## Ecosystems as adaptation solutions: new and innovative approaches

The BMU EbA project will propose sources of alternative livelihoods that build on ecosystem management. In many cases, there are some initial experiences, and it is particularly important to diversify income bases under changing climate, and have a portfolio of livelihood options.

A study carried out on Non-Timber Forest Products **(NTFPs)** in Panchase[17] identified the microenterprise potential of NTFPs. For example, sustainable harvesting of Lokhta can contribute to a small paper industry, the molo shrub's juice can be consumed by trekkers, and clothes can be made out of Allo fibers. But local communities often lack knowledge on local **markets** and do not respond to existing market demand for e.g. medicinal plants[18]. They rely on intermediaries, and they lack access to investment finance. Access to markets and secure income is essential for improving livelihood portfolios to prepare for, and respond to climate change shocks. Access to credit grows in importance with adaptation, to safeguard "bad agricultural years".

**Ecotourism** has potential. For example, Panchase is an area of exceptional natural beauty, with spectacular mountains views and biological diversity, is already a popular tourist destination, and is recognized by the Master Plan for the Development of Rural Tourism in the Panchase region. In Nor-Yauyos Cochas, a Peruvian NGO (Grupo GEA) has begun work on strengthening local capacities for ecotourism, including planning, developing products and marketing, while Mt Elgon National Park has some local level ecotourism. Ecotourism can provide alternative livelihoods for local communities in the face of climate change, with more income generation and employment opportunities.

**Payment for ecosystem services** can provide EbA benefits, by increasing the provision of critical ecosystem services such as fresh water, which are likely to be particularly affected by climate change[19]. A pilot scheme for the payment for **hydrological services** is being developed for the Integrated Management of the Cañete River Basin in the Nor-Yauyos Cochas Reserve. It focuses on downstream users connecting with upstream providers, to find agreements and new forms of management to ensure the health and functioning of the river basin ecosystems. The scheme is being supported by the Regional Governments of Junin and Lima.

In Mount Elgon, the Uganda Wildlife Authority/FACE project restored over 6,000 Ha of natural forest, to conserve forests and to sequester Carbon. The Benet landscape in Mt Elgon has been selected as a pilot for **Reducing Emissions from Deforestation and forest Degradation (REDD)** preparedness, which can also be linked to the Mountain EbA project. Nepal, Peru and Uganda have all submitted REDD Readiness proposals. Carbon and REDD projects could be an increasingly important source of livelihoods, and is an example of how ecosystem conservation and management can provide benefits for both adaptation and mitigation.

## Management approaches for EbA

Involving stakeholders, appropriate forms of property rights and institutional capacity are some requisites for sustainable management of ecosystems[21]. Many of these considerations are equally relevant for EbA[22].

**Improved and negotiated management arrangements** in Mt. Elgon led to better managed resources in the Park and more productive agricultural landscapes. This is based on local empowerment and facilitates locally driven informal and formal decision making structures. For example, Community Resource Management agreements (CRM) signed between communities and the Park Authorities establish particular zones for resource collection and specific days for resource harvesting. Agreements have reduced conflicts and made it easier to monitor illegal activities, e.g. poaching, as communities are safeguarding the boundaries of the Park in areas where CRM has been introduced.

**Community forestry** is well-established in Nepal, and aims to generate a genuine feeling of local ownership which encourages people to be actively involved in forest management. Many lower parts of the Panchase hill forests near the settlements are community forests. About 31% of the forests in the region are managed as community forests, while the remainder is controlled by the government. Where the Panchase forest is managed by the government, villagers consider it as open access with unrestricted use of most forest products, which has led to overharvesting. Establishing further community forests is a way of generating ownership for the protection of Panchase forest from human impact and open grazing. Community Forestry User Groups, Drinking Water Groups and Irrigation User Groups are also in place in Panchase to manage natural resources.

Clarity of tenure and governance arrangements will be increasingly important under a changing climate, when the likelihood of conflict over scarce resources, undermined by e.g. floods and droughts, could increase. It is essential to have adaptive, participatory management systems in place, which can be used to plan for and respond to changing climatic conditions. Groups such as community forest user groups and drinking water groups in Nepal may be increasingly relevant in e.g. forest and watershed restoration and exploring options around Payment for Ecosystem Services.

20 Millennium Ecosystem Assesment. 2005. Our Human Planet: Summary for Decision-makers. Washington, US.

21 Andrade Perez, A., Herrera Fernandez, B. and Cazzolla Gatti, R. (eds.). 2010. *Building Resilience to Climate Change: Ecosystem-based adaptation and lessons learned from the field*. IUCN. Gland, Switzerland

Current projects in Mt. Elgon, including the Livelihoods and Landscapes project of IUCN, **emphasise adaptive management**, the importance of process and action combined, and see pilot activities as **action learning** sites. This has promoted an approach of **learning by doing,** which has been supported by learning meetings of stakeholders and others, site visits and the identification of champions. Both policy makers and stakeholders in Mt Elgon region have been engaged in the action learning. The model has been replicated elsewhere by the Ugandan Government. Climate change adaptation is very much a practice dealing with uncertainties, and embracing learning-by-doing and adaptive management approaches will be critical.

At all project sites, local governments are involved in managing ecosystems. In Nor-Yauyos Cochas, regional and local governments have assumed greater responsibilities in relation to the territorial planning and management of natural resources, as well as for the formulation and implementation of regional climate change strategies and plans. The process of decentralization has not been completed and further devolution of rights and responsibilities are required. Climate change adaptation will put further demands on local authorities. New capacities will be required for analysing climate change information, vulnerability and impact assessments, and to plan and implement required adaptation options. Support from national authorities, including in terms of providing climate information, will be required. The BMU project will work to strengthen local and national capacities for EbA, including thorough training, knowledge generation and action learning.

## Integrating EbA into Plans and Policies

EbA is seen as a key component of **climate change policy** in the 3 countries. Peru has a National Climate Change Strategy and Nepal a Climate Change Policy, both of which integrate visions and objectives that are in line with EbA. Uganda is currently in the process of developing a national climate change policy, which provides a good opportunity for including EbA. The NAPAs of Nepal and Uganda, and the National Action Plan for Adaptation and Mitigation of Peru include several activities around EbA, in particular in the forest, water and agriculture sectors. Though several sectoral policies (e.g. on water, wetlands, environment and agriculture) recognize the importance of ecosystems and ecosystem services for development, they do not mention or integrate this with adaptation. Integration of EbA into such policies will be essential as to be able to deliver cross-sectoral, ecosystem scale adaptation interventions on the ground.

**Local management plans** will be critical in delivering EbA. The Management Plan for Nor-Yauyos Cochas Reserve focuses on conserving ecosystems and respecting rural communities who depend on natural resources. It includes several objectives that are relevant for EbA, e.g. conserving genetic material, maintaining diverse landscapes, and respecting traditional practices of land-use. However it does not consider climate change or adaptation. The Biodiversity and Orchid Conservation Action Plan for Panchase 2010-2015 promotes the conservation of natural resources, ecosystem scale management and participatory approaches. It further identifies practices relevant for EbA such as community forest management, water source protection and landslide stabilization, but does not integrate adaptation. The BMU project will revise and update the Nor-Yauyos Management Plan as to incorporate climate change criteria and actions. Further, the Junin and Lima regional governments are in the process of developing Regional Climate Change Strategies, another good opportunity to integrate EbA. Nepal is in the process of developing Local Adaptation Plans of Action (LAPAs), also providing scope for incorporation of EbA.

EbA needs to be included in relevant development, climate change and sectoral plans and policies, from national to regional and local level, as to provide a supportive government framework for actions on the ground in Nepal, Peru and Uganda.

## Conclusions

Panchase in Nepal, Nor-Yauyos Cochas in Peru and Mt Elgon in Uganda are all vulnerable mountain ecosystems. They are likely to face several of the same challenges and opportunities in implementing EbA.

EbA options to manage these impacts can build on traditional knowledge and practices. New approaches, including ecotourism are relevant at all sites, which are in biodiverse mountainous areas of scenic beauty. There are already some positive experiences of participatory community natural resource management, local organization and adaptive management and learning-by-doing which are likely to be of particular relevance for EbA. The capacities of local actors, both government and communities, need to be enhanced. The provision of adequate climate change information, including vulnerability and impacts assessments, will be an essential prerequisite for EbA. Whilst certain national policies encompass EbA-type visions and actions, there is scope for more cross-sectoral integration and for including EbA in local management plans as to deliver ecosystem-scale adaptation solutions on the ground.

The EbA in Mountain Ecosystems project will work to address many of these challenges and harness the opportunities for EbA. It is hoped that by strengthening the capacity of Nepal, Peru and Uganda to include EbA in boader adaptation strategies, the vulnerability of communities in mountain ecosystems will be reduced.

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# Ecosystem-based Adaptation in Mountain Ecosystems:

## Challenges and Opportunities in Nepal, Peru and Uganda

### Introduction

**Ecosystem-based Adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse impacts of climate change. It uses sustainable management, conservation and restoration of ecosystems, takes into account anticipated climate change impact and reduces the vulnerability of communities to these impacts.**

**This brief discusses EbA opportunities and challenges in Nepal, Peru and Uganda, (Box 1 & 2). It provides an overview of climate change impacts; assesses drivers of vulnerability; presents existing and new approaches to EbA; assesses lessons learnt in ecosystem management and governance relevant to adaptation; and identifies opportunities for integrating EbA into policy.**

**Box 1. Ecosystem-based Adaptation in Mountain Ecosystems project**

The project sponsored by BMU for a period of 4 years (from December 2010), looks at the impacts of climate change on the integrity and functioning of mountain ecosystems in **Nepal, Peru and Uganda**. The project is a joint effort of UNEP, UNDP and IUCN. The objective of the project is to strengthen national capacities to implement Ecosystem-based Adaptation (EbA) options and to reduce the vulnerability of communities, with particular emphasis on mountain ecosystems.

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# Climate change impacts in Nepal, Peru and Uganda

Nepal, Peru and Uganda are endowed with ecosystems and ecosystem services upon which many communities depend, including mountain ecosystems which have particular vulnerabilities to climate change. Peru ranks higher on the Human Development Index accounting for income, health and education, scoring 80, while Nepal and Uganda score 157 and 161 respectively (UNDP, 2011).

An average temperature increase of 1.2°C by 2030 is expected in **Nepal**[1], with accompanying high intensity rainfall events, glacier retreat and glacial lake outburst flows (GLOFs). Glaciers are retreating at rates of 10 to 60m per year (ICIMOD, 2007)[2]. There is already a perceived increase in the number and frequency of droughts, floods, landslides and avalanches[3].

A temperature increase of 1.4°C is expected in **Peru** by 2030. In mountain areas, rainfall is expected to increase by 20%. Other anticipated climate change impacts include an increase in the frequency and intensity of the El Niño / La Niña phenomena, glacier retreat, changes in biodiversity, rising sea levels and increased vulnerability to natural disasters, such as land and mudslides, floods, drought and water scarcity[4].

In **Uganda**, climate change models point to an increase in temperature between 0.7°C to 1.5°C by 2020, and a likely increase in the variability of rainfall with most areas getting higher rainfalll[5]. Uganda has also experienced increased floods and storms, as well as more frequent droughts, which is influencing food security and increasing the threat of famine[6].

In all three regions where the EbA Mountains project (see Box 2) is being implemented, recent changes have been observed, which are widely perceived to be related to longer term climate change. In the Nor Yauyos-Cochas Landscape in Peru, glacier retreat has been observed, which has caused debris flows and landslides. The increased runoff from glaciers has formed new lakes and raised water levels in existing lakes. The Mt Elgon ecosystem in Uganda is particularly vulnerable to climate change impacts, including floods and landslides. In March 2010, following unusually heavy rains, landslides occurred in the Bududa district of the Mount Elgon region. Landslides buried three whole villages and caused many deaths. Hundreds of households were displaced, two primary schools were destroyed and the main health centre serving the area was severely damaged. In 2011, the District of Bulambuli was affected by landslides, which destroyed homes and crops, with 23 lives lost. Increases in rainfall in all countries would be expected to affect the sites of the EbA project. But no vulnerability and impact assessments have been carried out at the project sites to date, and such assessments of ecosystem services are important to understand the impacts of climate change and so as to design EbA actions[7]. This will be a key first step in informing EbA approaches, and is an intitial activity under the EbA Mountains project.

### Box 2. BMU EbA Mountain Project Sites

**The Harpan Watershed, Panchase in Nepal** lies in the mid-hills of Nepal and consists of valleys, hills and the high mountains of the Himalayas. The economy of the Panchase is largely subsistence, based on crop production and livestock. There is high climatic variation due to changes in altitude and an average rainfall of 3, 355mm. The selected project site, the Harpan watershed, is about 15 km² with sub-tropical to temperate climate. There are about 900 households with a population of 4,598.

**Mount Elgon landscape in Uganda** is the seventh highest mountain in Africa, a major catchment area and straddles the border between Kenya and Uganda. The climate is cool with a mean annual rainfall of 1,270 mm. The population of Mount Elgon is almost entirely rural and dependent on subsistence agriculture, with approximately 564,000 people living in the 4 districts which make up the project site. The region is home to Mt Elgon National Park and is of great conservation value, but high population density means that agriculture is spreading rapidly.

**The Nor Yauyos-Cochas Landscape in Peru** is comprised of the National Scenic Landscape Reserve Nor Yauyos – Cochas and its buffer zone, in the high Andean area of the upper Cañete and Pachacayo river basins. The reserve is a living landscape of significant conservation value, in which local communities maintain their ancestral ways in harmony with nature. The climate is variable due to altitude and annual rainfall varies between 500 to 1000 mm. The population living in the Reserve is confined to 12 communities with an estimated population of 10, 390. The main economic activity of these communities is agricultural and livestock production for local subsistence

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1 NAPA, 2010
2 Bajracharya *et al*, 2007. *Impact of Climate Change on Himalayan Glaciers and Glacial Lakes*. ICIMOD. Kathmandu, Nepal.
3 Government of Nepal (GoN), NAPA, 2010. The increase in hazard events is largely based on people's perceptions and location-specific evidence, as there are no specific trends across Nepal due to the extreme variability in precipitation across the country.
4 Second National Communication, 2010
5 National Development Plan, 2010
6 NAPA, 2007

# Drivers of vulnerability relevant for EbA

Local people depend on **ecosystems and their services for their livelihoods** in all project sites. The Nor Yauyos-Cochas landscape provides water for agriculture, livestock, fishing, tourism and energy. Communities living in the vicinity of Mt Elgon National Park depend on it for medicinal plants, firewood, livestock grazing and craft material. These critical ecosystems are being degraded, which has negative impact on ecosystem functioning and the ecosystem services on which communities depend.

**Overgrazing** has caused a loss of vegetation and degradation in all project sites, which exposes land to rainfall and run-off, and exacerbates soil erosion. **Fuel wood, timber and fodder** harvesting has degraded forests, and the resultant bare slopes are prone to soil erosion, and increased risks of landslides. The sites have inadequate management of **freshwater resources**, with actions upstream affecting water quality and availability downstream, through soil erosion and siltation. This degradation reduces the ability of these ecosystems to provide critical ecosystem services on which local livelihoods depend, including soil formation, flood regulation and provision of fresh water, food and wood. It has caused losses in income and had a direct negative impact on livelihoods.

**Climate change** is likely to further **exacerbate the problems** related to ecosystem degradation. Increased frequency of floods is expected to negatively affect crop yields and livestock in general across the world, especially in areas of subsistence farming[8]. Current water management practices are likely to be inadequate to reduce negative impacts of climate change on water-supply reliability and flood risk[9]. At the project sites, increased and more intense rainfall is likely to exacerbate problems of soil erosion and landslides. Melting of glaciers in Peru may cause flooding in the short-term in some areas and water shortages in decades to come. Current drivers of vulnerability need to be addressed as to help buffer communities against climate shocks[10]. Further, EbA should address the negative and cumulative effects of current and previous practices on ecosystems, as to reduce the vulnerability of ecosystems, and the services they provide, to climate change impacts[11].

The **poor and vulnerable** are often hit hardest by climate change, which tends to exacerbate **gender** inequalities[12] and **children** are often more susceptible to adverse effects of environmental degradation and climate change[13]. In both Nor-Yauyos Cochas in Peruand Panchase in Nepal, there is a stronger percentage of women compared to men. This is due to high rates of economic out-migration by the men. In Nor-Yauyos Cochas, there is chronic malnutrition among children and high rates of child mortality. In Mt. Elgon, a poverty analysis found that the poorest group was landless women, who had migrated into the landscape in search of opportunities to earn income[14].

Particular attention will need to be employed at the project sites in being sensitive to these vulnerabilities and engaging men and women, poor and marginalized groups in decision-making and implementation of Ecosystem-based Adaptation. For example, women often drive adaptation interventions, especially in areas of ecosystem management where they have specific knowledge[15]. Adequate access to resources, information and decision-making for women will be essential. The EbA Mountains project will pursue a gender-sensitive, participatory approach and promote the participation of women and marginalized groups in training, activities and management committees.

7 Andrade *et al*, 2010. Building Resilience to Climate Change. IUCN. Gland, Switzerland.
8 IPCC. 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contirbution of Working Group II to the Fourth Assessment Report of the IPCC. Parry, M, Canziani, O., Palutikof, J., van der Linden, P. and Hanson, C. (eds.). Cambridge, UK.
9 IPCC. 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contirbution of Working Group II to the Fourth Assessment Report of the IPCC. Parry, M, Canziani, O., Palutikof, J., van der Linden, P. and Hanson, C. (eds.). Cambridge, UK.
10 McGray *et al.* 2007. *Weathering the Storm: Options for Framing Adaptation and Development.* WRI. Washington, US.
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12 Aguilar, L. 2009. *Training Manual on Gender and Climate Change*. IUCN, UNDP, GGCA. San Jose, Costa Rica.
13 UNICEF. 2008. *Climate Change and Children*. Florence, Italy.
14 Nakangu, B., Chemongei, A., and S. Kelleher (2010). The LLS Mountain Elgon Landscape – Learning lessons. IUCN, 27p.
15 Aguilar, L. 2009. *Training Manual on Gender and Climate Change*. IUCN, UNDP, GGCA. San Jose, Costa Rica.

**Table 1. Planned project activities under the EbA Mountains project**

| Sustainable management, conservation and restoration activities | Ecosystem-based adaptation relevance: some examples[16] |
|---|---|
| Reforestation and restoration of native forests in Panchase, Nor Yauyos-Cochas and Mt. Elgon | Maintenance of nutrient and water flow; prevention of landslides; regulate hydrology and local climate |
| Restoring or constructing terraces in Nor-Yauyos Cochas and Mt Elgon | Provide water storage and flood regulation; prevention of landslides |
| Sustainable water management in Panchase, Nor Yauyos-Cochas and Mt. Elgon | Provide water storage and flood regulation |
| Maintaining and restoring upland watersheds in Panchase, Nor-Yauyos Cochas | Reduce risk of flooding, maintain regular water flows |
| Restoration of wetlands in Nor Yauyos Cochas and Mt Elgon | Maintenance of nutrient and water flow, quality, storage and capacity; Protection against floods |
| Conservation of agro-biodiversity and organic agriculture in Panchase, Nor-Yauyos Cochas | Conserving genetic diversity and maintaining agricultural diversity to secure food provision; Provision of specific gene pools for crop and livestock adaptation to climatic variability |
| Maintaining corridors of natural vegetation along rivers in Mt Elgon | Reduce risk of flooding, prevent soil erosion and siltation of river and downstream water sources |
| Conservation of medicinal plants used by local and indigenous communities in Nor-Yauyos Cochas | Local medicines available for health problems resulting from climate change or habitat degradation, e.g. malaria, diarrhea |
| Sustainable management of grasslands and pastures in Nor-Yauyos Cochas | Protection against floods; Storage of nutrients; Maintenance of soil structure |

# Ecosystems as adaptation solutions: building on existing practices and local knowledge

While ecosystem degradation increases vulnerabilities, and this is expected to worsen under climate change, the sustainable management, conservation and restoration of ecosystems can increase the resilience of livelihoods and enable people to adapt. EbA options can build on existing practices,traditional knowledge and institutions, many of which are coping strategies developed to deal with climate variability. These approaches are available and provide "no-regrets" adaptation solutions, which increase development benefits, conserve biodiversity and, in many cases, are likely to increase adaptive capacities.

For example, the Nor-Yauyos Cochas Management Plan proposes **restoring native species** to control erosion, conserve water sources and increase productivity. This is based on experience with the restoration of natural forests, with support from local governments. As an adaptation approach, restoring natural forests can maintain nutrients and water flows, and prevent landslides. Restored areas can also regulate local climate. In the Mt Elgon National Park, the Kaproron sub-county and a local development association have worked to **restore a riparian zone** on a river flowing out of the park. Replanted vegetation has reduced soil degradation and erosion, whilst protecting the watershed catchment and securing water provision to the local town. Restoring riparian zones to prevent soil degradation, erosion and reduce flooding will be an increasingly relevant adaptation option with expected increases in rainfall.

The BMU EbA project will build on these and other approaches and focus on their relevance as adaptation options. This work will aim to sustain essential ecosystem provisioning and regulating services in the face of climate change, and to restore ecosystems. Table 1 provides examples of some of the activities proposed under the project and their relevance for adaptation.

16 Adapted from Secretariat of the Convention on Biological Diversity. 2009. Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Montreal, Technical Series No. 41.
17 MachhaPuchhre Development Organisation, year unknown
18 Reserva PaisajisticaNor Yauyos-Cochas, Plan Maestro 2006-2011
19 Wertz-Kannounikof, S., Locatelli, B., Wunder, S., Brockhaus, M. 2011. Ecosystem-based Adaptation to Climate Change: What scope for payments for environmental services? *Climate and Development*. 3:2, pp. 143-158.