives to sustainably manage their trees.

Participants were trained in rain water harvesting and sustainable agricultural practices with the aim of diversifying their livelihoods and generating personal income. This program highlights the potential success of incorporating EbA into land management practices in Kenya. The regional significance of GBM shows the importance of transboundary collaboration to improve the sustainable development of shared resources. GBM is one example of how a regional entity can mobilize communities and cultivate cross-sector partnerships through EbA measures.



*Women participating in the GBM working their farms.
(Photo credit: Sisters of Resistance)*

Conclusion

Kenya Vision 2030 has been the overarching framework informing policies over the past decade.¹¹ The goals and progress are set and monitored in the MTPs which are released every five years. Within the third MTP, which extends from 2018-2022, climate change is recognized as an emerging challenge with the potential to result in up to 2% annual losses to Kenya's GDP.¹² The role of the third MTP is to continue to move the economy towards a 10% economic growth rate by the end of 2022. By integrating EbA measures into the fourth MTP, Kenya will be able to support the intended growth target while creating a more sustainable society and mitigating the negative impacts of climate change on the economy.

While incorporating EbA measures into the national policy ensures national goals are met, collaborative language should be included to galvanize regional, and especially bilateral, cooperation to protect transboundary ecosystems. Bungoma and Trans-Nzoia could also benefit from incorporating EbA programs and projects into each of their five-year County Integrated Development Plans (CIDPs), in which case, intercounty coordination will be necessary to exchange knowledge regarding best practices. Lastly, improving women's access to agricultural inputs and extension services may also be a ready way to offset the rise in unsustainable farming practices in rural areas.

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¹[Rhino Ark, Fact Sheet 3, Importance of Kenya water towers](#)

²[Kenya at a Glance, FAO, 2018\]](#)

³[Sector Brief, Agriculture: Established & Emerging Trends, Kenya Business Guide, 2017](#)

⁴[Mountain Farming is Family Farming, FAO, 2013](#)

⁵[De Bauw et al., Soil fertility gradients and production constraints for coffee and banana on volcanic mountain slopes in the East African Rift: A case study of Mt. Elgon, 2016](#)

⁶[Ecosystem Based Adaptation, Conservation International, 2017](#)

⁷[Vision 2030, GoK, 2018](#)

⁸[Vision 2030 Social Pillar, GoK, 2018](#)

⁹[Kenya Climate Smart Agriculture Framework Program, Ministry of agriculture livestock and fisheries, Ministry of environment and natural resources, 2015](#)

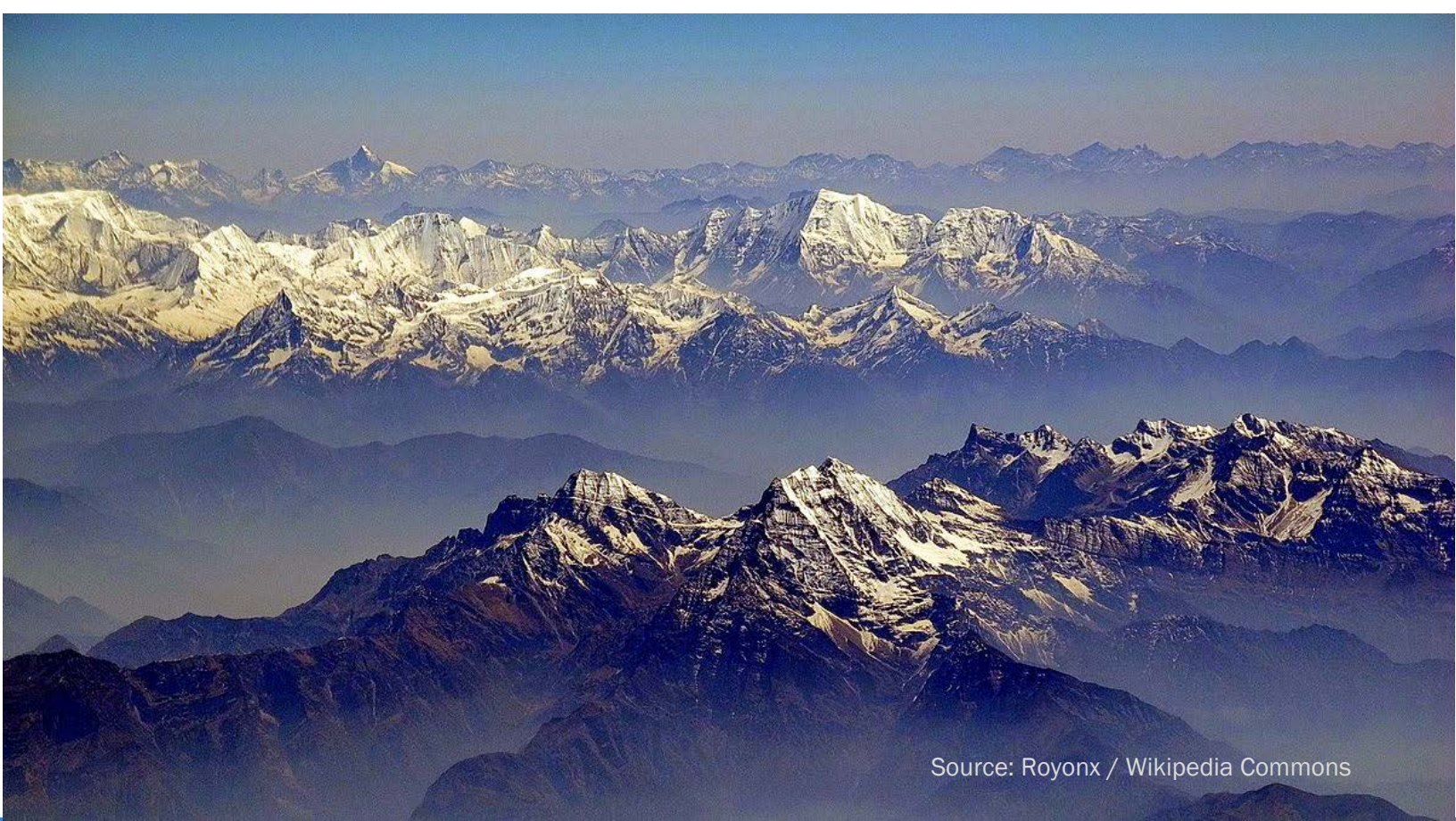
¹⁰[Green Belt Movement Annual Report, 2015](#)

¹¹[Vision 2030 Social Pillar, GoK, 2018](#)

¹²[Concept Note on Medium Term Plan 2018-2022, GoK, 2017](#)

Scaling up Ecosystem-based Adaptation in Mountains – Nepal

Ecosystem-based Adaptation



Source: Royonx / Wikipedia Commons

Recommendations

As a central tool for implementing the policy objectives outlined in Nepal's National Adaptation Programme of Action (NAPA) and the National Climate Change Policy, the Local Adaptation Plans for Action (LAPA) Manual should include Ecosystem-based Adaptation as one of the main principles underlying the development of local adaptation plans.

Introduction

Ecosystem-based Adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. As the changing climate makes Nepal's mountain communities more vulnerable to e.g. droughts, glacial melt, and increased intensity of rains, EbA has proven to be a promising approach to reducing these adverse impacts. For example, restoring the degraded freshwater ecosystem in the Parbat District, Panchase has provided the local community with a reliable source of clean water in a changing climate.¹

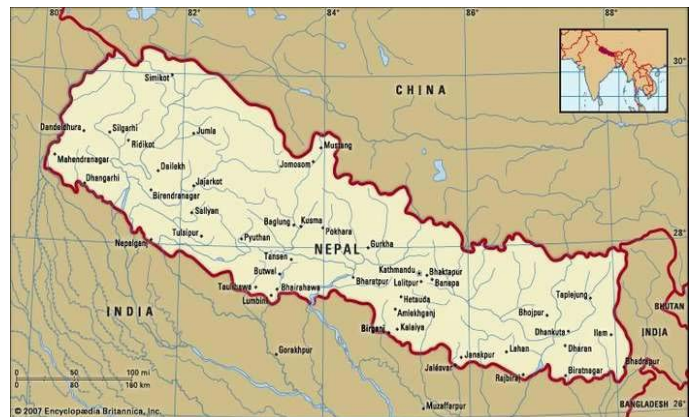
The EbA approach is characterized by providing three benefits at once: i) adaptation to climate change; ii) conservation or sustainable management of ecosystems; and iii) socio-economic and cultural co-benefits for local communities.² The approach is holistic, meaning that failure to integrate the three pillars potentially undermines progress in other areas.

Background

Climate change in Nepal: Temperatures in Nepal are rising at a faster rate than the global average; the mean annual temperature is projected to increase by an average of 1.2 degrees Celsius by 2030 and 1.7 degrees Celsius by 2050 when compared to 2000 pre-baseline. In addition, warming is more pronounced in high altitude regions compared to the Terai and Siwalik regions. 80% of Nepal's annual precipitation falls during the monsoon season and will increase by 15 to 20% due to warmer temperatures, while winter rainfall is expected to decrease. As such, climate change is going to exacerbate the contrast between wet and dry seasons, which will result in an increase of rainy season downpours that are both extreme in intensity and duration. Furthermore, higher temperatures, increased rates of evapotranspiration and decreased winter precipitation may increase instances of drought. These climatic changes are expected to cause a spread of invasive species, a shift of species from lower to higher altitudes, water stress, climate induced disaster, and threats to certain important species (e.g. orchid, rhododendron).

For example, while damming a river might adapt a community to increased glacial melt, it also involves the risk of undermining the provisioning services that the ecosystem provides, for example healthy fish populations. Therefore, EbA should be an integrated part of adaptation planning in Nepal.

To some extent, EbA as a concept has already found its way to national policy documents. For example, Nepal's Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) explicitly recognizes the value of EbA. Likewise, a number of EbA-related strategies are present in the National Adaptation Programme of Action (NAPA). However, the crucial manual for formulating Local Adaptation Plans for Action (LAPAs) does not encourage EbA measures. This policy brief argues that the Nepali national government should make sure EbA becomes part of the local adaptation planning process by including it among the guiding principles of the LAPA Manual.



The population of Nepal is largely rural (roughly 70%), and poverty is generally more severe in rural areas – particularly in mountains. Approximately 84% of the population depend on subsistence agriculture for livelihoods and food security. Life in poverty combined with close dependence on local ecosystems make the Nepali people very vulnerable to environmental change. In remote mountainous regions, many of the poorest reside in areas prone to flooding or landslides, further exacerbating the threats of climate change.

Policy background: Formulated in 2010 and submitted to the UNFCCC, the NAPA is a strategic tool to assess climatic vulnerability and systematically respond to climate change adaptation issues by developing appropriate adaptation measures. It discusses needs, practices and options across different climate adaptation sectors, and presents priority adaptation projects. The LAPA Framework supports the operationalization of the policy objectives outlined in the NAPA by facilitating the

integration of climate change resilience into local-to-national development planning processes and outcomes. While the LAPAs are to be formulated at village development committee (VDC) level, the LAPA Manual (2013) provides guidance on the process including how to prepare, integrate, implement, and assess each of the 3,157 plans.³ As of 2016, 101 have been prepared and are under implementation in some of the country's most climate vulnerable district.⁴

Analysis

Analysis of Nepal's major national climate policies shows that, while EbA is not a dominant concept, it is explicitly or implicitly mentioned in certain central documents. For example, the Nationally Determined Contribution (NDC) – submitted to the UNFCCC in 2016 – explicitly recognizes the value of EbA, and four out of nine national adaptation priorities identified in the NAPA (2010), are implicitly or explicitly ecosystem-based.

Similarly, the Strategic Program for Climate Resilience (SPCR) from 2009 explicitly mentions EbA as a core principle underlying its projects. However, the critical Climate Change Policy from 2011 only scarcely references EbA, and the LAPA Manual, despite its comprehensiveness, does not mention EbA as a concept or principle for local planners to consider when developing adaptation plans. References to EbA are entirely absent from the Manual's guiding principles and criteria for prioritizing adaptation actions (the four guiding principles for the LAPA Framework are bottom-up planning, inclusiveness, responsiveness, and flexibility).

The LAPA Manual exists to directly shape the formulation of local adaptation plans. The LAPA for Khumba in North Western Nepal, for instance, describes how “[e]ach step [of the LAPA Manual] was carefully considered as to why it is important and what actions should be undertaken.” The authors of the technical report, both from The Mountain Institute, make it clear how closely the Manual was consulted in the formulation of local adaptation priorities. To the extent that local policy makers stringently follow these steps in other VDCs, this indicates that local adaptation planning is in fact being shaped the LAPA Manual. Incidentally, it also shows that EbA was not mentioned or referenced as a concept or approach to climate change adaptation in Khumbu.

These results exhibit the risk that EbA approaches are systematically filtered out from the local adaptation planning processes as a consequence of the current form of the LAPA Manual. By explicitly including EbA among the guiding principles of adaptation planning in the LAPA Manual, the chances that ecosystem-based approaches to adaptation play a more prominent role in local plans are expected to increase significantly.

Conclusion

The Local Adaptation Plans for Action (LAPA) are crucial pieces of Nepal's climate change adaptation strategy. To ensure synergies between adaptation, ecosystem conservation, and socioeconomic development, local policy makers should be encouraged to incorporate Ecosystem-based Adaptation approaches when designing their adaptation plans. To promote the use of EbA at the local level, the Ministry of Science, Technology and Environment should add ecosystem-based adaptation to the LAPA Manual's list of guiding principles.

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¹ T. Rossing, N. Chhenjum Sherpa and A. Egan. (2015) "Water source restoration and conservation: Improving ecosystem resilience in the mountains of Nepal". [Online] UNDP. Retrieved from: <https://undp.exposure.co/challenging-gender-roles-and-crossing-castes>

² Based on the UNCBD definition.

³ Bahadur et al. (2017). Nepal's Approach to Climate Change Adaptation with Local Adaptation Plans for Action (LAPAs): a Water Resource Perspective. Global Water Partnership. Retrieved from <https://www.gwp.org/contentassets/731a9cc2fdde482abe2ce1622034d595/wacdep-case-study-nepal.pdf>

⁴ Ibid.

Scaling up Ecosystem-based Adaptation in Mountains - Bhutan

Ecosystem-based Adaptation



Source: Wolfgangbeyer / Wikipedia Commons

Recommendations

Given the increased economic importance of the forestry, agriculture and hydropower sectors due to their significant contributions to Bhutan's national GDP per capita, the key recommendations have been formulated to integrate ecosystem-based adaptation processes (EbA) into the respective policies, strategies and plans related to the three sectors. These recommendations are:

1. Prioritizing research in the potential use of forest management as EbA.
2. Stronger need for including adaptation strategies in the Climate Smart Agriculture (CSA) Strategy within the National Agricultural Policy.

Introduction

Ecosystem based adaptation is a form of sustainable development in communities whereby the focus is purely on the socio-economic benefits, climate change adaptation and biodiversity and ecosystem conservation. The failure to integrate these three pillars leads to a situation where other efforts are potentially undermined. EbA is most accepted and successful in communities where a culture of protecting the natural environment in the long term despite the attractive and lucrative short-term financial gains is in place.

Furthermore, EbA is also most successful in regions where the implications of climate change will be catastrophic and thus adaptation strategies are needed not only for increased economic development and conservation of biodiversity but also for the well-being and existence of the community. EbA is also successful in communities with a focus on expanding their economy. Hence these particular characteristics, make Bhutan an ideal location for this particular form of sustainable development.

Background

Bhutan's Himalayan range is directly connected to the rest of the ecosystems. As mentioned earlier, any glacial flooding affects soil erosion rates, water sources, agricultural yields, and human life. Since the 1800s there have been over 21 GLOFs, 4 of which have happened since 1970. The most recent GLOF took place in 1994 which resulted in 22 deaths, almost 2,000 acres of agricultural damages, and 6 tons of food supply being destroyed. Since there have been four GLOFs since the 1970s, and average temperatures increasing in Bhutan, it is expected that there will be more instances of GLOFs in Bhutan.² These floods also have direct impacts on forest lands

Bhutan is a landlocked country in Southern Asia and is surrounded by India and China. Over 70% of Bhutan's land area is covered by forest ecosystems, while the rest is alpine, aquatic, and agricultural. Bhutan's mountain ecosystem has biological, physical, and topographic characteristics that make it dependent on factors such as climate change and agricultural development. It is crucial for there to be policies constructed and implemented related to mountain ecosystems, as they directly affect the forest ecosystems in Bhutan. This is because glaciers in the Himalayas (located in Bhutan) are receding at a high rate, which is causing increasing instances of glacial lake outburst floods, or GLOF. These upstream floods affect the water sources downstream where the forests and agricultural lands are located. As a result, soils, water bodies, and even the air are all affected by these mountain floods.¹

Another implication of increased temperatures leading to GLOF's amongst other threats such as soil erosion, landslides and droughts to name a few, damage to hydropower infrastructure.

with increased flooding leading to a dramatic decrease in forest lands.

Focusing on the three sectors that contribute the most to Bhutan's national GDP, there are certain policies and strategies that have been put in place, however there are gaps in terms of how each of these actually incorporates EbA in the general framework. The policies are:

1. The National Forestry Policy (2009)
2. National Agricultural Policy
3. Climate Smart Agriculture (CSA) strategy
4. 11th Five-Year Plan

Analysis

Analysis of these main policies and strategies showcase that while although EbA is not explicitly stated it is alluded to in most of these policies and strategies.

Forestry: After analyzing the National Forest Policy document, we have identified that it does not attempt to integrate ecosystem conservation with climate change adaptation. An example of this would be forests that are strategically managed and conserved which will reduce the impacts of soil erosion and the likelihood of forest degradation as well as landslides, but such opportunities are not being identified, explored and acted upon in the current policy.³

Calls for more support in the form of relevant research to “support policy implementation and development including integration of climate change issues” is currently occurring which is a positive sign. Bhutan should act on this and prioritize research in the role of forests in EbA in order to harvest the synergetic benefits of conserving forest ecosystems in mountains.

Alternative Recommendation

Although we have focused on sector specific policies we do have to realize that EbA might not be the most productive way for these sectors to contribute as heavily as they do to the national economy. Hence, it might be wise to focus on strategies and plans in certain key locations of Bhutan or even programs that allude to EbA that are helping certain key regions that other intergovernmental organizations are carrying out. For example, the World Bank has earmarked

Agriculture: Bhutan's National Agricultural Policy mentions climate adaptation implicitly, but there is a stronger need for a clear, comprehensive policy that lists adaptation strategies. Bhutan's Climate-Smart Agriculture (CSA) strategy which is a part of the National Agriculture Policy is an excellent initiative because it asks for the “integration of agriculture development and climate responsiveness.”⁴ Although mentioning the need for strategies to avert climate change impacts, Bhutan's CSA targets climate mitigation rather than climate adaptation strategies. Furthermore, improvements in implementation strategies should be formulated. Although there are CSA technologies that are in theory ways to improve agricultural resiliency, farmers and the agricultural community as a whole are not necessarily familiar with the concepts. Therefore, a gap in this strategy would be the lack of focus on climate adaptation strategies and the lack of education and outreach provided about the technology to the farmers. Our recommendation is to include climate adaptation or more specifically EbA strategies to complement the climate mitigation strategies already in place within the document.

regions in northern Bhutan for their respective programs. Hence rather than focusing on forcing in EbA at a national level it might be more prudent to focus on a more ground and community scale level through projects and action plans. Furthermore, it should be noted that although EbA is not explicitly mentioned the allusion to it still does count. After all it is not the semantics that are important but the actual work that is carried out for the betterment of the community.

Conclusion

Within this document, we have provided key recommendations based on situation and policy analyses that have been carried out thus far which basically state that further research and explicit use and inclusion of EbA initiatives in the forestry and agriculture sector should be carried out for the benefit of the mountain communities.

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¹ [Royal Society for Protection of Nature. \(2011\). "Mountain ecosystems and impacts of Climate Change on water resources of Bhutan".](#)

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Scaling up Ecosystem-based Adaptation in Mountains - Peru

Ecosystem-based Adaptation



Source: Ed Pax / Wikipedia Commons

Recommendations

In the past decade, several advances have been made in relation to the Ecosystem-based Adaptation (EbA) approach in Peru. Yet on-the-ground EbA measures, specifically in mountain ecosystems, remain to be widely implemented. Given the success of the International Union for Conservation of Nature's (IUCN) Mountain EbA Flagship Programme, this approach should be further upscale through various policy and implementation measures in the Peruvian Andes. Information concerning EbA approaches could also be disseminated to communities; investment opportunities in ecosystem services could be promoted; regions could develop their climate adaptation strategies; and studies can be conducted to illustrate the effectiveness and the benefits of such measures at the community and national level.

Introduction

Healthy mountains in Peru help buffer the impacts of climate change for downstream populations and local communities that rely on their surrounding ecosystems for water, food, raw material and pasture. Given that the country's main source of freshwater comes from glaciers located in the Andes, the threat of reduced water availability for human consumption, agriculture and hydroelectric energy due to climate change remains cardinal. Similarly, agriculture and cattle are the primary source of income for indigenous

communities and those residing in high-Andean ecosystems.¹ The development of these activities is highly dependent on climate, altitude, and indigenous agricultural knowledge and tools. However, changes in temperatures, frost, and droughts have severely impacted these practices, furthering the need for EbA.² Peru's dependence on its high-mountain ecosystems needs to be recognized in order to promote their conservation, and to increase their resilience to the adverse effects of climate change^{3,4}

Background

Peru is relatively advanced in its inclusion of EbA policies for mountain ecosystems at the national level. Internationally it has presented a Nationally Determined Contribution (NDC) focused on adaptation, in which two of the five prioritized areas include water and agriculture. In March 2018, Congress also passed the Climate Change Framework Law which establishes the legal framework for climate change management and reducing vulnerability. In Article 3, the law recognizes "adaptation based on ecosystems" as one of the approaches that should be used in the fight against climate change⁵.

The Ministry of Environment, with the support of the Ministry of Housing and the National Superintendence of Water and Sanitation, is also promoting the

development of green infrastructure to reduce the degradation of high Andean ecosystems and conserve water resources⁶. This initiative is done in the context of the Remuneration Mechanisms for Ecosystem Services Law^{7,8}. Billing rates have already been established for ecosystem services, charging consumers in order to fund disaster risk prevention and climate change adaptation projects⁹. Other sectors working on EbA-related initiatives include the Agricultural Ministry's Risk Management and Adaptation to Climate Change plan under the general Agricultural Sector Plan,¹⁰ as well as the Ministry of Economy's methodological instrument to formulate public investment projects for the recovery of ecosystem services, including mountain ecosystems.

Analysis

The Andes mountain range is particularly important for Peru as it not only regulates its climate, but it is also the source of water for domestic consumption, irrigation and hydropower generation based on the meltwater from glaciers. Peru is considered the third most vulnerable country to climate change worldwide due to the rapid loss of its glaciers. It is estimated that

around 22% of the Peruvian glacier's surface area has disappeared in the past 30 years, leading to a reduction of surface water runoff is expected. This will not only affect high-mountain communities, but those living downstream. Therefore, emphasize the importance of adaptation measures in these mountains is now critical.

Peru has done a thorough job of including climate change adaptation, and to a lesser extent EbA, in its national laws, policies and strategies. The most recent inclusion has been the Climate Change Framework Law passed through Congress in March 2018, under the direct patronage of the Ministry of Environment. At a subnational level, regional climate change strategies have been pursued by 16 out of the 25 regions in the country. Promoting EbA in the remaining nine regions could increase the incidence of the approach under the direction of the Ministry of Environment. The ministry could also play a role in promoting the use of other already established tools and mechanisms. For example, a Guideline for Public Investment in Ecosystem Services was developed to include the recovery of biodiversity and ecosystem services in projects funded by the national governments. Promoting this type of policy instrument will help the country collectively adapt to climate change.



Canchayllo community, part of the IUCN pilot project
Photo credit: IUCN, MINAM

It is also important that communities and local governments that have not participated in pilot projects by IUCN and other organizations such as USAID, are aware of the opportunity posed by EbA. As such, information obtained from various pilot projects could be consolidated and disseminated to local communities, so that they can have a better understanding of EbA and how their specific community can benefit from similar measures. With this knowledge sharing, communities or local governments will have the ability to assess issues through an EbA lens and choose the appropriate tools without being dependent on external intervention. This can also help in rescuing the wealth of agricultural techniques and traditional knowledge (such as terraces or green infrastructure) held by indigenous Andean communities. Such EbA efforts result in improved animal and agricultural productivity, grasslands management, increased income, as well as strengthened capacities for water, grassland and livestock management. Additionally, research and studies could be conducted to show the ecosystem and economic benefits of EbA beyond the community level.

Finally, Peru has some of the world's most abundant mineral deposits and since 2006, it has experienced an economic growth rate of more than 6 % annually, largely driven by the mining sector. However, this has been accompanied by a rise in conflict with local communities and environmental degradation. This may pose a challenge for widespread EbA implementation and the implications should be considered in future research.

Case Study

Peru's National System for Public Investment (NSPI) is an administrative system that certifies the quality of projects financed with public sector resources. The Ministry of Economy and the Ministry of Environment developed a guideline in 2016 that described how to include projects having the objective of recovering biodiversity and ecosystem services in the NSPI¹¹. An example of this is the recovery and maintenance of the Silcon Micro Watershed Project in district of Circa, within the Apurimac Region. The project included various diagnoses on the degrading conditions of the area, the productive units (lakes, wetlands and springs) and the population served by the resource. With this information a plan was structured with specific EbA-like actions including native species reforestation, wetland protection and water resources management training¹². Mainstreaming these initiatives through the National System for Public Investment as done by this project allows the promotion of widespread adoption and minimal reliance on assistance from external organizations.

Conclusion

Given the increasing threats of climate change and losses of community knowledge, Peru should take advantage of the policies and mechanisms already established in the country, in order to promote the up-scaling of EbA approaches at the national and subnational level. Mainstreaming these tools will allow the dissemination of information concerning this approach and help protect the mountain ecosystems that are essential to the country's economic prosperity and local livelihoods.

This policy brief was prepared by:



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Scaling up Ecosystem-based Adaptation in Mountains - Colombia

Ecosystem-based Adaptation



Source: Mauricio Morales / Murillo, Tolima Department, Colombia

Recommendations

Colombia's Ministry of Environment and other government agencies have achieved progress in initiatives to adapt to and mitigate the impacts of climate change in Colombia. However, evidence-based Ecosystem-based Adaptation (EbA) presents an opportunity to strengthen Colombia's measures against the increasing threats of climate change. While Colombia has already implemented some EbA initiatives through partnerships with local and international organizations, expanding EbA policies and practices, specifically for the Colombian páramos, would help protect a valuable source of water, its world-renowned biodiversity, and the livelihoods of the people living in and near the páramos. Including EbA in the developing National Climate Change Law (Ley de Cambio Climático) and in Integral Regional Climate Change Plans (PRICCs) will allow the Colombian people to benefit from increased water security, food security, socioeconomic resilience, and conservation of biodiversity.

Key Recommendation: Implement EbA to protect the páramos of Colombia.

Why:

1. Protect water security
2. Protect food security
3. Protect Colombia's biodiversity
4. Support Colombian mountain livelihoods

How: Strengthen EbA in national and regional policy, and expand partnerships between multiple levels of governments with nonprofit and private sectors.

Introduction

Colombia's mountains make up 1.8% of the country's land area, providing ecosystem services to millions of people both directly and indirectly.ⁱ Climate change, increased climate variability, and climate induced disasters, in conjunction with political, economic, and social marginalization, result in increased vulnerability of Colombia's mountain communities to poverty and food shortages when mountain ecosystems suffer.ⁱⁱ Ecosystem-based Adaptation is an approach well suited to supporting the Colombian people in adapting to these challenges.

Temperatures in the Colombian Andes are increasing at a rate of 0.6 degrees Celsius per decade for the minimum daytime temperatures and at a rate of 1.3 degrees Celsius per decade for the maximum daytime temperatures.ⁱⁱⁱ As a result, temperature-sensitive crop productivity suffers, which puts both domestic food supplies as well as exportable crops at risk. Increasing temperatures threaten the biodiversity of mountain ecosystems when plants and animals living

Ecosystem-based Adaptation

Ecosystem-based Adaptation (EbA), or *Adaptacion basada en Ecosistemas (AbE)*, is a type of climate change adaptation that includes both socio-economic benefits as well as ecological benefits. Whether or not a practice is explicitly labeled as EbA, it can be considered as EbA if it includes all three of these elements:

1. **Social and economic benefits** - such as promoting local livelihoods, alternative income sources, sustainable production of crops, or increasing a city's water security.
2. **Ecological benefits** - such as protecting the habitat of an endangered species, promoting biodiversity, or conserving threatened ecosystems.
3. **Climate change adaptation** - such as adapting to increased temperatures, changing precipitation patterns, or increased soil erosion.

in these areas can no longer find a suitable habitat. Furthermore, increasing temperatures dry the water-storing páramos, threatening the iconic frailejon or espeletia plants that help to capture water from low-hanging clouds. Local and downstream populations rely on the water stored and gradually released from these páramos, but higher temperatures are disrupting this important water source.^{iv}

Overall, changes in temperature and precipitation patterns have contributed to retreat of glacier ice caps and increase in natural and anthropogenic forest fires. Because mountains provide about 70% of the Colombia's freshwater resources and mountain forests are home to 75% of the Colombian population and much of the country's continental biodiversity, adapting strategically to lessen the impacts of climate variability is essential.

Ecosystem services are incredibly important for Colombian economic development and mountain ecosystems are extremely sensitive to changes in

climate conditions. Therefore, adaptation measures must be taken in order to preserve these ecosystems.^v Integration of EbA in the country's plans will enable Colombia to adapt to the effects of climate

and land use change while strengthening the resilience of its social, economic, and ecological systems, preventing the demise of mountain livelihoods throughout Colombia.^{vi}

Background

Colombia values its biodiversity highly, for it ranks in the top four countries in the world for number of plant, amphibian, reptile, bird and mammal species inhabiting the country.^{vii} Colombia created its National Biodiversity Plan in 1996 to address the country's need for biodiversity protection as a tool for development. Though the plan is focused on protecting biodiversity, EbA is only utilized as a tool for managing various aquatic ecosystems.^{viii}

Approximately 15 years later the plan was updated to make it fit the more current needs of the country and fill the gaps in the original plan, including strengthening community participation in management of biodiversity. In addition, Colombia has a national Climate Change Policy currently undergoing development in anticipation of legislative review.

Analysis

Strengthening mountain EbA policy and implementation in the páramos will address threats posed by climate change against water security, biodiversity, and mountain livelihoods. Furthermore, there are opportunities now that lend themselves to greater policy inclusion of mountain EbA, in the proposed Climate Change Act, in Colombia's National Climate Change Policy (PNCC), and in Integral Regional Climate Change Plans (PRICCs). Taking action now to strengthen mountain EbA inclusion in policy will leverage unique and intersecting opportunities in current policy processes in Colombia.

While Colombia's existing national and regional climate change policies are compatible with EbA implementation as discussed earlier, there are now specific opportunities to strengthen inclusion of EbA. Colombia can incorporate EbA in its Climate Change Law, first presented to Congress in 2015, in 2016 as a draft law (Proyecto de Ley 054 de 2016 Senado)^{ix} and still under review as a draft October 2017.^x The drafted Law already includes climate change adaptation and ecosystem conservation, so this provides an opportunity to explicitly integrate EbA into national policy.^{xi} Similarly, Colombia's National Climate Change Policy of 2014 (PNCC), proposed to coordinate the many policies and strategies

The Colombian government and various NGOs have also implemented other ecosystem preservation studies and programs throughout this time, including an Intended Nationally Determined Contribution (iNDC), Integrated National Adaptation Plan, UNDP's National Biodiversity Report of Colombia and Conservation of the páramos and montane forests of the Colombian Massif, OAS Inter American Program for Sustainable Development, and Action Plan for the National Strategy for the Conservation of Colombia's Plants. Colombia's National Biodiversity Strategies and Action Plan (NBSAP) addressed the importance of ecosystem adaptation and services as a result of the damage caused by the 2011 El Niño. It also advocates for intersectoral coordination, in particular between the Ministry of the Environment and the agricultural sector, to align rural development policies with and diminish pressures on biodiversity conservation and ecosystem services.

addressing climate change, is a new and key policy for integrating EbA more comprehensively.^{xii} In addition, the Integral Regional Climate Change Plans (PRICCs) provide opportunities to include EbA tailored to regional social, economic, and ecological characteristics. The PRICCs for regions with páramos ecosystems are particularly relevant to expanding EbA, if Colombia intends to continue toward the goals of protecting water security, biodiversity, and mountain livelihoods.

Considering the simultaneous climate change vulnerability and the high value of water, biodiversity, and livelihoods in the páramos, strengthening EbA in such areas is an approach that addresses each threat and protects each of these resources.^{xiii} While warming temperatures threaten water stored in the páramos, mountain EbA techniques can help to improve water security. In addition, the National Biodiversity Strategies and Action Plans (NBSAP) and the Convention on Biological Diversity provide a mandate to implement measures to protect biodiversity in Colombia. EbA is an effective approach to conserving biodiversity that would be compatible with these other goals while advancing the nation's progress in protecting its rich biodiversity.

For example, International Union for Conservation of Nature (IUCN) protects water security in the Nor-Yauyos Cochas Landscape Reserve of Peru through EbA techniques in conserving micro-watersheds and watercourses. Adopting EbA and tailoring these techniques to the Colombian páramos would help to preserve the water that supports the people of Bogota and the surrounding area, while minimizing negative impacts on upstream communities and ecosystems. Implementing EbA in the páramos would not only improve water security and enhance protections for

biodiversity, but also support the livelihoods of communities that depend directly on the integrity of these areas. In the example of the Nor-Yauyos Cochas Landscape Reserve in Peru, EbA implementation there included adjusting livestock management practices from raising cattle, which accelerated soil erosion with their hard hooves, to raising vicuña, which are better suited to the area, do not cause as much erosion, and provides income for the people managing the vicuña.

Case Study: The Chingaza Massif^{xiv, xv, xvi}

The Chingaza Massif, located northeast of Bogota, is a vital source of water, food, biodiversity, soil protection, hydropower potential, indigenous Muisca and Guayupes cultural sites, and ecotourism. However, climate change and development threaten all of these resources.

Chingaza is comprised of páramos and both high Andean and sub-Andean forests. Páramos are alpine tundras and home to the iconic frailejon. These plants capture moisture from low-hanging clouds and deposit it in the ground, where it is stored by lagoons and mosses that can hold up to forty times their weight in water. This watershed provides almost 80% of the water for the 10 million people living in the region of the capital city, Bogota, and 11 surrounding municipalities.

As temperatures increase, the water-storing ability of the páramos weakens, while overgrazing cattle erode the soils and increased agricultural production uproot local flora and fauna. Recognizing the value of the Chingaza Massif, Colombia is implementing Ecosystem-based Adaptation (EbA) methods to restore and conserve high mountain ecosystems, to adopt locally resilient farming systems, and integrated cross-sectoral planning. Further EbA implementation, planning, and policy inclusion is essential to securing the future of the vital resources of the Chingaza Massif. These adaptation measures could also be replicated in similar ecosystems throughout the country and the larger region.

Conclusion

Colombia has made great strides in climate change adaptation, including in using EbA. To continue this progress and make the most of current policy opportunities, Colombia should strengthen the implementation of EbA in the fragile páramo ecosystems, while increasing the inclusion of mountain EbA in key proposed national policies and regional plans. Taking these steps is essential to protecting the vital waters of the páramos, the renowned biodiversity of the nation, and the livelihoods of mountain communities.

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Situation Analyses

Scaling Up Ecosystem-based Adaptation in Mountains

Uganda Situation Analysis



Source: Nlorusso / Wikipedia Commons

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1. Introduction

Uganda's mountain ecosystems are endowed with rich supplies of natural resources and water catchment areas of local and regional significance. The Rwenzori, Eastern Rift, and Virunga ranges of Uganda are among the most biologically diverse zones in Eastern Africa. Water, forests, wildlife, and biodiversity originating from these ecosystems also form the basis for much of the country's socioeconomic development in the agricultural, tourism, transport, and health sectors.¹

The Uganda National Development plan and Vision 2040 recognize that the climate of Uganda is its most valuable natural resource and a major determinant of its soils, water, forests and wildlife, as well as the human activities dependent on them.² However, the impacts of climate change (droughts, floods, storms, heat waves), as well as Uganda's rapidly growing population, pose a significant threat to the country's food security, water supply, livelihoods, and overall development. Temperatures are expected to increase in Uganda by up to 1.5°C in the next 20 years and by up to 4.3°C by the 2080s. Changes in rainfall patterns and total annual rainfall amounts are also expected but these are less certain than changes in temperature.³ Thus, Uganda needs to respond to the challenges posed by climate change through both adaptation and mitigation to build resilience that is crucial to ensuring sustainable development.

Though climate change is a global challenge to which global solutions must be found, the effects of climate change are local, and local solutions are necessary while taking into consideration regional and national contexts. Integrating Ecosystem-based Adaptation (EbA) measures into Uganda's climate change and development policies, will help reduce the country's vulnerability to climate change, and promote sustainable development among communities directly and indirectly reliant on mountain-based natural resources.

2. Development, Climate Change and Mountain Areas in Uganda

a. Demography

Uganda is a landlocked country with an area of 241,500 Km² lying astride the equator. The country is bordered by the Republic of Kenya to the east, Tanzania and Rwanda to the south, the Democratic Republic of Congo to the west and South Sudan to the north. Of the total area coverage of 241,500 km², about 15.3% is open water, 3.0% is permanent wetlands and 9.4% is seasonal wetlands. The perimeter of Uganda is approximately 16,630km.

Uganda's 2014 Status of Poverty report showed that the poverty rate in the country fell to 19.7% in 2012/13 from 24.5% in 2009/10.⁴ The total number of Ugandans living below the poverty line had declined to 6.7 million in 2012/13 from 7.5 million in 2009/10.⁵ Some of the critical causes of poverty are adverse weather conditions, which disrupt agricultural and other economic activity, high dependency ratio, and growing population pressure contributing to land fragmentation and soil degradation. Other factors concern social welfare such as education, health, housing and access to information, among others.⁶

Employment reports show that only 18.5% of the total population of Uganda is engaged in wage employment. From 2005 to 2010, the proportion of rural households relying primarily on subsistence agriculture declined from 64% to 54%, which reflects significant diversification into non-farm activities.⁷ Several of the new livelihoods emerging among the employable youth population include trade in agricultural produce, brick making in stone and sand quarries, transport businesses, mobile money services, and entertainment.

b. Mountain ecosystems, land cover, and resource use

Mountain ecosystems cover large areas of the country, including the biodiversity rich Albertine rift region that lies along the western section of the East African Rift Valley system. The western Uganda Mountains include Rwenzori, Mgahinga, Muhabura and parts of the Virunga mountain range, and are the richest biodiversity zone of the country. In eastern Uganda, the Mt. Elgon ecosystem is a highly populated and important water tower for both Uganda and western Kenya, while Kadam and Imatong Mountains are also important mountain ecosystems in the woodlands of northeastern Uganda.

Mt. Elgon

The Mt. Elgon ecosystem is located within the Lake Victoria Basin and is shared between two EAC Partner States- Kenya and Uganda. The Mt. Elgon system covers the massive but extinct volcanic mountain range on the border of Uganda and Kenya. Mt. Elgon is one of Africa's few single-standing mountains over 2,000m above sea level. It is the continent's seventh highest mountain, with a dome shaped peak. The foothills of the mountain begin at 1,000m on the lower eastern and northern slopes. The highest peak on the Ugandan side is Wagagai at 4,321m above sea level, while on the Kenyan side the highest peak is Koitobos at 4,155 m. The peaks form the edges of an eight km wide caldera - a flat-bottomed depression on top of the mountain. Other unique landforms include spurs, caves and valleys that give Mt. Elgon its scenic value.

The Mt. Elgon ecosystem comprises two National Parks, one National Reserve, several Forest Reserves, open areas and other categories of land use without conservation status. It is an important water catchment for Lakes Victoria, Kyoga, Turkana and the Nile River. Its forests receive up to 3000mm of rain each year, which they store and release to support the unique flora, fauna and large human populations on either side of the two countries. The combined Kenyan and Ugandan protected areas are sufficiently large to maintain viable populations of the rare species of mammals that are threatened by extinction in smaller National Parks. These include the elephant, buffalo, leopard, giant forest hog, waterbuck, bushbuck, duiker and various monkeys.

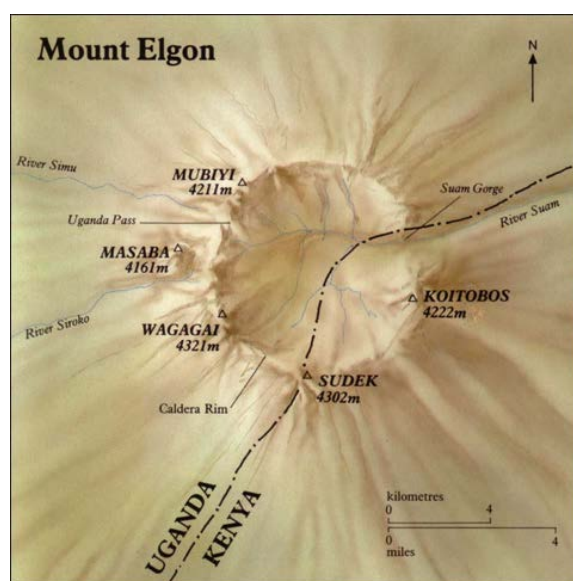


Figure 1. The Mt Elgon caldera and its surrounding peaks
(Source: skimountaineer.com)

The ecosystem also supports other species of extreme conservation importance which are characterized by rare and /or limited distributions. The International Union for Conservation of Nature (IUCN) has listed 37 globally threatened fauna species in the area (22 mammal, 2 insect and 13 bird species, of which nine species are endemic), making the area a priority for species conservation. Mt. Elgon is one of the locations where the Elgon Teak (*Oleacapensis*) is found. Mt. Elgon has been given the status of an Important Bird Area due to the rarity of some of its bird species.

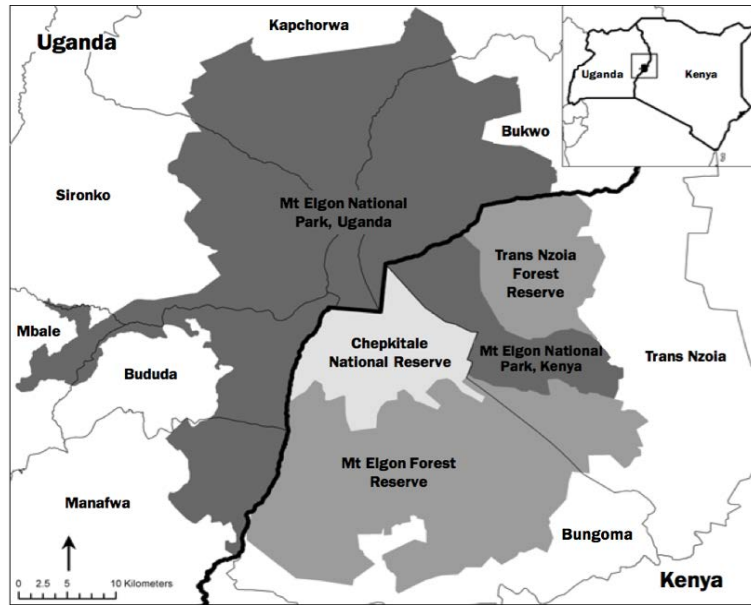


Figure 2. Map of the protected area regimes on Mt. Elgon, straddling the Uganda-Kenya border, with surrounding districts (Source: M. Sassen, IUCN, 2009)

3. Economy and Livelihoods

a. General information

Uganda has sustained an economic growth rate of 6 to 7% over the last decade, which has enabled one of the region's most impressive reductions in poverty levels. The number of people living in extreme poverty fell from 53.2% in 2006, to 34.6% in 2013, making the country a regional leader in ensuring that high levels of economic growth lead to poverty reduction (Figure 3).⁸ Poverty reduction among households working in agriculture accounted for 79% of the national poverty reduction observed between 2006 and 2013.⁹ However, this trajectory was jeopardized in 2010/2011 when an extensive drought destroyed staple crops, cash crops and livestock, and triggered economic losses of \$470 million, which underscores the centrality of climate to the country's economic stability and food security.¹⁰

Agriculture remains the backbone of Uganda's economy. In 2017, the agricultural sector accounted for 24.5% of the country's GDP.¹¹ It employs about 60% of the total labor force (formal and informal), 77% of whom are women, and 63% are youth, mostly residing in the rural areas.¹² Tourism is another important sector that has been growing consistently since the restoration of peace and security, and it now accounts for around 9% of GDP, amounting to \$1.7 billion. The mineral sector has provided a significant contribution to wealth through revenue accruing from private enterprise royalties and family income through artisanal small-scale mining (ASM) activities at the household level. Artisanal mining alone provides employment to over 20,000 miners, with direct and indirect labor numbering over 54,000. However, the ASM sector is still deficient in regulatory framework and health, environment and safety standards.

POVERTY HEADCOUNT RATE, 2002-2012

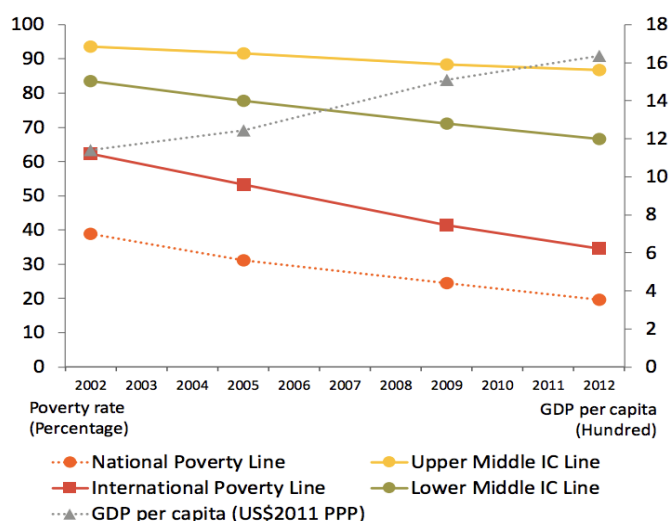


Figure 3. Poverty headcount rate for Uganda (orange bullets) between 2002-2012 (Source: World Bank, Country Poverty Brief 2017)¹

b. Key indicators for mountain economies

In many developing countries, mountain regions are the least developed, even though they cover a significant proportion of the land area and sustain the livelihoods of large, and primarily rural, populations.¹³ Mountain populations tend to be more isolated, with limited access to diversified livelihoods and education. The economies of mountain systems are largely agricultural and are often marginalized due to lack of access to information and markets as well as due to limited capacity and access to new agricultural techniques.^{14,15}

In Uganda, land in high altitude regions is fragmented into small-sized farms with restricted productive capacity. Subsequently, the mountain populations rely almost exclusively on rain fed, subsistence farming and on the mountain's natural resources for energy, materials, medicines, food and water. Before 2009, a mere 10% of the country's population had access to the electricity grid. As a result, approximately 89% of the rural population relies on firewood for their domestic energy supply.¹⁶ The ever-increasing rural population has been one of the major driving forces of deforestation. The people residing around natural forests are also amongst the poorest in the country. They are usually disconnected from the markets and are thus almost exclusively dependent on forest resources.^{17,18} In addition, the people inhabiting in high altitudes rely on the mountain's provisioning services for their freshwater as well as on the soil's fertility for agricultural activity. Livestock keeping in upland regions is common and supports food security and nutritional diversity. It is worth mentioning however, that one of the most food insecure and climate vulnerable regions in Uganda, the Karamoja region, holds 20% of the country's cattle and approximately 50% of the sheep population.

Case Study: Food insecurity in Karamoja, Uganda. Could EbA be the solution?

The Karamoja region, which is located at the northeast corner of Uganda, is the home of approximately 1.3 million people.¹ The region is one of the poorest in the country, with more than 80% of the population living under the poverty line. The land is mostly arid and so the exclusively rain fed agricultural production is low and inconsistent. Most people practice transhumant pastoralism, meaning that the pastoralists travel across the landscape looking for fresh forage and water.

The region can be divided in three agro-climatic zones: the arid zone in the east (high altitude), the semi-arid in the central area and the sub-humid in the west (low altitude). Each zone sustains different livelihoods and faces diverse challenges. The arid, high altitude zone in the east is characterized by low fertility soils and so the majority of the population relies on pastoral activities. The soils of the semi-arid zone support some production of crops (maize, sorghum, millet) and livestock. The sub-humid zone in the west of the Karamoja region is characterized by more fertile soils that sustain the agricultural production of several staple crops (maize) and cash crops (sesame, cucumber, mangoes, bananas).



One of the major issues in the region is soil compaction due to animal traffic. Food insecurity in Karamoja has been further exacerbated by the impacts of climate change, which are manifested as increasing average temperatures, dry-spells, erratic precipitation patterns and a 15-20% decrease in total annual

rainfall.¹ Both agricultural and pastoral productivity are highly dependent on meteorological conditions and so the locals are exposed to increased climate vulnerability and subsequently to food insecurity. In such a setting,

EbA approaches can provide substantial benefits to the local people by helping them adapt to the changing conditions. For example, a rainwater harvesting system can increase the availability and distribution of water, while the adoption of sustainable agriculture can reduce soil compaction and erosion while retaining soil moisture. EbA strategies coupled with a community approach where the locals are provided access to training, tools and high-quality inputs can go a long way in increasing the community's resilience to climate change.

c. Contribution of mountain ecosystem services and biodiversity to the economy

Agriculture:

Mountain ecosystems provide a wide array of ecosystem services, many of which tend to go unnoticed. Agricultural activity of both cash crops and staple crops is sustained on mountainous areas.¹⁹ Staple crops such as maize, millet, cassava and sweet potato are in high demand for local consumption, while cash crops such as bananas, coffee and horticulture products, which are traditionally cultivated in higher elevation zones, are on high demand for exports.²⁰ Coffee production in particular, accounts for approximately 25% of Uganda's foreign exchange profit and 90% of it is produced by small-scale farmers.²¹

Water:

Mountains also serve as the country's water towers. Rivers originate far up in the mountains, springing from the melting ice and snow. In addition, mountains serve as watersheds, which play a crucial function in regulating the release of water in rivers, lakes and aquifers. The watersheds are a precious source of drinking water and freshwater supply for irrigation and livestock keeping.²² In addition, the gravitational water flow is harnessed to produce hydroelectric energy. In 2014, 80% of domestic power generation was produced through hydroelectric infrastructure and the country is planning on doubling its hydropower capacity through the Chinese funded Aaygo Hydropower project in Northern Uganda.²³ Therefore, ensuring adequate river flows and controlling siltation²⁴ are going to be two crucial points in the midst of Uganda's structural transformation and rapid development.

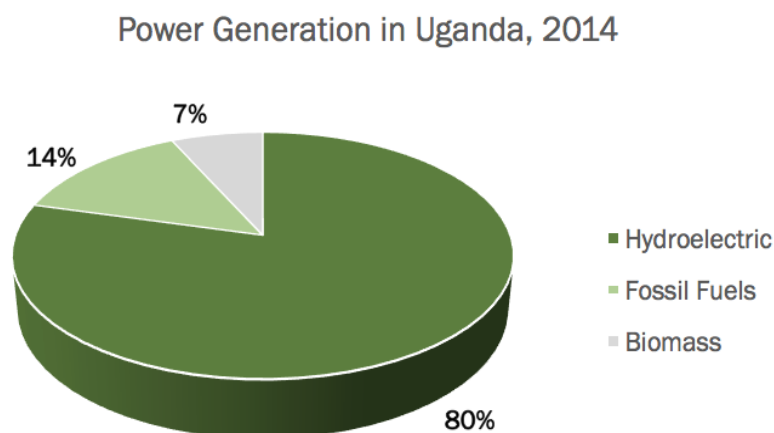


Figure 4. Power generation by source in Uganda, 2014 (Data source: Ministry of Energy and Mineral Development, 2014 Statistical Abstract)

Forest Cover:

Forest cover and vegetation are essential in that they provide several ecosystem services. Vegetation increases the infiltration rate of the soil, protecting against flooding and maintaining the soil's structure. Proper water infiltration is essential for flood control and water purification as well as for the recharge of aquifers. Maintaining the soil's structure protects against soil erosion and subsequently from landslides. Forests also act as carbon

interconnectedness and complexity of the ecosystem.²⁷ Mountain regions also serve as gene pools, preserving a diverse and precious array of agricultural and medicinal plant varieties.²⁸ Last, but certainly not least, Uganda's rich species diversity has attracted global attention, drawing in crowds and supporting a lucrative eco-tourism industry.^{29,30}

d. Gender and mountain livelihoods

According to Global Gender Gap 2016, Uganda ranks 61st out of 144 countries in terms of addressing the gender gap.³¹ Although both Uganda's Vision 2040 and Second National Development Plan have prioritized gender equality and the empowerment of women, gender disparities have remained relatively stable, particularly with respect to women's access to and control over land, wage employment in non-agricultural sectors, gender-based violence, and community and national decision-making.³²

The majority of Ugandan women are engaged in agricultural production, however, only 27% of registered land is owned by women.³³ There are no regional or national laws explicitly prohibiting women from owning land, but customary and inheritance laws make it difficult for Ugandan women to hold long-term land rights.³⁴ Female-headed households comprise 80.5% of the agricultural subsistence workers, compared to 67.5% of the male-headed households.³⁵ Therefore, engaging female stakeholders in any proposed land-use change will become more and more critical as the gender gap continues to narrow.

Family farming is one of the most predominant forms of agriculture in East Africa. In recent decades, family farming in many mountain areas around Uganda has been affected by the outmigration of youth and males in search of work elsewhere, which means heavier workloads for the remaining women and elderly.³⁶ Although women are increasingly taking on traditionally male duties as a result, ongoing gender disparities leave them at a disadvantage. According to a 2012 UNESCO census, the literacy rate among Ugandan females over the age of 15 is 62%, compared to 71% among males, and this gap is more pronounced in rural areas.³⁷ Lower education levels among women in rural areas affects their ability to access information, agricultural extension services, and improved technologies.³⁸ On average male-managed agricultural plots in Uganda are 60% larger and 11% more productive than female-managed plots.³⁹ This productivity gap can largely be attributed to women's greater child care responsibilities and limited access to cash crop seeds, credit and savings facilities, and resources for information-sharing.⁴⁰ In many cases, the innovation potential of these farms is further limited by the women's lack of recognized land tenure rights.

Several ongoing initiatives, including Farming First's Fill the Gap campaign in Northern Uganda, have demonstrated that the establishment of local women's groups can enhance agricultural knowledge exchange and market penetration of crops from female-managed plots.⁴¹ Community-based childcare systems also have the potential to equalize resource distribution among rural female farmers, but more evidence is needed to prove their efficacy.⁴²

e. Mountain livelihoods reliant on the Mt. Elgon ecosystem

Mt. Elgon volcanic soils provide a fertile environment for the commercial production of coffee and bananas, making the Mt. Elgon highlands one of the most productive areas in Uganda.^{43,44} However, overexploitation of the soil and suboptimal agricultural practices, such as excessive tilling and low fertilizer inputs, have led to declining soil fertility. In the attempt to expand agricultural activity and sustain the booming population around Mt. Elgon, one third of which is living under the poverty line, encroachment in the national forest areas has become a common phenomenon. The main economic activities in the lower altitudes of the mountain revolve around fisheries, beekeeping, livestock ranching (cattle, goats) and the cultivation of maize, cassava, sweet potato, rice, and leguminous crops.⁴⁵ In higher altitudes where land is fragmented and the hillsides are terraced, the main agricultural products are Arabica coffee, passion fruit, vanilla, spices (cardamom and white/black pepper), and dairy as well as the production of maize and potatoes.^{46,47}

4. Mountain Areas Environmental Issues

a. Threats to the mountain environment

The table below outlines several key threats to Ugandan mountain ecosystems, as well as a summary of their associated impacts on the environment.

Deforestation is a particularly large threat to Uganda's mountains. More than 30% of tropical high forests, which provide a disproportionate amount of natural resources, ecological services, and biodiversity, are destroyed or degraded.⁴⁸ Forests are being cleared and fragmented for many purposes, including the expansion of agricultural land or the harvesting of timber, fuelwood, and other resources. As Uganda's population grows, pressures from human use, in conjunction with the effects of climate change, threaten the ability of Uganda's montane ecosystem to provide its valuable services.

Table 1: Threats and Impacts

Threats	Impacts
Deforestation	Loss of habitat, increased erosion, risk of landslides, increased malaria risk, decreased groundwater recharge and purification
Climate Change	More intermittent rainfall, increased frequency and intensity of drought, increased pressure on mountain freshwater resources
Overgrazing by livestock	Less vegetation cover leads to decreased groundwater recharge and carbon storage
Cultivation of marginal soil	Expansion of agricultural land contributes to habitat loss
Soil erosion	Increased risk of landslides, loss of soil fertility

Landslides	Risk to infrastructure, risk to human health, destruction of agricultural land
Habitat loss	Loss of biodiversity and genetic variability
Wildfire	Habitat loss, risk to infrastructure, risk to human health, contributes to risk of erosion

Table 1. Key threats to Ugandan mountain ecosystems and associated impacts on the environment

a. Climate change impacts on mountain areas

Climate forms the basis for the state of all other natural resources, such as water, forests, and biodiversity. Because of this, even small changes in the Earth's climate system have the potential to cause devastating impacts in sensitive environments. Natural climate variability, global climate change, and anthropogenic factors like changing land use all have interacting effects on mountains. Thus, it can often be difficult to isolate the impacts of climate change alone.⁴⁹ However, current predictions do indicate that the following dangerous changes may be in store:

Global Climate Modeling (GCM) data indicates that mean global annual temperature is projected to increase by between 0.8 and 1.5 °C by 2030, and 1.6 to 2.7 °C by 2060. While average rainfall volume and intensity is projected to increase by 2060, rain events are likely to become more episodic in nature. This is particularly dangerous in conjunction with mountain deforestation, which is driven by the need for agricultural expansion into forested areas.

Furthermore, poor logging practices and over-cultivation of vegetation on unstable steep slopes increase the likelihood of landslide occurrences. Mt. Elgon has been identified as the most vulnerable area to landslides in Uganda.⁵⁰ The Bududa district, located in the southern slopes of Mt. Elgon, experienced an unprecedented wave of landslides in the late 1990s and early 2000s. These natural disasters were largely attributed to climatic changes (El Niño rains), deforestation, soil erosion, and over cultivation on the mountain's steep slopes.⁵¹ Given that rainfall volume and intensity is projected to increase in the area in response to climate change, communities living around Mt. Elgon will likely need to enhance community preparedness to reduce landslide risks.

On the other hand, climate change is projected to cause an increase in the frequency, intensity, and duration of droughts. Historically, periods of drought have led to severe crop losses, famine, and population displacement. More intense and frequent droughts would only exacerbate these issues.

Uganda's mild climate is one of its most valuable natural resources. The impacts of climate change will most likely reduce the benefits derived from Uganda's natural resource base. This will have serious consequences for agricultural production, food security, forests, water supply, infrastructure, health systems, incomes, livelihoods and overall development. Consequently, Uganda's Vision 2040 acknowledges the importance of climate as a determinant of the health of the country's environment.

5. Environmental Policies and Climate Change Strategies

Uganda is party to the UNFCCC and has moved to assimilate climate change into its national policies. EbA is gaining recognition in the country, as a way to adapt to the local impacts of climate change. In fact, Uganda has incorporated EbA measures into the National Biodiversity Strategies and Action Plan (NBSAP II) and the National Development Plan (NDP II). The Uganda National Development Plan 2010/11-2014/15 forced climate change issues to the front of national policy by integrating climate change into development plans, policies and budgets across sectors. This was soon followed by the Climate Change Policy of 2013 which provided guidance and direction to institute adaptation and mitigation methods to address the effects of climate change.

Uganda has shown commitment to the inclusion and implementation of EbA measures. This is seen no more prominently than during the United Nations Environment Assembly (UNEA) in 2014, in Nairobi when Uganda submitted a resolution to increase financial support to EbA programs, encourage the consideration of indigenous traditions in programs, and enhance integration of EbA measures in national policies.⁵² Uganda has served as the pilot country for a number of EbA projects which have demonstrated the success in a number of scenarios, including: (a) building resilience through Vulnerability Impact Assessments (VIA) and Community Environment Conservation Fund (CECF); (b) making EbA work through Public-Private-Partnerships (PPP) in ecosystem/ landscape restoration approach; (c) linking EbA to Payment for Ecosystems Services (d) landscape restoration through local adaptation actions; (e) zones and villages adaptation actions, as an approach to building community resilience and (f) building resilience through Community Conservation Groups and on-farm interventions.⁵³

Table 2: Strategies

Sector	Strategies suggested in the Climate Change policy
Water	• Promote and encourage water harvesting and efficient water use among individuals, households, institutions and sectors • Promote and strengthen the conservation and protection against degradation of watersheds, water catchment areas, river banks and water bodies • Promote the integrated planning, development and management of water resources including contingency planning for extreme events such as floods and drought • Improve and strengthen transboundary cooperation regarding water resources • Support institutional and human capacity building in water resource use, development and management • Strengthen water resource monitoring networks and flood warning systems
Fisheries	• Promote and encourage the adaptive management of fishing capacity based on climate and environmental forecasts, to protect against extreme events • Promote sustainable fish farming as a means of economic diversification and to reduce overfishing in inland lakes and rivers • Promote awareness of the impacts of climate change on fisheries among stakeholders such as local communities, resource managers and policy makers • Provide economic incentives to diversify livelihood options to reduce dependence on climate sensitive fishery resources • Promote biological engineering and restoration of stress-tolerant organisms
Transportation and public works	• Integrate climate change into the existing infrastructure risk assessment guidelines and methodology • Building on work already underway, establish and enforce climate change-resilient standards for transportation and infrastructure planning and development through monitoring and reporting systems • Encourage the integration of climate change into transportation and infrastructure development strategies • Promote and encourage water catchment protection in transportation infrastructure development and maintenance • Climate-proof existing and future infrastructure by conducting geotechnical site investigations (GSIs) to determine whether areas are appropriate or inappropriate for infrastructure development

Forestry and wetlands	• Strengthen the existing national forestry and wetlands policy to prevent forest and wetland degradation and encroachment • Promote intensified and sustained afforestation and reforestation programs implemented by the government, institutions, households and individuals, the private sector, civil society and multilateral organizations • Promote and intensify wetland protection and restoration of degraded wetlands • Promote alternative energy sources, energy conservation initiatives and efficient biomass energy production and use of technologies to reduce biomass consumption • Encourage agroforestry, which will enable poor rural households to meet their subsistence and energy needs • Strengthen existing forestry and wetland research and encourage conservation and restoration of ecosystems critically threatened by climate change
Biodiversity and ecosystems	• Identify biodiversity hotspots where only restricted development should be allowed • Encourage collaborative management and sustainable use of biodiversity and ecosystems • Promote payment for ecosystem services and streamline other ecosystem benefit-sharing schemes • Ensure that any human activity within the vicinity of protected areas does not compromise the integrity of the ecosystem
Health	• Assess the impacts of climate change on human health and well-being • Improve the capture, management, storage and dissemination of health information; Heighten the surveillance of disease outbreaks and provide subsequent rapid responses to control epidemics • Strengthen public health systems by building hospitals and supplying them with medicine, equipment and well-trained personnel • Make provisions for a safe water chain and sanitation facilities to limit outbreaks of water-borne diseases, and implement strong public awareness programs to promote better hygiene • Increase the health workforce awareness of and sensitivity to the relationship between climate change and human health • Develop further support action plans against HIV/AIDS • Create 'green spaces' in urban centers to moderate temperatures and provide fresh air for healthy living

Energy	• Promote and participate in water resource regulation to ensure the availability of water for hydropower production • Promote and participate in water catchment protection as part of hydroelectric power infrastructure development • Diversify energy sources by promoting the use of alternative renewable energy sources (such as solar, biomass, mini-hydro, geothermal and wind) that are less sensitive to climate change • Promote energy-efficient fuelwood cooking stoves and solar and liquefied petroleum gas (LPG) cookers • Conduct research to determine the potential impacts of climate change on the country's power supply chain
Human settlements and social infrastructure	• Promote proper planning of urban centers by encouraging the adoption of urban planning principles and standards to make urban areas more resilient to climate change • Revise and harmonize structural/building codes and standards, as well as the training on such standards, taking into account the expected changes in climate • Improve disaster preparedness by increasing the number of well-equipped health facilities, constructing dams and dikes in flood-prone areas, and improving disaster preparedness and management knowledge and skills in regions prone to such climatic disasters • Strengthen housing development policies, including subsidies to low-income communities • Establish insurance schemes to provide reparations in regions affected by climatic disasters • Develop climate change awareness programs involving all communities and stakeholders • Disseminate climate-change and early-warning information in local languages to improve community disaster preparedness • Diversify economic activities to improve the resilience of rural communities dependent on climate-sensitive sectors such as agriculture and livestock rearing

Disaster risk management	• Develop and implement a climate change-induced disaster risk management strategy • Create an appropriate legal and regulatory framework for disaster management • Promote vulnerability risk mapping (including the social and economic impacts of climate change) of the whole country and all sectors • Improve early-warning systems and preparedness to avoid or minimize the adverse impacts of climate change • Strengthen climate change-induced disaster management institutions at the national and local levels to reduce causality and ensure preparedness • Provide basic needs to victims of climate change-induced disasters in the form of financial assistance or donations of food, goods and services as the need arises • Encourage the formation of resident associations that can respond to emergencies, and involve them in key decision-making • Strengthen the National Emergency Coordination and Operations Centre and establish a national contingency fund
Gender issues and child welfare	• Ensure that communities are empowered and that both men and women participate meaningfully in planning, testing and rolling out adaptation and mitigation activities in rural and urban areas • Ensure that climate change response policies and activities are gender sensitive; Build on efforts already underway to include gender and climate change in education curriculum and training programs • Strengthen the capacity of relevant stakeholders at national and local levels to promote gender sensitive approaches to climate change adaptation
Vulnerable groups	• Make provisions to ensure that vulnerable groups and communities are empowered to effectively and adequately adapt to the impacts of climate change • Support and encourage vulnerable groups to engage in sustainable adaptation mechanisms to cope with climate change impacts • Integrate climate change-related issues into economic policies and action plans that address the needs of vulnerable groups

Table 2. Strategies suggested in the Climate Change policy by sector

6. Legal and Administrative Setup

Table 3: Government institutions

Institution	Mandate
Ministry of Water and Environment (MWE)	Hosting the Climate Change Department (CCD) The CCD will be tasked with preparing a consolidated annual progress report on the overall implementation of the policy implementation strategy, for consideration by the Cabinet and the Prime Minister's Office. The CCD may provide guidance to the various ministries, departments and agencies as they develop their PMFs and reporting formats, to ensure consistency and focus on result-based management in the implementation of the policy.
Ministry of Finance, Planning and Economic Development	• Ensure that national-, sectoral- and district-level budgets and indicative planning figures integrate climate change through appropriate provisions for the implementation of the policy and its strategy • Review quarterly and semi-annual reports from the ministries, departments and agencies concerned, to ensure that resource use is in line with expected and actual progress in implementing the policy • Facilitate the introduction of relevant financial mechanisms and tools to the relevant stakeholders, as per the implementation strategy, to support financial resource mobilization and investment for the implementation of the policy
Ministry of Local Government (MoLG)	• Provide guidance to the districts to translate the policy priorities and the implementation strategy into coherent plans • Ensure that districts make adequate provisions in their development plans, annual plans and budgets for the implementation of the climate change policy • Ensure that these are acted upon as planned through a review of relevant reports from the districts and appropriate follow-up actions by the MoLG, as required
National Planning Authority (NPA)	• Ensure that the ministries, departments and agencies concerned integrate climate change through adequate provisions in their annual work plans for the implementation of the climate change policy, building on the guidance provided in the costed implementation strategy but consistent with all relevant national policies and legislations • Ensure that these agreed work plans are implemented, through a review of quarterly and semi-annual reporting by the institutions concerned and appropriate follow-up actions by the NPA
Other line ministries, authorities, departments, local governments (LGs)	Oversee/monitor the actual implementation of climate change related interventions and report to the CCD on quarterly basis.

Table 3. Government institutions directly responsible for implementing adaptation strategies and policies

a. The level of coordination and cooperation between institutions

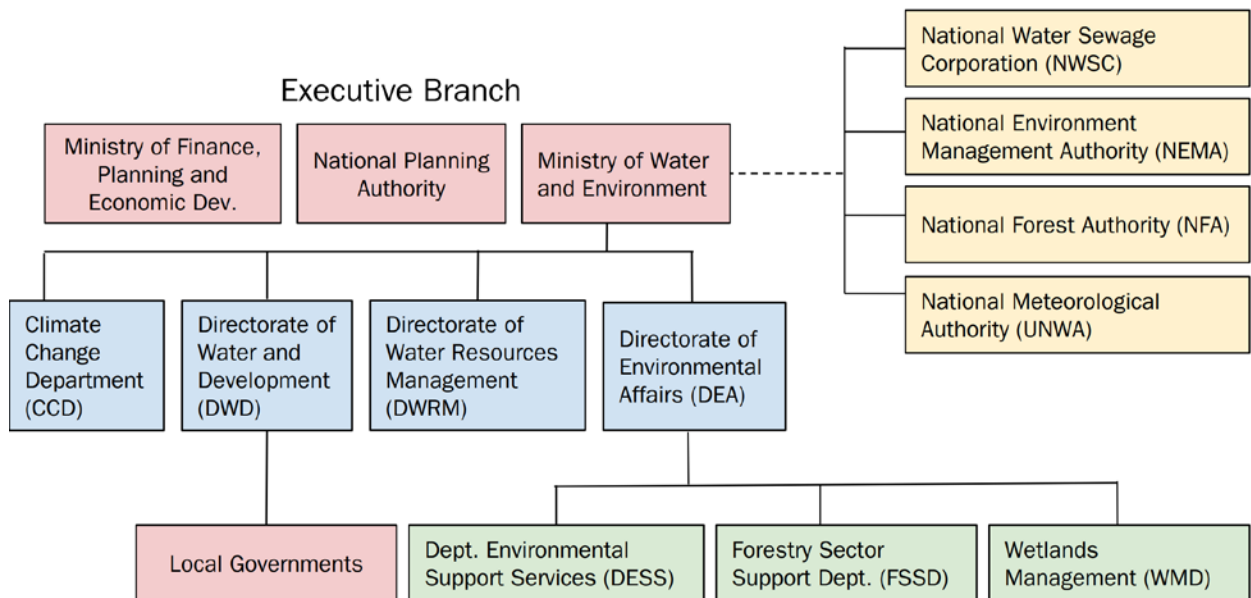


Figure 6. Organogram of Institutions. Red indicates the executive branches, **yellow** indicates semi-autonomous organizations, blue indicates branches or directorates situated within an agency, and green indicates bureaus within a directorate.

The Ministry of Finance, Planning and Economic Development (MoFPED); Its major role is to ensure that national, sectoral and district-level budgets and indicative planning figures integrate climate change through appropriate provisions for the implementation of the policy and its strategy; Review quarterly and semi-annual reports from the ministries, departments and agencies concerned, to ensure that resource use is in line with expected and actual progress in implementing the policy and to facilitate the introduction financial mechanisms and tools to the relevant stakeholders, as per the implementation strategy, to support financial resource mobilization and investment for the implementation of the policy.

Ministry of Local Government (MoLG): Gives guidance to the districts to translate the policy priorities and the implementation strategy into coherent plans at the district level; ensures that districts make adequate provisions in their development plans, annual plans and budgets for the implementation of the climate change policy; and ensures that these are acted upon as planned through a review of relevant reports from the districts and appropriate follow-up actions by the MoLG as required.

The National Planning Authority; its major role is to ensure that the ministries, departments and agencies concerned integrate climate change through adequate provisions in their annual work plans for the implementation of the climate change policy, building on the guidance provided in the costed implementation strategy but consistent with all relevant national policies and legislations; ensure that these agreed work plans are implemented, through a review of quarterly and semi-annual reporting by the institutions concerned and appropriate follow-up actions by the NPA.

Ministry of Water and Environment; acts as a national coordination center for climate change in Uganda. This is because a climate change coordinating body must possess the authority to conduct business with the various cross-sectoral Ministries, Departments and Agencies involved in the implementation of the policy. Collaboration and coordination at the national level also involves the Policy Committee on environment that coordinates policy implementation and ensures information flow on resource allocation for the implementation of the policy. The National Climate Change Advisory Committee ensures working level coordination and provide technical input to the National Climate Change Policy Committee. The work of these two coordination mechanisms will be guided by the Implementation Strategy.

b. How has the country contributed to the UNFCCC?

Uganda signed the UNFCCC Convention on the 13th of June 1992 at the Earth Summit in Rio de Janeiro, Brazil and subsequently ratified it on 8th of September, 1993. Uganda committed itself to fully participate and contribute to the attainment of the objective of the Convention. Uganda submitted its Second National Communication to the UNFCCC on 2nd December 2014.⁵⁴

Contributions: Through regular participation in the meetings of the Conference of Parties to the UNFCCC, Uganda is keenly following the events leading to the new Climate Change Agreement that was negotiated in Paris, France during the UN Climate Conference in December 2015. Uganda submitted its Intended Nationally Determined Contribution in compliance with Decision 1/CP.19 (Further advancing the Durban Platform: and in particular Paragraph 1 (b & c)) and as elaborated in Decision 1/CP.20 (Lima Call for Climate Action and in particular paragraph 11) premised on the Convention and guided by its principles. Uganda's INDC has a Mitigation and Adaptation component up until 2030. The proposed priority measures for 2030 will build upon ongoing policies and plans, whose implementation will be accelerated in the period between 2016 and 2030.

Mitigation: For mitigation, Uganda will focus on implementation of a series of policies and measures in the energy supply, forestry and wetland sectors. In the business-as-usual (BAU) emissions projection for Uganda, including Land Use Change and Forestry, the estimated emissions for Uganda in 2030 will be 77.3 million tons of carbon dioxide equivalent per year (MtCO₂eq/yr). Total emissions in 2000 were 36.5 million tons of carbon dioxide equivalent per year (MtCO₂eq/yr). The estimated potential cumulative impact of the policies and measures could result in approximately 22% reduction of national greenhouse gas emissions in 2030 compared to BAU. Uganda proposes to implement the identified policies and measures, and their impact may be higher or lower than these estimations illustrate.

Adaptation: The livelihood of the people of Uganda is highly dependent on the exploitation of the country's natural resources, including its climate. In submitting this INDC, Uganda's priority is adaptation. The country will continue to work on reducing vulnerability and addressing adaptation in agriculture and livestock, forestry, infrastructure (with an emphasis on human settlements, social infrastructure and transport), water, energy, health and

disaster risk management. Sustainable Land Management (SLM) and Climate Smart Agriculture (CSA) will be scaled up to increase resilience at the grassroots level.

Monitoring and Evaluation: Mitigation and adaptation intentions set out in Uganda's INDC are based on the country's National Climate Change Policy (NCCP) (2015), which is derived from the Constitution of the Republic of Uganda. The effectiveness and efficiency of the implementation of Uganda's NCCP is to be monitored against its approved outcomes and outputs on an annual basis. Information from ministries, departments and agencies will be reported to the Ministry of Finance, Planning and Economic Development and copied to the National Planning Authority and the Climate Change Department, which will prepare a consolidated annual progress report. An independent evaluation is planned after the first five years of implementation of the NCCP. The recommendations will feed into the revision of the climate change policy, which should be informed by a thorough public consultation process.

Fairness, ambition and contribution: To develop a fair and ambitious contribution that helps achieve the objective of the Convention but recognizes Uganda's national circumstances as a Least Developed Country (LDC), Uganda has considered how it can prioritize the actions and measures that achieve emissions reductions while ensuring increased resilience and development outcomes for Uganda. As an LDC with low emissions and high vulnerability to climate impacts, Uganda's ability to undertake climate action without external support is extremely low when compared to other countries.

7. Ecosystem based Adaptation (EbA) related Strategies and Policies

Table 4: National EbA related Policies

Primary Policy	Climate Change/Environmental Component	EbA approaches
National Biodiversity Strategies and Action Plan (NBSAP II), 2015-2025	By 2020, all fish, invertebrate stocks and aquatic plants are managed and harvested sustainably and legally	Applying ecosystem based approaches, so that overfishing is avoided; Recovery plans and measures are in place for all depleted species; Impacts of fisheries on stocks, species and ecosystems are within safe ecological limits
Uganda National Development Plan 2010/11-2014/15	Includes climate change in development plans, policies and budgets of all sectors	Promotes EbA to restore and maintain the integrity and functionality of degraded fragile ecosystems
National Development Plan II (NPDII)	Economic plan to propel Uganda towards middle income status by 2020 by strengthening competitiveness for sustainable wealth creation, employment and inclusive growth through (i) agriculture; (ii) tourism; (iii) minerals, oil and gas; (iv) infrastructure development; and (v) human capital development	EbA is promoted as a strategy for delivering climate change and environment programs
National Climate Change policy of Uganda, 2013	To effectively address the challenges posed by climate change impacts on biodiversity and ecosystems, so as to ensure ecosystem health and provision of ecosystem services that are crucial to sustainable and resilient development	EbA-type strategies are promoted under the sector specific priorities, including for agriculture, water and forestry
National Forest Policy, 2001	Promotes the sustainable management of forests to provide ecological and socio services, while producing economic goods for present and future generations	The three pillars of EbA are addressed in the vision: “sufficiently forested, ecologically stable and economically prosperous”
Energy Policy, 2002	Energy needs of Uganda’s population to be met in an environmentally sustainable manner	Addresses the three pillars of EbA in the vision
Agriculture Sector Development Strategy and Investment Plan, 2010	Under section 2.6.6, the country’s vulnerability to climate change impacts is recognized; Assessment of risks as they are currently witnessed is under way	A number of ecological issues are outlined as threats to the agricultural sector including: declining soil fertility, low production, increase in diseases, overexploitation of natural resources etc.
The National Land Policy, 2013	Climate change is highlighted under the land use and land management framework; Acknowledges that deforestation, wetland degradation, land degradation and poor settlements planning are issues of great concern	Under section 6.10, the policy lays down ecosystem-related strategies to mitigate and adapt to climate change such as ecosystem protection and preservation and mitigation of the degradation of forests and water bodies

Table 4. EbA related national policies

Table 5: List of all National communications and documents

National communiqués and documents	Submission date	URL
Uganda Submits its Climate Action Plan Ahead of 2015 Paris Agreement	16 th October 2015	http://newsroom.unfccc.int/unfccc-newsroom/uganda-submits-its-climate-action-plan-ahead-of-2015-paris-agreement/
Uganda launches work plan on climate change deal	28 th March 2015	http://www.newvision.co.ug/new_vision/news/1323209/uganda-launches-plan-climate-change-deal
Road Map to Paris	15 th September 2015	http://ccd.go.ug/index.php/component/content/article/12-ccd/197-road-map-to-paris
Uganda Climate Action	November 2015	https://www.irishaid.ie/media/irishaid/allwebsitemedia/20newsandpublications/publicationpdfsenglish/Country-Climate-Action-Reports-Uganda-FINAL.pdf
Uganda National Plan of Action, 2007	December 2007	http://unfccc.int/adaptation/workstreams/national_adaptation_programmes_of_action/items/4585.php http://unfccc.int/resource/docs/napa/uga01.pdf
Uganda INDCs	14 October 2015	http://www4.unfccc.int/submissions/INDC/Published%20Documents/Uganda/1/INDC%20Uganda%20final%20%2014%20October%20%202015.%20minor%20correction.28.10.15.pdf
First National Communication to UNFCCC	26 October 2002	http://unfccc.int/resource/docs/natc/uganc1.pdf
Second National Communication to UNFCCC	2 December 2014	http://unfccc.int/resource/docs/natc/uganc2.pdf

8. Recommendations and Conclusion

In Uganda, EbA has been gaining recognition in many recent policies spanning many sectors, including the country's Second National Development Plan (NDP II), National Climate Change Policy, Agriculture Sector Development Strategy and Investment Plan, National Energy Policy, National Forest Policy, and National Biodiversity Strategies and Action Plan (NBSAP II) to name a few. While the number of policies incorporating EbA measures is increasing, few are being implemented as the policies intend. This is especially the case for national policies focusing on land management. A 2009 study conducted by the International Mountain Society followed the implementation of several policies that aimed to restore Uganda's essential water catchments.⁵⁵ The results showed that even though the policies were in place, the status of their implementation was limited by a deficit of technical capacity and funding.

Part of the implementation failure relates to the political decentralization Uganda went through in the mid-1990s. Decentralization of decision-making power has typically been effective in promoting democracy, community participation, and local accountability. Presumably, many of the same attributes would be necessary to effectively implement EbA policies. The decentralization of the Ugandan government allocated the main political and administrative duties to the district governments at the local level, and those in power are democratically elected by the district voters. The district level receives guidelines from the central authorities concerning national policies and is responsible for their implementation.

This transformation however, did not occur without a cost. Tensions have risen between the district and national levels of government, primarily concerning the allocation of financial resources. The district governments often have to face challenging socio-economic situations without the appropriate financial resources. On the district level, the District Environmental Officers (DEOs) are the technical staff members who are responsible for the development of the district environmental action plans and ensure non-state actor participation (NGOs, local people, businesses etc.). DEOs are often more receptive of national environmental policies. It has been noted however, that the locally elected officials are reluctant to adopt national environmental policies that may alienate their voters, such as the restriction of the use of forest resources.

The anthropocentric nature of EbA offers a platform for the promotion of environmental approaches that are politically palatable. As a result, these policies may be more easily adopted by both local politicians and the people who vote for them. In addition, since EbA can simultaneously provide solutions to issues of different policy domains (agriculture, natural resource management, forestry etc.) it lessens the competition between the limited financial resources. The implementation of EbA at a bilateral regional scale, as is the case for Mt. Elgon, would be integral for the successful implementation of EbA. While one district may be able to mitigate the threats humans pose to the ecosystem, if the same or similar measures are not taken in other districts surrounding the Mount Elgon, then human encroachment and land degradation will continue to damage the ecosystem. For this reason, the creation of a forum that will facilitate inter-district collaboration for the implementation of EbA initiatives in the Mt. Elgon ecosystem is encouraged.

Inclusive, gender equitable participation may also increase the likelihood of implementation success for EbA initiatives. The outmigration of men and youth has resulted in a loss of active human capital in the rural areas of Uganda. As a result, the remaining female population must take on heavier workloads with the disadvantage of operating under significant gender-specific prejudices. Agriculture and livestock extension programs and educational initiatives should be used to help address the gender gap in agricultural productivity and plot size. The establishment of women's groups has also been proven to enhance agricultural knowledge exchange and market penetration of crops from female-managed plots.

A lack of awareness and understanding of EbA by policy and decision makers acts as a barrier to the successful implementation of EbA measures at the national, sectoral, and regional levels. An effective case cannot be made to include EbA as a part of climate change adaptation strategies moving forward if the potential benefits are not effectively communicated to and understood by those implementing the legislation.

Education and awareness-building activities should be carried out at multiple levels, mainstreaming the idea of EbA can help break down the barriers to mainstreaming EbA as an integral part of policies at many levels. Activities can target schools and universities, all the way up to decision makers including governmental parties, development partners, and NGOs. Any activity that can be undertaken to enhance the awareness and understanding of EbA at all levels in Uganda will help facilitate EbA's implementation.

In conducting this research, the major challenges that arose concerned the access to complete and accurate information. Census data are outdated and incomplete and there is no readily available information on how many people are directly or indirectly dependent on mountain ecosystems. However, EbA projects can help raise awareness of the vulnerability of the mountain ecosystems and the populations dependent on them and thus drive momentum for more systematic investigation and data collection.

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- ⁵ GOUa 2015 Second National Development Plan (NDPII) 2015/16 – 2019/20, National Planning Authority, Kampala, also available at <http://www.npa.ug>
- ⁶ MFPED Poverty Status Report, 2014
- ⁷ Ibid.
- ⁸ worldbank.org/en/country/uganda/publication/uganda-poverty-assessment-agriculture-a-driver-of-growth-and-poverty-reduction
- ⁹ Ibid.
- ¹⁰ <https://reliefweb.int/sites/reliefweb.int/files/resources/wfp289992.pdf>
- ¹¹ <https://www.cia.gov/library/publications/the-world-factbook/geos/ug.html>
- ¹² <http://www.worldbank.org/en/country/uganda/publication/uganda-poverty-assessment-agriculture-a-driver-of-growth-and-poverty-reduction>
- ¹³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5355443/>
- ¹⁴ https://sustainabledevelopment.un.org/content/dsd/dsd_aofw_par/par_pdfs/par-fair-csd-17/MOUNTAIN_PARTNERSHIP_WORKING_SESSION_6MAY.pdf
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- ¹⁶ <https://www.theguardian.com/society/katineblog/2009/jun/25/uganda-deforestation>
- ¹⁷ <https://programs.wcs.org/portals/49/media/file/ValueofUgandasForests.pdf>
- ¹⁸ https://www.researchgate.net/publication/275401990_DEFORESTATION_AN_ENVIRONMENTAL_PROBLEM_A_REVIEW_OF_UGANDA_FORESTRY_POLICY_AND_NATIONAL_ENVIRONMENTAL_MANAGEMENT_POLICY#pf4
- ¹⁹ <https://www.export.gov/article?id=Uganda-Agriculture>
- ²⁰ <http://aciablog.blogspot.com/2014/07/farming-in-mountains-shadow-uganda.html>
- ²¹ https://www.researchgate.net/publication/263725702_The_Impact_of_Climate_Change_on_Coffee_in_Uganda_Lessons_from_a_case_study_in_the_Rwenzori_Mountains
- ²² http://www.geo.fu-berlin.de/en/v/iwm-network/living_laboratories/uganda/geointro/index.html
- ²³ <http://africanbusinessmagazine.com/sectors/energy/uganda-east-africas-hydro-powerhouse/>
- ²⁴ Siltation is caused by bank erosion, which is usually the effect of deforestation. Excessive siltation incapacitates the hydroelectric dams and costs millions of dollars for repair.
- ²⁵ https://www.researchgate.net/publication/275401990_DEFORESTATION_AN_ENVIRONMENTAL_PROBLEM_A_REVIEW_OF_UGANDA_FORESTRY_POLICY_AND_NATIONAL_ENVIRONMENTAL_MANAGEMENT_POLICY#pf4
- ²⁶ <http://www.fao.org/docrep/w7714e/w7714e05.htm>
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- ²⁸ Ibid.
- ²⁹ <https://uganda.wcs.org/Wildlife/Biodiversity.aspx>
- ³⁰ http://www.vub.ac.be/klimostoolkit/sites/default/files/documents/uganda_biodiversity_assessment_usaid.pdf
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- ⁵² <http://enb.iisd.org/vol16/enb16122e.html>
- ⁵³ <http://www.natureuganda.org/downloads/Ecosystem-based%20Approaches%20to%20Climate%20Change%20Adaptation-National%20guidance.pdf>
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Scaling Up Ecosystem-based Adaptation in Mountains

Kenya Situation Analysis



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1. Situation Analysis Introduction

Mountain ecosystems, including the Aberdare Mountains, the Cherangani Hills, Mt. Elgon, and Mt. Kenya, represent four of Kenya's five water towers. Although these water towers cover only 2% of the country, they supply more than 75% of Kenya's renewable surface water. These regions are also vital national assets in terms of climate regulation, flood and erosion control, groundwater recharge, and carbon storage and sequestration.¹ Kenya's economy is highly dependent on rain-fed agriculture, tourism, and the service industry. The agricultural sector represents 51% of the country's gross domestic product (GDP) and employs 75% of the population.² Millions of farmers live on the slopes of mountain forest ecosystems and depend on their rich soils and micro-climatic conditions for the production of high-yield agricultural crops.

Kenya Vision 2030, which was adopted in 2008, is the national long-term development policy that aims to transform Kenya into a newly industrialized, middle-income country.³ The program's target growth rate in terms of GDP is 10% by 2030. This rate of growth will inevitably result in an increased demand for water, food, and other limited natural resources in Kenya. Furthermore, climate change is expected to exacerbate existing stressors on Kenya's vulnerable mountain ecosystems and pose a direct threat to economic development, water and food security, and poverty reduction in the country.

Ecosystem-based Adaptation (EbA) - the conservation, sustainable management and restoration of natural ecosystems to help people adapt to the effects of climate change - has great potential to reduce Kenya's vulnerability to a range of climatic impacts and provide significant co-benefits for biodiversity and people.⁴ Adopting EbA approaches in the management of mountain ecosystems can have a positive impact directly on local communities and indirectly on the Kenyan population as a whole. Such measures can contribute to both the Kenya Vision 2030 goals for socioeconomic development, as well as the UN's Sustainable Development Goals (SDGs) of eliminating poverty, zero hunger, provision of clean water and sanitation, climate action, and sustainable life on land.

2. Development, Climate Change and Mountain Areas in Kenya

a. Demography

Kenya's population has grown from 38 million in 2009 to about 50 million in 2018.⁵ Nearly three quarters of the population is under the age of 30. Life expectancy in Kenya is estimated to be around 59 years of age as of 2016.⁶ Kenya's capital of Nairobi is the 14th largest city in Africa with a population of approximately 6.54 million people.

99% of the population is comprised of ethnic groups including Kikuyu, Luhya, Luo, Kalenjin, and Kamba, among others, while the remaining 1% is non-African.⁷ There are over 40 distinct ethnic groups in Kenya, ranging in size from about seven million Kikuyu to about 500 El Molo who live near the shore of Lake Turkana.⁸

b. Mountain ecosystems, land cover, and resource use

Global mountain ecosystems are home to 600 million people and serve as the headwaters for more than half of the world's population. Kenya is home to two major mountains - Mt. Elgon, which straddles the border between Uganda and Kenya, and Mt. Kenya, located in central Kenya. The international boundary divides the two largest ethnic groups native to Mt. Elgon, the Sabel/Sabaot and Bagishu.⁹ The project will work with local communities living in the Chepkitala National Reserve and along the fringes of the Mt. Elgon Forest Reserve and National Park in Bungoma county (Figure 1).

The Mt. Elgon ecosystem is located within the Lake Victoria Basin and is shared between two East African Community (EAC) Partner States - Kenya and Uganda. The Mt. Elgon system covers the massive but extinct volcanic mountain ranges on the border of Uganda and Kenya. Mt. Elgon is one of Africa's few single-standing mountains over 2,000m above sea level. It is the continent's seventh highest mountain, with an altitude that ranges from 1,000m on the lower eastern and northern slopes, to Wagagai, the highest peak, at 4,321m above sea level on the Ugandan side. Other unique landforms include spurs, caves and valleys that give Mt. Elgon its aesthetic value.¹⁰

The Mt. Elgon ecosystem is comprised of two National Parks and Forest Reserves, one National Reserve, and several areas without official conservation status. It is an important water catchment for Lake Victoria, Kyoga, Turkana and the Nile River. The area's forests receive up to 3000 mm of rain each year, which they store and release to support the unique flora, fauna and large human settlements on either side of the mountain. The combined Kenyan and Ugandan protected areas are sufficiently large enough to maintain viable populations of many of the higher and rare species of mammals which are vulnerable to extinction in smaller National Parks. These include elephants, buffaloes, leopards, giant forest hog, waterbuck, bushbuck, duiker and various monkeys. It supports other species of extreme conservation importance which are rare and /or have limited distributions. IUCN has listed 37 fauna species in the area as globally threatened (22 mammal, 2 insect and 13 bird species), making the area a priority for species conservation. Mt. Elgon has also been given the status of an Important Bird Area due to the rarity of many of its endemic bird species.

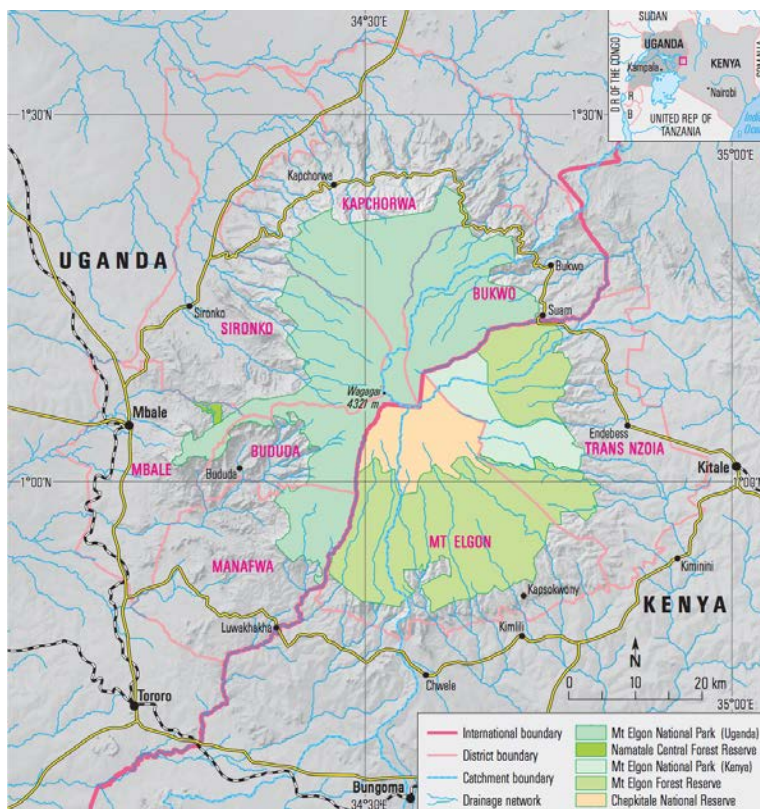


Figure 1: Map of the protected area regimes on Mt. Elgon, straddling the Uganda - Kenya border (Source: Andreas Brodbeck)

3. Economy and Livelihoods

a. General information: Kenya's economy

Kenya is classified as a lower middle-income country. Economic growth over the past decade has been driven by the service industry, yet the economy of Kenya is still largely dependent on the agricultural sector. Agriculture accounts for about 26% of the country's GDP and 50% of the country's revenue from exports.^{11,12} More importantly, 7 out of 10 people rely on agriculture for their livelihoods.¹³ Even though Kenya's economy is slowly moving towards a structural transformation investing in services, industrial expansion and infrastructure, agriculture still forms the base of the economy. To put the amount of available land in perspective with the demand for agricultural space, 23% of Kenya is classified as mountainous while more than 70% of the rural population depends on subsistence farming. Therefore, both the provisioning and regulating services provided by mountain ecosystems are integral to the well-being and prosperity of the rural populations and smallholder agriculture.¹⁴

Over the past decade, several counties in Western Kenya have experienced declines in agricultural productivity, largely due to soil degradation caused by poor land management practices. Some such devastating practices include monoculture farming and the overuse of chemically-based fertilizers and pesticides.¹⁵ A recent Economics of Land Degradation study identified the application of manure to the land and intercropping as two of the most cost and time efficient sustainable land management practices for the area.¹⁶ Agroforestry and physical terraces in forested mountain ecosystems are also sustainable land management promising practices, but they both require high upfront investments and maintenance costs.

b. Key indicators for mountain economies¹⁷

The rural populations living around Kenya's natural forests largely depend on the ecosystem's provisioning services and forest products. In particular, the people residing around the forest area gather timber, fuelwood, fruits, medicinal herbs, and fodder (sometimes illegally).¹⁸ In addition, rural mountainous communities keep livestock, which serve an important source of food security and income. Livestock population data from 2009 indicate that the locals bred mostly indigenous chicken as well as cattle and sheep.¹⁹ Capture fisheries and freshwater aquaculture also supply the local and regional markets with a great source of protein while sustaining the livelihoods of the local fishermen.²⁰ Some freshwater fish species are particularly productive at higher altitudes. For example, trout is mostly cultured in the Mt. Kenya region because of the species' temperature sensitivity.²¹

Forest sector:

The forest sector accounts for about 1% of the Kenyan economy.²² However, forests contribute significantly to the energy sector because 75% of domestic energy production is reliant on fuelwood and charcoal. Wood is widely used in Kenya for industrial (wood, paper, chemical) and construction purposes (Table 1).

	2000	2004	2008
Food, beverages and tobacco	0.5%	0.6%	0.3%
Wood and cork products	13.5%	2.6%	1.5%
Paper and paper products	10.7%	19.7%	10.4%
Chemical industry	24.1%	24.6%	15.4%
Construction	2.1%	0.9%	1.3%
Households	0.9%	1.4%	1.7%

Table 1: Percentage share of forest products in intermediate and final demand. The chemical industry was the number one consumer of forest products (Source: UNEP, 2012)²³

In 2005, the charcoal industry employed about 700,000 people throughout the value chain (production, transport, trade). The number increases significantly when accounting for the dependent family members (about 2 million). The rural populations are even more dependent on forest products, especially on wood fuel; 90% of rural households depend on firewood as their primary source of energy for cooking and heating.²⁴ Agricultural expansion and mining activities coupled with lack of governance and enforcement have led to extensive deforestation and land degradation in many parts of Kenya.²⁵ With the forestry sector contributing around 20% to the overall economy, the conservation of Kenya's forests is integral to the country's economic prosperity (Figures 2 & 3).

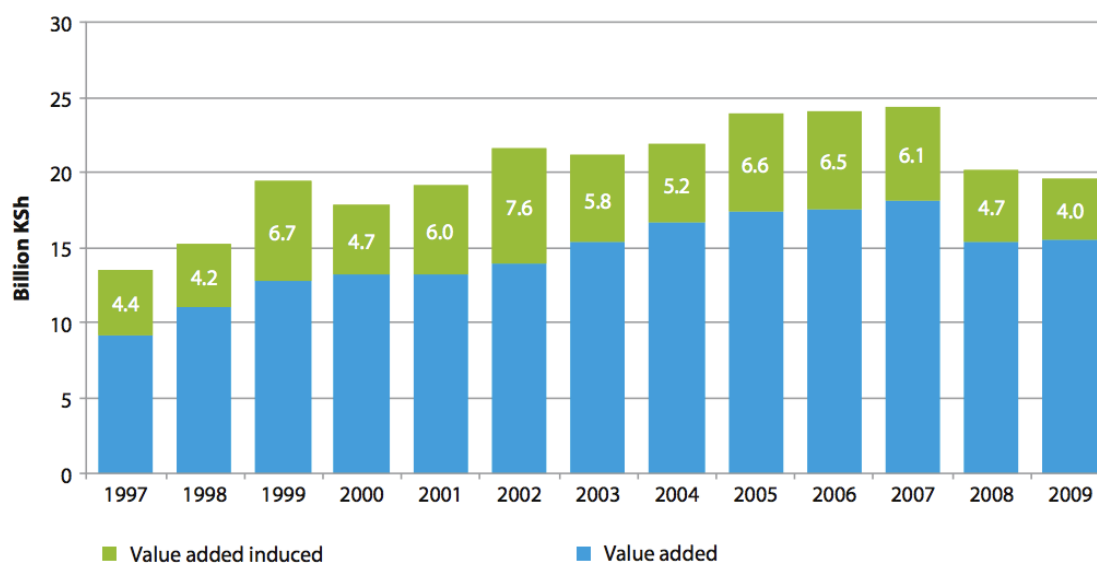


Figure 2: Value added to the economy by the forestry sector (Source: UNEP, 2012)²⁶

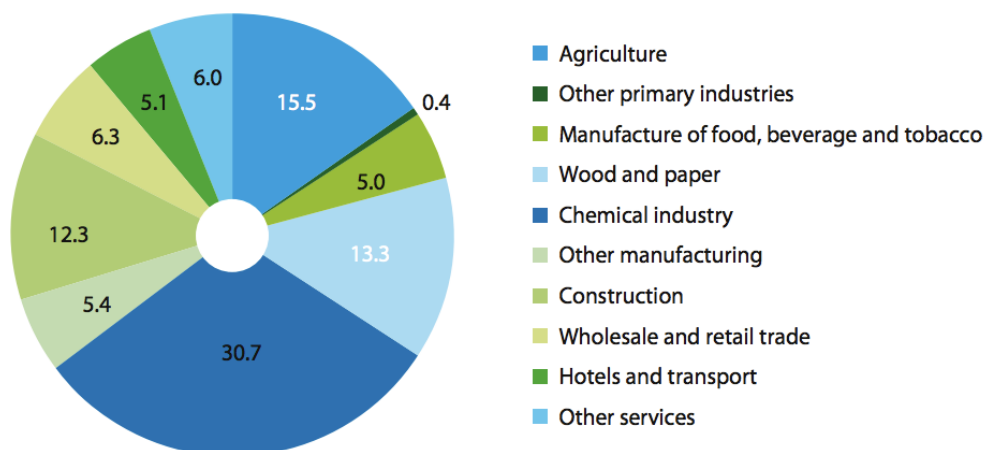


Figure 3: Value added by the forestry sector to different industries. The chemical industry, wood and paper production and agriculture are the three sectors that rely the most on the forest resources (Source: UNEP, 2012)²⁷

Fishing Sector:

Fishing accounts for 0.4%-0.6% of the national GDP annually. 94% of the total fisheries output in Kenya is derived from freshwater fisheries and approximately 90% of fish production is located in the Kenyan portion of Lake Victoria.²⁸

Agricultural Sector:

The crops, livestock and fisheries subsectors are the main components of the agricultural sector, contributing 77.6%, 19.6% and 2.0% of the agricultural GDP respectively. Horticulture and industrial crops account for 90% of the exports. Agriculture in high altitude areas is focused on high value crops such as banana and coffee.²⁹

c. Contribution of mountain ecosystem services and biodiversity to the economy

Regulating services defined in the MA	Description
Local climate regulation	Ecosystems may influence climate both locally and globally (e.g. locally, land cover changes can affect temperature and precipitation; globally, ecosystems play an important role in the carbon cycle).
Water regulation	The timing and magnitude of runoff and flooding can be strongly influenced by changes in land cover, including, in particular, changes in the water-storage potential of the system such as the conversion of wetlands or the replacement of forests with croplands or croplands with urban areas.
Erosion regulation	Vegetative cover plays an important role in soil retention and the prevention of landslides.
Water purification and waste treatment / Water pollution sink	Ecosystems can help to filter out and decompose wastes introduced into inland waters and coastal and marine ecosystems. In many cases the waste-removal capacity of the ecosystem may be exceeded. In such cases the ecosystem serves as a water-pollution sink
Disease regulation	Changes in ecosystems can directly change the abundance of human pathogens such as cholera and can alter the abundance of disease vectors such as mosquitoes.

Table 2: Ecosystem services provided by Kenya's five indigenous montane forest areas, or water towers: Mau Forest Complex, Mount Kenya, the Aberdares, Mount Elgon and Cherangani (Source: UNEP, 2012)

Water:

Four out of five of Kenya's water towers are mountains. Water towers are essential for storing water during the wet seasons and slowly releasing it during the dry seasons, thus providing a measure of resilience against drought (Table 2).³⁰ The water infiltrating through the soil is purified by microorganisms, a crucial process for the provisioning of clean water. In addition, 35% of Kenya's power supply comes from hydroelectric dams.³¹ However, none of these dams are located in the Mt. Elgon region. Although Kenya has been largely dependent on hydroelectricity in the past, it is now shifting towards geothermal and fossil fuels because of the decreased capacity of the dams due to drought.³²

Agriculture:

The high altitude and cooler climate of Kenya's mountains support tea and coffee production, two of the country's primary exports.³³ Interestingly, most of the production is held by smallholder farmers. Another major export, cut-flowers, is grown on certain mountainous regions around the country, including Bungoma and Trans-Nzoia counties and Mt Kenya.³⁴ Mountain slopes also support rain fed subsistence agriculture, which primarily includes maize, wheat and rice, as well as cattle-herding.^{35, 36}

Forest Cover:

Forest cover is essential as a protection measure against soil erosion, flooding and landslides. The roots of the trees maintain the soil's structure and prevent landslides. The

forest canopy intercepts rainfall and thus decreases soil washout while also contributing to temperature regulation. In addition, tree-covered soils have higher water infiltration rates, which are essential for flood control and water purification as well as for the recharge of groundwater supplies. Forests also act as carbon storages by removing CO₂ from the atmosphere and are integral for nutrient recycling and climate regulation.^{37,38}

Biodiversity:

Kenya is the home of more than 35,000 species of flora and fauna. Its rich biodiversity supports a booming ecotourism industry that contributes 3.7% to the country's GDP.³⁹ The country's biological resources are essential for resilience against environmental disturbances and provide the local populations with both food and medicinal plants.⁴⁰ Biodiversity has been recognized as an integral pillar for human development and as an indispensable factor for achieving the Vision 2030 development goals.^{41, 42}

d. Gender and mountain livelihoods

Women were granted the same legal rights as men under the third redrafting of the Kenyan Constitution adopted in 2010. In an effort to promote gender equality, the redrafted Constitution seeks to remedy the traditional exclusion of women and promote their full involvement in every aspect of growth and development.⁴³ Although it became legal for women to have their name on a land deed in 2010, only 3% of the land in Kenya was owned by women as of 2013.⁴⁴ In Bungoma County at the foothills of Mt. Elgon, 9% of title deeds are held by women.⁴⁵ Furthermore, approximately 51% of people living in Bungoma County have no knowledge of women's constitutional right to inherit land.⁴⁶ The lack of progress in female land ownership is largely due to prevailing social stipulations about land inheritance. In only a few of Kenya's 47 counties does the majority of the population view women inheriting property as socially acceptable, which suggests that customary laws are still very powerful in the exclusion of women from inheriting land.⁴⁷ The enforcement of Kenya's new constitution and women's legal right to own land will be necessary to equalize access to agricultural capital across genders.

Women in Kenya generally farm smaller and less productive plots than their male counterparts.⁴⁸ As a result, female-headed farming households earn only 58% of the income earned by male-headed households in rural areas.⁴⁹ The gender gap in plot size and agricultural productivity can largely be attributed to women's limited access to labor and credit services. A 2014 study of over 13,000 rural farming households in Kenya found that male-managed farms receive higher levels of technical assistance and access to extension services for agricultural production from the national government and nonprofit organizations.⁵⁰ Women's continued land tenure insecurity also prevents them from receiving loans that would help them finance their farms for better productivity and maintenance.⁵¹ According to a 2007 report by the World Bank, eliminating gender based inequalities in education and access to agricultural inputs could result in a one-off increase in output by as much as 4.3 percent points of GDP, followed by sustained year-on-year increase of 2.0 to 3.5 percentage points in GDP growth in Kenya.⁵²

Within the environmental sector, the Green Belt Movement (GBM) has played a significant role in promoting gender equality. The women's GBM was first established in 1977 to

address the problems of soil erosion, deforestation, and water scarcity. GBM has prioritized 30 watersheds in 25 counties in the five major mountain complexes in Kenya, including Mt. Elgon. GBM's network of over 4,000 community groups in Kenya volunteer to protect their natural environment through a wide variety of landscape and farm-based restoration projects.⁵³ GBM empowers local women by having them plant trees, which gives them the customary right to have a say in how the trees and areas around them are managed.⁵⁴ The participants are also trained in rain water harvesting and sustainable agricultural practices with the aim of diversifying their livelihoods and generating personal income.

e. Mountain livelihoods reliant on the Mt. Elgon ecosystem

Mt. Elgon is home to more than 2 million people who directly rely on the mountain's resources for subsistence and commercial farming, livestock keeping and ecotourism.^{55,56} The mountain itself crosses over the border between Kenya and Uganda. In Kenya, Mt. Elgon is categorized under three geographical zones: the foothills, the forest belt and the mountain's peak. The forest belt is further divided in three distinct protected areas: Chepkital National Reserve, Mt. Elgon National Park and Mt. Elgon Forest Reserve.⁵⁷ Several ethnic groups inhabit Mt. Elgon, with the Abaluyia and the Kalenjin being the principal ones.⁵⁸

Most of the local economic activity is located in the foothills of the mountain, where the land is intensely cultivated. However, agriculture in the region is primarily rain-fed and the lack of access to high quality seeds, fertilizer and technology have resulted in low yields.⁵⁹ For years, the resources provided by the forest belt had been a significant source of livelihood for the local populations who used to hunt and gather food.⁶⁰ However, since the forest area came under government protection, the locals were no longer allowed to forage for mushrooms and honey, graze their livestock, or collect firewood, timber and other materials that were traditionally used for construction.⁶¹ This underscores the challenge of finding an equilibrium between conservation and development.⁶² Mt. Elgon is also central to the region's water security and availability. It is one of the nation's water towers, indicating it serves as a freshwater drainage basin.⁶³

Mt. Elgon serves as the catchment area for the Nzoia river, which ends in Lake Victoria. The communities living around the Nzoia watershed cultivate two water intensive crops, sugarcane and rice. 7% of sugarcane produced in Sub-Saharan Africa is produced in Kenya and a large portion of it originates from the foothills of Mt. Elgon.⁶⁴ Sugarcane is a lucrative industry and so some smallholder farmers switched to cane. This shift has been met with concern, fearing that it might exacerbate food insecurity in certain areas.⁶⁵ Subsistence farming is also ubiquitous at the slopes of Mt. Elgon and the Nzoia watershed, with maize, beans, sweet potatoes and cassava being the primary crops.⁶⁶

4. Mountain Areas Environmental Issues

a. Threats to the mountain environment

Kenya's mountains play host to many natural resources that support the nation's economy and mountain peoples' livelihoods, but the intensity of cultivation, the growth of the human

population, and the planet's changing climate all have the potential to compromise the health and productivity of the ecosystem . The table below outlines several key threats to Kenyan mountain ecosystems, as well as a summary of their associated impacts on the environment.

One of the largest threats to Kenya's mountains is deforestation. Only 2% of Kenya is still covered by its indigenous forests.⁶⁷ Deforested areas are more vulnerable to erosion due to the lack of vegetation anchoring the soil and can be vulnerable to flooding due to decreased water infiltration rates; this increases the risk of disasters such as landslides. Forests also create microclimates that can regulate air temperature. This not only makes the environment more comfortable to occupy, but also can decrease the fecundity of mosquitoes, protecting people from malaria.⁶⁸ Deforestation occurs for many reasons, such as timber and fuelwood harvesting or the clearing of space for agriculture, but too much extractive use directly threatens the ability of Kenya's montane forests to provide their valuable services.

Threats	Impacts
Deforestation	Loss of habitat, increased erosion, risk of landslides, increased malaria risk, decreased groundwater recharge and purification
Climate Change	More intermittent rainfall, increased frequency and intensity of drought, increased pressure on mountain freshwater resources
Overgrazing by livestock	Less vegetation cover leads to decreased groundwater recharge and carbon storage
Cultivation of marginal soil	Expansion of agricultural land contributes to habitat loss
Soil erosion	Increased risk of landslides, loss of soil fertility
Landslides	Risk to infrastructure, risk to human health, destruction of agricultural land
Habitat loss	Loss of biodiversity

b. Climate change impacts on mountain areas

Climate forms the basis for the state of all other natural resources, such as water, forests, and biodiversity. Because of this, even small changes in the Earth's climate system have the potential to cause devastating impacts in sensitive environments. Because natural climate variability, global climate change, and anthropogenic factors like changing land use all have interacting effects on mountains, it can be difficult to isolate the impacts of climate change alone.⁶⁹ However, current predictions do indicate that the following dangerous changes may be in store:

Global Climate Modeling (GCM) data indicates that mean global annual temperature is projected to increase by between 0.8 and 1.5 °C by 2030, and 1.6 to 2.7 °C by the 2060s. This overall rise in temperature may compound the natural temperature and precipitation variation based on the El Nino Southern Oscillation to cause periods of intense droughts and flooding.

East Africa is also characterized by large variability in rainfall volume and intensity, and such variability is predicted to become more pronounced in response to climate change. As Kenya's water towers, mountains collect and store water during rainy periods that then flows downstream to supply lower-lying parts of the country in drier times. With less vegetative cover, mountains cannot store water as effectively, and therefore may not be able to meet the needs of users downstream as rainfall becomes more intermittent.

Another consequence of global warming is sea level rise. Even though mountain communities are not directly threatened by coastal flooding, saltwater intrusion of freshwater aquifers limits the availability of freshwater. If aquifers are compromised, water stress will increasingly be transferred Kenya's vulnerable water towers, including Mt. Elgon.

Finally, climate change is projected to cause an increase in the frequency, intensity, and duration of droughts. Periods of drought are associated with increased famine, human-wildlife conflict, and population displacement, and more frequent and intense droughts would only exacerbate these issues. Furthermore, as drought episodes become more common, community conflicts driven by competition for scarce water and pasture resources are expected to increase.

Vulnerability to water and food insecurity will be exacerbated by climate change impacts and by human caused stressors such as deforestation, unsustainable agricultural production and population growth.⁷⁰ Justifiably, Kenya's Vision 2030 identifies the rehabilitation of indigenous forests on and around Kenya's five water towers, water conservation structures along major rivers, and a target of 10% forest cover as key goals.

5. Legal and Administrative Setup

a. Climate Change Legislation

In 2016, the Kenyan government approved the Climate Change Act to create a legislative mitigation and adaptation framework. The Act provides a framework for promoting climate resilient low carbon economic development. The Act aims to (Article 3-2).⁷¹

1. "Mainstream climate change responses into development planning, decision making and implementation;
2. Build resilience and enhance adaptive capacity to the impacts of climate change;
3. Formulate programs and plans to enhance the resilience and adaptive capacity of human and ecological systems to the impacts of climate change;

4. Mainstream and reinforce climate change disaster risk reduction in strategies and actions of public and private entities;
5. Mainstream intergenerational and gender equity in all aspects of climate change responses;
6. Provide incentives and obligations for private sector contributions to achieving low carbon climate resilient development;
7. Promote low carbon technologies to improve efficiency and reduce emissions intensity by facilitating approaches and uptake of technologies that support low carbon, and climate resilient development;
8. Facilitate capacity development for public participation in climate change responses through awareness creation, consultation, representation and access to information;
9. Mobilize and transparently manage public and other financial resources for climate change response;
10. Provide mechanisms for, and facilitate climate change research and development, training and capacity building;
11. Mainstream the principle of sustainable development into the planning for and decision making on climate change response; and
12. Integrate climate change into the exercise of power and functions of all levels of governance, and to enhance cooperative climate change governance between national government and county governments.”

The Act establishes a National Climate Change Council (NCCC), chaired by the President, with Deputy President as vice-chair, which serves as the foremost national climate change coordinating body. The NCCC shall, foremost “ensure(s) the mainstreaming of climate change functions by the national and county governments”, and “approve and oversee the implementation of the National Climate Change Action Plan (NCCAP).” The agency lead for the NCCC is the Ministry of Environment and Natural Resources and will be chaired by the Cabinet Secretary of the National Climate Change Secretariat (NCCS). The Cabinet Secretary is responsible for reviewing and updating the NCCAP every five years with implementation reviews conducted every two years and provide technical assistance on climate change actions and responses to County governments.

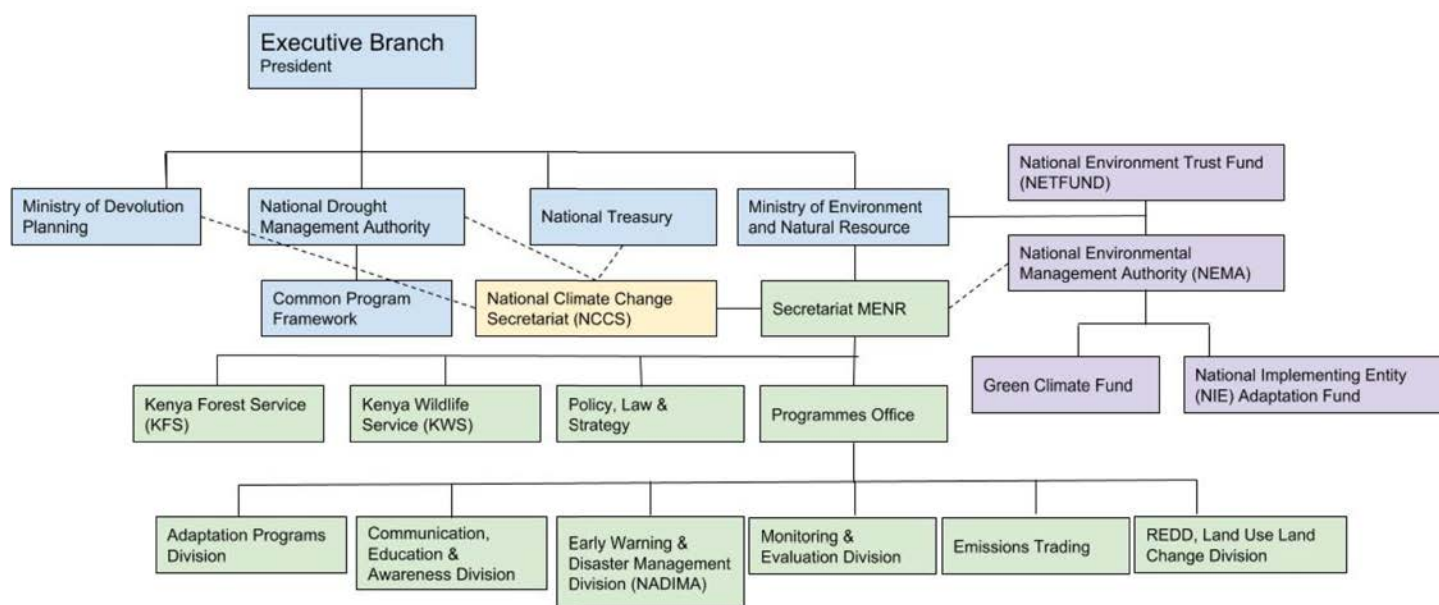
Two additional offices within the NCCS responsible for climate change management include the Policy, Law and Strategy Office and the Programmes Office.⁷² The Policy, Law and Strategy Office, in conjunction with NEMA, initiate all necessary policy, legal, strategy and planning processes, and promote and cooperate on legal information on matters related to climate change. This office will lead international climate change negotiations and coordinate with other government agencies to phase out programs that conflict with objectives outlined by the UNFCCC. The Programmes Office serves as the central administrative office for all climate change programs and collaborates with all other program divisions that include climate change projects.

There are seven main agencies that are responsible for implementing climate change policies passed by CCA legislature, these include, National Government Sectoral Agencies (NCCA), Ministry of Environment and Natural Resource (MENR), National Environmental Management Authority (NEMA), National Drought Management Authority (NDMA), Water Resource Management Authority (WARMA), National Disaster Risk Management Authority (NADIMA), and County Governments.

Implementing Agency	Implementing Role
National Government Sectoral Agencies	Integrate the NCCAP into sectoral strategies, action plans and other implementation projects. They report annually to the National Climate Change Council on the status and progress of all assigned climate change duties and functions
Ministry of Environment and Natural Resource (MENR)	Responsible for implementing and regulating policies and programs to improve, maintain, protect, conserve and manage Kenya's water, forestry, wildlife and environment
National Environmental Management Authority (NEMA)	A semiautonomous agency in the Ministry of Environment and Natural Resources, is responsible for monitoring and enforcing compliance of climate change interventions. NEMA is the implementing entity for the Adaptation Fund and the Green Climate Fund
National Drought Management Authority (NDMA)	Coordinates drought management and disaster risk reduction actions under the Ending Drought Emergencies program reports annually to the NCCC The Common Program Framework works within the NDMA to develop and strengthen institutions, mechanisms and capacities that build resilience to drought and climate change
Water Resource Management Authority (WARMA)	In the Ministry of Water; coordinates water resource management and flood preparedness at the national and subnational level
National Disaster Risk Management Authority (NADIMA)	Leads and coordinates the country's approach to disaster prevention, preparedness, mitigation, response and recovery, however this office has only been proposed via the Climate Change Act of 2016 and has not yet been established ⁷³

County Governments	Integrate and mainstream climate change actions, interventions and duties into County Integrated Development Plans (CIDPs); and designate a County Executive Committee member to coordinate climate change affairs; submit a report on the implementation progress to the County Assembly for review and debate
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a. Institutional setup for climate change: Organogram



Organogram Legend: **Purple** indicates semi-autonomous organizations. **Blue** indicates branches or directorates that report to the executive branch. The **Green** indicates bureaus or offices within a branch. **Yellow** indicates cross-sector governing office of climate change.

b. Financing Climate Change Initiatives

Within Kenya, there are a number of organizations that are able to finance climate change initiatives.

National Environment Trust Fund (NETFUND): Serves as a semi-autonomous corporation under the Ministry of Environment and Natural Resources, which was established by the Ministry in 2004 to fulfill the Environment Management and Coordination Act (EMCA). EMCA established the National Environment Trust Fund to mobilize, manage and provide resources for environmental management. NETFUND programs support access to clean water; create green jobs; promote reuse, composting and recycling to reduce waste; and foster clean technology in Kenya through solar, hydro-power and recycled biomass.

African Climate Change Fund (ACCF): Created by the African Development Bank in April 2014 with an initial contribution of €4.725 million from the German government to support African countries in building their resilience to the negative impacts of climate change and in transitioning to sustainable low-carbon growth.⁷⁴ To date, the ACCF has approved 8 small grant projects for a total of USD \$3.3 million. The approved projects are supporting six countries, including Kenya, to strengthen their capacities to access international climate finance, as well as two multinational projects.

Strengthening Adaptation and Resilience to Climate Change in Kenya Plus (StARCK+): Funded by the Government of the United Kingdom, StARCK+ has supported the National Drought Management Authority (NDMA) through the Adaptation Consortium to assist five counties to mainstream climate change in planning and budgeting and be climate-finance ready. This includes the establishment of county climate change funds that support community-prioritized adaptation investments.

County Climate Change Funds (CCCFs): CCCFs are devolved finance mechanisms under the authority of each county government that promote mainstreaming of climate change adaptation into local planning and budget systems. The CCCFs are aligned with national priorities set out in Kenya's NAP, and enable these county governments to strengthen and reinforce national climate change policies while delivering on local adaptation priorities.⁷⁵ CCCFs are structured to blend financial resources from international climate finance, multilateral development banks, the private sector, the Government of Kenya and their own county budgets. So far, CCCFs have only been established in the counties of Garissa, Isiolo, Kitui, Makueni and Wajir, but the program has the potential to expand to the Mt. Elgon area.

c. Kenya contribution to the UNFCCC

The National Adaptation Plan (NAP) served as the adaptation component of Kenya's Intended Nationally Determined Contribution (INDC) submitted to the UNFCCC. While not directly specifying EbA, EbA like measures are included in the text. Specifically:

1. Highlight the importance of adaptation and resilience building actions in development;
2. Integrate climate change adaptation into national and county level development planning and budgeting processes;
3. Enhance the resilience of public and private sector investment in the national transformation, economic and social and pillars of Vision 2030 to climate shocks;
4. Enhance synergies between adaptation and mitigation actions in order to attain a low carbon climate resilient economy;
5. Enhance resilience of vulnerable populations to climate shocks through adaptation and disaster risk reduction strategies.

6. Ecosystem-based Adaptation (EbA) related Strategies, Policies and Projects

Cognizant of the vulnerabilities induced by climate change, Kenya has incorporated mitigation and adaptation commitments into the country's national policies. The term EbA

was coined by IUCN and partners during the 14th session of the UNFCCC COP in Poznan in 2008. A year later the EbA definition was accepted by the Convention of Biological Diversity (CBD) Secretariat to which Kenya has been a party to since 1994.⁷⁶ Even though EbA was incorporated into international law in 2008, EbA strategies have yet to be explicitly found in Kenya's national policies. However, EbA type approaches have been proposed in Kenya's National Climate Change Response Strategy (NCCRS), National Climate Change Action Plan (NCCAP), National Adaptation Plan (NAP) and Intended Nationally Determined Contribution (INDC).

Policy	Climate Change Component	EbA approaches	Focal Agency
<u>National Climate Change Response Strategy (NCCRS)</u> (adopted 2010)	Includes, among others, the identification of key threats, the development of indicators for vulnerability assessments and impact monitoring. Its adaptation and mitigation strategies address all sectors, including land and water management and agriculture. EbA could potentially supplement several of these strategies and assist in achieving the plan's objectives	Rehabilitation of naturally degraded areas or areas cleared for charcoal burning. Natural resource management schemes to enhance ecosystem services and adapt to climate change. Land use management for both mitigation and adaptation to climate change	Ministry of Environment and Natural Resources
<u>National Climate Change Action Plan (NCCAP) 2013-2017</u>	Kenya's NCCAP was used to identify a low carbon development pathway, climate change adaptation and mitigation strategies, financing opportunities and established performance measurement indices. The plan also proposes a policy and legislative framework as well as constitutional reforms through which NCCAP objectives will be fully accomplished	On-going EbA related responses to climate change include, among others: conservation agriculture, integrated soil fertility management, animal breeding, conservation of catchment areas, afforestation, agroforestry, community forest management	Ministry of Environment and Natural Resources
<u>Climate Change Act 2016</u>	The Climate Change Act mandates the creation of the National Climate Change Council which is the governing body responsible for providing coordination between national and county governments, overseeing the implementation of the NCCAP and provide policy direction. The Act also establishes the Climate Change Fund, a mechanism to finance "priority climate change actions and interventions"	No, other than mentioning that when formulating the new NCCAP ecosystem services should be taken into account (Article 5.e)	Climate Change Council

<u>East African Community Climate Change Policy, 2009</u>	Drafted in response to the growing concern about the increasing threats of the negative climate change impacts to the development of set targets and goals in the region. In addition, fulfilling objectives of the EA Community; to develop policies and programs aimed at widening and deepening cooperation among Partner States	Mentions EbA like measures to guide Adaptation and mitigation actions to address Climate Change. Aims to strengthen meteorological services and improving early warning systems, increasing preparedness for disaster risk management, scaling up of efficient use of water and energy resources, irrigation, crop and livestock production, protection of wildlife and key vulnerable ecosystems such as wetlands, coastal, marine and forestry ecosystems, improving land use, soil protection, tourism, infrastructure and human settlement; intensify diseases, vectors, and pests control	EAC Secretariat
<u>National Adaptation Plan (NAP) 2015-2030</u>	NAP is considered the continuation of the NCCRS and NCCAP. NAP informs the adaptation of Kenya's Intended Nationally Determined Contribution that was submitted to the UNFCCC Secretariat. In the long-term, actions proposed include integration of ecosystem and community-based approaches in sector strategies in support of adaptation to reduce natural resource based conflicts as well as rehabilitation of water catchment areas in order to provide sustainable ecosystem services	Explicitly mentions that low-regret measures are prioritized. Programs with EbA type measures include: Implementing a resilience framework to support climate change adaptation in the Mt. Elgon Region of the Lake Victoria Basin Project; Planning for Resilience in East Africa through policy, adaptation, research and economic development program (PREPARED); Catalyzing Forest and Landscape; rehabilitation for climate resilience and biodiversity conservation in East Africa; Integrate ecosystem and community based approaches in sector strategies in support of adaptation to reduce natural resource based conflicts. Climate Smart Agriculture Programme	Ministry of Environment and Natural Resources
<u>Kenya's Intended Nationally Determined Contribution (INDC)</u>	Kenya's INDCs include ambitious goals to lower GHG emissions while providing adequate energy supplies for a growing and more energy-demanding population.	INDC specifically mentions, "enhancing the resilience of ecosystems to climate variability and change" as a priority adaptation action. Measures include the adoption and promotion of climate smart agriculture (CSA), afforestation and reforestation, decreased reliance on wood fuels, land reforms and climate change adaptation in the water sector	Ministry of Environment and Natural Resources

<u>Kenya Vision 2030</u>	Kenya's development program aims to make Kenya into a "newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment." Development revolves around three pillars: economic, social and political. The provisions relating to the environment include agriculture under the economic pillar and water and land management under the social pillar. Several "flagship projects" have been launched to support this vision	EbA-type projects include the rehabilitation of indigenous forests in Kenya's five water towers, water conservation structures along the Nzoia and Nyando rivers	Ministry of State
<u>National Water Master Plan 2030</u> (adopted 2014)	Kenya has acknowledged that its water resources will be increasingly under stress due to climate change impacts and increasing demands. The National Water Master Plan 2030 is part of Vision 2030 and aims to evaluate the state of the country's water resources and their vulnerability against climate change in order to prepare effective action plans for the management of their water resources. They have identified five water bodies to be assessed (Lake Victoria, Rift Valley, Athi, Tana, Ewaso Ng'iro)	Watershed conservation and afforestation to decrease soil erosion are mentioned but not identified as pressing issues. There is however a target of 10% reforestation cover in the Kenya Vision 2030. Integrated Water Resources Management (IWRM) is proposed to regulate irrigation and water supply simultaneously, which would be in accordance with the Irrigation Act	Ministry of Environment and Natural Resources
<u>National Environmental Policy 2013</u>	Policy recognizes climate change as a significant risk to the Kenyan population. Disaster management, water, food and energy security are identified as serious challenges	Ecosystem approach is one of the guiding principles. EbA-type strategies include: sustainable management of mountain ecosystems, integrated watershed management, land use management	Ministry of Environment and Natural Resources
National Disaster Management Policy, 2013	This policy recognizes that environmental protection and sustainable use of natural resources is critical for prevention of disasters. It notes that damage to local ecosystems increases the risks of particular hazards and impacts on vulnerable groups. Apart from working with other sectors on environmental management, the policy recommends that effort be made during relief and recovery to prevent additional damage to the environment. The proposed coordinating agency (i.e. NADIMA) will in collaboration with other stakeholders enact policies and regulations that guide land use in rural and urban areas in order to minimize disaster risk and vulnerabilities	No mention of EbA strategies	National Disaster Management Agency (NADIMA)
<u>Kenya Agricultural Sector Development Strategy 2010-2020</u>	Blue-print of the agricultural sector to implement Vision 2030. It sets out a detailed plan to "position the agricultural sector as a key driver for delivering the 10% annual economic growth rate envisaged under the economic pillar of Vision 2030". It envisions "a food-secure and prosperous nation" and aims to increase productivity; commercialization and competitiveness of agricultural commodities and enterprises; and develop and manage key factors of production	No direct mention of EbA but advocates for sustainable land management and scaling up of appropriate technologies suitable for drought-prone areas. It further proposes programs for mitigation and adaptation to climate change	Ministry of Agriculture, Livestock and Fisheries

<u>Kenya Climate Smart Agriculture Strategy (CSA) 2017-2026</u>	Allows for adaptation to climate change while making agricultural systems more resilient and thus promoting food and nutritional security. In addition, CSA significantly decreases GHG emissions from agricultural activity and therefore CSA strategies will be adopted to help meet the country's NDC contribution. The loss of biodiversity and ecosystem services are identified as significant threats to agricultural production and sustainable development	EbA is not explicitly mentioned but EbA-type approaches include forestry, farm forestry and agroforestry, agro ecosystem approaches, integrated watershed management and upstream water catchment conservation	Ministry of Agriculture, Livestock and Fisheries
<u>National Biodiversity Action Plans (NBSAP) 2011-2020</u>	NBSAP is the implementation instruments for the Convention of Biological Diversity I. Climate change is recognized as a threat to plant and animal species	EbA is mentioned as an approach towards achieving Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	Executive Branch
<u>Forestry Master Plan (1995-2020)</u>	Contains various implementation strategies that target the conservation of indigenous forests and their biodiversity; particular attention is given to habitats of high biodiversity and endemism and priority areas for conservation, including wetlands (especially seasonal wetlands), forests, highland grasslands and natural areas near large urban areas	No mention of EbA strategies	Kenya Forest Service
<u>National Forest Programme (NFP) Strategy (2016-2030)</u>	Strategic framework for forest policy, planning and implementation to coordinate the sector's development. Forest sector challenges to address climate change include (section 8.7 (Forest and Climate Change Cluster)): weak forest sector governance; unsustainable use of forest products; decreased potential to mitigate effects of climate change due to loss of forest cover; uncontrolled erosion and land-uses changes; increased exposure to risks of climate change extremes in droughts, floods and landslides; complex direct and proximate drivers of deforestation and degradation.	EbA-type approaches include Climate Smart Agriculture, reforestation and agroforestry	Kenya Forest Service
<u>Environmental Management and Coordination Act (2012)</u>	Establishes the National Environment Management Authority (NEMA) which is responsible for coordinating the various environmental management activities being undertaken by lead agencies and for promoting the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensure the proper management and rational utilization of environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya	No mention of EbA strategies, mostly rules and regulations on water quality and conservation of the natural resources	NEMA

<u>The Forest Act 2005</u>	Development and sustainable management, including conservation and rational utilization of forest resources for the socio - economic development of the country. The Act applies to all forests and woodlands on state, local authority and private land. All forests in Kenya other than private and local authority forests are vested in the state. The Kenya Forest Service (KFS) is established as the principal agency responsible for forest resources in Kenya. Local authorities are responsible for local authority forests. The provisions of the Act are to be carried out in accordance with Kenya's obligations under any treaty or international agreement concerning forests or forest resources to which it is a party	No EbA strategies mentioned. Determines forest user rights as long as biodiversity is conserved	Kenya Forest Service
<u>The Forest Conservation and Management Act, 2016</u>	To provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes. Grants county or Cabinet Secretary authority to gazette any community or private forest mismanaged or neglected to be a provisional forest	EbA not directly mentioned but takes into consideration economic and biodiversity conservation elements to direct forest management.	Kenya Forest Service
National Land Policy 2009	Kenya's National Land Policy provides for various policy actions for addressing the environmental problems such as the degradation of natural resources, soil erosion and pollution	No direct mention of EbA, but includes key land policy principles on conservation of land quality, land reclamation, integrated land management, ecosystem protection and management, integrated watershed management.	Ministry of Lands
<u>The Community Land Act, No. 27 2016</u>	Recognizes, protects, and registers community land rights; allows for the management and administration of community land; and designates the role of county governments in relation to unregistered community land and related matters	EbA is not mentioned but the policy provides a new classification and framework of land governance. Communities should take action to protect critical ecosystems and habitats	Kenya Forest Service
<u>Participatory Land Management Guidelines</u> (adopted 2015)	The main objectives of PLM are to conserve biodiversity while enhancing people's livelihoods and to ensure the sustainable use of our forests. Climate change is recognized as a threat to livelihoods	No EbA strategies mentioned	Kenya Forest Service

7. Recommendations and Conclusion

The Kenya Vision 2030 has been the overarching framework informing policies over the past decade.⁷⁷ The goals and progress towards Vision 2030 are set and monitored in the Medium Term Plans (MTPs) which are released every five years. Within the third MTP, which extends from 2018-2022, climate change is recognized as an emerging challenge with the potential to result in up to 2% annual losses to Kenya's GDP.⁷⁸ The role of the third MTP is to continue to move the economy towards a 10% economic growth rate by the end of 2022. By integrating EbA measures into the subsequent MTP for the 2023-2027 period, Kenya will be able to support the intended growth target while creating a more sustainable society and mitigating the negative impacts of climate change on the economy.

There is a need for a regional transboundary EbA management approach and strengthened institutional collaboration between all stakeholders concerned at different levels. As the MTPs are revised on a five year basis, so are the local county equivalent, the County Integrated Development Plans (CIDPs). The CIDPs are required to be aligned with the Kenya Vision 2030 and MTPs. Therefore, CIDPs serve as essential links between the national and county governments by facilitating the implementation of Vision 2030 flagship projects.⁷⁹ The two counties surrounding the vulnerable Mt. Elgon ecosystem, Bungoma and Trans-Nzoia, could benefit from incorporating EbA programs and projects into each of their CIDPs. While one county may be able to mitigate the threats humans pose to the ecosystem, if the same or similar measures are not adopted in other counties surrounding the Mt. Elgon, than human encroachment and land degradation will continue to damage the ecosystem. For this reason, the creation of a forum that will facilitate inter-district collaboration for the implementation of EbA initiatives in the Mt. Elgon ecosystem is encouraged.

In addition to intercounty coordination, strengthened bilateral transboundary collaboration is integral to the successful implementation of EbA. Since the mid-1990s, bilateral management of Mt. Elgon has been dictated by the Mt Elgon Regional Ecosystem Conservation Programme (MERECAP) jointly supported by the Governments of Norway and Sweden in collaboration with a number of NGO's including IUCN.⁸⁰ MERECAP started in 2006 and was designed to enhance the conservation status and support natural resource management. The MERECAP is one example of transboundary protected areas management (TBPAM) projects, which have been used as a tool to connect ecosystems that span political boundaries. TBPAM provides a mechanism to improve joint enforcement that would benefit both counties by providing employment, protecting charismatic wildlife, and improving the East African Community security.

Mountain ecosystems are integral to Kenya's development, particularly for their provisioning services in food production and water supply. Since mountains are the source of livelihood for many people who are already in a vulnerable situation, building mountain communities that are resilient to climate change is of paramount importance. EbA can successfully empower communities to adapt to the impacts of climate change. To capture the full potential of EbA approaches, there is also need for capacity building, education and female empowerment.

Women's limited ability to own land and property negatively affects their ability to participate in producer groups, receive cash remuneration for their labor, and benefit from agricultural extension services.⁸¹ Awareness-building and enforcement activities should be carried out to promote women's constitutional right to own and inherit land. Given that access to extension services could influence agricultural productivity variability by up to 41.6%, further efforts should also be made to promote equal access to extension services among male and female-managed farms in order to boost their productivity.⁸²

In conducting this research, the major challenges that arose concerned the access to complete and accurate information. Census data are outdated and incomplete and there is no readily available information on how many people are directly or indirectly dependent on mountain ecosystems. However, EbA projects can help raise awareness of the vulnerability of the mountain ecosystems and the populations dependent on them and thus drive momentum for more systematic investigation and data collection.

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Scaling Up Ecosystem-based Adaptation in Mountains

Nepal Situation Analysis



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1. Introduction

The Mountain EbA Flagship Programme was developed in the Himalayas (Nepal), Mount Elgon (Uganda) and the Andes (Peru), by the International Union for Conservation of Nature (IUCN), The Mountain Institute (TMI), the United Nations Development Program (UNDP) and the United Nations Environmental Program (UNEP) between 2011 and 2016. Following the success of this program, TMI and IUCN have teamed up to expand the EbA approach within these three countries and three neighboring countries Bhutan, Kenya and Colombia. The project looks to benefit local people directly and help them adapt to the adverse effects of climate change, while also providing positive benefits for millions downstream who also depend on the resources coming from mountain ecosystems.

This document focuses on the most updated situation in Nepal. It seeks to analyze public policies, strategies, and projects related to EbA in the country, in order to find gaps and opportunities for the implementation of this approach at the national and subnational level. The information gathered in this situation analysis will be used to develop a policy brief that summarizes the main points and recommendations developed. It will also be used by TMI and IUCN in the development of the second phase of the program, in order to build wider support and generate financing for EbA within national governments and at international forums.

2. Development, Climate Change and Mountain Areas in Nepal

a. General information on Nepal's mountain areas^{1 2}

The Federal Democratic Republic of Nepal is a landlocked country in South Asia located within the heart of the Himalayan Mountain Range. As a result, it has a tremendous geographic diversity. The terrain rises from as low as 59 m in the tropical Terai (northern rim of Gangetic Plain) through the snow line to around several peaks over 7000 meters including Sagarmatha or Mount Everest at 8,848 meters. Precipitation varies from 160 mm (rain shadow north of Himalaya) to 5,500 mm on windward slopes.

Nepal can be divided into three belts from the south-north: the Terai, Pahad and the Himal.

- Terai are the hill regions, classified into Inner (dunn valleys) and Outer - the Shivaliks.
- Pahad is the mountain region, which does not contain snow. It is nearly uninhabited.
- Himal is the mountain region containing snow above 3000m. Unlike the Terai and Pahad, the Himalaya is not continuous across Nepal, but consists of around 20 subranges.

From east to west, the country is divided into three major river systems: Koshi, Gandaki/Narayani and Karnali, which are all tributaries of Gangaji. The Gangaji-Yarlung-Zangbo-Brahmaputra watershed cuts across the Nepal-Tibet border, however several Gangaji tributaries run inside Tibet.

IUCN has already earmarked sites for the programs, which have been implemented in Panchase located in Western Nepal, and new initiatives are being undertaken in the Chilime watershed of the Rasuwa District located in Central Nepal. Both of these projects will be aimed at building support for EbA approaches in mountains both on the field and in local, national and international policy.

b. Demography^{3 4}

As of 2018, the population of Nepal was 29 million. Among the many ethnic groups within the country, the main ethnic groups within the projects sites are the Brahmin, Chhetri and the Magar. Most of the population is Hindu (81.3%), followed by Buddhist (9%), Muslim (4.4%), Kirant (3.1%), and Christian (1.4%) (2011 estimates). Most of the population is divided between the southern-most plains of the

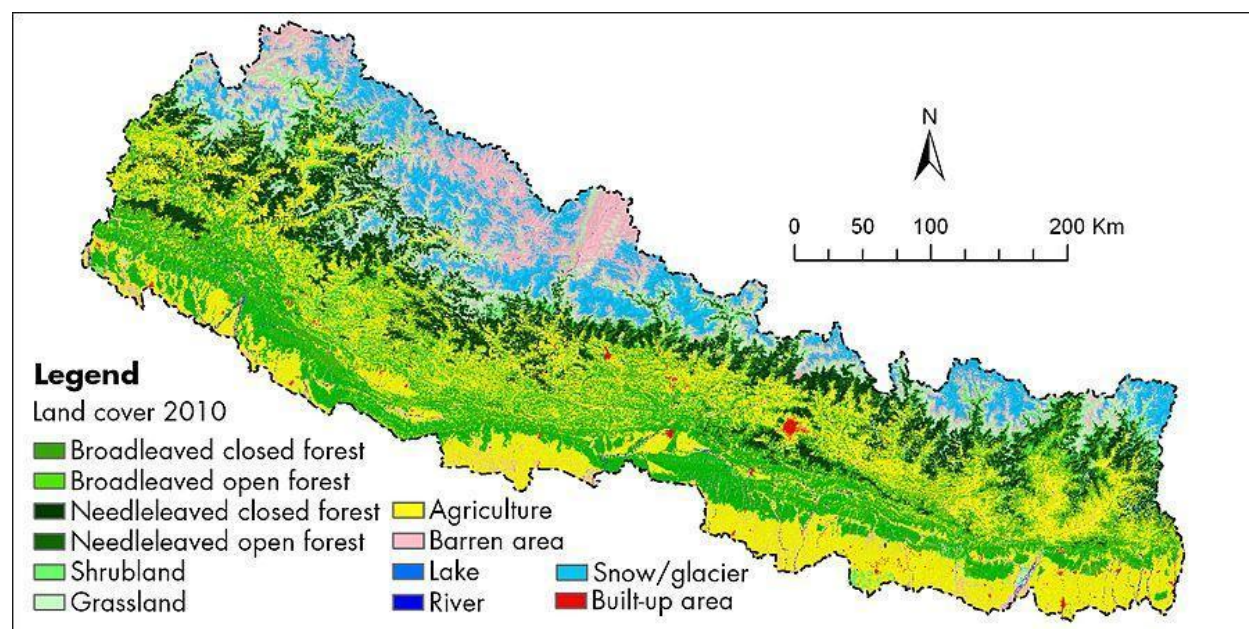
Terai region and the central hilly regions with overall density being very low. Overall population density for Nepal in 2016 was around 200 per square kilometer,⁵ which compares to countries like Italy and is around half the density of neighboring India.

c. Gender and mountain livelihoods^{6 7 8}

Rain-fed agriculture forms the major source of income of $\frac{2}{3}$ of Nepalese families but accounts for only $\frac{1}{3}$ of GDP (Chapagain, 2015; CIA). Industrial activity mainly involves the processing of agricultural products such as jute, pulses, sugarcane and tobacco and grain. There is also the potential for hydropower expansion. Tourism into the higher regions is also another source of income in terms of mountain livelihood.

d. Mountain ecosystems, land cover, and resource use^{9 10 11 12}

Broadleaved open and closed forests dominate the land cover of Nepal, as seen from the map below. According to ICIMOD, 45% of Nepal is covered by forests and 27% by agricultural land. Although this is the case, there has been a steady decrease in glaciers (Paudel et al., 2016). However, in the last decade there has been a steady increase in forestlands due to conservation efforts, however degradation and deforestation still continue in parts of Nepal. This can be seen in the figure below to where forestlands are equal to where they were in 2000. Forest and forestlands are used as resources in terms of plants used for medicinal purposes, subsistence, wood, regional and local farming and fertilizer amongst other uses (Dangol, 2002). The timber industry is expanding and hence there are large swaths of these forests that have been deforested. Fluctuations in the amount of forest lands are due to a combination of climate change related issues such as flooding due to the volatile nature of changing rainfall patterns and GLOFs which wreck a huge amount of physical damage as well as development related activities (Mandal, 2017). This leaves the soil vulnerable to erosion as the soil matrix is disturbed. With increasing cases of flooding, the top soil layer is washed off leaving the trees more vulnerable to losing stability and physically falling. Fluctuations in forestlands have also arisen due to the development of hydropower facilities.



3. Economy and Livelihoods

Nepal is one of the poorest countries in the world, with about one-quarter of the population living below the poverty line according to national surveys.¹³ Poverty varies widely across geographic location, ethnicity, caste and gender. The population is largely rural and, naturally, is heavily dependent upon agriculture as well as forestry. About 69% of the workforce lives in rural areas and agriculture contributes 27% of GDP. Poverty is much more severe in rural areas (35%) compared to urban areas (10%) and particularly so in mountainous areas. Nonetheless, over the past 10 years many social indicators have improved, with the extreme poverty rate falling from 46% in 2003 to 15% in 2010. The average growth rate in the 10-year period before 2017 was 3%,¹⁴ significantly less than the global goal of 7% per year in least developed countries¹⁵

The Nepali economy is heavily dependent on remittances, which amount to as much as 30% of GDP.¹⁶ In 2014, more than 500,000 labor permits were issued to citizens wishing to work abroad, primarily in Malaysia, Qatar, Saudi Arabia, UAE and Kuwait. With only 5% of permits being issued to women, overseas employment is heavily male dominated.¹⁷ In turn, the share of women in the domestic workforce keeps growing, particularly in agriculture. This trend has social implications, as women increasingly become the decision makers in their family. One case study of the village of Phulbari, for example, suggests that most women see the farming work as an opportunity to have a say in the community, and hence a source of empowerment.¹⁸

More than $\frac{2}{3}$ of the workforce work in agriculture, and approximately 84% of the population depends on subsistence agriculture for livelihoods and food security.¹⁹ Livestock is an important source of cash income for farm households: roughly 87% of households keep livestock of some sort. Generally, farm families in mountains raise Yak or Chauri and sheep. Nepal is richly endowed with agro-biodiversity, with rice, maize, millet, wheat, barley and buckwheat being the major staple food crops, although the vast majority of rice and wheat is grown outside of mountain communities. Buckwheat, millet and barley, on the other hand, are predominantly being grown in mountains.²⁰

The economy of many mountain communities is largely based on subsistence agriculture (crops and livestock), but the tourism, forestry and water sectors contribute much to the economy as well. At the time of writing this document, it was not possible to obtain quantitative data on mountain ecosystem contributions specifically to the overall economy.

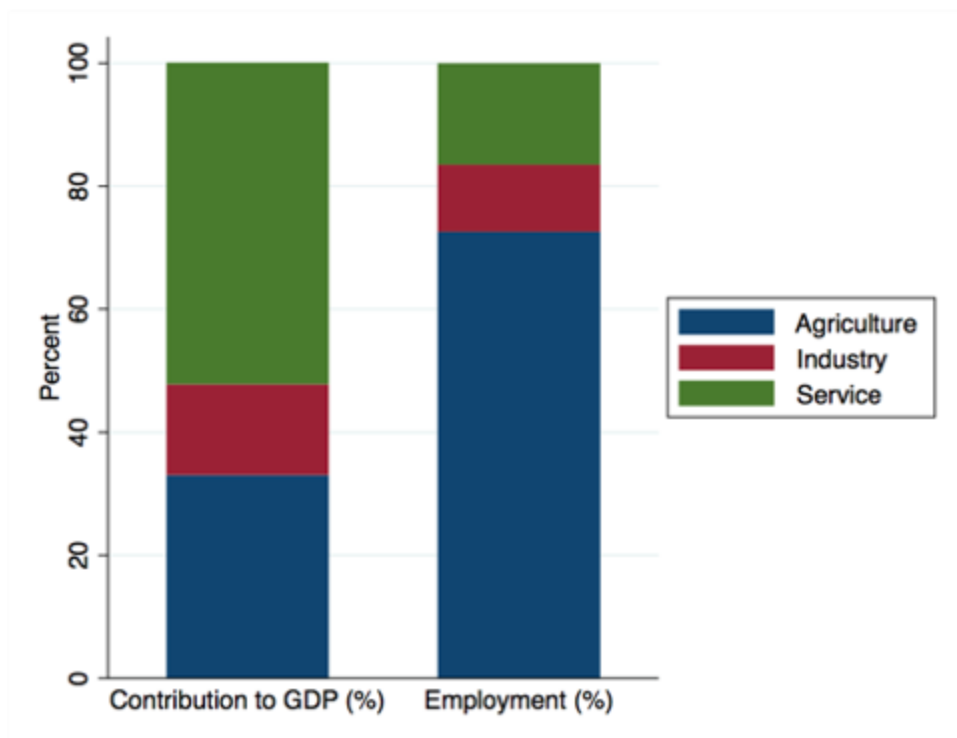


Figure 1. Agriculture contributes 27.0% of GDP while employing 72.6% of the workforce. Industry contributes 13.5% of GDP while employing 10.9% of the workforce (for tourism alone the numbers are 7.5% and 6.4%, respectively). Services contribute 51.5% of GDP while employing 16.5% of the workforce. Source: WB WDI (figures from 2017); CIA (tourism figures from 2014). According to the World Trade and Tourism Council, tourism directly supported 427,000 jobs and indirectly supported another 518,000 jobs in 2016.²¹

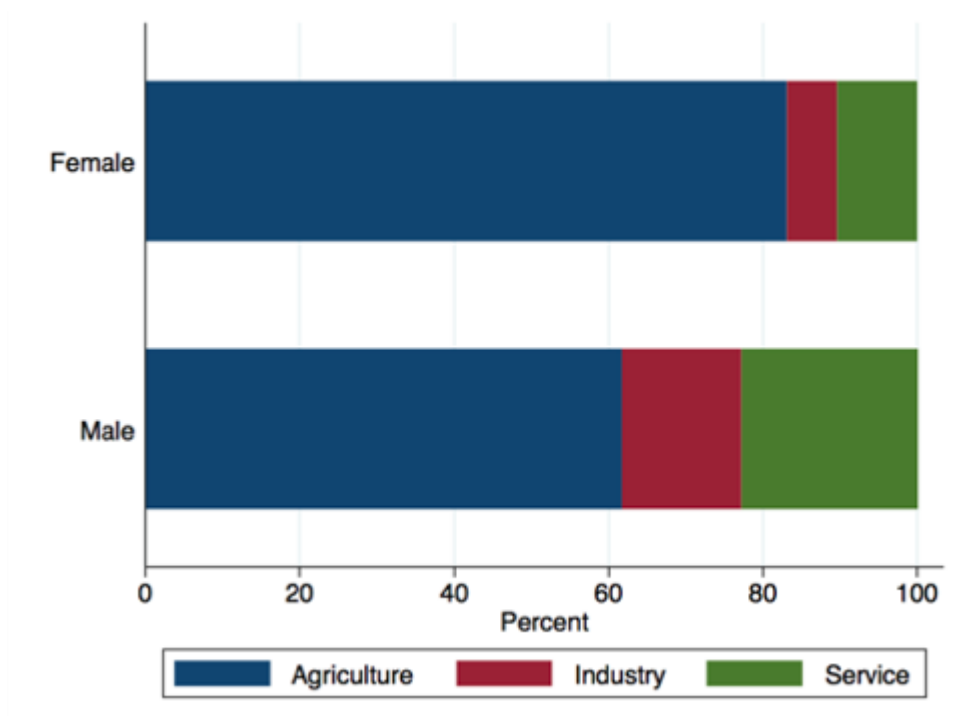


Figure 2. 83.1% of women work in agriculture, 6.5% work in industry, and 10.4% work in services. 61.7% of men work in agriculture, 15.5% work in industry, and 22.9% work in services. Source: WB WDI (figures from 2017).

4. Climate Change and Environmental Issues in Mountain Areas

a. Threats and Climate Change Impacts to the mountain environment ^{22 23 24 25 26 27 28 29}

Threats	Climate Change Impacts
Soil Erosion	With the increased amount of flooding due to changing climatic patterns and a potential volatility in the arrival of the rains, an increased volume of water flows atop the surface, thereby disturbing the topsoil layer as well as the soil matrix of forest and agricultural land (Mandal, 2017). This soil matrix is eroded from the land and flows as sediment within the water discharge (Mandal, 2017). Currently 240 million m ³ of topsoil has been eroded annually. 13% of Nepal's land has deteriorated seriously with a 10,000 km ² are in danger of desertification (Mandal, 2017).
Landslides	Increased soil erosion and the erosion of the soil matrix, weakens the stability of the vegetation which leads to the lateral movement of soil, rocks, trees and other vegetation down hills and terrain with high and low altitudes (Mandal, 2017), (Heyojoo, Yadav, Subedi, 2017).
Flood	Floods occur with changing climatic patterns, whereby summer monsoonal rainfall is delayed which does not enable a significant amount of time for the infrastructure to cope with the increased winter rainfall which leads to an increased volume of water flowing through the built environment (Heyojoo, Yadav, Subedi, 2017). Past long-term rainfall data shows us volatile rainfall patterns with higher intensities of rainfall but less rainy days indicating that there were drought periods and heavy rains and floods at other points of the year (Malla, 2008), (Heyojoo, Yadav, Subedi, 2017).
Glacier Lake Outburst Floods (GLOFs)	Increased temperatures will lead to the melting of glaciers, which will lead to an increased volume of water that is discharged from the Himalayan glaciers. Total estimated ice reserves have decreased between 1977 to 2010 decreased by 29% (MOPE, 2017) with the number of glacier lakes increasing by 11% and glaciers as a whole receding by 38 km ² per year during the same period (Heyojoo, Yadav, Subedi, 2017). The increased discharge leads to flooding. An increased number of these are dangerous for not only communities and the built environment but also for sectors such as agriculture and forestry, which may be negatively, affected due to the increased physical volume of water involved (Heyojoo, Yadav, Subedi, 2017).
Droughts	Changing climatic patterns, lead to the potential of later monsoon rains which lead to lands being drier in the warm spring summer months (Heyojoo, Yadav, Subedi, 2017). On some occasions, the rainfall is so sparse that there is literally no moisture for the agricultural land to take up leading to drought situations and therefore low agricultural yields (Heyojoo, Yadav, Subedi, 2017).
Forest Degradation	Forest degradation comes in a variety of forms. These are from increased human activity such as the timber and natural resources industry. Hence, large swaths of forestlands are deforested. However, the main climate change impacts come in the form of soil erosion that causes the forest to degrade when flooding occurs and the topsoil as well as the soil matrix are disturbed (Mandal, 2017).

	The disturbance is exacerbated when deforestation occurs (Mandal, 2017). Flooding also damages trees directly by uprooting them while forest fires also burn them a large number of them.
Forest Fires	Forest fires have the potential to occur in the dry summer months before the monsoons and cause devastating amounts of forest degradation. With changing climatic patterns, this may happen much more frequently, leading to a loss of a large amount of productive and lucrative forestland.
Land Use Changes	Land use changes in Nepal are predominantly caused by population growth rate, developmental and climate changes (Li et al., 2017). Focusing on purely the climate change implications, floods caused by volatilities in rainfall patterns and GLOF's caused by increased temperatures and glacier melting cause devastating destruction to forests, wetlands and agricultural lands (Li et al., 2017). Forest fires also lead to changes in the use of land (Li et al., 2017). In short, forestlands, wetlands and permanent snow and ice decreased whereas croplands, artificial lands and bare lands have been increasing (Li et al., 2017). In terms of agriculture, traditional subsistence cereal crops have been replaced commercial vegetables and high-value crops such as cardamom, ginger, seeds, and fruits (Pradhan and Sharma, 2017).

Table 1. Main environmental threats and climate change impacts.

b. Future climate change scenarios

Average rainfall is approximately 1800mm but temporal variations exist. Precipitation is decreasing by 11.17 mm per annum (Heyojoo, Yadav, Subedi, 2017), (Mallo, 2008). Monsoon rain is most abundant in the east and declines in the west with the winter rains highest in the northwest and declining as we move southeastwards. Highest rainfall is experienced in the central and mid hill regions around Pokhara and northeast and east of the Kathmandu Valley.

Temperature varies with altitude and season increasing from north to south and decreasing with altitude. Winter season is coldest, with the highest temperature during pre-monsoon period (April-June).

The annual average maximum and minimum temperatures increases at the rate of 0.043 degrees Celsius and 0.023 degrees Celsius, respectively (Heyojoo et al., 2017; Mallo, 2008). Seasonal temperatures are rising at a faster rate than the global average. The mean annual temperature is projected to increase by an average of 1.2 degrees Celsius by 2030, 1.7 degrees Celsius by 2050 and 3 degrees Celsius by 2100 when compared to 2000 baseline. 80% of Nepal's annual precipitation falls during the monsoon season, which will increase, by 15 to 20% due to warmer temperatures, while winter rainfall is expected to decrease. Climate change is going to exacerbate the contrast between wet and dry seasons, which will culminate in an increase of rainy season downpours that are both extreme in intensity and duration. In addition, higher temperatures, increased rates of evapotranspiration and decreased winter precipitation may increase instances of drought.

Precipitation as well as temperature extremes should be areas of key focus for Nepal in terms of climate adaptation.

5. Institutions, Governance, and Climate Change Policies

a. Legal framework

The executive branch in Nepal includes the Head of State, the Prime Minister, Council of Ministers, and administrative structures. The Nepal government established the National Adaptation Programme of Action (NAPA) in 2010 which looks into the most “urgent and immediate needs to adapt to climate change”. The document is a strategic tool that assesses climate vulnerabilities and strategies on how to tackle these issues through adaptation methods. The LAPA Framework supports the operationalization of the policy objectives outlined in the NAPA by facilitating the integration of climate change resilience into local-to-national development planning processes and outcomes. While the LAPAs are to be formulated at village development committee (VDC) level, the LAPA Manual (2013) provides guidance on the process including how to prepare, integrate, implement, and assess each of the 3,157 plans. As of 2016, 101 have been prepared and are under implementation in some of the country’s most climate vulnerable districts. The LAPA Manual of 2013 does not have explicit mentionings of EbA.

However, the Nationally Determined Contribution (NDC) does explicitly state EbA as a valuable way to improve livelihoods. The NDC, which was submitted to the UNFCCC in 2016, has nine priorities listed in the NAPA, of which four are framed around EbA. Finally, the Strategic Program for Climate Resilience of 2009 mentions EbA as a concept in its projects. The Climate Change Policy of 2011, which is largely about adaptation, mitigation, and resilience, only mentions EbA sparingly.

Stakeholder	Description
The Ministry of Forest and Environment (MoFE)	Serves as an important ministry for climate change and environmental matters including being the focal point to the UNFCCC and Kyoto Protocol. The MoFE is also the Designated National Authority (DNA) to the UNFCCC, meaning it administers Nepal’s Clean Development Mechanism (CDM) activities. The Climate Change management Division of MoFE, which was established on 2010, houses the Ministry’s work on climate change. MoFE’s coordinating role is supported by a 25 member Climate Change Council (CCC) operating within parliament and headed by the Prime Minister of Nepal. The MoFE is essentially directly responsible for implementing adaptation strategies and policies, but respective sectors are responsible for implementing sector specific adaptation strategies. In addition, the MoFE is responsible for forest management and national parks and serve the country’s focal point agency in the UNFCCC for the United Nations Collaborative Programme on Reducing Deforestation and Forest Degradation in Developing Countries (REDD+).
Centre for Climate Change Management (CCC)	The CCC provides coordination and guidance for the implementation of climate related policies and legislation in Nepal. NAPA framework established a final consultative body for climate change related matters is the Multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC) serve as a multi-stakeholder forum to support the CCC and includes representatives from national ministries, national and international non-governmental organizations (NGOs), academia and private sectors and donors.

The Ministry of Agriculture and Development	Responsible with integrating the Agriculture relevant climate policy and legislation into sector initiatives.
The National Planning Commission	Tasked with coordinating individual ministry program and projects with other ministries to ensure coherence and avoid conflicting/contradictory policies and regulations.

Table 2. Key stakeholders.

b. Local governance

The LAPA Manual provides information about local governance as well as subnational setups. The framework is designed in a way that allows for the integration of climate change solutions at a subnational and local level. Village development committees, or VDCs, are included in the LAPA Manual. Each VDC is to formulate their plan and prepare for implementation. In Nepal, there are 3,157 of these VDCs, all of which will ideally formulate a plan for adaptation.

c. Climate change policies and strategies

Nepal ratified the UNFCCC in May 1994 (70th country to do so) and in September 2005 accessed the Kyoto Protocol before it entered into force on December 2005. Nepal has been contributing to the UNFCCC by submitting documents such as National Communication Reports, National Adaptation Plan of Actions, Intended Nationally Determined Contribution etc.

Policy	Relevant National Body	Introduction
Climate Change Policy (2011)	Climate Change Council, Ministry of Environment	A broad national policy featuring goals and objectives across mitigation, adaptation and resilience, disaster risk reduction, capacity building and local empowerment, natural resource management, as well as science and research.
Intended Nationally Determined Contribution (INDC) (2016)	The Climate Change Management Division in the Ministry of Population and Environment and the REDD Implementation Centre under the Ministry of Forest and Soil Conservation	Nepal's Nationally Determined Contribution to the UNFCCC provides an overview of the country's actions to address climate change. The document includes plans to reduce greenhouse gas emissions.
National Adaptation Programme of Action (NAPA) (2010)	Ministry of Environment	The NAPA is a strategic tool to assess climatic vulnerability, and systematically respond to climate change adaptation issues by developing appropriate measures. It discusses the needs, practices and options across different climate adaptation sectors. Through a consultative process, 250 adaptation options were boiled down to 9 priority adaptation projects.

Local Adaptation Plans of Action (LAPA) Framework (2011)	Ministry of Environment	The LAPA Framework supports the operationalization of the policy objectives outlined in the NAPA and the National Climate Change Policy by facilitating the integration of climate change resilience into local-to-national development planning processes and outcomes.
Second National Communication (SNC) (2014)	Ministry of Environment	The SNC provides an overview of Nepal's climate challenges and government responses. It describes existing adaptation efforts within nine sectors such as agriculture, water resources, and forestry and biodiversity, and includes a table of all adaptation actions under the national government.
Strategic Program for Climate Resilience (SPCR) (2009)	Ministry of Environment	The SPCR is the first phase of the Pilot Program for Climate Resilience (PPCR), sponsored by the Climate Investment Fund (CIF) to support implementation of Nepal's country-led programs, including the NAPA. With the overall objective demonstrating ways to integrate climate risk and resilience into core development planning, the SPCR has initiated four concrete resilience development projects.
National Biodiversity Strategies and Action Plan (NBSAP) (2014)	Global Environment Facility and UNDP	The NBSAP designed for the period from 2014-2020 is aimed to provide a strategic framework for the conservation of Nepal's biodiversity. The NBSAP envisions a conserved biodiversity for sound and resilient ecosystems and national prosperity and was built upon the work carried out by the Nepal Biodiversity Strategy in 2002 and the Implementation Plan in 2006. Strategies included were pertaining to sustainable management and use of resources, conservation of country's biodiversity and use of technology. Action plans were mainly centered around conservation of biodiversity through ecosystem improvement with no explicit link to climate change, although the document does recognize the need for a better understanding of the impacts of climate change on biodiversity. Major threats to mountain ecosystems are mentioned. These include natural disasters like landslides, glacial lake outburst floods, and droughts.

Table 3. Overview of the key strategies and policies Nepal has put in place to tackle climate change.

General Documents Reviewed	Policy	Date Submitted	URL
Nepal Communication Report, 2004	Initial Report,	2004	http://unfccc.int/resource/docs/natc/nepnc1.pdf
Nepal Communication Report, 2015	Second Report,	2015	https://unfccc.int/resource/docs/natc/nplnc2.pdf
National Capacity Self-Assessment 2008		2008	http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/mainstreaming/national-capacity-self-assessment-synthesis-report/NCSA-101209.pdf?download
National Programme of Actions	Adaptation	September 2010	http://www.nccsp.gov.np/publication/NAPA.pdf
Kala patthar Declaration 2011		2011	
Technology Assessment	Need	2015	http://learningportal.wwfnepal.org/dashlib/files/Technological%20Needs%20Assessment%20Report.pdf
National Adaptation Plan		2017	http://www4.unfccc.int/nap/Documents%20NAP/Supplements/Understanding_mandates_NAPs.pdf
Intended Determined Contributions	Nationally	February 2016	http://www4.unfccc.int/submissions/INDC/Published%20Documents/Nepal/1/Nepal_INDC_08Feb_2016.pdf
Local Adaptation Plan of Actions Framework	(LAPA)	2011	http://www.nccsp.gov.np/publication/National%20Framework%20on%20Local%20Adaptation%20Plans%20for%20Action.pdf
Climate Change Policy 2011		January 2011	http://www.nccsp.gov.np/publication/Climate%20Change%20policy.pdf
Climate Planning	Resilient	2011	http://www.climatenepal.org.np/main/?p=research&sp=onlinelibrary&opt=detail&id=721
National Framework for Nature Conservation (NSFNC)	Strategic	2015	http://cmsdata.iucn.org/downloads/nepali_nature_conservation_national_strategic_framework_for_sustainable_development.pdf

Table 4. List of national communiqués and other relevant documents.

6. EbA related Strategies, Policies and Projects

a. Overview

Nepal's NDC explicitly recognizes the value of EbA, and EbA-related strategies are present in the NAPA. However, only few references to EbA in the national Climate Change Policy and Local Adaptation Plans of Action (LAPA) Framework. The below table gives an overview of the role of EbA in each of the major climate change adaptation policies.

Policy	References to EbA
Climate Change Policy (2011)	While the vision set out in the policy does allude to the potential of environmental conservation to reduce impacts of climate change, even implicit references to EbA are very scarce . The section on science and research does not mention the potential of EbA.
Intended Nationally Determined Contribution (INDC) (2016)	The INDC explicitly recognizes the value of EbA , with reference to, inter alia, Nepal's Forestry Sector Strategy and the Pilot Program for Climate Resilience (PPCR).
National Adaptation Programme of Action (NAPA) (2010)	4/9 national adaptation priorities are implicitly or explicitly ecosystem-based . 2/9 options have unclear connections to the resilience of ecosystems, but have the potential to integrate such concerns.
Local Adaptation Plans of Action (LAPA) Framework (2011)	Despite its comprehensiveness, the LAPA manual does not mention EbA as a concept or principle for local planners to consider when developing adaptation plans. References to EbA are absent from the Manual's core principles and criteria for prioritizing adaptation actions.
Second National Communication (SNC) (2014)	Does not set out novel goals or anticipated policy instruments, but refers to existing policies such as the NAPA. Apart from the Ecosystem-Based Adaptation Project itself, the document does not explicitly address the term . However, it gives some indication of the extent to which EbA strategies are integrated in other national policies.
Strategic Program for Climate Resilience (SPCR) (2009)	SPCR explicitly mentions EbA as a core principle , but none of the projects are unambiguous instances of EbA. At least 2/4 of them at least have the potential to be ecosystem-based.
National Biodiversity Strategies and Action Plan (NBSAP) (2014)	No explicit mention of EbA however 1/8 of the tasks can be considered to involve EbA. Main threats to mountain ecosystems are mentioned and efforts to adapt have been tried and are still within the main plan, which overlap with other thematic efforts particularly with those related to protected areas. These include community based forest management plans and landscape management. Policy gaps or constraints include insufficient knowledge and understanding of mountain ecosystems, lack of long-term vision, and inadequate financial resources and technical capacities within the country.

Table 5. References to EbA in key policy documents.

b. Disaster Reduction (DRR) Policies

The National Strategy for Disaster Risk Management (NSDRM) from 2008 explicitly highlights the disconnect between risk mitigation and natural resource management as major gap in national policy. As the fourth priority action points out, “[i]ssues of climate change (...) and its relation to disaster risk management [are] not adequately understood and incorporated in national policies, plans and programs.” This is true for the policies in agriculture and food security as well as the water and sanitation sector strategies. An example of a potential remedy is to include Disaster Impact Assessment (DIA) along with Environmental Impact Assessments (EIA) in all major development projects. The NSDRM also has a high emphasis on bottom-up, inclusive planning, for example by identifying the VDCs as the main political entities to develop and implement DRM initiatives.

The Government of Nepal has initiated the process for formulation of a *National Disaster Risk Reduction Policy and Strategic Action Plan* as part of the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030. As of March 2018, no drafts were available in English.³⁰

Two of the policies analyzed in the above table are DRR related, and both of them may hold unharnessed opportunities for integrating EbA thinking. Firstly, the Climate Change Policy (2011) outlines 8 policies under the joint category of “Climate change adaptation and disaster risk reduction.” Of these, only one of them comes close to addressing the issue of ecosystems, and it is not clear whether this priority assumes a *trade-off* rather than a *synergy* between biodiversity conservation and climate change adaptation (Policy #6 reads: “Formulating and implementing integrated programmes taking into consideration the objectives and the provisions of the conventions related to climate change, desertification and biodiversity”). Secondly, in the National Adaptation Programme of Action, 250 adaptation options were boiled down to 9 priority adaptation projects, of which combined profile #4 is titled *GLOF Monitoring and Disaster Risk Reduction*. The activity components within this cluster do not, explicitly or implicitly, mention EbA. Stated objectives include providing alternative livelihoods to GLOF-vulnerable communities and develop climate proof infrastructure. Such objectives could perhaps be implemented on the basis of an EbA approach, but more research is needed.

c. Selected sector-specific policies

Forestry

The Forestry Sector Strategy (2016-2025) explicitly mentions EbA in that it aims to mainstream community/ecosystem-based adaptation by 2025 as a way of improving the sector’s resilience to climate change. One of the 5 intended outcomes of Nepal’s vision for the forestry sector (*Outcome 4: Climate resilience capacity of society and forest ecosystems enhanced*) is contingent on promoting ecosystem-based and community-based resilience measures. The strategy has as one of its priority themes to adapt the sector to climate change, including strengthening people’s climate resilience by promoting EbA.

The National REDD+ Strategy (2015), too, explicitly includes EbA. The second of 12 strategies in the plan is to “[i]ncrease non-carbon benefits by promoting climate resilience, ecological integrity, ecosystem-based adaptation and integrated watershed management” to mitigate climate change impact on people and ecosystems. According to the document, forest conservation policies have shifted from ‘people exclusionary’ and ‘species focused’ to ‘people-centered community based’ and ‘ecosystem/landscape approach’ in the past two decades, which is consistent with the EbA approach. Even so, the document holds that ecosystem services remain undervalued in acts and legislation.

Agriculture

The National Agriculture Policy developed in 2001 has a focus on developing a framework for the analysis of food security and the alleviation of poverty as well as the link to the economy. The

Agrobiodiversity Policy of Nepal developed in 2006 focuses on conserving the sustainable use of agricultural genetic resources and materials as well as the traditional knowledge of stakeholders from present and future generations. It also recognizes that agrobiodiversity is an integral part of the biodiversity of Nepal as a whole based on the spirit of national and international treaties and agreements in order to ensure the benefits to the Nepali people. The Agri Business Policy developed in 2006 highlights the diversification, commercialization, and promotion of private sector involvement within the agricultural sector. It states that the livelihoods of farmers will never improve unless the method of farming moves away from subsistence based agriculture to embrace commercial farming. The National Irrigation Policy calls for increased investment and expansion of irrigation systems to increase agricultural outputs. The Agriculture Development Strategy was developed by the Asian Development Bank for the Government of Nepal and basically provides an update of the agriculture sector as a whole before providing insights on land use management, food and nutritional security, institutional issues, climate change impacts, and social and geographic inclusion of the people within Nepal as a whole.

Agroforestry

Nepal developed its first national agroforestry policy in 2015. There is no mention of EbA, although there is an emphasis on resiliency, which is a component of EbA. At the moment, the goal of the agroforestry policy is to protect forests, promote forestry, and use the enhanced forestry to improve agriculture, and environmental security.

Hydropower

The 2001 Hydropower Development Policy is predominantly concerned with cheap electricity production, rural electrification, and exports.³¹ It does not address climate change adaptation. Similarly, the Rural Energy Policy (2006) does not mention adaptation to climate change as a concern.³²

7. Gaps and Recommendations

Policy Gap #1: Local Adaptation Plans for Action

Despite its comprehensiveness, the Local Adaptation Plans for Action Framework does not mention EbA as a concept or principle for local planners to consider when developing adaptation plans. References to EbA are entirely absent from the Manual's guiding principles and criteria for prioritizing adaptation actions (the four guiding principles for the LAPA Framework are bottom-up planning, inclusiveness, responsiveness, and flexibility). The LAPA Manual exists to directly shape the formulation of local adaptation plans. By not even mentioning EbA, there is a risk that such approaches are systematically filtered out from the local adaptation planning processes as a consequence of the current form of the LAPA Manual. By explicitly including EbA among the guiding principles of adaptation planning in the LAPA Manual, the chances that ecosystem-based approaches to adaptation play a more prominent role in local plans could increase significantly. Thus, to promote the use of EbA at the local level, the Ministry of Science, Technology and Environment should add ecosystem-based adaptation to the LAPA Manual's list of guiding principles underlying the development of local adaptation plans.

The LAPA for Khumba in North Western Nepal, for instance, describes how "[e]ach step [of the LAPA Manual] was carefully considered as to why it is important and what actions should be undertaken." The authors of the technical report, both from The Mountain Institute, make it clear how closely the Manual was consulted in the formulation of local adaptation priorities. Incidentally, it also shows that EbA was not mentioned or referenced as a concept or approach to climate change adaptation in Khumbu. To the extent that local policy makers stringently follow these steps in other VDCs, this indicates that local adaptation planning is in fact being shaped by the LAPA Manual.

Policy Gap #2: Agroforestry policy

Nepal began developing its first national agroforestry policy in 2015, which seeks to improve food security and soil quality.³³ While promising strong results, the policy does not mention EbA, although there is an emphasis on resiliency. At the moment, the goal of the agroforestry policy is to protect forests, promote forestry, and use the enhanced forestry to improve agriculture and environmental security. The policy is still being developed so there is scope for EbA inclusion in the framework. Furthermore, there can be an emphasis in the policy regarding mountain farming and its impact on agroforestry.³⁴

Nepali residents and stakeholders of the agroforestry sector are also concerned about lack of comprehension in the policy. A source states that there are thirty-two national policies that refer to agroforestry in Nepal; however, none of them are clear enough.³⁵ In other words, establishing yet another agroforestry policy may sound promising, but it still needs to be detailed and stringent enough that it can be cited and enforced.

Future studies

The following policies and concepts should also be analyzed and added to the policy analysis section in the future:

- Nepal Initial Communication of the United Nations Framework Convention on Climate Change (UNFCCC),
- REDD Readiness Preparedness Proposal (REDD RPP)
- Low Carbon and Economic Development Strategy (LCEDS)
- National Adaptation Plans Environment Friendly Local Governance Framework (EFLG).
- Nepal forest sector strategy
- National strategic framework for nature conservation
- National Strategy for disaster risk Management
- Nepal Environmental Policy and Action Plan (NEPAP),
- National Strategy for Resilient Local Communities(NSRLC) 2017
- Disaster Risk Reduction and Management Act
- Women involvement in mountain livelihood

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- ¹ CIA - World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>
- ² IUCN- Scaling Up Mountain Ecosystem-based Adaptation <https://www.iucn.org/asia/countries/nepal/scaling-mountain-ecosystem-based-adaptation>
- ³ CIA World Factbook <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>
- ⁴ Statista <https://www.statista.com/statistics/778508/nepal-population-density/>
- ⁵ Statista, 2016
- ⁶ Withdrawing from agrarian livelihoods: Environmental migration in Nepal (Chapagain, 2015) <https://search-proquest-com.ezproxy.cul.columbia.edu/docview/1648517915?pq-origsite=summon&accountid=10226>
- ⁷ CIA World Factbook <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>
- ⁸ The World Bank Group: Natural Resource Management in Nepal <http://lnweb90.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewForJavaSearch/F61FFB4220608DB3852567F5005D834A>
- ⁹ Paudel et al., 2016: Review of studies on land use and land cover change in Nepal <https://link.springer.com/article/10.1007/s11629-015-3604-9>
- ¹⁰ ICIMOD <http://rds.icimod.org/Home/DataDetail?metadataId=9224>
- ¹¹ Dangol, 2002. Economic uses of forest plant resources in western Chitwan, Nepal. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3469582/>
- ¹² Pradhan and Sharma, 2017. Land Use Change and Its Driving Forces in the Koshi Hills, Eastern Nepal. https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_4 https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_4
- ¹³ CIA World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>
- ¹⁴ World Development Indicators (World Bank)
- ¹⁵ According to the SDGs (Target 8.1)
- ¹⁶ CIA World Factbook
- ¹⁷ ILO. <http://www.ilo.org/kathmandu/areasofwork/labour-migration/lang--en/index.htm>
- ¹⁸ Reuters. <https://www.reuters.com/article/us-nepal-migration-agriculture-women/with-men-gone-women-shake-up-farming-in-rural-nepal-idUSKCN0YV0XT>
- ¹⁹ Dartmouth. Nepal Earthquake Case Studies. <http://journeys.dartmouth.edu/NepalQuake-CaseStudies/subsistence-economies-livestock-and-agriculture/>
- ²⁰ ICIMOD: Agriculture Atlas of Nepal. <http://geoportal.icimod.org/?q=21298>
- ²¹ World Travel and Tourism Council. *Economic Impact 2017 – Nepal*. <https://www.wttc.org/-/media/files/reports/economic-impact-research/countries-2017/nepal2017.pdf>
- ²² Mandal, 2017. https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_10
- ²³ Heyojoo, Yadav, Subedi, 2017. https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_9
- ²⁴ Mallo, 2008. <https://www.nepjol.info/index.php/AEJ/article/view/2119>
- ²⁵ MOPE (2016) Intended nationally determined contribution (INDC) communicated to the UNFCCC Secretariat in February 2016. Ministry of Population and Environment, Nepal.
- ²⁶ Haack, B.N. & Khatiwada, G. (2007). “Rice and Bricks: Environmental Issues and Mapping of the Unusual Crop Rotation Pattern in the Kathmandu Valley, Nepal.” *Environmental Management* 39: 774. <https://doi.org/10.1007/s00267-006-0167-0>

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- ²⁷ Gautam, R.D. 2010. AIR POLLUTION : ITS CAUSES AND CONSEQUENCES WITH REFERENCE TO KATHMANDU METROPOLITAN CITY. *The Third Pole*, 8-10, 27-33.
- ²⁸ Ainong Li, rGuangbin Lei, Xiaomin Cao, Wei Zhao, Wei Den, gHriday Lal Koirala, 2017. Land Cover Change and Its Driving Forces in Nepal Since 1990. https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_3
- ²⁹ Pradhan and Sharma, 2017. Land Use Change and Its Driving Forces in the Koshi Hills, Eastern Nepal. https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_4 https://link-springer-com.ezproxy.cul.columbia.edu/chapter/10.1007/978-981-10-2890-8_4
- ³⁰ Government of Nepal. National DRR Policy and Strategic Action Plan. <http://drrportal.gov.np/document/category/ndrrpsap>
- ³¹ The Hydropower Development Policy, 2001. http://www.moen.gov.np/pdf_files/hydropower_development_policy_2001.pdf
- ³² IEA. Rural Energy Policy of Nepal. <https://www.iea.org/policiesandmeasures/pams/nepal/name-159630-en.php>
- ³³ World Agroforestry Centre. *Nepal makes progress towards a national agroforestry policy.* <http://blog.worldagroforestry.org/index.php/2018/01/17/nepal-makes-progress-towards-a-national-agroforestry-policy/>
- ³⁴ Mkonda & He (2017). The Potentials of Agroforestry Systems in East Africa: A Case of the Eastern Arc Mountains of Tanzania. *International Journal of Plant and Soil Science*. DOI:10.9734/IJPSS/2017/31299
- ³⁵ Nepali Sansar. Nepal Mulls Agroforestry Policy to Protect Forests and Agriculture <http://www.nepalisansar.com/news/nepal-mulls-agroforestry-policy-protect-forests-agriculture/>

Scaling Up Ecosystem-based Adaptation in Mountains

Bhutan Situation Analysis



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1. Introduction

The Mountain EbA Flagship Programme was developed in the Himalayas (Nepal), Mount Elgon (Uganda) and the Andes (Peru), by the International Union for Conservation of Nature (IUCN), The Mountain Institute (TMI), the United Nations Development Program (UNDP) and the United Nations Environmental Program (UNEP) between 2011 and 2016. Following the success of this program, TMI and IUCN have teamed up to expand the EbA approach within these three countries and three neighboring countries Bhutan, Kenya and Colombia. The project looks to benefit local people directly and help them adapt to the adverse effects of climate change, while also providing positive benefits for millions downstream who also depend on the resources coming from mountain ecosystems.

This document focuses on the most updated situation in the mountainous Kingdom of Bhutan. It seeks to analyze public policies, strategies, and projects related to EbA in the country, to find gaps and opportunities for the implementation of this approach at the national and subnational level. The information gathered in this situation analysis will be used to develop a policy brief that summarizes the main points and recommendations developed. It will also be used by TMI and IUCN in the development of the second phase of the program, in order to building wider support and generating financing for EbA within national governments and at international forums.

2. Development, Climate Change and Mountain Areas in Bhutan



Figure 1. Physical map of Bhutan.¹

a. General information on Bhutan's mountain areas ^{2 3 4}

Located on the southern tip of the Eastern Himalaya, the Kingdom of Bhutan with its rugged terrain contains some of the world's most prominent geographic features. The highest peak Ganghkhar Puensum stands at an imposing 7,570 meters above sea level (24,850 ft). The mountains of Bhutan can be defined within three main geographical zones: The Great Himalaya, the Lower Himalayan Range and the Sub-Himalayan Range (Sinha, 2001). The northern Great Himalaya consists of peaks ranging from 5500m to 7500m with an arctic climate at highest elevations. Pastorage occurs in the alpine valleys due to water from the snow-fed rivers (Hunter, 1908). The Lower Himalaya mountain range

runs northwest to south east in western Bhutan and northeast to southwest in eastern Bhutan and are generally 1500m to 5500m in elevation. The economic and cultural heart of the Kingdom can be found in these western valleys (Sinha, 2001). The sub-Himalayas range from 100m up to 1500m in height (Sinha, 2001).

b. Demography ^{5 6}

As of February 19th 2018, Bhutan's population stands at 813,517 people with its population density being a very low 18 people per square kilometer. Thimphu, the capital and largest city, has a population of nearly 80,000 and metro population of 115,000. At an altitude of more than 2,000m, Thimphu is the fourth highest capital in the world. The majority of the population inhabit the western valleys which is where the capital Thimphu is located (see map below; Hoy et al., 2015). Most Bhutanese belong to either the Ngalops (western Bhutanese) or Sharchops (eastern Bhutanese) respectively (50%). Southerners of Lhotshampa are primarily of Nepali descent.

Another 15% of Bhutan's current population is indigenous. This does not include the Ngalops and Sharchops who are considered to originate from outside of Bhutan. The three main languages spoken are Sharchhopka 28%, Dzongkha (official) 24%, Lhotshamkha 22%, other 26% (includes foreign languages) (2005 est.) The main religions practiced are Lamaistic or Vajrayana Buddhist 75.3%, Indian- and Nepalese-influenced Hinduism 22.1%, other 2.6% (2005 est.)

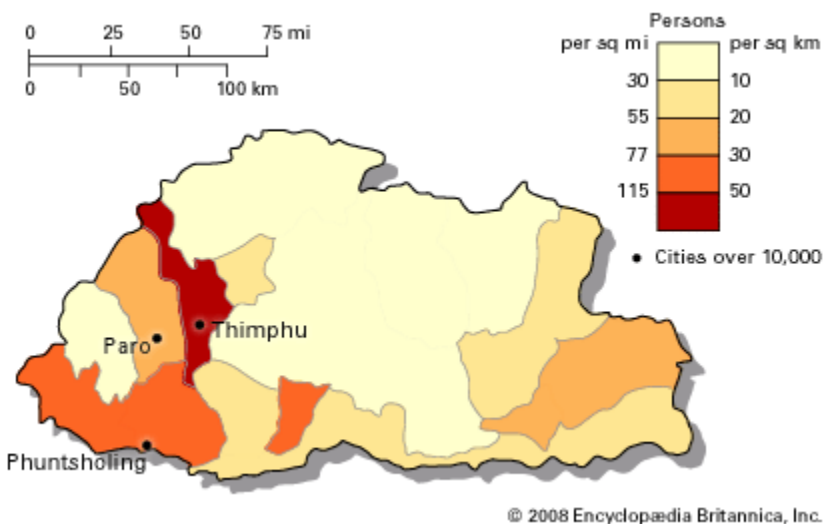


Figure 2. Population density in Bhutan.

c. Gender and mountain livelihoods ^{7 8}

With 89% of its 800,000 people residing in mountains, Bhutan has the highest proportion of mountain people of any nation in the world.⁹ Mountain livelihoods in the high Himalayas are centered around agricultural farming practices, and there has always been evidence of pastoralism (Wangchuk and Wangdi, 2015). Yak farming is the main livelihood source for the high altitude communities in the eastern Himalaya and is an age-old tradition (Wangchuk and Wangdi, 2015). However, this is being overtaken by the *Cordyceps* collection industry¹⁰ since the *Cordyceps* collection was legalized (Wangchuk and Wangdi, 2015). Post-legalization saw an increased number of women working in yak-husbandry along with their household commitments. It also led to a decline in the grassland condition, which saw a larger number of herders moving north a month earlier, towards the summer-grazing lands. Legalization also led to an increased number of households buying commercial feeds for their

yaks. Yak mortality increased and scarcity of fodder became more acute, leading to severe constraints to yak farming.

Women have an increased amount of share in the yak-farming business in comparison to men (Wangchuk and Wangdi, 2015). ICIMOD is carrying out programs to enhance gender equality in the Himalayan regions before the Bhutan10+ conference and Rio Summit (Molden et al., 2014).

d. Mountain ecosystems, land cover, and resource use ^{11 12 13 14 15 16}

The Kingdom depends highly on its forestry and agriculture sector (Hoy et al., 2015). Forests occupy the largest share of the land cover with 70% being forestlands (Hoy et al., 2015). Due to the large forest cover, Bhutan is considered a net-sink of carbon (Hoy et al., 2015) – 3 times more sequestered than emitted (NEC, 2011). The extreme topographical variations make it difficult to cultivate land, especially because of soil erosion. As a result, agriculture only takes up 2.6% of the land despite being the livelihood for the majority of the country's citizens.¹⁷

Hydropower is the other main source of governmental revenue (Hoy et al., 2015) providing 99% of the country's electricity. Although this is the case, hydropower in Bhutan leads to a significant amount of logging and deforestation and flooding of forests to create necessary reservoirs. Hence, although there are no emissions through the creation of hydropower energy, there is the release of carbon while forests were logged for the creation of the hydropower facility.

Rivers and large water bodies in the form of reservoirs are needed for hydropower facilities to function. Most of the rivers originating in Bhutan are glacier-fed from the Himalayas and are the major source of water for large communities all over the Kingdom (Hoy et al., 2015). Current water demand is well below water availability but this is expected to change in the future with the population steadily increasing. Currently, the annual water discharge rate is 73,000 million m³/year, which provides the world's highest per capita water availability - 109,000 m³ on average (Hoy et al., 2015).

The country is characterized by an extreme degree of variability within its mountain environments, leading to a diverse distribution of crops and crop varieties.

3. Economy and Livelihoods

a. General information on the economy

With an average per capita growth of 5.8% per annum between 2007 and 2016, Bhutan's economy is among the fastest growing in the world.¹⁸ After only Dominica and India, *The Economist* expects Bhutan to be the best-performing economy in the world in 2018, growing 7.6%.¹⁹ Yet Bhutan remains a middle-income country with a GDP per capita (PPP) of USD 8,700, comparable to countries like Morocco, Ukraine, and El Salvador, and roughly 20% of the average for OECD countries.²⁰

The political and economic environment is stable, and Bhutan has made tremendous progress in reducing the rate of extreme poverty to less than 2% (2012) and promoting gender equality.²¹ Yet attention is still needed to address inequality issues; the latest available data show income inequality declining in the years before 2007 but since stabilizing around a Gini-coefficient of 0.36 in 2012.²² Combined with high growth rates, these are signs that Bhutan's recent economic growth has benefited the rich more than the poor.

A large share of Bhutan's economic boom can be explained by expansion of hydropower, the largest economic sector ahead of agriculture. The hydropower industry represented 22% of GDP in 2010, but

employed less than 1% of the workforce. As of 2017, there are five operating large-scale hydropower plants with a total capacity of 1,600 MW, and an additional five more projects are under development. The nationwide potential for hydropower is estimated to be around 30,000 MW, of which close to 80% is considered techno-economically feasible for development.²³ Exploiting the country's abundant rivers for electricity generation is therefore expected to remain an important driver of economic growth, as seen in the 10th five-year plan.²⁴ The agriculture and tourism sectors are expected to grow steadily.²⁵

In contrast to the less labor intensive hydropower industry, the agriculture and forestry sectors employ roughly 60% of the labor force (65% of women, 51% of men),²⁶ and a similar share of the population depend directly on agriculture for their livelihood. The ongoing economic transition away from agriculture-based subsistence and increasing reliance on imports to meet growing consumer demand puts pressure on the economy to absorb those looking to shift industries.²⁷ In 2011, roughly a quarter of cultivated land was irrigated, 90% of which was through small-scale systems drawing surface water from streams and rivers. The mountainous character of the country means that there are no groundwater resources to extract, which has implications for the agricultural sector's resilience to droughts.²⁸

Bhutan maintains strong economic and strategic relationships with India, particularly as a major trading partner, as a source of foreign aid and as a financier and buyer of hydropower.²⁹

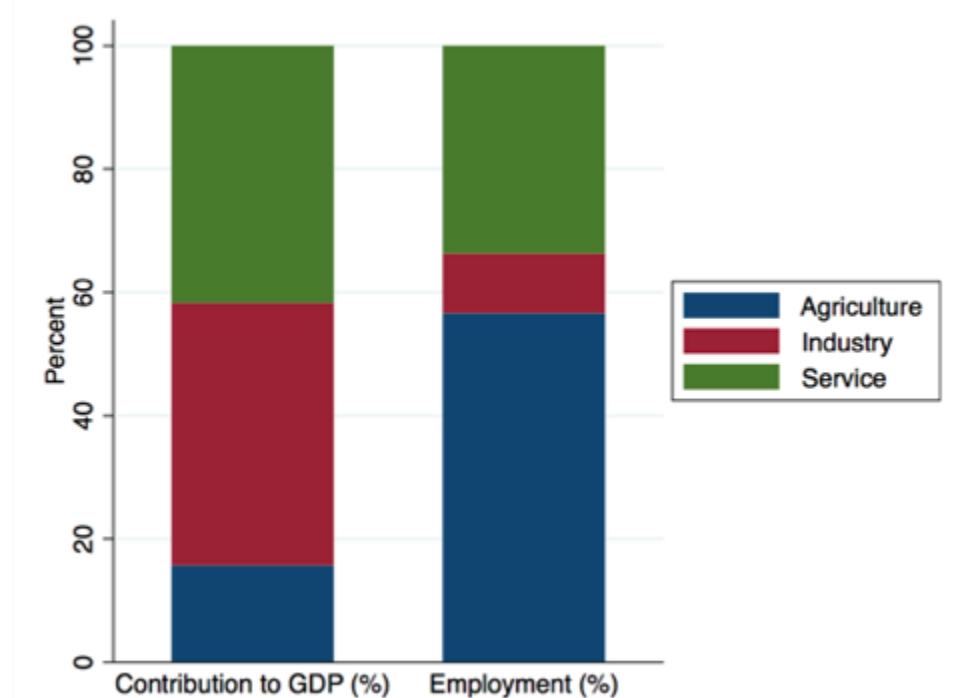


Figure 3. Agriculture contributes 15.7% of GDP while employing 56.6% of the workforce. Industry contributes 42.6% of GDP (hydropower 22%, tourism 15%) while employing 9.7% of the workforce (hydropower employs less than 1% and the tourism sector employs roughly 21,000). Services contribute 41.7% of GDP while employing 33.7% of the workforce. Source: [CIA \(2015 estimates\)](#) and [ILO \(via WB, 2017 estimates\)](#)

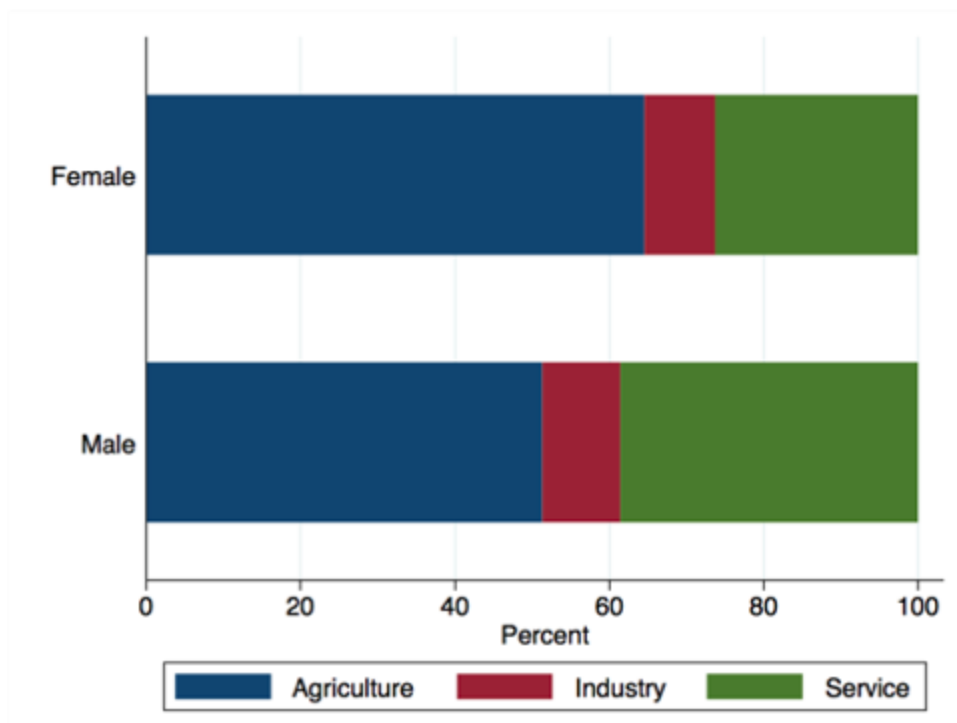


Figure 4. 64.5% of women work in agriculture, 9.7% work in industry, and 26.3% work in services. 51.3% of men work in agriculture, 10.1% work in industry, and 38.6% work in services. Source: [ILO \(via WB, 2017 estimates\)](#).

b. Contribution of mountain ecosystem services to the economy

Bhutan's main industries – hydropower, agriculture, forestry/wood products, and tourism – are generally tightly connected to and dependent on ecosystems. Hydropower, as mentioned above, contributes significantly to GDP and is a key driver of growth. It also provides 99% of the country's electricity, making it key to the country's economic and social development.³⁰ As dependence on this natural resource will only grow, it is crucial to understand how environmental change impacts the sector's potential, as well as how hydropower facilities impact mountain environments. (This question is explored in the following section.) The tourism industry, too, depends highly on the pristine conditions of the Himalayan mountain ecosystems, including its rich biodiversity. Contributing to approximately 15% of GDP,³¹ this sector is a significant source of income and directly and indirectly employs more than 20,000 people.³² Finally, the 60% of the population residing in rural areas (of which the vast majority are in mountains) largely lives off of agriculture or, to a smaller extent, forestry (forestry employed 5,000 people in 2005).³³ In sum, the people of Bhutan are highly dependent on healthy and resilient mountain ecosystems.

4. Climate Change and Environmental Issues in Mountain Areas

a. Threats to the mountain environment³⁴

Due to climate change, glacial retreat and thinning lead to increased water outflow. Coupled with the rain from the monsoon months this outflow can cause floods, lead to landslides and soil erosion. Soil erosion affects the growth of trees due to glacial retreat; in addition, melting ice is leading to soil erosion, which is affecting forest cover. There is a decrease in the growth and maintenance of forests

land potentially due to increased development leading to a situation where carbon sequestration rates may decrease. This is mainly due to human activity in the form of clearing forests for hydropower facilities where the creation of reservoirs entails flooding forestlands. Furthermore, forests are also used for timber. Forestry is also a major national economic sector for Bhutan, so a lack of trees may affect the Kingdom much more.

Due to climate change, increased frequency of flooding may lead to a decrease in the agricultural output of the Kingdom leading to a reduced economic output. With this, tourism may be affected, particularly in monsoon months. Hence, climate change has the effect of causing large-scale economic damage. Increased temperatures in certain parts of the Kingdom may lead to a decrease in certain vegetation types. Finally, lack of freshwater generation may be a dangerous situation for drinking water availability (Hoy et al., 2015).

Threats	Impacts
Glacier Lake Outburst Flood (GLOF's)	GLOF's have the potential to degrade and destroy townships, forests and farmland due to the physical volume of water flowing due to the melting of large glaciers. GLOFs have a significant negative impact on infrastructure of mountain regions and can cause loss of life. GLOFs also lead to other threats such as soil erosion and landslides.
Soil Erosion	Soil erosion leads to the destruction of forestlands, which is one of the largest sectors that contribute to Bhutan's GDP per capita.
Landslides	Soil erosion leads to the weakening of soil, which generally holds trees together. This leads to landslides, which can cause immense infrastructure damage as well as loss of life in mountain regions.

Table 1. Impacts of key environmental threats.

b. Climate change impacts on mountain areas ^{35 36 37 38}

Due to climate change, an increase number of GLOFs (Glacier Lake Outburst Floods) are causing a huge amount of damage to the safety of settlements, the economic facilities of these settlements, and tourism activities (Hoy et al., 2015). Glacier thinning, which is already occurring, coupled with the summer monsoons lead to an increased risk of GLOFs (Rupper et al., 2012). Soil erosion, floods and landslides are the most common forms of natural disasters in the mountain ecosystem, which will only be exacerbated by climate change (Komori et al., 2012) (Dahal and Hasegawa, 2008).

Climate change will also have a negative impact on pastoralism in the form of yak farming where summer grazing pastures may be either flooded out or become too dry. A shortage of pastureland is already becoming a major constraint to yak farming and climate change is likely to exacerbate that constraint so much, so that there may be a situation where an age-old tradition may cease to exist.

Droughts and both unexpected monsoon and winter rains have the potential to decrease agricultural yield within Bhutan. Monsoon rains that are delayed in the summer arrive too close to the winter rains and therefore flood surrounding areas thereby destroying the harvest. Droughts in the early part of summer when the monsoon rains are supposed to arrive also cause the same amount of devastation. These unexpected rainfall events also have the potential to increase soil erosion in forest and agricultural lands thereby disturbing the soil matrix and again decreasing yield.

c. Future climate change scenarios³⁹

Due to climate change, glacial retreat and thinning lead to increased water outflow and the formation of glacier lake outburst flooding (GLOFs). GLOFs risk will be higher during the warmer summer months but will still continue to be a threat all year round due to the unpredictability of the melting of glaciers. Temperature increases are known to be increasing throughout the year leading to warmer summer months and warmer winter months as well. This leads to precipitation extremes with natural precipitation levels occurring with the monsoons in the summer and decreased winter rainfall leading to a scenario where flooding occurs which leads to landslides and soil erosion. Soil erosion affects the growth of trees due to glacial retreat. Melting ice is leading to soil erosion, which is affecting forest cover and growth. The decrease in the growth and maintenance of forests land due to soil erosion is leading to a situation where carbon sequestration rates may decrease. Forestry is also a major national economic sector for Bhutan so a lack of trees may affect Bhutan much more. Increased frequency of flooding may lead to a decrease in the agricultural output of the Kingdom leading to a reduced economic output. Tourism may be affected particularly in monsoon months.

5. Institutions, Governance, and Climate Change Policies

a. Legal framework

Bhutan's government is split into the legislative, executive, and judicial branches. The Prime Minister leads the executive branch. The executive, legislature, and local government all make up the general electorate. Despite being a monarchy, the King of Bhutan's role is that of external outreach regarding political reforms. As the figure below shows,⁴⁰ there are several subsections within each of these categories, which are comprised of ministries. Bhutan's judicial system has been separate from the legislative and the executive branches since 1968.⁴¹

In Bhutan's local government as of the Local Government Act of 2009, Dzongkhag Tshogdu (the District Council), is the non-legislative executive body. Gewog Tshogde, or the Gewog Council, is the subordinate branch of the Dzongkhag Tshogdu. There is a headman, deputy headman, and elected ministers from villages. In addition, the Thromde Tshogde is an administrative division, which is another subordinate body. This is all summarized under the 'Local Government' section of the diagram below.

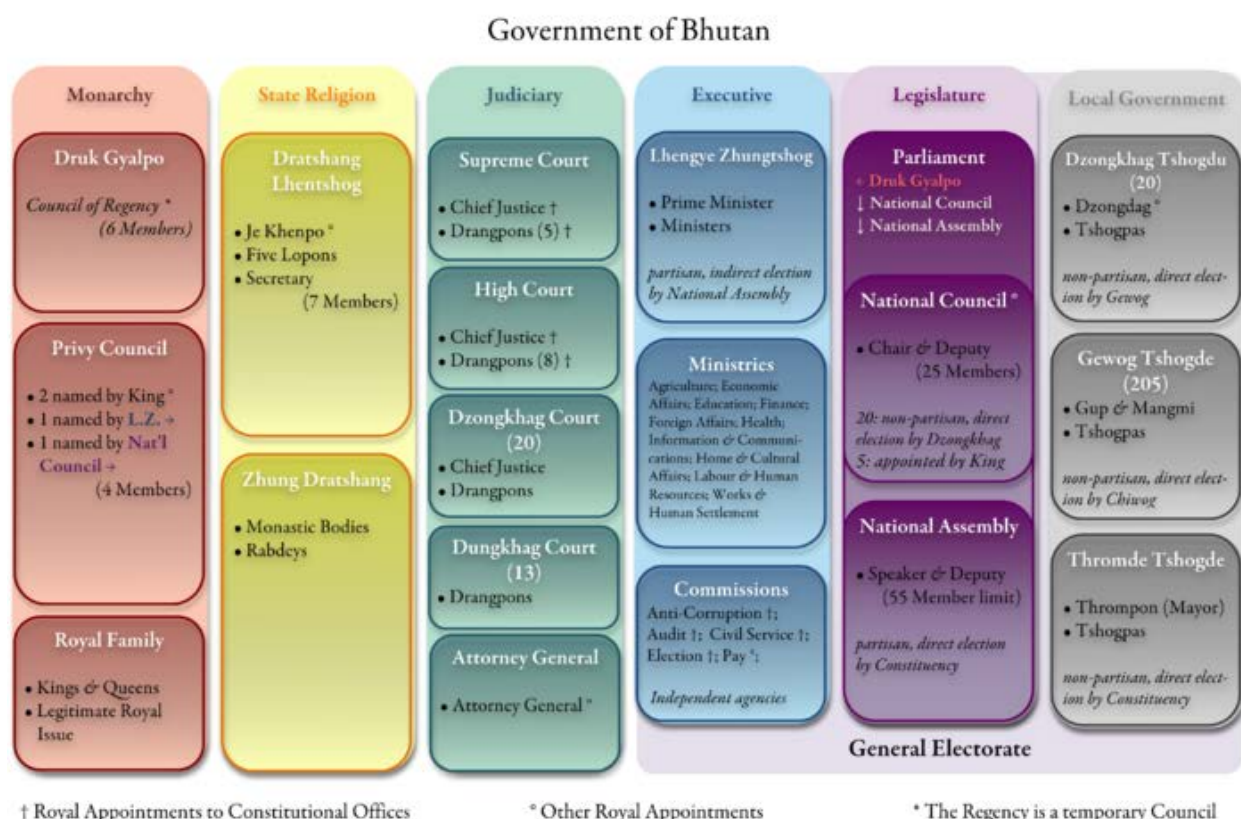


Figure 5. Government of Bhutan.

b. Institutional and administrative setup

Bhutan involves several key stakeholders in creating and administering environmental policies relating to climate change. Some of these key stakeholders include the National Environment Commission (NEC), the Gross National Happiness Commission, and the Ministry of Agriculture and Forests. The table below gives a comprehensive overview of stakeholders in Bhutan.

Together, these stakeholders interact with each other in various ways. The ministry groups publish their findings and policies, which can be used by other stakeholders. Agencies use these policies to do further research. Agricultural communities and the general population are affected by environmental policies.

Stakeholder	Description
National Environment Commission (NEC)	An autonomous agency that plays a role in key environmental laws and policies and focuses on the most urgent environmental issues in Bhutan. Environmental development, regulations, and natural resources' use are the primary priorities of the National Environment Commission.
The Gross National Happiness Commission	A government organization that works with policy decisions relating to Bhutan's residents' quality of life, and review resource allocations. Climate change impacts would directly affect quality of life, making the organization is a key stakeholder.

The Ministry of Agriculture and Forests	A Bhutan government ministry that reviews sustainable practices and the economic stability of agriculture and forests. If climate change were to affect agricultural yield or forest cover, or even biodiversity, this ministry would be impacted as well.
The Ministry of Economic Affairs	A similar stakeholder as the Ministry of Agriculture and Forests because any agricultural yield or commodities like timber from forests would be lower if there was a drought. Therefore, the economy of Bhutan would be affected. Furthermore, since a significant majority of Bhutan relies on hydropower, a drought or flood would also affect the economy.
The Ministry of Works and Human Settlements	Develops infrastructural policies in Bhutan. In the event of there being a flood, there needs to be infrastructure in place to manage the excess water. Conversely, if there is a drought, the infrastructure to hold water as surplus storage should also be in place.
The Tourism Council of Bhutan	An important stakeholder because climate change could directly affect tourism. If the temperatures are too high for tourists to tour the country safely, fewer may choose to come to Bhutan. Similarly, tourism rates would drop if trees would die from heat or drought since the aesthetic value of Bhutan would also decline.
The general population of Bhutan	The general population would be affected and is thus an integral stakeholder in this conversation. The general population's water and food supply, infrastructure including homes, and even health would be at risk due to climate change.
The hydropower sector	A key stakeholder because of hydropower generating over a fifth of Bhutan's GDP. If water sources were to be impacted, the hydropower sector would be negatively affected.
Farmers and agricultural communities	These are important stakeholders, since it is their efforts that ensure that Bhutan has enough food and water. With droughts, high temperatures, and lack of infrastructure, it is going to be a challenge for Bhutan's agricultural communities to combat climate change unless climate policies are improved.

Table 2. Key stakeholders in Bhutan's environmental politics.

c. Local governance

Bhutan is made up of 20 districts that all have a District Officer. These twenty districts have sub districts, which consist of village groups. There are over 205 villages in Bhutan.⁴² These villages elect headmen who oversee administrative processes.⁴³

The village groups, also known as Gewogs, do not have the power to pass laws. However, they do have the ability to regulate road, architecture, parks, and other areas' construction, agricultural plans, and other municipal-level projects. In addition, the Gewogs also work under the Ministry of Finance to create budget reports for their respective village groups.⁴⁴

d. Climate change policies and strategies

In 2000, Bhutan identified all major climate change based threats and acknowledged its national responsibility of sequestering carbon. These threats were included in the 2006 National Adaptation Programme of Action (NAPA), wherein five aspects of climate change issues including water resources, natural disasters and infrastructure, and forestry and biodiversity were discussed. Bhutan's NAPA document can be updated if there are new developments relating to the five key areas.⁴⁵

Bhutan ratified the UNFCCC on 25 Aug 1995⁴⁶ and the Kyoto Protocol on 26 Aug 2002. Bhutan's NDC to the Paris Agreement builds on the declaration to remain carbon neutral made in 2009 and it remains committed to the ideals and missions of the UNFCCC.⁴⁷

Policy	Introduction
Nationally Determined Contribution (NDC) (2015)	The NDC, or the INDC, has a strong focus on adaptation components. With its particular vision of improving economic development, Bhutan's hydroelectric power source and its agriculture sector remain most vulnerable to changes in climatic conditions leading to potential GLOFs. Hence, adaptation measures are primarily focused on providing increased resilience to hydropower sources and agriculture as well as forest land for economic development. Mitigation strategies are also provided in the document, although maintaining carbon neutrality is a secondary focus.
Strategic Program for Climate Resilience (SPCR) (2017)	The Kingdom of Bhutan and the World Bank signed into effect the preparation of the SPCR grant of 1.5 million dollars to help support Bhutan in its efforts to formulate long-term plans for climate resilience. The SPCR builds on ongoing activities and engagements within Bhutan and provides a structure to incorporate components of resiliency within development, creating a process of engagement in terms of climate issues with existing institutions as well as creating a plan for increased investment opportunities in the future. This SPCR includes: innovative eco-system based approaches to Integrated Flood-Based Management (IFBM) of river basins; Climate-Oriented Watershed Management Plans; Climate SMART Thromde (Township) planning; a robust and innovative Resource Mobilization Strategy, with non-traditional financing options and sustainability mechanisms and other components unrelated to EbA.
National Adaptation Programme of Action (NAPA) (2006)	Bhutan's NAPA addresses the most severe climate threats faced by the Kingdom while outlining approaches for adaptation and mitigation. The list of adaptation priorities include, inter alia, Disaster Management Strategy (including planning for food security), landslide management and flood prevention, flood protection of downstream industrial and agricultural areas, rainwater harvesting, and community-based forest fire management and prevention.

Second National Communication (2011)	The National Communication to the UN Framework Convention on Climate Change (UNFCCC). Contents of the report include: national circumstances of the country, inventory of greenhouse gases for a given base year, actions taken to mitigate emission of greenhouse gases, actions needed or taken to adapt to the adverse impacts of climate change.
National Biodiversity Strategies and Action Plan (NBSAP) (2014)	Bhutan's National Biodiversity Strategies and Action Plan provides a comprehensive plan on Bhutan's conservation strategies. The report provides an overview of biodiversity in Bhutan, past reports, lessons learned from past NBSAPs, and how the current plan was formulated. The plan then discusses the threats to biodiversity, which range from forest fires to poaching. The report also talks about indirect pressures on biodiversity like climate change. Based on the threats, both direct and indirect, the report discusses further issues and possible opportunities like incentives and technological solutions. The mission of the plan is to have a valued biodiversity with sustainability initiatives by 2020.
National Disaster Risk Management Strategy (2017) ⁴⁸	A national strategy developed to guide risk prevention and reduction, preparedness, response, recovery and reconstruction activities in Bhutan in line with national legislation and the Sendai Framework for Disaster Risk Reduction. Among its main objectives is to establish linkages and coherence between disaster risk management, climate change adaptation, and sustainable development.

Table 3. Overview of the key strategies and policies Bhutan has put in place to tackle climate change.

Date submitted	Document	URL
September 30, 2015	Nationally Determined Contribution	http://www4.unfccc.int/ndcregistry/PublishedDocuments/Bhutan%20First/Bhutan-INDC-20150930.pdf
May 2006	NAPA	http://www.adaptation-undp.org/sites/default/files/downloads/bhutan_napa.pdf
2014	NBSAP	http://nbc.gov.bt/wp-content/uploads/2010/06/2015-02-12-FINAL_NBSAP2014_web.pdf
2000	Initial National Communication (2000)	URL no longer valid - http://www.nec.gov.bt/nec1/wp-content/uploads/2012/10/Bhutan_INC1.pdf
2011	Second National Communication (2011)	http://adaptation-undp.org/sites/default/files/downloads/bhutan-second_national_communication.pdf

Table 4. List of national communiqués and other relevant documents.

6. Ecosystem based Adaptation (EbA) related Strategies, Policies and Projects

a. Overview

Bhutan's policies and strategies generally feature a strong emphasis on EbA, although the term is seldom used explicitly. This is particularly true for the NDC, NAPA, and NBSAP. The below table gives an overview of the role of EbA in each of the major climate change adaptation policies.

Policy	References to EbA
Nationally Determined Contribution (NDC) (2015)	5/10 adaptation priorities are implicitly ecosystem based , but EbA measures are not explicitly mentioned. The main purpose for these adaptation plans is in order to increase resiliency of hydropower sources as well as the agriculture sector. These are the two most important sectors for enhanced economic development. Other vulnerable and important sectors include forests and water sources.
Strategic Program for Climate Resilience (SPCR) (2017) ⁴⁹	3/6 adaptation priorities are ecosystem based . EbA adaptation plans include strategic management of target watersheds and water sources, resiliency to flood hazards, Climate-SMART human settlements.
National Adaptation Programme of Action (NAPA) (2006)	4/9 adaptation priorities are ecosystem based with a focus on disaster management strategies, landslides and flood prevention measures as well as forest fire management and prevention plans as well as artificial lowering of Thortho Lake.
Second National Communication (2011)	EbA adaptation not explicitly stated . In the energy sector a range of hydropower projects are being carried out in different river basins along with vulnerability assessments but no mention of adaptation as such.
National Biodiversity Strategies and Action Plan (NBSAP) (2014)	The NBSAP directly, albeit briefly, mentions EbA in two of its priority actions on conservation of mountain biodiversity and increasing funding for management of biodiversity, respectively. However, EbA does not appear among the 8 underlying principles or the plan's 13 strategic approaches. To the extent that EbA is mentioned, its value is not being discussed or compared to alternative approaches.
Disaster Management Strategy (proposed in the NAPA 2006)	Focuses on planning for food security and emergency medicine to vulnerable communities in the event of disaster. Generally, the strategy deals with disaster response rather than disaster reduction, and therefore does not address EbA as an approach for mitigation .

Disaster Risk Management Status Review (2017/2018)	The government review of its Disaster Risk Management lists, as one of its priorities, the need to invest in DRR for resilience, including in the agriculture and energy sectors. While there is adequate awareness within the agriculture sector about the need to integrate DRR and climate change adaptation policies, the report identifies a lack of specific technical knowledge on how to do so in planning and implementation processes. Neither the review or the National Disaster Risk Management Strategy itself make any references to EbA.
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Table 5. References to EbA in key policy documents.

b. Policies in the forestry sector

According to the National Forest Policy (2009), Bhutan has seen a shift from a primary focus on protection and conservation towards a focus on balancing conservation with sustainable utilization. Associated with this change of emphasis has been a move towards a more decentralized and people-centered approach to implementation. Overall, the National Forest Policy puts great emphasis on ecosystem management and biodiversity conservation; however, it only addresses climate change adaptation to a very small extent. Of 20 recommended policy measures, only one addresses climate change and does so rather vaguely: *“Carry out research to generate knowledge, information and technology to support policy implementation and development including integration of climate change issues.”*⁵⁰ The National Forest Policy is administered by the Ministry of Agriculture.

c. Policies in the agriculture sector

The 11th five-year plan (2013-2018) focuses on the commercialization of the sector by shifting away from subsistence and promoting private sector participation.⁵¹ While it does cite environmental issues and climate change as some of the sector’s challenges, these concerns are second to financial and economic concerns such as decreasing public investment, lack of infrastructure, labor shortage, and rural-urban migration. Environment, climate change, disasters, and gender are being categorized as crosscutting issues needing to be addressed systematically with other goals and objectives under the Ministry of Agriculture and Forestry. The plan does not explicitly allude to EbA. The Ministry of Agriculture is responsible for the implementation of Bhutan’s agriculture policy.

d. Policies in the hydropower sector

The major political challenges for the hydropower sector revolve around financing the investments in new projects and meeting consumer demand. While mainly discussing social and economic problems, the 11th five-year plan (2013-2018) does recognize Glacier Lake Outburst Floods (GLOFs) as a main challenge. Yet the plan only briefly deals with the issue, claiming, *“Risk has been reduced substantially after the mitigation works undertaken in the Tenth Plan”* with no further elaboration.⁵² Likewise, the Sustainable Hydropower Development Policy (2008) only briefly touches upon environmental issues, indicating that no laws are in place to regulate the environmental impact of hydropower development specifically.⁵³ Instead, the government is responsible to ensure that construction and operation are in line with existing environmental legislation, and the developer is required to conduct a comprehensive Environmental Impact Assessment (EIA) as well as develop and implement an Environmental Management Plan (EMP). The Department of Energy (DoE) under the Ministry of Economic Affairs (MoEA) is responsible for policy making and planning of all aspects of the energy and power sector.

7. Conclusions and Recommendations

a. Conclusions

The mountains of Bhutan are crucially important to the country's economy and its people's livelihoods. With 9 of 10 citizens living in the Himalaya, the country is deeply dependent on the services provided by the mountain ecosystems. Major industries like agriculture, forestry, hydropower, and tourism are all vulnerable to adverse impacts of climate change, and for that reason, adaptation is high on the government's agenda. A myriad of rivers and streams flow from the great mountain tops in the north directly through the country towards India, providing drinking water for humans and livestock, irrigation for crops, and clean hydropower for the local communities. As the climate changes in complex ways across the extremely diverse landscapes, glaciers melt at faster rates and the regular monsoon patterns are disrupted. The consequences are increased risk of GLOFs, landslides, floods and droughts, which pose challenges for agriculture and pastoralism, forestry, hydropower, and tourism.

Current overarching policies and strategies related to climate change adaptation tend to have a strong emphasis on ecosystems; however, EbA is seldom mentioned explicitly. This is particularly true for the NDC, NBSAP, and NAPA. There is a general dearth of concrete initiatives and strategies for adapting individual sectors to the impacts of climate change. The sector specific policies on forestry and disaster risk reduction have yet to set out a concrete strategy for adaptation, but both of them explicitly recognize the need to do so.

b. Gaps, Challenges, and Recommendations

Bhutan should prioritize research in the potential of utilizing forest management as EbA

While Bhutan's forestry policy does have ecosystem conservation in focus, it only addresses climate change adaptation to a small extent and does not specifically mention EbA. The few mentionings of adaptation deals with how to reduce climate impact on the forestry sector rather than how forests can provide a means of adaptation to communities. In other words, the National Forest Policy does not attempt to integrate ecosystem conservation with climate change adaptation. For example, strategically managed forests can ameliorate the increased risk of landslides to communities on mountainsides,⁵⁴ but such opportunities are not being explored in the current policy. The document does, however, call for more research to “*support policy implementation and development including integration of climate change issues.*” Bhutan should act on this and prioritize research in the role of forests in EbA in order to harvest the synergetic benefits of conserving forest ecosystems in mountains.

Potential strategic partners include IUCN's Commission on Environmental, Economic and Social Policy (CEESP) and the Commission on Ecosystem Management (CEM), particularly the thematic group on Ecosystem based Adaptation and Mitigation under CEM. Since this gap is fundamentally a knowledge gap, it might also be possible to engage the academic community in research on how forest conservation can mitigate climate impacts.

Agriculture sector

Climate change adaptation is implied in Bhutan's agricultural policy, but there is a stronger need for a clear, comprehensive policy that lists adaptation strategies. Bhutan's Climate-Smart Agriculture (CSA) strategy is an excellent initiative because it seeks to integrate agriculture development and climate responsiveness.”⁵⁵ A gap within this strategy is the fact that there are no climate adaptation initiatives included. However, there are climate mitigation initiatives. Therefore, our recommendation would be to include more EbA focused climate adaptation initiatives to complement the climate mitigation initiatives already in place within the CSA strategy.

Another cause for concern is concerning CSA technologies and their implementation. Although CSA approaches could theoretically improve agricultural resiliency, farmers and the agricultural community as a whole are not necessarily familiar with the concepts. Therefore, a gap in this strategy is based on a lack of awareness and educational outreach. If farmers are well versed in CSA strategies and technologies, they will be able to produce agricultural yields that are more sustainable and mindful of changing climate.

There is a set of strategic partners that can assist in mainstreaming EbA into Bhutan's agriculture policy. Each of the key stakeholders listed Table 2 can act as proponents of mainstreaming EbA; in particular, the agricultural communities of Bhutan can implement EbA strategies in their local daily practices. A key challenge in this regard is to convince local farmers of the benefits of EbA, not only from an environmental point of view, but from an economic perspective as well. The joint report by IUCN, UNEP, and UNDP on *Making the Case for Ecosystem-based Adaptation* provides concrete examples of the type of cost-benefit analyses that are critical inputs to implementing change. The Ministry of Agriculture and Forests should dedicate funding towards educational workshops for agricultural communities (especially farmers) so that they can learn more about EbA strategies and the value added by implementing them.

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- ⁸ <https://search-proquest-com.ezproxy.cul.columbia.edu/docview/1566187662?pg-origsite=summon&accountid=10226> Gender Equality as a Key Strategy for Achieving Equitable and Sustainable Development in Mountains : The Case of the Hindu Kush-Himalayas (Molden et al., 2014)
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- ⁴³ <https://www.britannica.com/place/Bhutan/Government-and-society>
- ⁴⁴ https://en.wikipedia.org/wiki/Gewogs_of_Bhutan
- ⁴⁵ UNDP. <http://adaptation-undp.org/explore/bhutan>
- ⁴⁶ UNFCCC. http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php

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⁴⁸ Department of Disaster Management. *Disaster Risk Management Status Review*

http://www.ddm.gov.bt/download/Bhutan_DRM_Status_Review.pdf

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[documents/ppcr_21_4_strategic_program_for_climate_resilience_for_bhutan_final.pdf](https://www.climateinvestmentfunds.org/sites/default/files/meeting-documents/ppcr_21_4_strategic_program_for_climate_resilience_for_bhutan_final.pdf)

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⁵¹ Government of Bhutan. *RNR Sector: Eleventh Five Year Plan*.

www.moaf.gov.bt/download/Five%20Year%20Plans/11FYP%202013-2018.pdf

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<http://www.gnhc.gov.bt/12rtm/wp-content/uploads/2013/10/Eleventh-Five-Year-Plan-Volume-I-Final.pdf>

⁵³ Sustainable Hydropower Development Policy (2008). <http://www.moea.gov.bt/wp-content/uploads/2017/07/Hydropower-Policy.pdf>

⁵⁴ CIFOR. *Forest-based Adaptation to Climate Change*. <https://www.cbd.int/forest/doc/wscb-fbdcc-01/Sept4/cifor-adaptation-daniel-murdiyarso-bruno-locatelli-en.pdf>

⁵⁵ Climate-Smart Agriculture in Bhutan

<http://sdwebx.worldbank.org/climateportal/doc/agricultureProfiles/CSA-in-Bhutan.pdf>

Scaling Up Ecosystem-based Adaptation in Mountains

Peru Situation Analysis



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1. Introduction

Between 2011 and 2016, the Mountain Ecosystem-based Adaptation (EbA) Flagship Programme was developed in the Himalayas (Nepal), Mount Elgon (Uganda) and the Andes (Peru), by the International Union for Conservation of Nature (IUCN), The Mountain Institute (TMI), the United Nations Development Program (UNDP) and the United Nations Environmental Program (UNEP). Following the success of this program, TMI and IUCN have teamed up to expand EbA within these three countries and introduce the program into three neighboring countries: Bhutan, Kenya and Colombia. The program looks to directly benefit local communities, assisting them to adapt to the adverse effects of climate change, and simultaneously providing benefits to millions of individuals downstream who also depend on the resources found in mountain ecosystems.

This document focuses on the most updated situation in high-mountain ecosystems across Peru specifically. It seeks to analyze public policies, strategies, experiences and projects related to EbA in the country in order to find gaps and opportunities for the expansion of this approach at both the national and subnational level. It will be used by TMI and IUCN in the up-scaling process to build wider support for EbA and generate financing mechanisms within national governments and at international forums for adaptation. The information gathered in this Situation Analysis will be used to develop a policy brief, to be disseminated to government officials in Peru, concerning main adaptation recommendations.

2. Development, Climate Change and Mountain Areas in Peru

a. Mountain ecosystems and demography

Peru is a South American country located between Ecuador and Chile, with an area of 496,200 km² and a population of 30, 38 million people¹. Due to its already perturbing shortage of water, and the rapid losses of its mountain glaciers, Peru is considered the third most vulnerable country to climate change worldwide².

Peru is also extremely unique for its Andes mountain range, which divides the country into three geographic regions: coast, highlands and jungle. The jungle region occupies about 60% of the entire territory, while the coast and highlands comprise approximately 11% and 29%, respectively³. The Andes mountain range is particularly important for Peru as it not only regulates its climate, but also consists of rivers and massive glaciers (totaling 71% of the world's tropical glaciers), which together provide freshwater to majority of the population⁴. The region also delivers key ecosystem services such as carbon sequestration and fertile agricultural land to most of the population within the country⁵.

Approximately 11,173,196 people, 36% of Peru's population, live between the Western dry Pacific and the Intermontane Valleys and Altiplano Plateaus in the East⁶. Small indigenous communities are dispersed around the Andes regions in Peru, and rely heavily on mountain ecosystems for medicines, food, construction materials and cultural crafts. Although many of them live in poverty, these communities hold a wealth of agricultural techniques and traditional knowledge that may be critical to climate change adaptation⁷.

The Peruvian mountain geography is composed of forests, hillsides and plains, as well as a wealth of biodiversity and mineral resources, such as oil and natural gas⁸. The country hosts about 25,000 plant species, 30% of which are endemic⁹. In addition, 4,400 of these species have known commercial and cultural properties and are used by the population. Moreover, the area has almost 2,000 fish species;

1,736 bird fauna species; 332 amphibian species; 460 mammals and 365 reptile species; 760 of which are endemic species¹⁰. However, due to climate change related impacts, only the Northern Andes are expected to lose almost 2,000 endemic species, dramatically impacting ecosystem functioning and biological diversity, as well as livelihoods¹¹.

b. Gender and mountain livelihoods

Many of the strategies for climate change adaptation in Peru have been directed at general territories or communities without consideration of the varying roles of men and women. The importance of women in mountain communities has been particularly overlooked. Yet, they are commonly in charge of the use, administration and conservation of natural resources within their social structures¹². Studies have also shown that women tend to have less access to information than men in Andean communities.¹³ Equal access and training to climate change information is essential between women and men of every age, this way the entire community can contribute their individual visions, knowledge and experiences to climate adaptation efforts. In order to achieve this, it is necessary that female ancestral knowledge is rescued and valued, and that women are actively involved in the decision-making process concerned with adaptation.¹⁴

Due to the increasing recognition that climate change has different impacts on men and women, as well as how these climate impacts tend to deepen gender gaps, Peru has recently instituted the Gender and Climate Change Action Plan. The plan has been used as a public management instrument to guide the actions of different Peruvian State entities in order to decrease gender inequality, in parallel with greenhouse gas emission reduction and climate adaptation actions. It has eight priority areas, including water resources and food security. Additionally, it recognizes that Peruvian women, especially those residing in rural areas, have restricted access to resources, which in turn limits their capacity to adapt to climate change.¹⁵

3. Economy and Livelihoods

The Peruvian economy has traditionally been based on the exploitation of natural resources, specifically through agriculture, mining and fishing¹⁶. Key indicators for mountain economies include fishing, mining, agriculture and land-use, water for hydrological power and agriculture, population size (migration of youth), deforestation/forestation, cattle herding and glacier reduction. The following activities represent a small portion of the unmatched contribution of mountain ecosystem services and biodiversity to the economy.

- **Mining:** Compounding its tremendous physical and biological diversity, Peru has some of the world's most abundant mineral deposits. Consequently, mineral exports are crucial to Peru's economy. The principal area for mining activity in the country is located in Peru's mountainous porphyry deposits rich in copper, gold, silver and molybdenum, largely found near the southern border shared with Chile¹⁷. More than forty metallic and nonmetallic resources are currently being exploited in the country, accounting for a significant percent of global mineral production¹⁸. This is especially true given that the country is the world leader in the production of silver, and a major producer of gold, tin, lead, copper and zinc. Over the last eight years, the mining sector has been growing steadily, and in 2009, mining accounted for over 5% of the national GDP and 61% of Peru's export revenue¹⁹.
- **Tourism:** The Ministry of Tourism and International Trade estimates that in 2010, tourism in Peru generated \$274.1 million in revenue, increasing 12.4% from 2009. Tourism activities and attractions focus mainly on the natural resources and cultural heritage of Peru, many of these sights being located in the Andes. Machu Picchu, the main tourist attraction in Peru, as

well as Lake Titicaca and the Colca Valley, are clear examples of the importance of the Andes in the industry, ²⁰.

- **Agriculture:** There are three main agricultural systems for native crops in Peru based on altitude: the maize area (2800-3300 m altitude), the potato area (3,300-3800 m altitude) and the livestock area with high altitude crops such as quinoa, cañihua (3,800-4500 m altitude)²¹. For Quechua and Aymara communities, agriculture is the primary source of income. This is largely due to the wealth of indigenous agricultural knowledge such as terraces, ridges fields, local irrigation systems and traditional agricultural tools, crops and livestock spread at different altitudes. Similarly, the Nor Yauyos-Cochas Landscape Reserve (NYCLR) is located in the Andean highlands in the Junín regions and the southern part of Lima, and there, communities primarily rely on subsistence agriculture and livestock farming for their livelihoods. As such, access to water and pastures is essential²².
- **Water from glaciers:** Home to 71% of the world's tropical glaciers, the Peruvian Andes are a formidable source of water. During droughts or the dry season, the meltwater of the glaciers in the Peruvian Andes is used for domestic consumption, irrigation, hydropower generation (80% of total electricity produced in Peru) and mining operations²³. All of which play a vital role in the development of the country, particularly in the arid Pacific coast and Andean front ranges containing 70% of the population²⁴. However, Peruvian tropical glaciers have lost 22% of their surface area in the past 30 years alone. In 1970, the area covered by glaciers was 2041 km², but by 1997, it was only 1595 km².²⁵ .

4. Environmental Challenges in Mountain Areas

a. Water Shortages

Because of rising temperatures, 40% of glacier surface area in the tropical Andes has disappeared since the 1970s; the region has warmed 0.7 °C between 1950 and 1994²⁶. As compared to current levels, national water availability scenarios for 2050 show an additional decrease of glacier runoff averages in the highlands by 52%²⁷. Such an unprecedented retreat will likely affect water supply to future generations of Andean populations²⁸. In recent years, one of the most dramatic changes in Peru has been the disappearance of the Broggi Glacier in Huascaran National Park, a World Heritage site northeast of Lima²⁹. One result of accelerated glacier retreat is the formation of new lakes in the highlands. In addition to hindering the glaciers' ability to regulate water, thereby increasing water shortages, this melt further increases the risk of floods and landslides³⁰. Moreover, given that 95% of the Peruvian population depends on water coming from high mountains, water availability is an issue of concern for local communities as well as those living downstream³¹.

b. Agriculture and Cattle Herding

More than 92% of agricultural producers in Peru can be considered small producers, from which 70.6% are found in mountain areas³². Yet another issue facing mountainous regions concerns land use such as agriculture and cattle herding. Economic studies expect losses of 24-33% in the agriculture sector's gross domestic product between 2010 to 2100. According to local stakeholders for example, the NYCLR has been experiencing increasing environmental pressure largely due to changes in precipitation patterns and grassland overuse by the local people. The loss of traditional knowledge and the lack of market access have increasingly resulted in low agricultural production for the area, particularly of native crops. This has led to the migration of the local population, especially youth, towards urban areas. Migration has forced many households to shift towards less labor-intensive cattle farming. This shift, coupled with weak community organization and dense cattle distribution, is causing native grassland ecosystems in certain areas to be extremely degraded³³. The issues observed in the NYCLR are characteristic of countless other communities in high-mountain ecosystems in Peru.

Populations located in the Andes hold low rankings on the Human Development Index due to the majority of the communities living in poverty or extreme poverty³⁴. Communities in high mountain ecosystems found in the central and southern regions of the Andes have been identified as highly vulnerable to climate change due to their low incomes, social exclusion and high exposure to extreme climate events. Frost conditions, for instance, regularly affect high mountain ecosystem and residing communities, and are expected to increase with climate change. Recurring frost events affect agricultural production, cattle and the health of vulnerable populations in the Andes³⁵. Risks are further exacerbated for these communities as a result of new lakes formed due to glacier melting, increasing the probability of avalanches and landslides³⁶.

c. Mining Activity

Since 2006, Peru has seen an economic growth rate of more than 6 percent annually, largely driven by the mining sector³⁷. This impressive increase in mining has been accompanied by a rise in conflict and environmental degradation around large-scale mining operations. Remote and prodigiously poor Andean highlands communities have been the most affected. They have sought to block mining projects not only because their livelihoods have not improved despite tremendous profits realized by mining companies, but also because such activities contaminate their local land and water sources³⁸. The environmental impacts of mining are manifold and include the formation of sinkholes, water resource depletion, erosion, biodiversity and habitat loss, as well as soil, groundwater and surface water contamination. For instance, it is estimated that almost 40 metric tons of mercury are discarded into the Peruvian environment annually and burned off after amalgamation due to illegal gold mining³⁹.

5. Climate Change in Mountain Areas

There is a myriad of trends in Peru associated with climate change, including rising temperatures, extreme temperature fluctuations, sea level rise, changing rainfall patterns and an increasing rate of glacier melt in the Andes. Given that the majority of Peruvians live in water-sensitive areas, are working in resource-dependent sectors such as agriculture or fishing or live on the margins of poverty (or in poverty), Peru is highly vulnerable to these climate related changes⁴⁰. In mountain ecosystems, one of the biggest threats is changes in temperature. Climate change projections indicate that temperatures will increase between 0.61°C and 1.12°C between 2011 and 2030. Although this will not result in any changes in the amount of annual rainfall, changing patterns and a reduction of surface water runoff is sure to occur⁴¹.

It is expected that the effects of climate change in Peru will be four-fold by the year 2050.

1. During the summer, an increase in temperature by 1.3°C and a reduction in humidity by 6% will occur. The consequences will be an increase of 'freezing nights' as well as a 3 to 4°C increase in ocean temperatures.
2. Precipitation will be reduced between 10%-19% in the North, South and Central parts of the country.
3. Sea level rise will result in flooding, erosion, salt water penetration into underwater springs, and general coastal damage.
4. Climate change will translate into the increased frequency and greater consequences of the occurrence of climatic phenomena such as "Fenomeno De El Niño"⁴².

a. Future Climate Change Scenarios

According to the Thornthwaite classification, Peru has 27 of the 32 types of climate existing around the world. The Andes' climate is mainly determined by altitude changes within the mountain range⁴³. At a national level, Peru has developed climate projections in accordance with the Representative Concentration Pathways (RCP) from the last IPCC report (AR5). The study used the 4.5 and 8.5 RCP scenarios, showing an increase in the average precipitation and temperatures in Peru at a national level. Between 2036 and 2065, an increase in 10-20% of rainfall and a 2-6° C in temperature is expected. While the spatial variation at a regional level is strong, the increase in temperatures in the Andean plateau is clear, especially in reference to minimum temperatures⁴⁴.

At a regional scale, Peru has elaborated climate projections for a selection of mountain areas. In Apurímac and Cusco regions for example, climate projections show that by 2030 the average rainfall is not expected to change, except for the provinces of Quispicanchi and Abancay where it will increase by 15-30%, while the average temperature is expected to increase 0.7-1.2°C by 2030 in both regions. The climate scenarios for 2050 show a 75% reduction in precipitation in the southern part of both regions between June and August; and an increase in 1.4-2.2°C of the average temperature. Another study shows that the minimum and maximum temperatures are expected to increase in the regions of Ancash, Huancavelica, Huanuco and Puno average⁴⁵.

The Vulnerability and Impact Assessment for Nor Yauyos Cochas Landscape Reserve, where an EbA project was successfully implemented, revealed an increase in the average temperature between 0.61 to 1.12°C from 2012 and 2030. Trends also show a greater increase in temperature at higher elevations in the reserve⁴⁶.

6. Climate change policies and strategies

a. Contributions to the UNFCCC

Peru became part of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and since then, has presented and ratified its own Nationally Determined Contribution (NDC). The NDCs include mitigation and adaptation contributions for Peru based on available scientific information, and consultations with relevant sectors, regions and civil society. Five sectors have been prioritized for the country, each with its own scope and goals: water, agriculture, fishery, forestry and health. As shown in their goals, the water and agricultural sector goals relate directly to high mountain ecosystems:⁴⁷

- Water- Encourage and promote actions and projects that increase the availability of water in the context of climate change.
- Agriculture- Reduce the negative impact of climate change on agrarian activity (agriculture, livestock and forestry).

Vulnerable populations have also been recognized as a priority to fight climate change. This includes rural populations reliant on subsistence family farming and/or weak market linkages, many of them grouped in peasant and indigenous communities; small farmers; artisanal fishermen; native communities; small forest producers; and, from a health perspective, infants, women and seniors.⁴⁸

b. Climate change strategies and policies

The main climate change strategies and policies for Peru can be found in the following table.

Document	Date of submission	Description	Links
Climate Change Framework Law	15 March 2018	The objective of the law is to establish the legal and institutional framework to implement different measures against climate change, reduce the vulnerability of the country, take advantage of the opportunities of low carbon growth and fulfill the international commitments assumed by Peru before the UNFCCC. This law states that the Ministry of Environment is the responsible institution within the country to act as the focal point for climate management. ⁴⁹	https://www.scribd.com/document/368875326/Dictamen-ley-marco-de-cambio-clima-tico#from_embed
National Climate Change Strategy 2015	April 2015	This is the most updated National Climate Change Strategy for Peru. It looks to ensure that public entities and government sectors have a road map for effective management by incorporating climate change into sustainable development, based on a low carbon economy. It looks into both mitigation and adaptation strategies and establishes the Ministry of Environment as the focal point for its implementation.	http://sinia.minam.gob.pe/documentos/estrategia-nacional-ante-cambio-climatico-2015
National Family Farming Strategy 2015-2021 (Estrategia Nacional de Agricultura Familiar 2015-2021)	2015	This is the national strategy to guide and organize government interventions for family farming in Peru. It includes a commitment for the social and economic inclusion of the rural population, indigenous and local communities, and the conservation and development of biological diversity. One of its strategic guidelines refers to the sustainable management of natural resources in the face of climate change. The Ministry of Agriculture is responsible for this strategy and its implementation.	http://www.agrorural.gob.pe/wp-content/uploads/2016/02/enaf.pdf
National Biodiversity Strategies and Action Plan (Estrategia Nacional de Diversidad Biológica al	2014	The document contains the National Biological Diversity Strategy and Action Plan for 2014-2018. It was developed by the Ministry of Environment, the focal point for the Convention on Biological Diversity. It contains Peru's six national strategic objectives and thirteen goals, which	https://www.cbd.int/doc/world/pe/pe-nbsap-v2-es.pdf

Document	Date of submission	Description	Links
2021) [In Spanish]		look to stop the loss and deterioration of biological diversity, improve their management and increase the sustainable use and equitable distribution of its benefits. It provides a general overview of Peru's current situation in regards to the conservation of its biological diversity. However, it does not focus on adaptation to climate change in particular. The Ministry of Environment is the institution responsible for the strategy and action plan.	
National Disaster Risk Management Plan	2014	This Plan considers the effects of climate change as a factor increasing the risks affecting sustainable development, given that it may increase the frequency and intensity of climate events such as floods, droughts, frosts, mass movement and hailstorms. However, it does not mention adaptation or EbA specifically.	https://www.preventiconweb.net/english/professional/policies/v.php?id=37923
Risk Management and Adaptation Plan for the Agricultural Sector, 2012-2021 period	2012	This is a document by the Ministry of Agriculture that includes a diagnosis of the local and institutional framework in the country, as well as a baseline to identify risks and vulnerabilities in the agricultural sector. It also links this plan to the national and international strategies on adapting to climate change. The Ministry of Agriculture is the responsible entity to manage this agricultural adaptation.	http://www.cambioclimaticoandes.info/evento/pdf/Plangracc_a.pdf
Bicentennial Plan: Peru Towards 2021	2011	This National Development Strategic Plan has six strategic national development policies for Peru by 2021. The sixth policy is entitled "Natural Resources and Environment", and establishes adaptation to Climate Change as one of its five priorities, as well as the need to develop objectives, goals and strategic actions. This plan was developed by Peru's National Center for Strategic Planning.	https://www.mef.gob.pe/contenidos/acercamin/docs/gestion/PlanBicentenarioversionfinal.pdf

Document	Date of submission	Description	Links
Organic Law of Regional Governments	2002	Law No. 27867 establishes and regulates the structure, organization, powers and functions of regional governments across Peru. It promotes the decentralization through Regional Government according to the Constitution. This law states that Regional Governments are obliged to coordinate and supervise the application of sub-national strategies related to climate change. In this case, Regional Governments are the entity in charge of developing each strategy.	https://www.mimp.gob.pe/ogd/pdf/2014-ley-organica-de-gobiernos-regionales_27867.pdf

c. National Contributions and Plans

The INDC presented by Peru to the UNFCCC in 2015 contains its mitigation and adaptation commitments. It was ratified in 2016, and as an NDC, it is no longer “intended” but is an actual commitment. As mentioned in the previous section, Peru’s main commitment identifies five prioritized areas for adaptation in the country: water, agriculture, fishery, forestry and health. Five cross cutting areas, where action must be taken in order to address adaptation effectively, are also identified: disaster risk management, resilient infrastructure, poverty and vulnerable populations approach, gender approach and promotion of private investment in climate change adaptation. Peru has also been working on its National Adaptation Plan (NAP), but this document has not yet been published.

The following table includes links to the national contribution, as well as the communications presented by Peru to the UNFCCC.

Document	Date of submission	Links
Intended Nationally Determined Contributions	28 September 2015	http://www4.unfccc.int/submissions/INDC/Published%20Documents/Peru/1/iNDC%20Per%C3%BA%20en%20ingles.pdf or http://www.minam.gob.pe/indcs/
Third National Communication	23 April 2016	http://unfccc.int/resource/docs/natc/pernc3.pdf
Second National Communication	28 September 2010	http://sinia.minam.gob.pe/documentos/segunda-comunicacion-nacional-peru-convencion-marco-las-naciones
First National Communication	21 August 2001	http://pe.seeg.global/primer-comunicacion-nacional-del-peru-a-la-convencion-de-naciones-unidas-sobre-el-cambio-climatico/

7. Institutional setup for climate change

a. Government institutions directly responsible for implementing adaptation strategies and policies

Articles 5 and 6 of the newly released Climate Change Framework Law establish that the Ministry of Environment is the national authority in charge of climate management and regulation in Peru. Other ministries, regional and local governments are also competent authorities for the promotion, coordination, articulation, implementation and monitoring of climate change within their respective jurisdictions. However, all of them must report to the Ministry of Environment their progress annually. Additionally, regional and local authorities will have to include mitigation and adaptation measures within their Strategic and Operational Plans, as well as pursue studies concerning the identification of vulnerable areas and adaptation measures such as the use of traditional knowledge⁵⁰.

b. Level of coordination and cooperation between institutions

The National Commission on Climate Change (NCCC) was created in 1993, with the primary function of coordinating, designing and implementing Peru's National Strategy for Climate Change. It is also used for promoting the implementation of the different commitments found under the UNFCCC. Although the Ministry of Environment hosts the NCCC, it also involves involvement from government research institutions and non-governmental organizations.⁵¹ The complete list of members can be found in the following organigram:

National Commission on Climate Change (NCCC)



Found in the Deputy Ministry of Strategic Development of Natural Resources, within the Ministry of Environment, is the President of the NCCC with the responsibility of monitoring various public and private sectors concerned with adaptation. The President also helps properly orient and inform these sectors about national, sectoral and regional development strategies, plans and projects. The regulation of the NCCC was introduced in 2014, establishing five thematic working groups. One of those groups focuses on ecosystem management and climate change^{52,53}. The Climate Change Framework Law introduced in 2018 reaffirms this role of the NCCC and promotes the continuity of the High-Level Commission on Climate Change formed for the proposal of the NDCs. This Commission is presided over by the Presidency of the Council of Ministers with the support of the Ministry of Environment.⁵⁴

The climate change law introduces the principle of transversality, which indicates that the intervention of the State in the face of climate change is transversal and multilevel, and as such, requires the intervention of different government sectors, the private sector and civil society.

8. EbA related Strategies, Policies and Projects

The following table includes the main strategies, policies and projects concerning EbA or a similar approach in Peru.

Strategies, Policies and Projects	Relation to Ecosystem based Adaptation (EbA)
Climate Change Framework Law ⁵⁵	Article 3 of this law establishes that “adaptation based on ecosystems” is one of the approaches required to manage climate change in the country. In article 15, it states that the Peruvian State must: include adaptation measures in all levels of government, prioritize the efficient use of water, and the develop actions for the prevention of climate risks.
Nationally Determined Contributions ⁵⁶	Scope 4 of Peru’s INDC emphasizes “protecting ecosystem services that forests provide and attending to the most vulnerable groups (indigenous communities and small forest producers).” Water and agriculture are also considered two of the main issues to focus Peru’s adaptation strategy, which are highly related to the EbA approach.
National Biodiversity Strategies and Action Plan (Estrategia Nacional de Diversidad Biológica al 2021) ⁵⁷	This states that the impacts and threats on biodiversity in Peru increase the country’s vulnerability to climate change, especially in the inter-Andean valleys. It therefore identifies climate change as a new stressor on biodiversity. It also recognizes traditional agricultural knowledge used for climate adaptation as an important source of protection for biodiversity.
Remuneration Mechanisms for Ecosystem Services Law ⁵⁸	This law looks to promote, regulate and supervise the compensation mechanisms for ecosystem services as a way to recover and promote their sustainable use. This mechanism is used as an incentive to generate, transfer and invest economic, financial and non-financial resources toward conserving ecosystem services. The Ministry of Environment is using this law to implement green infrastructure projects for managing water.

Strategies, Policies and Projects	Relation to Ecosystem based Adaptation (EbA)
Organic Law of Regional Governments	This law establishes the need for Regional Government to develop a Regional Strategy on Climate Change. The strategy must identify the most vulnerable areas and sectors of each region, to take measures that reduce the negative impacts of climate change. While it does not mention EbA specifically, it includes adaptation as a major concern.
Regional Climate Change Strategies	There are currently 16 regions in the country that have or are developing a Regional Climate Change Strategy and a Regional Technical Groups on Climate Change. ⁵⁹
Risk Management and Adaptation Plan for the Agricultural Sector, 2012-2021	This document is highly relevant to EbA efforts in mountain ecosystems as it deals with one of the main economic activities for communities living in the Andes- agriculture.
Public Investment in Ecosystem Services ⁶⁰	The Ministry of Economy and the Ministry of Environment developed a methodological instrument for the formulation of public investment projects that focus on biological diversity and ecosystem services through this National Public Investment System. It states that projects may include the recovery of degraded species, ecosystems or ecosystem services. It also determines what the ecosystem (watersheds, wetlands, rivers, lakes and soils) and ecosystem services (water regulation and control of soil erosion) can be included. It also mentions mountains as one of the ecosystems where a project can be developed, and notes that any level of government may request funding through this system for related projects.
PARA-Agua Project	The project focuses on watershed management in the context of climate change and includes the use of innovative adaptation tools and practices. The project was developed by USAID and the Peruvian National Water Authority. The results included the creation of payment environmental services (PES) projects and the development of institutional capacities that promotes EbA-like management.
PACC Peru	PACC Peru is a project focused on reducing the vulnerability of medium and high poverty populations in rural High Andean areas (in the Cusco and Apurimac Region) to climate change through an EbA-like approach. Results for the first phase of the PACC project in the rural communities of Huacrahuacho and Mollebamba focused on political and technical equipment, and regional and local investment policies and management, and national policies. It was developed by the Peruvian Ministry of Environment and the Swiss Agency for Development and Cooperation (SDC).
High Mountains Adaptation Partnership	The goal of the project is to strengthen climate change adaptation capacities (scientific, social and institutional) of people who live and/or depend on high mountain glacial watersheds and the ecosystem services they provide, as well as disaster risk mitigation and management of potentially dangerous glacial lakes and other climate-related disasters. It

Strategies, Policies and Projects	Relation to Ecosystem based Adaptation (EbA)
Sowing Water - Recovery of the Ecosystem Services for Water Regulation in Milloc micro-watershed	is part of the broader USAID Climate Change Resilient Development (CCRD) project. AQUAFONDO, through the Remuneration Mechanisms for Ecosystem Services Law, formulated the first public investment green infrastructure project. It was developed in the Milloc micro-watershed and was funded by SEDAPAL (Lima's water utility company). The main objective of the project is to increase the water supplied directly by this micro-watershed to the Carampona community, and indirectly to the city of Lima, by improving vegetation cover, optimizing livestock management practices and implementing conservation strategies in water ecosystems.
Climate Change Adaptation Program (GPAP)	USAID developed this project to help communities and local governments adapt to changes in water availability through "green infrastructure" projects and advancing climate science research. In addition, by empowering local communities through sound environmental management practices, it serves to ensure long-term sustainability of their water resources.
Securing Mountain Water and Livelihoods Project	The Project's aim was to improve community capacities for landscape management for the conservation of ecosystems and to contribute to human well-being in the context of climate change. This was done by implementing three technical assistance and training activities: generating information for adaptation, developing public investment to finance adaptation actions, and increasing capacity and implementing actions for resilient communities. This was conducted by TMI in partnership with University of Texas, Austin under a three-year cooperative agreement with USAID (as part of the larger USAID-Peru Climate Change Adaptation Program).
Mountain EbA Flagship Program	The program was developed by the UNDP, UNEP, TMI and IUCN, with funding from the German Government. It used sustainable management, and conservation and restoration of ecosystems, as part of an overall climate change adaptation strategy to reduce vulnerability and enhance the resilience of select fragile mountain ecosystems and their local communities. It is a global partnership that involves national and regional government agencies, civil society and local communities in three pilot countries: Uganda, Nepal and Peru. In Peru, the pilot program was introduced in three communities that live in the Nor Yauyos-Cochas Landscape Reserve, located between the Lima and Junin Regions.

9. Conclusions and Recommendations

As seen above, climate change adaptation has been introduced in several policies and strategies in Peru, mainly at the national level. While the Ministry of Environment is the leading agency in the government in respect to managing climate change, other sectors such as the Ministry of Agriculture, have developed adaptation strategies for agriculture practices and small farmers specifically. Many of these policies, strategies and projects include an EbA approach. The recently passed Climate Change Framework Law re-enforces the use of the EbA approach as one of the tools required to assist the country in adapting to the adverse effects of climate change.

However, EbA as an approach still needs to be mainstreamed into other sectors and levels of Peruvian government. While other ministries are part of the NCCC, they have not fully integrated the approach into their own policies or economic decisions when dealing with high-mountain ecosystems. In the same way, some regions have started developing their Regional Climate Change Strategies, while nine regions have not touched the subject since it was passed by the Organic Law of Regional Governments in 2002.

The Ministry of Environment has been focusing its efforts on promoting green infrastructure (which is directly related to the EbA approach), concentrating on the conservation of water resources for local communities as well as for the country as a whole. This is a major issue, as Peru's water is mainly sourced from retreating glaciers. The Ministry of Economics has put forward a methodological instrument for the formulation of public investment projects, which can include the recovery of degraded ecosystem services in mountain areas. Pilot projects, such as the one developed by IUCN, have been implemented mainly at a community level in mountain ecosystems. The results have proven to be beneficial for the communities but are not easily transferable to other communities or at the larger scale.

From the identified gaps, the following opportunities are proposed for Peru.

In the last decade, several community level projects have been developed in the high mountains of Peru. This includes the IUCN flagship program, as well as other initiatives from TMI, USAID and other organizations. These projects have collected important results and lessons that need to be transferred to other mountain communities in the country. This information should be consolidated and packaged to promote the benefits of EbA and give step-by-step information on implementing EbA-like projects for different high-mountain communities. With this knowledge sharing, communities and local government will have the ability to assess issues through an EbA lens and choose the appropriate tools needed to solve them.

It is necessary to integrate EbA into policies from other government sectors and in subnational governments (regional and local). In order to have increased implementation of EbA projects, the Ministry of Environment could promote EbA to the remaining nine regions that have not already developed their regional climate change strategies.

The consolidation and operationalization of EbA related projects is still needed to disperse the approach through mountain areas at a faster pace. As the main stakeholder for climate change management and EbA, the Ministry of Environment, should promote the widespread use of already existing mechanisms and tools that help the country collectively adapt to climate change. The Guidelines for Public Investment in Ecosystem Services is a good example of this, as it highlights and explains how public investment can be made to restore ecosystem services at all levels of government and provides financial resources for project implementation.

The EbA approach has mainly been implemented at a community level. While the Ministry of Environment has been successfully promoting green infrastructure, projects based on the Remuneration Mechanisms for Ecosystem Services Law, only two projects have been implemented up to this moment. There needs to be further research and studies on larger scale EbA projects in order to show the positive impacts on ecosystems and the economy. This would allow other sector and subnational governments to see the benefits of EbA and adopt the approach.

Finally, Peru has some of the world's most abundant mineral deposits and since 2006, it has seen an economic growth rate of more than 6 percent annually, largely driven by the mining sector. However, this impressive increase in mining has been accompanied by a rise in conflict with local communities and environmental degradation around large-scale mining operations, this could be a challenge for widespread EbA implementation and the implications should be considered in future research.

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Scaling Up Ecosystem-based Adaptation in Mountains

Colombia Situation Analysis



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1. Introduction

The Mountain EbA Flagship Programme was developed in the Himalayas (Nepal), Mount Elgon (Uganda) and the Andes (Peru), by the International Union for Conservation of Nature (IUCN), The Mountain Institute (TMI), the United Nations Development Program (UNDP) and the United Nations Environmental Program (UNEP) between 2011 and 2016. Following the success of this program, TMI and IUCN have teamed up to expand the EbA approach within these three countries and three neighboring countries Bhutan, Kenya and Colombia. The project looks to benefit local people directly and help them adapt to the adverse effects of climate change, while also providing positive benefits for millions downstream who also depend on the resources coming from mountain ecosystems.

This document focuses on the most updated situation in high-mountain ecosystems across Colombia. It seeks to collect public policies, strategies, experiences and projects related to EbA in the country, to find gaps and opportunities for the implementation of this approach at the national and subnational level. The information gathered in this Situation Analysis will be used to develop a policy brief that summarizes the main points and recommendations developed. It will also be used by TMI and IUCN in the development of the second phase of the program, in order to building wider support and generating financing for EbA within national governments and at international forums.

2. Development, Climate Change and Mountain Areas in Colombia

a. Mountain ecosystems and demography

Colombia is located on the northwestern coast of South America, sharing borders with Venezuela, Brazil, Peru and Ecuador. The total size of Colombia is 1,138,910 km² with 48.7 million people occupying this land.^{i,ii} Though the main language spoken in Colombia is Spanish, there are 65 languages between the indigenous peoples with five having “no capacity for revitalization” and 19 in danger of disappearing.ⁱⁱⁱ Overall, the population of Colombia is represented by ethnicities including Mestizo (58%), White (20%), Mulatto (14%), and African (4%) Zambo (3%), and Amerindian (1%).^{iv}

About half of Columbia’s territory consists of marine and coastal lands, though the population is distributed much differently.^v A majority of the population lives within the north and west region of the country because of agricultural opportunities and natural resource abundance. This area accounts for 40% of Colombia’s land area^{vi} and where the Andes mountain communities, Sierra Nevada de Santa Marta mountain communities, and over ten national parks can be found.^{vii}

An estimated 75% of the Colombian population lives within the Andes region of the country.^{viii} A majority of the people residing in these areas of Colombia, with exception to the urban populations such as Bogota or Medellin, rely on farming for their livelihoods. The urban areas of Colombia account for 77% of the country’s population and the annual growth rate of urban

areas is 1.47%.^{ix} Colombia is home to an estimated 1.5 million people in 87 indigenous ethnic groups (1.5% of the overall population)^x with 80% of this population mainly residing in the Andes region in areas with very low population density. The Sierra Nevada de Santa Marta mountains were the birthplace of the Tayrona, a mountainous indigenous community with approximately 70,000 people living in Colombia.^{xi} There are three other indigenous peoples that inhabit in this area, the Arhuaco, Wiwa, and Kankuamo. There are currently 126 endemic species of flora and 44 endemic and 49 endangered species of fauna registered in this area. The most significant of these species includes the Condor, Tapir, Jaguar, Paujil, and Paramo Deer.^{xii} There are 16 rivers that originate in the Sierra Nevada de Santa Marta, all of which are a source of water for the aqueducts that provide water to approximately 1.5 million people in nearby areas as well as for farms growing bananas, palm, rice, and cotton.^{xiii} This mountain area has a very diverse ecosystems, with sub-Andean and Andean forests, paramo, and snow filled areas, depending on the altitude.

The paramos regions of Colombia are incredibly biodiverse and one of the world's largest paramos regions on the planet.^{xiv} They are categorized as regions between high mountain Andean forests and the areas of "permanent" snow, or between 3500m and 4500m above sea level.^{xv} The paramos region has a climate of average temperatures below 10 degrees Celsius with high fog and cloud cover.^{xvi} This climate allows for growth of unique flora that serves as sources and reservoirs of water. This flora includes wetland moss species, which can hold up to 40 times their weight in water^{xvii}, and the frailejon, which captures water from low hanging clouds and releases it back into the soil.^{xviii} The upland paramo areas of this region are home to 70% of Colombia's water supply, which provides water for consumption, irrigation, and hydropower. [ix] Chingaza, an 8,000-hectare paramo region and national park, provides 80% of the water for the country's capital of Bogota, which is home to 8.7 million people.^{xix}

b. Gender and Mountain Livelihoods^{xx}

Within the Colombian Andes, many of the climate change policies and strategies - detailed in later sections - designed to address issues like erosion, overgrazing, and water insecurity do not take into equal account the differences between the perceptions of men and women in regards to climate. Colombia does not yet have a Climate Change Gender Action Plan (ccGAP), which could help with understanding and empowering women's roles in mountain communities, where many of those in charge of local resource use are women.

It is important that women and men of every age have equal access to climate change information and training, in order for them to contribute their own visions, knowledge and experiences towards climate adaptation. Women tend to have less access to information than men in Andean communities. Increasing recognition and incorporation of women's knowledge of traditional land management and resource practices would benefit more effective climate change adaptation measures. Further official policy development in this area, such as developing a ccGAP, along with prioritizing greater gender equity in both gathering stakeholder input, in decision-making, in distributing resources for implementing EbA, and in who participates in EbA are as-yet not fully realized opportunities to improve gender equity in mountain communities. Deliberate, strategic, and realistic inclusion of women and gender issues for conservation in high-mountain ecosystems like the paramos can contribute to more

sustainable income diversification, resilience of agricultural systems and food security, increased water security, and protection of other ecosystem services for both women and the communities they support.^{xxi}



Map 1 (above): Natural Regions of Colombia

c. Mountain Ecosystems, Land Cover, and Resource Use

Although Colombia has a wide diversity of ecosystems, the country has five widely recognized natural regions, shown in Map 1 of the Natural Regions of Colombia. The Andes region includes the vast majority of Colombia's mountains, and the Caribe region includes the Sierra Nevada de Santa Marta.

Map 2 highlights these mountain regions in gray, as well as the glaciers (shown with a * symbol) and the rivers (in blue) that flow from these mountains. The Colombian Andes are made up of three *cordilleras*, or mountain ranges - Cordillera Occidental (western), Cordillera Central, and Cordillera Oriental (eastern) - and the Sierra Nevada de Santa Marta.

Changing land and resource use in the Colombian Andes results from results partially from changing crop patterns: increasing palm oil production, shutting down illegal coca operations, and increasing both small-scale and commercial potato farming.^{xxii, xxiii}. After increasing development led to significant deforestation, some areas of Colombia experienced unexpected reforestation in the last decade. However, this regrowth is neither complete nor applicable across ecosystems; the paramos of Colombia showed little regrowth since the beginning of the 21st century.^{xxiv}

For example, cattle, introduced to the paramos in the late 18th century, can be damaging to the paramos when not managed sustainably; this photo shows once thriving paramos now severely eroded by overgrazing and wind.^{xxv}



Map 2 (right): Mountainous Regions and Glaciers of Colombia



3. Economy and Livelihoods

Selected Key Economic Facts for Colombia

GDP ^{xxvi}	\$282.5 billion
Exports ^{xxvii}	\$30.2 billion
Top 75% Exports ^{xxviii}	Mineral products (48%); fruit/vegetable products (16%); chemical products (6.3%); precious metals (4.6%)
Agricultural Products ^{xxix}	Coffee; cut flowers; bananas; rice; tobacco; corn; sugarcane; cocoa beans; oilseed; vegetables; shrimp and fish; forest products

The Colombian government identifies the top six priority sectors of the overall economy as transport, energy, agriculture, housing, health, and trade, tourism and industry. The health of Colombia's mountain economy can be measured through key indicators including agricultural production, population, mining, agricultural land use change (deforestation), and Andean mountain glacier snowmelt.^{xxx} The iNDC of Colombia states climate change considerations will be utilized as planning instruments for implementing innovative adaptation actions, for a great amount of Colombia's economy relies on ecosystem services.^{xxxi} As seen in the chart above, nearly 70% of the country's exports are agriculturally produced or are natural resources, most of which come from farming and mining in the Andes mountain areas.

Because most of Colombia's population lives in the Andes region, the food production, climate change driven increases in snowmelt, and agriculturally driven land use changes are incredibly impactful on the future strength of the economy. The mountain regions are home to fertile soil that supports much of the country's crop growth, with a majority of the peoples inhabiting these areas depending on agriculture to support themselves. Coffee, responsible for half of Colombia's fruit/vegetable exports and \$2.45 billion dollars in export revenue, mainly grows between 3,000 and 5,000 feet above sea level.^{xxxii} In addition, potatoes, grains, and vegetables are grown between 6,000 and 10,000 feet above sea level and are important to the food supply of the country.^{xxxiii} The Andes mountains, being home to many trees, also helps fuel the \$38.3 million dollar wood product export sector, some of which is used for industrial purposes and a part for charcoal and fuel.^{xxxiv} Furthermore, mining of coal and gold contributes over \$5 billion dollars to the Colombian economy, but impacts the indigenous communities living in mining areas.

4. Mountain Areas Environmental Issues

Mountain ecosystems of Colombia, and the services they provide, are severely vulnerable to climate change. This is because the paramos ecosystems are home to mountain species that exhibit a low ability to adapt to the changing conditions caused by climate change, resulting in biodiversity loss being a great risk for these regions.^{xxxv}

Specifically, climate change produces the threats of increasing temperatures, change in rainfall, and higher occurrences of forest fires. The coldest temperatures have increased by about 0.6 degrees Celsius per decade and the warmest temperatures have increased at about 1.3 degrees Celsius per decade.^{xxxvi} At the same time, relative humidity per decade has been decreasing while the number of sunny days per month has increased.^{xxxvii} Overall, the Andes region is expected to shift from a semi-humid climate to a semi-arid climate over the rest of the century, impacting the types of flora and fauna that can exist in the ecosystems involved.^{xxxviii}

The temperature changes in Colombia also damage the paramos' ability to store and release water, putting pressure on crop yield and water security throughout the country. Temperature increases have led to glacier area loss of nearly 80% since 1850 levels, and by 2050, 78% of the remaining glacier cover will be negatively impacted.^{xxxix} These glaciers are the source of water for mountain areas as well as the rivers supplying water to populations downstream.^{xl}

Deforestation is another threat to ecosystems in these areas. Colombia has a forest cover of about 55%.^{xli} Clearing of Andean forests and paramos areas driven by agriculture or livestock impacts the water supply of millions because of the ecosystem's unique flora with the ability to store water and act as a reservoir for surrounding communities. This forest clearing takes place because of slash and burn agriculture as well as overgrazing from livestock. While the agricultural sector plays an important role in the economy of Colombia, there are large disparities between access to water in urban and rural areas, thus affecting poorer areas unequally.^{xlii}

5. Mountain Areas Management

a. Legal, Institutional, and Administrative Setup for Mountain Area Management

The Environmental Law 99 of 1993 in Colombia established much of the setup for mountain area management, along with environmental management in general. There are a number of institutions involved in the management of mountain areas and resources in Colombia, as follows. These entities are mentioned further in later sections of this document.

National

Key national ministries and departments include:

- Ministry of Environment and Sustainable Development (MADS or Minambiente, *Ministerio de Ambiente y Desarrollo Sostenible*)
- National Institute of Natural Renewable Resources and Environment (INDERENA, *Instituto Nacional de los Recursos Naturales Renovables*)
- National Park System
- National Planning Department (DNP, *Departamento Nacional de Planeación*)
- National Environmental Fund (FONAM, *Fondo Nacional Ambiental*)
- Institute of Hydrology, Meteorology and Environmental Studies (IDEAM, *Instituto de Hidrología, Meteorología y Estudios Ambientales*)
- Ministry of Agriculture
- National Environmental System (SINA)

Regional and Local Governance

There are also regional and local authorities involved in mountain area management. These two types of regional public authorities were established according to Article 23 of Environmental Law 99 of 1993. There are 33 within Colombia, defined below as two types of regional or development corporations.

The **Autonomous Regional Corporations** (CARs, *Corporaciones Autónomas Regionales*) are responsible for regional management of environmental policies, natural resources, and sustainable development. The **Sustainable Development Corporations** (CDSs, *Corporaciones de Desarrollo Sostenible*) have similar responsibilities to the CARs, with the additional responsibilities of working with native and indigenous populations in the region.

There are also **Urban Environmental Authority** (AAUs, *Autoridades Ambientales Urbanas*) for major urban areas. These do not exert direct influence on the mountain areas, but may be interested in activity involving nearby mountain areas, especially where the effects will be felt by the urban area.

All three of these types of regional corporations or authorities - CARs, CDSs, and AAUs - are responsible for providing technical support to local departments and environmental entities and to ensure that resources, policies, and development in each region are both suitable for the specific characteristics of the region and in compliance with larger regional and national policies and strategies. Because of the diversity of cultural groups, population density, ecosystems, livelihoods, and more throughout Colombia, these regional corporations play an important role in local policy development and implementation.

6. Climate Change and Mountain Areas

a. Climate Change Impacts and Scenarios for Mountain Areas

Temperatures in the Colombian Andes are increasing at a rate of 0.6 degrees Celsius per decade for the minimum daytime temperatures and at a rate of 1.3 degrees Celsius per decade for the maximum daytime temperatures.^{xliii} As a result, temperature-sensitive crop productivity suffers, which puts both domestic food supplies as well as exportable crops at risk. Increasing temperatures threaten the biodiversity of and mountain ecosystems when plants and animals living in these areas can no longer find a suitable habitat.^{xliv} Furthermore, increasing temperatures dry the water-storing paramos, threatening the iconic frailejon or espeletia plants that help to capture water from low-hanging clouds. Local and downstream populations rely on the water stored and gradually released from these paramos, but higher temperatures are disrupting this important water source.^{xlv}

Overall, changes in temperature and precipitation patterns have contributed to retreat of glacier ice caps and increase in natural and anthropogenic forest fires. Because mountains provide roughly 60-80% of the world's freshwater resources and mountain forests are home too much of the country's continental biodiversity, so such effects of climate change will be particularly impactful in mountain areas. Overall, the Andes region is expected to shift from a semi-humid climate to a semi-arid climate over the rest of the century, affecting the types of flora and fauna that can exist in the ecosystems involved.^{xlvi}

b. Climate Change Policies and Strategies

Colombia's Contribution to the United Nations Framework Convention of Climate Change

Colombia has contributed to the United Nations Framework Convention of Climate Change (UNFCCC) through its Intended Nationally Determined Contribution (iNDC). Since then, Colombia has submitted three communiques to the UNFCCC.

In the 2015 publication of its iNDC, the document states that although Colombia produced only 0.46% of global emissions in 2010, it is highly vulnerable to climate change threats.^{xlvii} The iNDC document specifies that adaptation and implementation, in addition to mitigation measures, must be part of both national and subnational actions focused on a resilient, innovative, and low-carbon economy.

Colombia's specific iNDC commitments are:

1. **Mitigation:** Reduce greenhouse gas emissions by 20% by 2030 compared to 2010 emissions.
2. **Adaptation:** The document outlines several strategic lines, including **socio-ecosystem based adaptation**. Specific prioritized actions for 2030 that are most relevant to mountain EbA and provide opportunities to strengthen inclusion in policy include (items below are quoted from the iNDC):
 - a. 100% of the national territory covered by climate change plans formulated and being implemented
 - b. Water resource management tools, which include climate change and variability considerations, will be in place for the country's priority water basins
 - c. Delimitation and protection Colombia's 36 "paramo" areas (high mountain

- Andean ecosystems) (approximately 3 million hectares).
 - d. Inclusion of climate change considerations in Projects of National and Strategic Interest (PINES).
 - e. 10 subsectors of the agricultural sector such as rice, coffee, livestock and silvopastoral, with improved capabilities to adapt appropriately to climate change and variability.
3. **Means of Implementation:** Colombia has several goals for how to implement these plans, with a strong focus on knowledge and technology transfer as well as developing a climate-finance strategy. One goal that provides an opportunity to integrate EbA into regional plans is (quoted from the iNDC):
- a. Articulation of the National Government, with regional and local governments for the formulation and implementation in the medium and long-term, of comprehensive climate change plans that foster competitive and sustainable cities.

The tables below include descriptions, documents links, and relevance to climate change adaptation and EbA for international communiques to the UNFCCC and other climate change policies and strategies of Colombia.

Table of International Climate Change Commitments and Communiques

Document	Agency/ Organization	Description & Link to EbA
iNDC (2015-2030) PDF (Spanish) PDF (English)		See above for more details.
ABCs of Colombia's Commitments for the COP21 (for the UNFCCC) PDF (Spanish)	Government of Colombia	This document outlines the various climate change mitigation goals Colombia participates in and their associated initiatives, objectives, and metrics. This document also contains general information about what the differences are between each commitment (for example, Kyoto vs. Paris Agreement).
National Adaptation to Climate Change Plan (PNACC) PDF (Spanish)	Government of Colombia	National Adaptation Plan for Colombia, which includes four sections: the context of the plan, conceptual bases, reasons to promote adaptation in Colombia, and guidelines for the planned adaptation of the country. The ultimate objective of the plan is to reduce the risk and the socio-economic and ecosystem impacts associated with the variability and climate change in Colombia. This document represents the first phase of adaptation planning which presents a first conceptual and

		methodological input to guide the Sectoral and Territorial Adaptation Plans.
National Biodiversity Strategy and Action Plan (NBSAP) (Plan de Acción de Biodiversidad 2016-2030) PDF (Spanish, version 3) PDF (English, version 2)	Government of Colombia	The document contains the National Biodiversity Strategies and Action Plans for 2016-2030 and was developed by the Ministry of Environment and Sustainable Development of Colombia. It describes Colombia's conservation policies, the current situation in regards to the conservation of its biological diversity and how the NBSAP is articulated with the regional environmental plans.
Plan of Action for the Sustainable Development of the Americas PDF (English)	Organization of American States	This plan includes the Americas-wide awareness of challenges including the lack of development of a balance between environmental, economic, and social components of agricultural production systems. It also includes the goal of establishing research programs to examine ecosystems, farms and watersheds in hopes of developing data for sustainable agriculture.
Third National Communication of Climate Change: New Scenarios of Climate Change for Colombia 2011 - 2100: Regional Focus (14 May 2015) PDF (Spanish)	Ministry of Environment; Ministry of Agriculture and Rural Development; Ministry of Education	This report outlines Colombia's progress in terms of vulnerability analysis, mitigation and adaptation measures, greenhouse gas emissions and education, training and public awareness actions on climate change with a focus on regional areas throughout the country from 2011-2100.
National Biodiversity Report of Colombia before the Convention on Biological Diversity (19 May 2014)	Government of Colombia	This report serves the purpose of outlining the importance of ecosystem services and biodiversity on human well-being in Colombia. It also offers decision-makers a national overview on the state and trends of biodiversity and its ecosystem services, identifying achievements, barriers and limitations.

PDF (Spanish)		
Third National Communication of Climate Change: New Scenarios of Climate Change for Colombia 2011 - 2100: Departmental Focus (14 May 2015) PDF (Spanish)	Ministry of Environment; Ministry of Agriculture and Rural Development; Ministry of Education	This report outlines Colombia's progress in terms of vulnerability analysis, mitigation and adaptation measures, greenhouse gas emissions and education, training and public awareness actions on climate change with a focus on each governmental department's role in the 2011-2100 plan.
First National Communication on Climate Change to the UNFCCC (18 December 2001) Full Text (Spanish) Executive Summary (English)	Ministry of Environment; Ministry of Agriculture and Rural Development; Ministry of Education	This document discusses Colombia's greenhouse gas emissions from 1990 and 1994, broken down into sector. The government's action plan for mitigating each sector's emissions includes: creating the National Energy Plan in 1994; emission controls on transportation and introduction of mass transit; creation of the "Cleaner Production" policy to control industry related emissions in 1997; introduction of the 1996 Forests Policy, 1998 Strategic Plan to Restore and Establish Forests, and 2000 National Forests Development Plan to combat emissions from land use change; and waste disposal management mitigation in 1997. To mitigate agricultural emissions, Colombia plans to grow their ecological products market.
Second National Communication on Climate Change to the UNFCCC (7 December 2010) Full Text Folder (Spanish) Executive Summary (English)	Ministry of Environment; Ministry of Agriculture and Rural Development; Ministry of Education	This document provides updates to the First National Communication and states that between 2002 and 2010, there were a number of initiatives to reduce GHG emissions. This includes the development of a national GHG capture project with a target of 200,000 tonnes of CO2 and implementation and growth of CDM projects.
Third National	Ministry of	This document outlines Colombia's previous GHG

Communication on Climate Change to the UNFCCC (12 September 2017) Full Text Folder (Spanish)	Environment; Ministry of Agriculture and Rural Development; Ministry of Education	emissions, what sectors are emitting the most, and how Colombia is comparing to other countries in SA and the world. Measures that need to be taken in the future are discussed as well.
REDD+ Collective National Strategy (2012) PDF (Spanish)		This document outlines the importance of jungles and forests throughout Colombia, describing their many ecosystem services. The national REDD + strategy is part of the actions on Climate Change foreseen in the Plan National Development Bank 2010-2014, by the National Government headed by the Ministry of Environment and Sustainable Development, and for its preparation actions are advanced through the Cooperative Fund for Carbon from Forests (FCPF), the United Nations REDD + Program, cooperation international, the IDEAM, some NGOs (Fund for Environmental Action and Children, Heritage Fund Natural, WWF, ONF Andina,) and national budget.

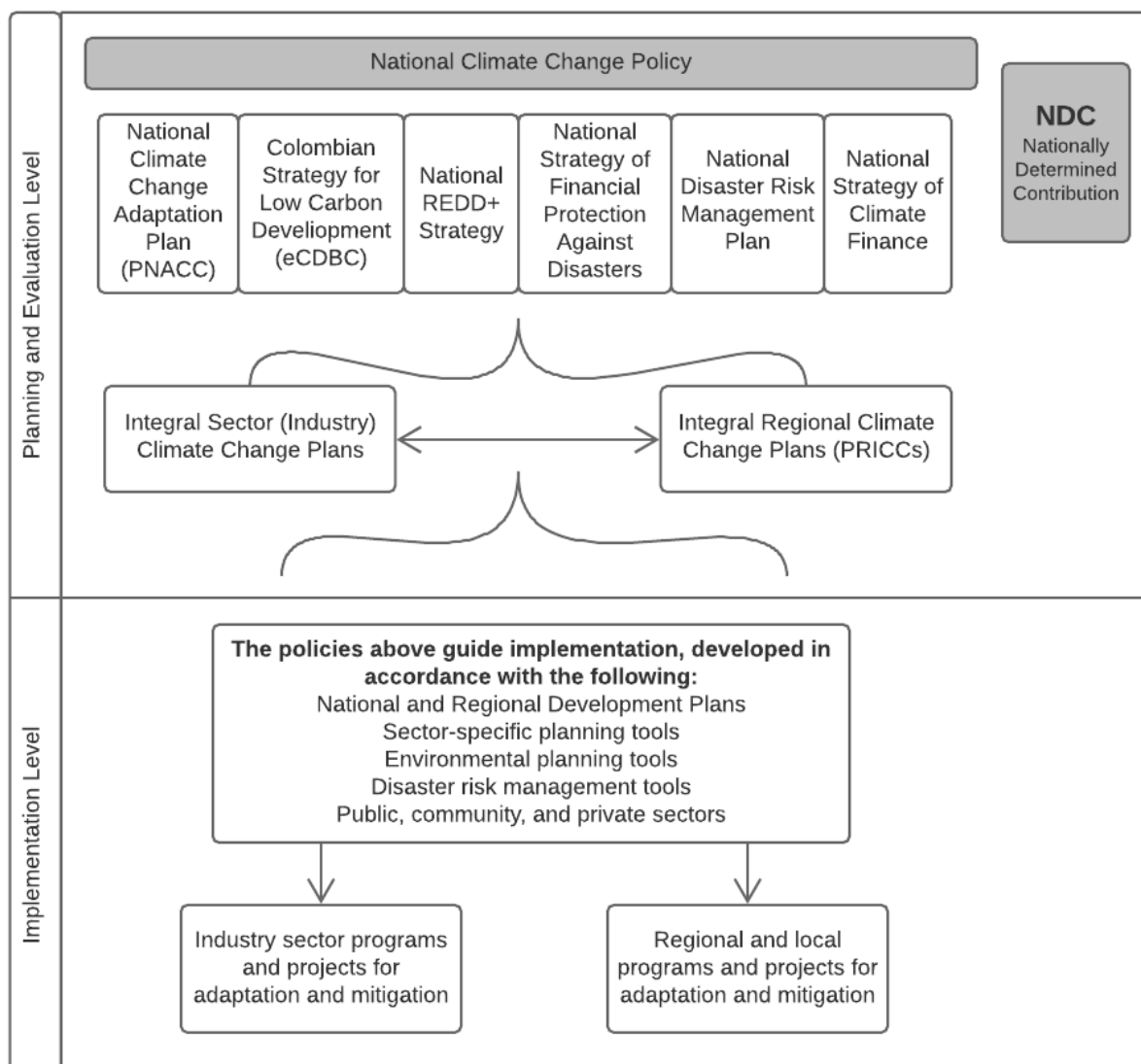
Table of Other Climate Change Strategies and Policies in Colombia

Document	Agency	Description and Link to EbA
Decree 926 of 2017 PDF (Spanish)	Ministry of Environment	In coordination with the establishment of a carbon tax in Colombia's 2016 Structural Tax Reform, Decree 926 of 2017 gave MADS the mandate to implement climate change mitigation initiatives that result in reduced GHG emissions or remove GHGs "in exchange for the non-causation of the tax."^{xlviii}
Colombian Strategy of Low Carbon Development (ECDBC)	Ministry of Environment	The Colombian Low Carbon Development Strategy (ECDBC) is a short, medium and long term development planning program, led by the Ministry of Environment and Sustainable Development (MADS), through the Climate Change Directorate, with the support from the National Planning Department (DNP), and the Sectoral Ministries of Colombia, which seeks to separate the growth of greenhouse gas (GHG) emissions from national economic growth.

Climate Change Law (Proposed in 2016, most recently under review in Congress as of March 2018) 2016 Drafted Law 054 Text - PDF (Spanish)	Ministry of Environment	This is a proposed national bill in development within the Colombian legislative process. This presents an opportunity to advocate for greater policy inclusion of EbA at a federal level that will impact regional and local policies as well.
National Climate Change Policy (PNCC) (2014) PDF (Spanish)	Ministry of Environment; Ministry of Agriculture and Rural Development	Proposed to coordinate the various national policies/strategies addressing climate change, via SISCLIMA
Decree 298 of 2016: Decree of the National System of Climate Change (SISCLIMA) (24 February 2016) PDF (Spanish)	Ministry of Environment; Ministry of Agriculture and Rural Development	This established a system to coordinate the many different entities and policies involved with climate change in Colombia.
Regional Integral Climate Change Plans (PRICCs or PICCs) Developed and Implemented Plans: Atlántico Cauca Cesar Cundinamarca Choco Huila Magdalena	Ministry of Environment; Ministry of Agriculture and Rural Development	These are individual, detailed climate change plans for mitigation adaptation, and implementation separated by areas called regional climate nodes and political region. Colombia has developed and implemented PICCs for many but not all of its regions. There is a mandate from Colombia's INDC to implement these plans across 100% of Colombia by 2030, and to include climate change adaptation measures within them, providing an opportunity to include mountain EbA in PICCs for any mountainous regions with not yet finalized PICCs. According to MADS in April 2018, there are:^{xlix} 13 finalized and implemented plans: Atlántico, Cauca, Cesar, Cundinamarca, Choco, Huila, Magdalena, Quindio, Santander, Arauca, Casanare, Vichada, and Meta

Quindio Santander Arauca (no link) Casanare (no link) Vichada (no link) Meta (no link) Link to other PICC documents		• 4 finalized plans: Boyacá, Guainía, Guajira, and Antioquia • 11 plans in development: Sucre, Bolívar, Tolima, Valle del Cauca, Norte de Santander, Vaupés, Guaviare, Caquetá, Putumayo, Caldas, and Amazonas
National Development Plan (DNP) 2014-2018 Summary (English) Full PDF (Spanish)	Ministry of Environment; Ministry of Agriculture and Rural Development	This plan includes a Green Growth strategy supporting adaptation and implementation via the National Climate Change Policy, although the DNP does not provide further details or explicit mention of EbA.

The diagram below, based on a similar diagram in Colombia's National Climate Change Policy (PNCC), shows the relationships amongst the policies and program implementation that together comprise Colombia's overall climate change policy.¹



c. Institutional Setup for Climate Change

Organogram of Minambiente

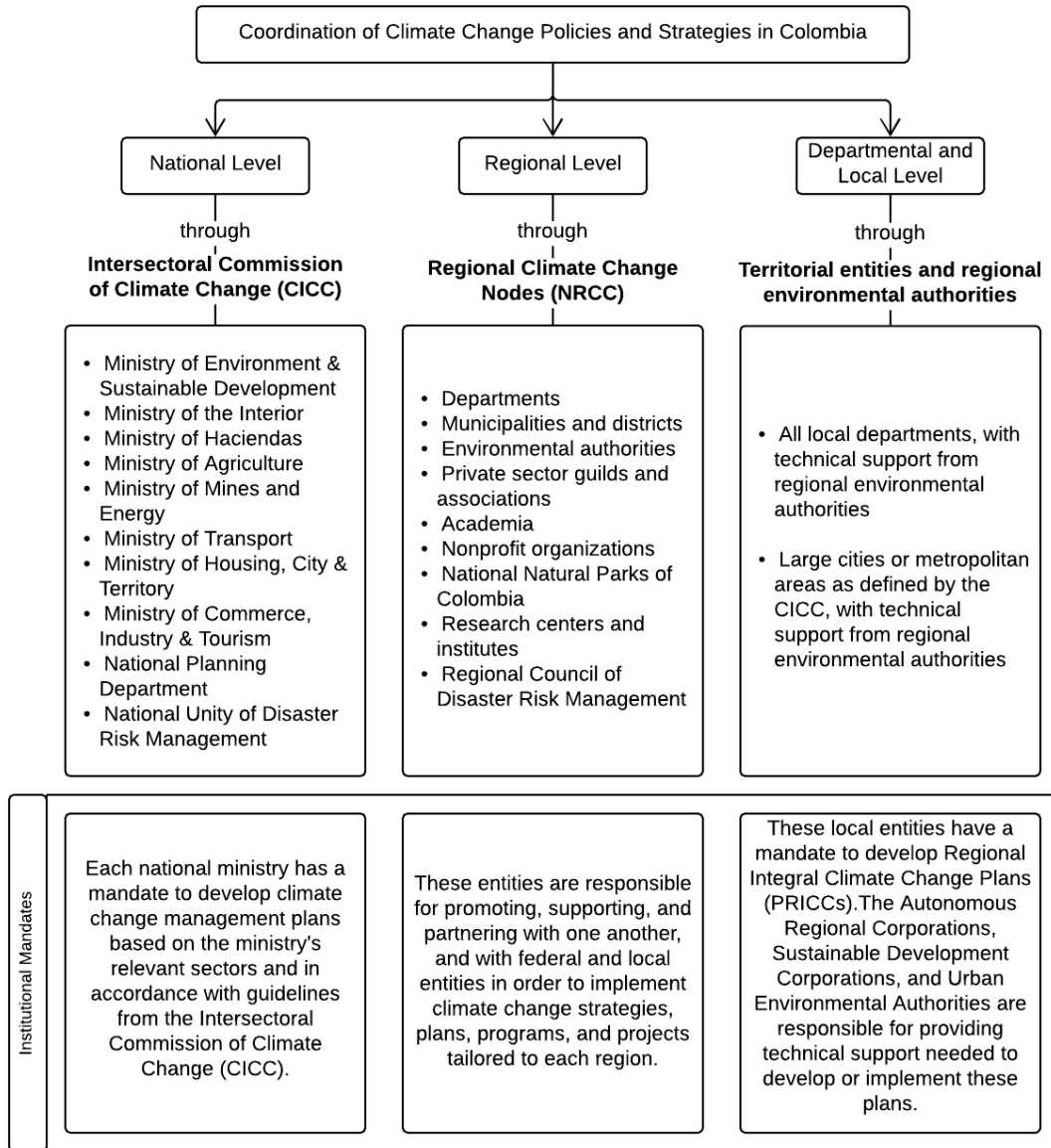
The organogram below, from the Ministry of Environment and Sustainable Development (MADS or Minambiente), shows the organizational structure of MADS offices and directorates. Note that the specific Directorate of Climate Change is under the purview of

the Office of the Vice Minister of Environment and Sustainable Development.ⁱⁱ



Institutional Coordination for Climate Change Strategies and Policies

The current environmentally related government institutions in Colombia were established following the enactment of Colombia's Environmental Law 99.ⁱⁱⁱ The following diagram, translated from a diagram in the National Climate Change Policy (page 54), identifies the entities responsible for implementing climate change adaptation strategies and policies; how these are coordinated at the national, regional and local levels; and the main mandates for entities at each level.ⁱⁱⁱⁱ



MADS directs the **National Environmental System (SINA)**, which coordinates environmental government agencies across Colombia. The Decree of the National System of Climate Change (SISCLIMA) applies this coordination specifically to climate change related strategies and policies. Regional agencies operate according to federal guidelines from MADS via SINA, although Colombia stated in its INDC that it is working on including more local and regional input to bridge the gap between top-down and bottom-up policies and implementation.

Under the PNCC, there are nine **Regional Nodes of Climate Change** (*Nodos Territoriales y Sectoriales de Cambio Climático*), established specifically to address change adaptation, mitigation, and management by region.^{liv} Government agencies, urban centers, municipalities, regional corporations, and other entities are coordinated within each regional node. The nodes are: Caribe, Pacífico Sur, Pacífico Norte, Centro Andino, Norandino,

Antioquía, Eje Cafetero, Amazonía and Orinoquía. These nodes were developed between the Government of Colombia and WWF Colombia in 2013. Colombia intends by 2030, pursuant to its iNDC, for each regional node to have and implement its own Integral Regional Climate Change Plan (PRICC).

The regional nodes with mountainous areas are the most most relevant to upscaling Mountain EbA in Colombia. These include:

- North Pacific Regional Node (Nodo Pacifico Norte)
- East Andean Center Regional Node (Nodo Centro Oriente Andino)
- Central Andean Node (Nodo Centro Andino)
- Coffee Axis Node (Nodo Eje Cafetero)
- North Andean Node (Nodo Norandino)

7. Ecosystem based Adaptation (EbA) related Strategies, Policies and Projects

Ecosystem-based Adaptation (EbA)

Ecosystem-based Adaptation (EbA), or *Adaptacion basada en Ecosistemas (AbE)*, is a type of climate change adaptation that includes both socio-economic benefits as well as ecological benefits. Whether or not a practice is explicitly labeled as EbA, it can be considered as EbA if it includes all three of these elements:

1. **Social and economic benefits** - such as promoting local livelihoods, alternative income sources, sustainable production of crops, or increasing a city's water security.
2. **Ecological benefits** - such as protecting the habitat of an endangered species, promoting biodiversity, or conserving threatened ecosystems.
3. **Climate change adaptation** - such as adapting to increased temperatures, changing precipitation patterns, or increased soil erosion.

EbA in Risk Mitigation Strategies in Colombia

Document	Agency/ Organization	Ecosystem Relation to Risk Mitigation	Link
Analysis for Disaster Risk Mitigation in Colombia	Global Federation for Disaster Risk Reduction - GFDRR	Discusses ecosystem management as a necessary means for climate mitigation in the country. "The vulnerability scenarios show that the natural or almost non-intervened ecosystems are less sensible to climate change than those spaces transformed in the rural environment"	iv,vi

National Adaptation Plan	Ministry of Environment	This document was created in part by National Unit for Disaster Risk Management and therefore includes DRR with ecosystem related strategy.	
National System for Disaster Risk Management	Ministry of Environment	Does not include ecosystem management in strategy	
National Plan for the Prevention and Attention of Disasters - PNPAD	Ministry of Environment	Created by the National Disaster Risk Management Law (1523), this plan addresses ecosystems at risk but not specifically ecosystem based adaptation.	
Sendai Framework for Disaster Risk Reduction 2015-2030	UNISDR - United Nations Office for Disaster Risk Reduction	This framework aims to implement ecosystem adaptation through the inclusion of a “strategic line” in the INDC, stating improvement of socio-ecosystem based adaptation, delimitation and protection Colombia’s 36 paramos areas, increase of more than 2.5 million hectares in coverage of newly protected areas in the National System of Protected Areas -SINAP-, in coordination with local and regional stakeholders, preservation of important Amazon ecosystems in order to stabilize greenhouse gas emission, and adaptation measures aiming at planning a rational use of ecosystem services.	lvii
National Biodiversity Strategies and Action Plans (CBD)	Ministry of Environment	This document discusses recognizing the importance of ecosystem adaptation and services as a result of the damage caused by 2011 El Niño as well as intersectoral coordination, in particular, between MADS and the agricultural sector, to make rural development policies compatible with those purposes of conservation of biodiversity and its ecosystem services, and to diminish direct and indirect pressures on biodiversity and ecosystem services.	

8. Conclusions and Recommendations

Major Gaps and Challenges to Integrating EbA into National Policy

The diversity of cultures, regional authorities, and ecosystems will require tailoring EbA integration carefully into each situation. It is important to bear in mind Colombia's very recent history of conflict, although the specific paramos areas identified by IUCN to begin mountain EbA in Colombia are not directly involved in those conflicts.

The relationship between IUCN and the Colombian government is new, so it may take some time to build trust and systems of knowledge sharing and coordination. However, Colombia's past and current work with other major international conservation projects signals its openness to do so. The phrase EbA, sometimes referred to as AbE in Spanish, is not widely known, but terminology such as socio-ecosystem adaptation or management are very similar in meaning.

Although the Flagship Programme in Peru is in a neighboring country, the ecosystems, level of policy integration, political structures, and local cultures are different in the Colombian paramos. Therefore, mountain EbA measures implemented successfully in Peru may not be appropriate in Colombia. This may require significant planning and more field research in order to increase the likelihood of success.

Recommendations to Promote EbA Inclusion in Policy and Planning Processes

This is currently an opportune time to incorporate EbA into national adaptation policy and planning processes. Colombia's drafted Climate Change Law - recently up for debate in the Colombian Congress as of March 2018 - presents an opportunity for interested Colombians to advocate for greater EbA policy inclusion.^{lviii} Furthermore, Colombia is in the process of developing and implementing Integral Regional Climate Change Plans (PRICCs) across the country by 2030. This presents the opportunity to influence regional planning with more specific EbA policy suggestions tailored to the dynamics of each region that does not yet have a finalized PRICC.

Building a strong relationship with local and regional entities, and not only with federal authorities, will likely improve the chances of successful EbA incorporation. While Colombia has stated iNDC goals to connect national, regional, and local levels more cohesively, it will be important to make sure that all levels are incorporated into the relevant planning and implementation processes. Otherwise, extensive efforts put into developing federal relationships and policies may fail to impact local areas as intended.

There are several issues impacted by climate change but helped by EbA that Colombia already recognizes as areas of value or concern: high biodiversity, threat to water security, higher population density in and near its mountain areas, international pressure to continue climate change mitigation and adaptation, and having a largely climate-reliant economy. Developing persuasive arguments for how EbA can address each of these areas may aid advocacy for greater incorporation of EbA into policies in Colombia.

Recommendations for Further Research, Partnerships, and Policy Development

One of the major gaps in climate change policies and strategies in Colombia is the lack of a formal Climate Change Gender Action Plan (ccGAP) in Colombia. This gap presents an opportunity to further develop the effectiveness and inclusivity of EbA policies while empowering women in mountain and other Colombian communities. Working with IUCN's Global Gender Office, EbA programs, UN Women, and multi-level entities within Colombia to develop this would take advantage of expertise gleaned from the process of creating ccGAPs in other countries while incorporating local knowledge.

A high potential partnership and entry point for implementing mountain EbA in Colombia is to connect with Conservation International's climate change adaptation project in the Chingaza-Sumapaz-Guerrero corridor near Bogotá.^{lix} The project, in partnership with the Colombian government and funded by the Global Environment Facility (GEF), focuses on climate change vulnerability assessment, high-risk high mountain communities, water security for Bogotá, sustainable land use, reforestation, climate change knowledge sharing, and local capacity building. This area, which includes Sumapaz - the largest paramos area worldwide - presents an opportunity to build upon established connections with local authorities and government agencies, to establish a successful high mountain EbA project in Colombia that can later serve as a model for further scaling up to other areas of Colombia and beyond.

Another area for development is to pursue further research into effective EbA methods specifically effective in paramos ecosystems. While there are paramos in other South American countries such as Ecuador and Venezuela, and there are alpine tundras elsewhere in the world, the 36 paramos of Colombia differ from one to the other as well as from other high mountain ecosystems in the world. For that reason, combined with the specific livelihoods, economies, social dimensions, and traditional or indigenous practices of these regions in Colombia, additional research and pilots will help in establishing effective long-term EbA solutions for the Colombian paramos.

Recommendations for Long-term EbA Sustainability

The measurement and evaluation (M&E) of successful EbA policy integration and on-the-ground implementation may prove difficult especially because of the individually customized nature of EbA implementation. Furthermore, many expected or intended effects of EbA occur on a longer time-scale than the length of the initial pilot projects. In order to meaningfully evaluate the success of this initiative in Colombia, implementation should be longer lasting or more self-sustaining, alongside institutional provision for long-term evaluation.

In addition, empowering and training local communities and agencies with the knowledges and resources to continue mountain EbA practices on-the-ground will promote longer-term sustainability of EbA implementation. With a developed set of educational resources as well as technical expertise, these local entities can then continue the program on a longer time scale than the length of a few years for a pilot program.

Annex:

Important/major projects run by government, NGOs or multilateral agencies addressing ecosystem-based adaptation or its equivalent

Integrated National Adaptation Plan: High Mountain Ecosystems, Colombia's Caribbean Insular Areas and Human Health (INAP)

UNDP - Conservation of the páramos and montane forests of the Colombian Massif

OAS - Inter American Program for Sustainable Development (PIDS)

UNDP - Climate Change Adaptation in the Cudinamerica Department of Colombia (TACC – Territorial approach to climate change)^{lx}

UNDP - Nationally Appropriate Mitigation Actions (Colombia NAMA) ^{lxi}

UNDP - "Scaling up Climate Resilient Water Management Practices for Vulnerable Communities in La Mojana, Colombia"^{lxii}

UNDP – Reducing Risk and Vulnerability to Climate Change in Colombia^{lxiii}

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