

Generating multiple benefits from Ecosystem-based Adaptation in mountain ecosystems

GLOBAL ECOSYSTEM-BASED ADAPTATION IN MOUNTAINS PROGRAMME

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Making the case for the multiple benefits of EbA

From 2011 to 2015, the global Ecosystem-based Adaptation (EbA) in Mountain Ecosystems Programme (hereafter referred to as the Programme) has been testing EbA measures in pilot mountain sites in the Himalayan foothills of Nepal, the Andes in Peru and Mount Elgon in Uganda.

Measuring the impact and effectiveness of EbA is essential to make the case for EbA to stakeholders, ranging from local communities and planners to national level decision-makers and donors. This brief makes the case for EbA by presenting how it can generate multiple environmental, social and economic benefits. Research shows that benefitting from a wide range of ecosystem services is closely correlated with communities' degree of resilience to challenges.¹

The following sections highlight how the Programme has been generating multiple benefits from EbA measures implemented in Nepal, Peru and Uganda. The information is a summary from the Programme's legacy report, ***Making the Case for Ecosystem-based Adaptation: The Global Mountain EbA Programme in Nepal, Peru and Uganda.***

While all project areas are situated in mountain ecosystems, **Figures 1-3** highlight the connections to downstream sites as well, such as the capital city of Lima in Peru. The figures also depict areas with and without the adopted EbA measures, while demonstrating the relationship between threats (both climatic and non-climatic), impacts, EbA measures and the various environmental, economic and social benefits that they are generating. **Tables 1-3** provide a more comprehensive overview of the implemented EbA measures and their respective multiple benefits. The final section provides some general lessons learned on how to secure multiple benefits from EbA, especially in mountain ecosystems.



Based on a decision of the German Bundestag

Environmental, economic and social benefits of EbA

The EbA measures implemented through the Programme have demonstrated significant environmental, social and economic benefits in the Programme lifetime. Additional benefits are expected in the medium to long term.

Environmental benefits

Learning Brief 1 provides a comprehensive explanation of how various ecosystem services generate a host of environmental benefits, which in turn enhance human wellbeing (Rossing 2015). As critical water towers/catchments, mountains provide vast downstream areas with freshwater for domestic use, irrigation, industry and hydropower (Kohler & Maselli 2009). Changes in rainfall, snow and glacial melt as a result of climate change, however, can have a direct impact on water provision and services, both on mountainsides and in downstream lowlands. The Programme, therefore, emphasized EbA measures associated with water conservation and management, such as restoring ponds, water sources and water channels, in all project sites. These measures have improved water provision and recharging of aquifers, and increased soil moisture and vegetation cover. They are also expected to regulate flooding and reduce siltation and landslides through safely channeling excess water.

Other EbA measures focused on sustainable grassland and livestock management, such as rotational grazing and planting of native grass species. In Tanta, Peru, for example, these measures have significantly improved the condition of pastures, evidenced by a visible increase in vegetation cover. In turn, the productive capacity of pastures has increased, with more fodder for livestock. The increase in vegetation is further expected to lead to better water infiltration capacity and reduced soil loss. In Uganda and Nepal, conservation agriculture has produced similar results, improving soil quality, retention and fertility and crop productivity. In Sanzara, Uganda, soil and water conservation measures, as well as the use of drought-resistant crops, have been so successful that the community has been able to produce food even during periods of drought.

Economic benefits

The Programme also implemented a range of EbA measures specifically aimed at generating income to diversify livelihoods. These measures included: beekeeping, commercialization

of non-timber forest products, and ecotourism promotion in Nepal; production of unbaked bricks, beekeeping, honey harvesting and home gardening in Uganda; and the promotion of vicuña fibre sales in Peru. As a result, an increase in household income has already been observed in all three project sites (Tiwari 2015).

Additional income has also been generated indirectly from other EbA measures. For example, water conservation measures have led to a steady and clean water supply for the irrigation of fields, which were previously only rainfed. Increased crop yields from irrigation have led to an increase in sales income. Some project measures, such as conservation agriculture, have also allowed for household savings through reduced expenditure on agricultural inputs.

Social benefits

Programme EbA measures have also provided a range of social benefits, including enhanced food security, access to clean water and access to a healthier diet. Across all project sites, EbA measures have further strengthened local organizational and technical capacities to manage natural resources. In Canchayllo and Miraflores, Peru, for example, the project has focused strongly on institutional strengthening and capacity building, which has strengthened local organizations and networks, important for increasing community resilience and adaptive capacity. Future climate impacts will require effective management and decision-making structures for continuing with EbA measures in the face of an increasingly unpredictable environment (Jones et al. 2014).

Programme measures have also provided a means of engaging women and vulnerable groups more proactively, giving them a voice they did not previously have. In Panchase, Nepal, women have been active participants in planning and implementing EbA measures associated with broom grass cultivation, due to the high rate of male out-migration and large number of women remaining in the communities. Broom grass cultivation and sales not only provided a new income for participating households, it also strengthened bonds across social and cultural barriers by including women from different castes. Women participating have been empowered to undertake livelihood activities and challenge traditional gender roles.

Lessons on securing multiple benefits through EbA

The project sites in Nepal, Peru and Uganda have different climate impacts, ecosystems, and drivers of degradation and vulnerability. However, there are also similarities typical of mountain ecosystems in terms of climate change impacts as well as opportunities and constraints for adaptation options. This section describes some general lessons learned regarding how to secure multiple benefits from EbA, especially in mountain ecosystems.

Generate short-term economic and social benefits to ensure buy-in for longer term environmental benefits

The potential for economic and social benefits has been one of the main requirements for making the case for EbA to local communities. This is not surprising, since mountain people tend to be among the world's poorest and most marginalized populations. Not only do many share the disadvantages of rural poverty and ethnic or religious discrimination, they also face cultivation challenges related to elevation, steep topography and severe climate. Livelihood options therefore tend to be limited. Agriculture and forestry are often the main sources of food security or income in mountain areas, such as in Panchase, Nepal, and Mount Elgon, Uganda. However, not all mountain areas are suitable for cultivation, so in places like Tanta, Peru, livestock grazing provides livelihoods for most community members.

An important lesson learned from these circumstances, therefore, is to ensure that EbA measures generate short-term economic and social benefits early on, in order to support livelihoods for the participating communities.

Create understanding of how different benefits are generated and relate to one another

Designing interventions to secure a wide range of EbA benefits requires an understanding of ecosystem services, how these services provide economic and social wellbeing, and how climate change can impact delivery of these services. Moreover, it also requires an understanding of how benefits are distributed over time over various geographic scales. The idea that EbA provides longer term and larger scale benefits can be a challenging message to convey and a difficult point

to prove, unless shorter term and local scale benefits can be tied to them.

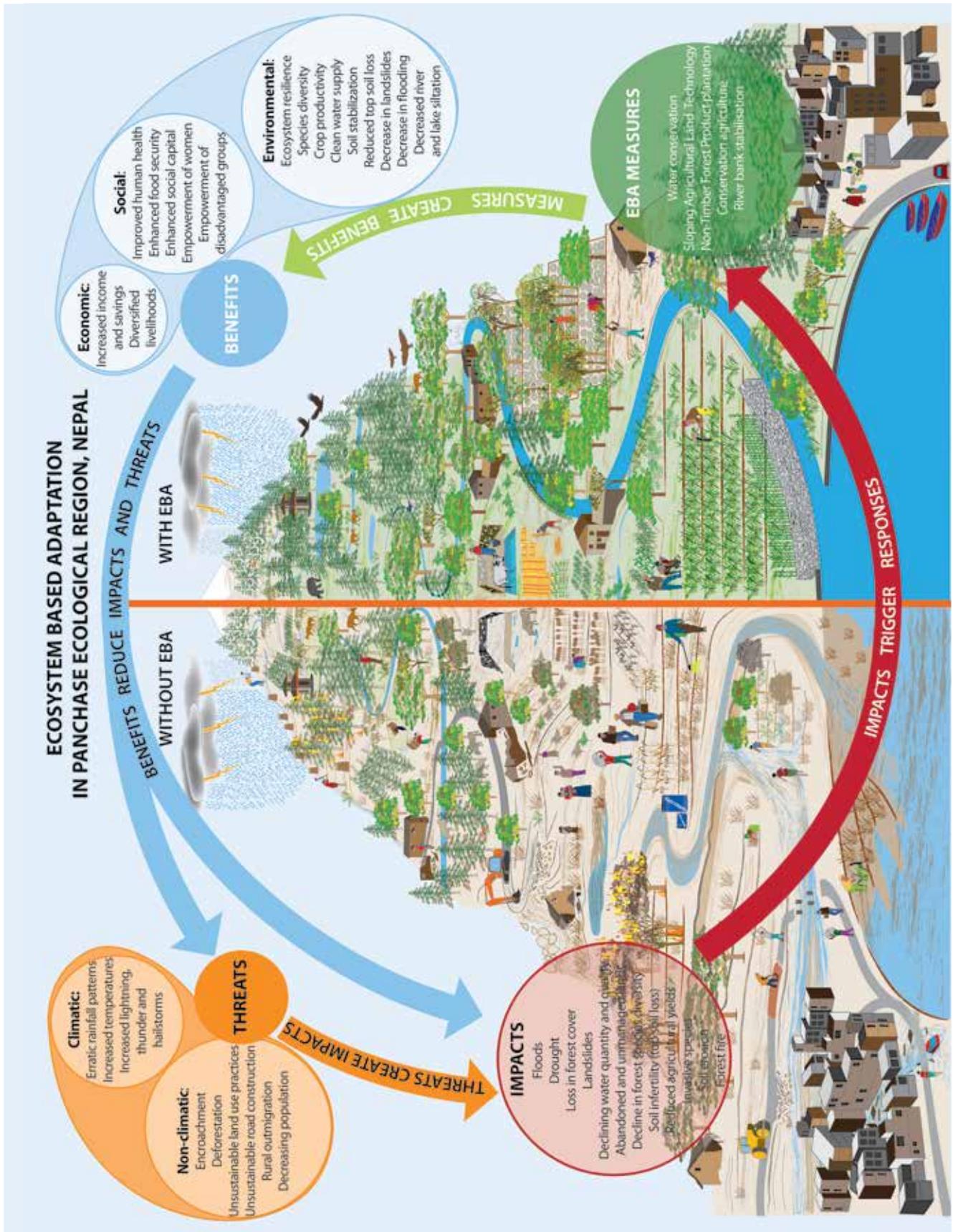
Despite the challenges, it is imperative to explain these temporal and spatial linkages to all stakeholders. When this is done properly, communities are better able to understand some of the expected benefits provided by ecosystem services. Also, short-term gains increase interest in and secure commitment to implementing ecosystem conservation, restoration and management measures in the medium and long term.

For example, enhanced access to water in Canchayllo, Miraflores and Sanzara was an essential entry point for making the case for EbA, as it was seen by communities as a means of increasing agricultural and/or livestock productivity, which would in turn lead to higher incomes in the short term and long term but also less expansive grazing and fewer inter-community conflicts.

Implement EbA at a landscape scale

Implementing EbA at landscape scale enabled a shift in interventions from stand-alone 'no regrets' activities² to EbA measures better integrated into ecosystems at a landscape scale and focused on the provisioning of ecosystem services. The Programme found that implementing EbA measures at an appropriate scale, such as at a local or district watershed level, ensured the attainment of benefits in a more comprehensive and sustainable manner. For example, many of the benefits provided by ecosystem services in the project watersheds downstream depended on the restoration, management and conservation of resources upstream. In Nepal, pond restoration was integrated with local wetland restoration and tree planting to support water recharge, enhance slope stability, and promote water source conservation. When individual water conservation approaches are integrated into a broader watershed management approach, the water regulation function of the ecosystem is enhanced. The natural hazard regulation function of the sub-watershed in terms of minimizing impacts of floods and landslides is also increased. Maintaining or enhancing these functions is important in the face of anticipated climate change impacts.

Figure 1 | Panchase Mountain Ecological Region in Nepal with and without EbA measures



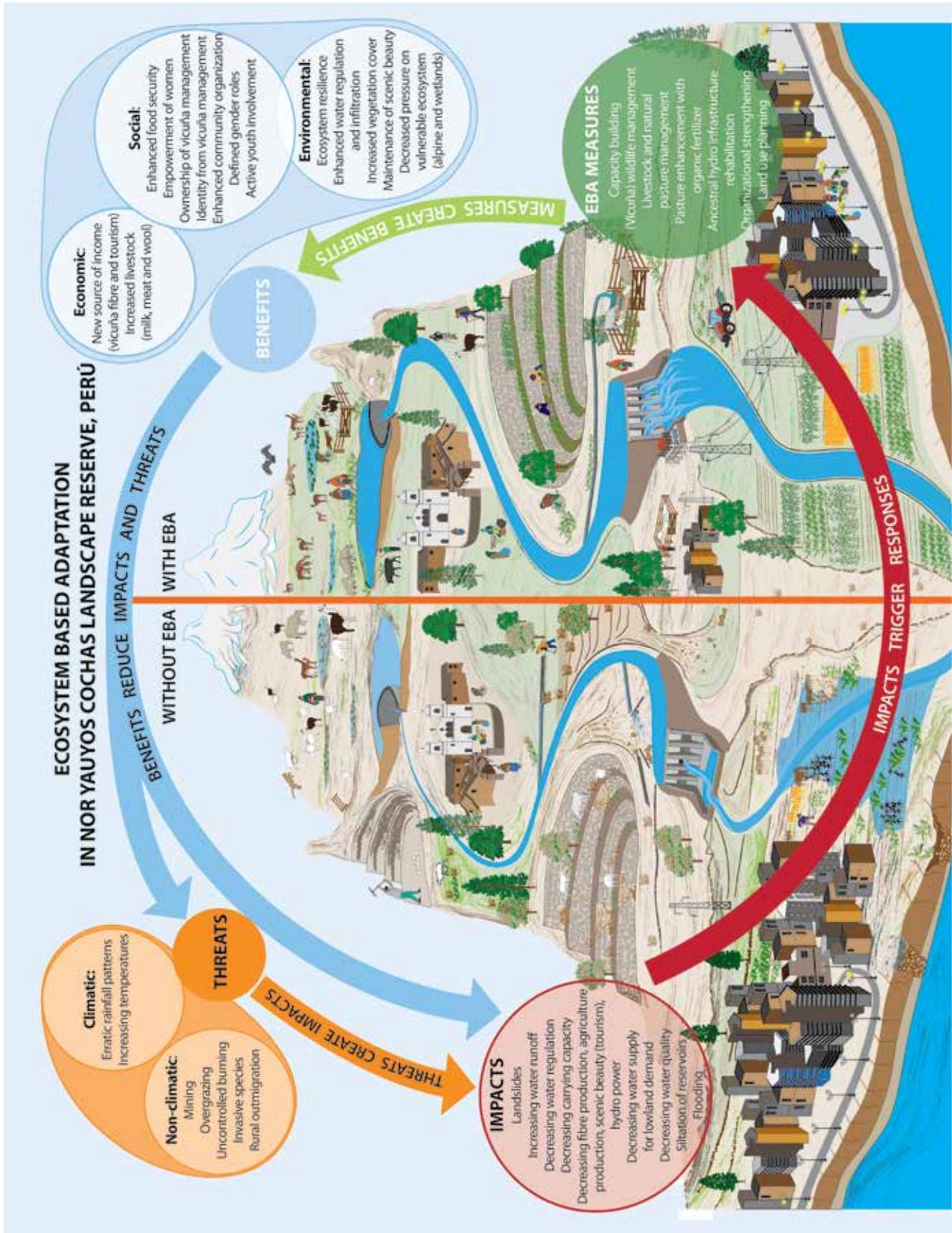
Source: Nieves Lopez Izquierdo/GRID-Arendal, based on technical guidance from T. Rossing, P. Dourojeanni, C. Petersen, N. Ikkala Nyman and P. Y. Rai.

Table 1 | Overview of select ‘no regrets’ and EbA measures implemented in the Panchase Mountain Ecological Region, Nepal, and their multiple benefits (observed and expected)

EbA measures	Location / implementer	Multiple benefits (observed and expected)		
		Environmental	Economic	Social and cultural
Water conservation: 1) Restoration of ponds and 2) water source rehabilitation	Bhadaure (IUCN) Chapakot, Pumdi Bhumdi, Kaskikot, Dhikurpokhari, Sarangkot / UNDP 1500 – 2484 masl	<ul style="list-style-type: none"> Increased water provision for domestic, livestock and agricultural use Increased groundwater recharge Increased water infiltration and regulation of ecosystem Enhanced soil moisture and soil fertility Increased water downstream Reduced risk of forest fire due to enhanced soil moisture 	<ul style="list-style-type: none"> Enhanced income from increased crops and yield due to clean and sufficient water availability downstream for agriculture Enhanced income from improved agricultural yield from use of water for irrigation during dry season 	<ul style="list-style-type: none"> Likely decrease in waterborne diseases for humans and animals Better human health from consuming healthier livestock products (milk and meat) Reduced conflict over scarce water resources Decrease in time spent in search for water
Sloping Agricultural Land Technology (SALT) plantation and reforestation	Several locations / UNDP 1500 – 2484 masl	<ul style="list-style-type: none"> Conservation of native and indigenous plant species of Panchase Increased reforestation Reduction in top and sub-soil loss due to strong plant root system 	<ul style="list-style-type: none"> Increase in income opportunities for locals from increase in visitors to Panchase for recreation purpose (orchids, scenic value) 	<ul style="list-style-type: none"> Enhanced human capacity in conservation practices to protect orchids of Panchase
Cultivation of native plants (broom grass, Timur)	Bhadaure / UNDP & IUCN 798 – 1500 masl	<ul style="list-style-type: none"> Fast rehabilitation of ecosystem, due to decrease in invasive species and regeneration of soil and moist levels Controlled overgrazing Reduced soil erosion 	<ul style="list-style-type: none"> New climate-resilient livelihood income for involved women from selling brooms commercially 	<ul style="list-style-type: none"> Creation of women’s empowerment and stronger social bond between involved women through capacity building and training Break down of caste-determined social and cultural barriers
Conservation agriculture: Integrated soil nutrient management (use of organic soil nutrients of compost dung and animal urine)	UNDP & IUCN 798 – 1500 masl	<ul style="list-style-type: none"> Enhanced soil productivity and fertility Enhanced moisture retention capacity Reduced soil erosion Reduced influx of nutrients into water bodies Decreased invasive plant invasions 	<ul style="list-style-type: none"> Increased farm and labour productivity Reduced expenses on chemical fertilizers Increased income from sale of high value crops, especially vegetables 	<ul style="list-style-type: none"> Improved nutrition and dietary diversity through cultivation of high value crops
Riverbank stabilization: Greenbelt and ‘green-grey’ infrastructure	Bhadaure, CHapakot, Kaskikot / UNDP 798 – 1500 masl	<ul style="list-style-type: none"> Farming yield improved in areas adjacent to gabion walls, due to flood control and absence of upstream debris collecting on farmlands Prevent landslides and flooding of adjacent farms Protected agricultural lands and reduced top soil loss 	<ul style="list-style-type: none"> Livelihood generated by preventing agricultural lands from being flooded Short-term employment in construction of green-grey infrastructure 	<ul style="list-style-type: none"> Reduced risk from flooding for riverside households and infrastructure Enhanced linkages with government agencies Enhanced mobility due to less flooding on roads and bridges

Sources: Developed by T. Rossing and N. Ikkala Nyman based on analysis of Adhikari et al. (2014), Baral et al. (2014), Dixit et al. (2015), Global Technical and Learning Workshop of the Mountain EbA Programme (2015), Kanel, K (2015), Khanal et al. (2013), Rizvi et al. (2014), and R Khanal, and P Y Rai, 2015, personal communications.

Figure 2 | Nor Yauyos Cochás Landscape Reserve in Peru with and without EbA measures



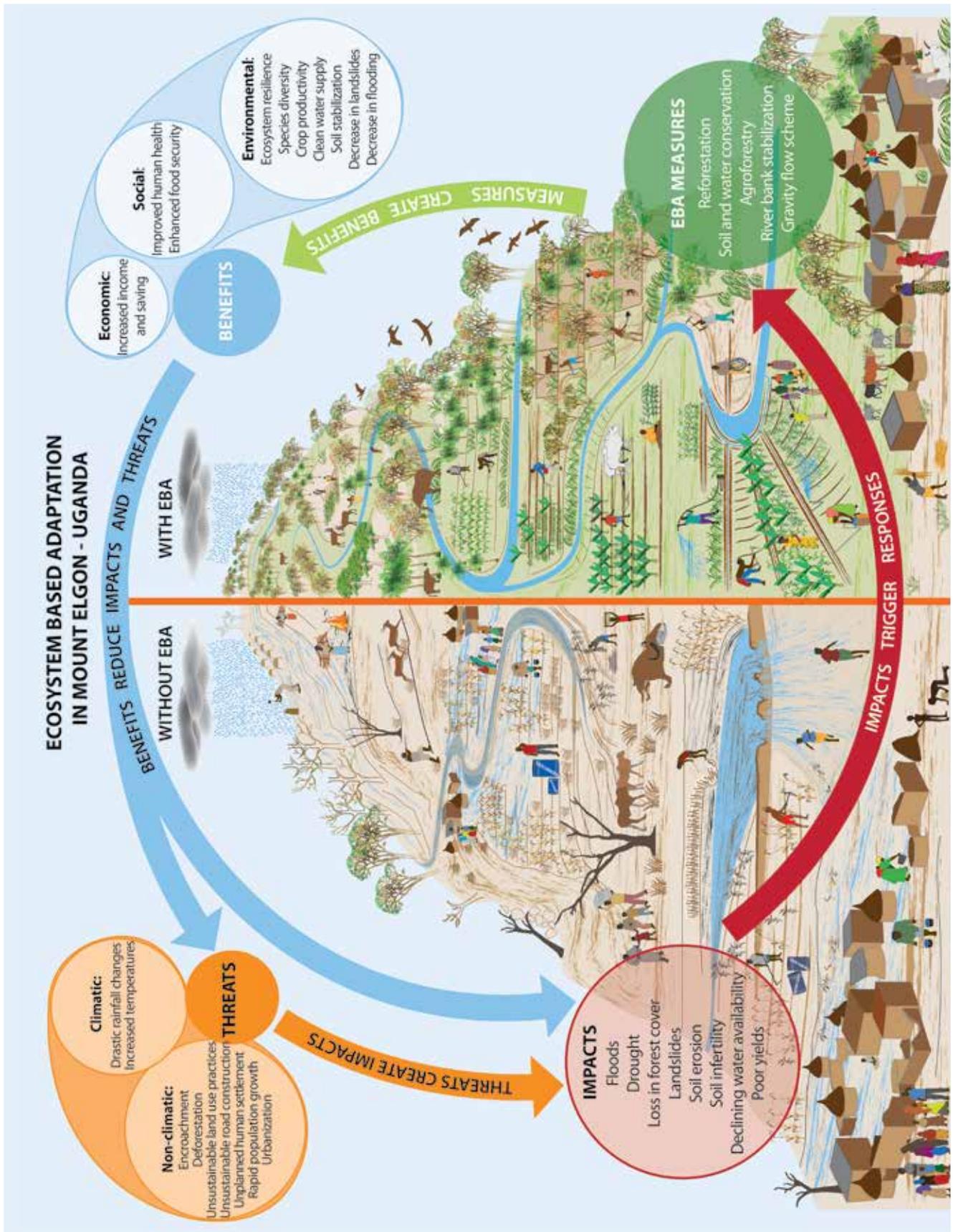
Source: Nieves Lopez Izquierdo/GRID-Arendal, based on technical guidance from T. Rossing, P. Dourojeanni, C. Petersen, N. I. Nyman, E. Fernandez-Baca, and A. Kato.

Table 2 | Overview of select ‘no regrets’ and EbA measures implemented in Nor Yauyos Cochis Landscape Reserve, Peru, and their multiple benefits (observed and expected)

EbA measures	Location / implementer	Multiple benefits (observed and expected)		
		Environmental	Economic	Social and cultural
Sustainable grassland/pasture management through:	Tanta / UNDP 4300 – 6000 masl	<ul style="list-style-type: none"> ■ Reduced pressure on natural pastures, wetlands and alpine ecosystems, promoting their recuperation ■ Enhanced water provision year round ■ Improved forage for grazing animals ■ Provision of diverse habitats for animals (predators and prey) ■ Enhanced production of animal fiber 	<p>New or increased income for local communities through:</p> <ul style="list-style-type: none"> ■ New income from commercial sale of vicuna fibre boosted by value chain development ■ Increased income from better and more milk products and meat from livestock ■ Boost in recreation and tourism activities 	<ul style="list-style-type: none"> ■ Enhanced scenic beauty ■ Likely increase in better health among community members from consuming healthier livestock products (milk + meat) ■ Strengthening of local organizations and management of communal lands ■ Enhanced capacity in sustainable livestock and vicuna management
1) Enhanced wild vicuna management and 2) improved animal husbandry	Tanta / UNDP 4300 – 6000 masl	<ul style="list-style-type: none"> ■ Increased vegetation cover ■ Enhanced soil moisture ■ Improved hydrological regulation ■ Enhanced provision of pastures and fodder 	<ul style="list-style-type: none"> ■ New income opportunity from generating organic fertilizer from fish waste 	<ul style="list-style-type: none"> ■ Likely better animal and human health from decreased exposure to chemical fertilizers
Pasture enhancement with organic fertilizer	Canchayllo / IUCN & TMI Tanta / UNDP 2700 – 4300 masl	<ul style="list-style-type: none"> ■ Reduced pressure on (over-grazed) grasslands and wetlands, favoring their recuperation ■ Allows wetland and grassland restoration ■ Increased vegetation cover ■ Enhanced soil moisture ■ Improved hydrological regulation ■ Enhanced provision of pastures and fodder 	<ul style="list-style-type: none"> ■ Increased livestock productivity and quality from improved livestock distribution and grassland quality and the creation of natural troughs → likely to lead to increased income 	<ul style="list-style-type: none"> ■ Strengthened institutional and governance arrangements and capacities for community management of water, grasslands and livestock
Native grassland management	Miraflores / Canchayllo IUCN & TMI	<ul style="list-style-type: none"> ■ Enhanced hydrological regulation including water storage, groundwater recharges and regulation services 	<ul style="list-style-type: none"> ■ Improved animal and agricultural productivity and quality from improved grasslands management at community and family levels → Likely increased income 	<ul style="list-style-type: none"> ■ Strengthened institutional and governance arrangements and capacities for community management of water, grasslands and livestock
Rehabilitation of upper micro-watersheds, wetlands and ancestral hydro infrastructure (water canals and reservoir dam)	2700 – 4300 masl	<ul style="list-style-type: none"> ■ Improved grassland condition ■ Enhanced fire prevention due to more moist grasslands ■ Decreased extreme events like frost and high temperatures impacts. ■ Biodiversity conservation and enhancement of carbon storage 		<ul style="list-style-type: none"> ■ Improved community management of water, grasslands and other shared resources

Sources: Developed by T. Rossing and N. Ikkala Nyman based on analysis of Dourojeanni et al. (2015), Dourojeanni et al. (2014), Fernandez-Baca et al. (2014), Global Technical and Learning Workshop of the Mountain EbA Programme (2015), Instituto de Montaña (2014), Podvin et al. (2014), Rizvi et al. (2014) and W A Castelo, A Gomez, E Fernandez-Baca, and J Leslie, 2015, personal communications.

Figure 3 | Mount Elgon in Uganda with and without EbA measures



Source: Nieves Lopez Izquierdo/GRID-Arendal, based on technical guidance from T Rossing, P. Dourojeanni, C. Petersen, N. I. Nyman and P. Nteza.

Table 3 | Overview of select ‘no regrets’ and EbA measures implemented in Mt. Elgon, Uganda, and their multiple benefits (observed and expected)

EbA measures	Location / implementer	Multiple benefits (observed and expected)		
		Environmental	Economic	Social and cultural
Soil & water conservation	Nabuzo / UNDP 1840 masl	<ul style="list-style-type: none"> ■ Provision of a cool environment for proliferation of fauna ■ Enhanced forest ecosystem from reduced influx of communities 	<ul style="list-style-type: none"> ■ Increase in income from enhanced agricultural productivity as a result of increased soil fertility 	<ul style="list-style-type: none"> ■ Increase in community cohesion and resilience as farmers help each other ■ Increased cultural values of the forests as less people go to the forests to collect forest products
Reforestation and green infrastructure (terracing, contours)	Bugitimwa / UNDP 1800 masl	<ul style="list-style-type: none"> ■ Increased species diversity with increase in pollination and productivity ■ Enhanced tree cover and decrease in degraded land and soil erosion 	<ul style="list-style-type: none"> ■ Agricultural livelihood protected from landslides and flooding 	<ul style="list-style-type: none"> ■ Protection from landslide risks
Agroforestry and reforestation (incl. Payment for Environmental Services Scheme)	Kaptpkwoi & Budadiri / UNDP & IUCN 1,600 masl	<ul style="list-style-type: none"> ■ Enhanced soil stability, productivity, fertility and moisture retention => less soil erosion ■ Provision of shelter for other plants, especially coffee and banana 	<ul style="list-style-type: none"> ■ Increase in income from enhanced agricultural productivity from increased soil fertility ■ Enhanced income prospects for ecotourism and PES scheme 	<ul style="list-style-type: none"> ■ Enhanced food security => improved human health ■ Increased community cohesion and resilience, as farmers help each other
River bank stabilization	Kaptpkwoi & Budadiri / IUCN & UNDP 1,200 masl	<ul style="list-style-type: none"> ■ Reduced soil erosion leading to better nutrient recycling ■ Improved rainwater formation cycle ■ Enhanced ecosystem resilience from reduced flooding 	<ul style="list-style-type: none"> ■ Enhanced income from fuel wood and simple building poles 	<ul style="list-style-type: none"> ■ Decrease in risk to human well-being from prevention of flooding
Community Gravity Flow Scheme, rainwater harvesting and reforestation	Sanzara / IUCN 890 masl	<ul style="list-style-type: none"> ■ Provision of steady water supply for both human consumption and agriculture ■ Improved health and variety of crops from steady and sufficient water supply 	<ul style="list-style-type: none"> ■ Improved agricultural livelihoods and more income from increased local commercial sale of more varied and healthier crops, enabled by the catchment-scale approach ■ Income could further be increased, if additional support was provided to access markets beyond local scale 	<ul style="list-style-type: none"> ■ Increased cohesion & social capital among all involved parish actors from establishing water community groups and jointly planning and implementing activities ■ Improved health from stable water supply, sufficient food and better nutrition ■ Decrease in time spent in search for water
Alternative livelihoods (beekeeping, unbaked bricks and fuel-efficient cook stoves)	Implemented in different locations and altitudes / UNDP & IUCN	<ul style="list-style-type: none"> ■ Enhanced ecosystem restoration from reduced deforestation ■ Increased species diversity and crop productivity from enhanced pollination 	<ul style="list-style-type: none"> ■ Increased savings from spending less on firewood ■ Additional sources of income 	<ul style="list-style-type: none"> ■ Women spend less time on cooking and collecting firewood ■ Improved human health from decrease in soot/smoke and healing properties of honey ■ More money for education of children ■ Empowerment of women

Sources: Developed by T. Rossing and N. Ikkala Nyman based on analysis of Global Technical Learning Workshop of the Mountain EbA Programme (2015), IUCN Uganda (2012a and b), NaFORRI (2012 and 2013), Rizvi et al. (2014), and R Gafabusa, S Kutegeka, and P Nteza, 2015, personal communications.

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END NOTES

- ¹ For a comprehensive analysis, please see Rossing (2015) *Learning Brief 1, Introduction to Ecosystem-based Adaptation: A nature-based response to climate change*.
- ² **'No regrets' measures**, as this term is used by the Mountain EbA Programme, means autonomous measures by communities which do not worsen vulnerabilities to climate change, or which increase adaptive capacities, as well as measures that will always have positive impact on livelihoods and ecosystems, regardless of how the climate changes.

INFORMATION ABOUT LEARNING BRIEF SERIES

This brief is part of a series of learning briefs produced by UNDP. These briefs draw together experiences and lessons learned from working on ecosystem-based adaptation (EbA) within the global Ecosystem-based Adaptation (EbA) in Mountain Ecosystems Programme from 2011 to 2015. The content also draws on lessons generated by the broader global EbA community of practice. The briefs are designed for practitioners, including local government representatives, civil society organizations and other actors working on climate change issues. They will also be useful for policy makers and donors engaged in planning and allocation of resources for adaptation action.

The Programme is a partnership between UNDP, UNEP and IUCN, with funding from the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). This global partnership also involves national and regional government agencies, civil society and local communities in Uganda, Nepal and Peru. By promoting the use of sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy, the Programme aims to reduce the vulnerability and enhance the resilience of fragile mountain ecosystems and their local communities to climate change impacts.

LEARNING BRIEF SERIES

This learning brief is part of the following series:

1. Introduction to Ecosystem-based Adaptation: A nature-based response to climate change;
- ▶ 2. Generating multiple benefits from Ecosystem-based Adaptation in mountain ecosystems;
3. Making the economic case for Ecosystem-based Adaptation;
4. Making the case for policy change and finance for Ecosystem-based Adaptation.

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ACKNOWLEDGMENTS

The following colleagues provided valuable suggestions, reviews and contributions to the larger report, on which this learning brief is primarily based: Anu Adhikari, Edmund Barrow, Essey Daniel, Pablo Dourojeanni, Cordula Epple, Edith Fernandez Baca, Silvia Giada, Hum Gurung, Adriana Kato, Sophie Kutegeka, James Leslie, Musonda Mumba, Assan Ngombe, Paul Nteza, Karen Podvin, Yalamber Rai, Felix Ries and Florencia Zapata.

Special thanks to Caroline Petersen for her detailed review, technical guidance and ideas.

DESIGN AND LAYOUT

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MAIN COUNTRY PARTNERS FOR THE MOUNTAIN EBA PROGRAMME

NEPAL	PERU	UGANDA
<ul style="list-style-type: none"> ■ Ministry of Forest and Soil Conservation, Department of Forest ■ Ministry of Science, Technology and Environment ■ Government Authorities of Kaski, Parbat and Syangja (District Forest Office, District Soil Conservation Office, Panchase Protected Forest Programme) ■ Machhapuchhre Development Organization and Aapasi Sahayog Kendra (ASK) Nepal ■ Panchase Protected Forest Council 	<ul style="list-style-type: none"> ■ Ministry of Environment; ■ National Service of Natural Protected Areas ■ Ministry of Economy and Finance ■ The Mountain Institute (IUCN's implementing partner) ■ Nor Yauyos Cochas Landscape Reserve ■ Regional governments of Junín and Lima and the district municipalities and community authorities in the Reserve 	<ul style="list-style-type: none"> ■ Ministry of Water and Environment ■ Ministry of Finance Planning and Economic Development ■ Ministry of Agriculture Animal Industry and Fisheries ■ Ministry of Health ■ National Planning Authority ■ Uganda Wildlife Authority ■ Makerere University Institute of Natural Resources ■ National Forestry Authority ■ National Environment Management Authority ■ Members of the Mt. Elgon Conservation Forum ■ Kapchorwa, Kween, Sironko and Bulambuli District Local Governments

Source: Mountain EbA Programme (2014)