UNDP's work on ecosystems, interrelated areas such as water resources & adaptation
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This submission to the Nairobi Work Programme (NWP) of the UNFCCC is in response to the invitation to contribute towards a synthesis report on ecosystems, water resources and adaptation, to be considered by the SBSTA in May 2017. The synthesis report, being prepared in collaboration with relevant NWP partner organizations, will provide key findings based on submissions and highlight good practices and lessons learned as well as relevant tools. The synthesis report will also summarize the key challenges that are barriers to adaptation actions addressing ecosystem and water resources and possible ways to address these for Parties to consider during SBSTA 46, in relation to:

- Lessons learned and good practices on adaptation planning processes addressing ecosystems and interrelated areas such as water resources
- Lessons learned and good practices in monitoring and evaluating the implementation of ecosystem-based adaptation;
- Tools for assessing the benefits of mitigation and adaptation to enhancing resilience and emissions reductions that ecosystem-based adaptation provides.

Introduction: UNDP's work on Ecosystem-based Adaptation and Resilient Integrated Water Resource Management

UNDP provides support to countries to adapt to climate change in the context of the 2030 Agenda for Sustainable Development, seeking to promote pro-poor and pro-growth adaptation which encourages climate-resilient economic development and sustainable livelihoods in the face of climate change. UNDP-supported projects and programmes at the country level are organized around six Signature Programmes: Supporting Integrated Climate Change Strategies; Advancing Cross-sectoral Climate Resilient Livelihoods; Fostering Resilience for Food Security; Climate Resilient Integrated Water Resource and Coastal Management; Promoting Climate Resilient Infrastructure and Energy; and Ecosystem-based Adaptation.

Climate-Resilient Integrated Water Resource Management

Through the Climate-Resilient Integrated Water Resource and Coastal Management signature programme, UNDP supports countries to promote integrated, ecosystem-based, climate resilient management of the world's major freshwater and marine trans-boundary waters systems through improved water and ocean governance.

An example is an Integrated Water Resource Management Programme in the Maldives, funded through the Adaptation Fund. The objective of this project is to ensure reliable and safe freshwater supply for Maldivian communities in a changing climate. As surface freshwater is generally lacking throughout the country, the key problems pertaining to freshwater security relate to the management of increasingly variable rainwater resources and increasingly saline and polluted groundwater. In order to reduce the aforementioned barriers to effective climate change adaptation in the water management sector, it is essential to reinforce the perspective of Integrated Water Resources Management

(IWRM) on inhabited islands. This will ensure that measures responding to additional, climate change-related risks (such as greater rainfall variability, unreliable recharge of aquifers, longer dry periods, and increasing damage to infrastructure from extreme weather events) are addressed in concert with a response to basic development problems (such as insufficient sewage and wastewater treatment, lack of environmental awareness, lack of water conservation, and lack of comprehensive stakeholder participation in the design and monitoring of water management schemes).

- *More detail on this and other climate-resilient integrated water resource projects can be found at http://adaptation-undp.org/projects/af-maldives*

Ecosystem-based Adaptation (EbA)

Through the *Ecosystem-based Adaptation (EbA)* signature programme, UNDP supports countries in incorporating nature-based solutions into their strategies for adapting to and mitigating the negative impacts of climate change. This involves working with communities, governments and civil society to conserve, manage and rehabilitate ecosystems for mitigation of, and adaptation to, climate change, whilst maximising developmental co-benefits. A mapping exercise conducted in November 2015 through the German Government-funded Mountain EBA Programme implemented by UNEP, UNDP and IUCN, found that UNDP's project portfolio worldwide includes 56 projects that can be classified as EbA.[1]

- *The report highlighting the 56 EbA projects can be downloaded at http://adaptation-undp.org/sites/default/files/resources/undp_eba_mapping_analysis_report_jan_2016_final_online.pdf*

Ecosystem-based adaptation can be defined as "the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change" including "sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities."[2] Expanding and connecting protected areas to conserve intact forests, wetlands, mangroves and coral reefs helps provide a natural buffer for communities vulnerable to disasters intensified by climate change. Maintaining natural vegetation in mountain catchments helps ensure continued water supply in the face of changing rainfall patterns. And nature also provides ecosystem services such as pollination and soil fertility that are essential to maintain or enhance agricultural productivity despite increasing climate variability. Ecosystem-based adaptation measures harness this power of nature to maximise communities' capacity to reduce their vulnerability by adapting positively to climate change, using both traditional knowledge and innovative techniques.

- *A series of photo essays highlighting the range of social, economic and environmental benefits of UNDP's support to countries on climate change adaptation is available at https://undp.exposure.co.*

[1] UNDP (2015) Ecosystem-based Adaptation Mapping Report.

[2] Convention on Biological Diversity, 2010, COP-10 Decision x/33 on Biodiversity and climate change.

1. Adaptation planning processes addressing ecosystems and interrelated areas such as water resources

UNDP supports countries in developing their adaptive capacity through better management of ecosystems, including freshwater resources, at local, sub-national, national and regional scales. This includes helping governments access funding from the Global Environment Facility through the International Waters focal area, for transboundary river basin projects through which participating countries step up action on improved governance and sustainable management of national and trans-boundary aquifers. Although the focus of this work has not been primarily on climate change adaptation, progress will depend on an increased understanding of this resource as a vital ingredient in long-term nexus planning and as a climate change buffer resource.[3]

At national level, UNDP is one of a number of agencies supporting countries to develop National Adaptation Plans (NAPS) and National Adaptation Programmes of Action (NAPAs), working with 42 countries in 2016 to access funding from the Global Environment Facility for this planning work, involving a range of stakeholders at national level. Support is also provided through the National Adaptation Plan Global Support Programme (NAP-GSP). Financed by the GEF-LDCF, the programme is the largest coalition among UN agencies including UNDP, UNEP, WHO, FAO, IFAD, UNITAR, UNFCCC and UNISDR and is working with key partners such as the German Government (GIZ), Global Water Partnership and the Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA).

- *Download a presentation here from May 2016 on "Lessons from using NAPAs and NAPs to Inform Action on Climate Change Adaptation"* *https://unfccc.int/files/cooperation_and_support/capacity_building/application/pdf/df5_pradeep_kurukulasuriya.pdf*

Mainstreaming EbA into national development planning and finance

In addition to national level planning specifically for adaptation, EbA projects have provided an opportunity to mainstream adaptation approaches into other national development plans and policies, as well as finance for implementation. The abovementioned Mountain EbA Programme, implemented by UNEP, UNDP and IUCN with the support of the International Climate Initiative, was successful in making the case for policy change for EbA through national development plans, national climate change policies, environment and conservation strategies, sectoral plans and policies in Nepal, Peru and Uganda. The programme provided technical guidance and policy review inputs for integrating EbA into, for example, the Forest Policy in Nepal, the Intended Nationally Determined Contribution in Peru, and the National Climate Change Strategy in Uganda. The table below shows further examples at national and sub-national scales.

- *A **Learning Brief from the Mountain EBA Programme** highlights how the case has been*

[3] Global Environment Facility Independent Evaluation Office, International Waters Focal Area Study, 2016

made for planning and policy changes at various levels to scale up EbA approaches; and the case for long-term, sustained financing for EbA. http://www.undp-alm.org/resources/project-brief-fact-sheet/learning-brief-4-making-case-policy-change-and-financing

Policy level	Global level policies and plans	National level policies	District and/ or regional plans	Protected area management plans	Local natural resource management plans
Examples of policies	UNFCCC decisions CBD decisions NWP	National development plans Climate change policies and strategies Sectoral policies: water, agriculture, forests, infrastructure, DRR, environment, etc.	Environment plans Climate change plans Development plans		Water management plans Forest management plans Pasture management plans
How relevant for EbA	Define EbA; provide guidelines and tools; influence adaptation funding; defines national reporting e.g. NAP and NBSAP	National priorities and visions for adaptation; influences national and sectoral budgets for adaptation; sets institutional priorities for adaptation; ensures political buy-in	Can provide an appropriate scale for EbA (landscape, watershed); multi-sectoral approach to EbA; Upstream-downstream linkages; local budgeting for EbA; technical support for implementation and monitoring of EbA; political buy-in	Guiding frameworks for EbA planning at landscape scale; governance and capacity to work at landscape scale; ownership; sustainability; monitoring of EbA	Detailed planning and implementation of EbA measures; management plans; sustainability across political changes; ownership; monitoring of EbA; political buy-in
Key stakeholders to engage	UNFCCC: SBSTA, NWP; CBD; Donors	Ministers; Technical officers; Parlamentarians; Cross-sectoral working groups	Line agencies; Extension workers; District officials and leaders	Protected area managers and staff; National protected area agencies	Natural resource management groups; Local leaders; Community assemblies; Community members
Additional, cross-scale bodies	Project coordination mechanisms and bodies: platforms for dialogue and coordination on roles and responsibilities for implementing EbA across sectors and levels; cross- scale institutions and agencies, such as: research institutes				

Policy and planning levels and opportunities for change in support of EbA[4]

Case Study: Public Investment in Ecosystem-based Adaptation in Peru

In Peru, the Mountain EbA project collaborated with the Ministry of Economy and Finance (MEF) and the Ministry of the Environment and Natural Resources (MINAM) on development of policy guidelines for public investment in biodiversity and ecosystems. The guidelines provided an opportunity for making the case to the two ministries for increasing public investment in EbA. The project played a key role in incorporating EbA in the guidelines through participating in *ad hoc* working group meetings, and providing technical guidance and text suggestions on ecosystem-based adaptation measures.

The Policy Guidelines for Public Investment in Biodiversity and Ecosystem Services 2015-2021 were approved by Ministerial Resolution of MINAM in August, 2015. The objective

[4] UNDP (2015) *Making the Case for Ecosystem-Based Adaptation: the Global Mountain EBA Programme in Nepal, Peru and Uganda*, New York, p. 99

of the guidelines is to promote public investment in conservation and sustainable use of biological diversity and ecosystems, so as to achieve social well-being. They provide a guiding framework for formulating and implementing public investment projects at local, regional and national level. Climate change is considered a cross-cutting issue under the guidelines. EbA is identified as a policy guideline under the specific objective of conserving and restoring biodiversity.

The National System for Public Investment (Sistema Nacional de Inversion Publica SNIP) is the main source of finance for public investments in Peru, traditionally focused on grey infrastructure, such as building roads or schools. The guidelines now open a path for investing public finance in projects such as watershed management and species conservation. Proposals for Public Investment Projects (PIP-Proyectos de Inversion Publica) are developed by project managers in a range of public sector offices in national government agencies, as well as regional and local governments. The guidelines thereby open a country-wide, cross-sectoral opportunity for developing EbA proposals for public investment in Peru.

- *Full case study available at http://www.undp.org/content/undp/en/home/librarypage/poverty-reduction/making-the-case-for-ecosystem-based-adaptation.html pages 120-121.*

Adaptation planning at local level: Mountain EBA Programme

A number of lessons about adaptation planning at local level were learned through the EbA in Mountain Ecosystems Programme, a global partnership jointly implemented by UNEP, UNDP and IUCN from 2011-2016, with funding from the Germany's Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). While global in scope, Uganda, Nepal and Peru were selected as pilot countries, because of their significant vulnerability to climate change, coupled with their endowment of fragile mountain ecosystems upon which a multitude of communities and economic activities depend. The programme made significant gains in strengthening adaptive capacity of governments and local communities, and reducing vulnerability to the effects of climate change through implementing EbA measures.

Learning from Peru, Nepal and Uganda[5] on adaptation planning at local / landscape scale included the following:

- **Participatory planning and assessments increases community ownership.** Framing EbA benefits can be challenging, as the links and causalities between livelihoods, ecosystems and climate change are complex, and often unfold over a fairly long time period. Participatory processes helped engender understanding of these linkages and the need for interventions, whilst facilitating a sense of ownership and buy-in for initially identified 'no regrets' measures[6].

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[5] UNDP (2015) *Making the Case for Ecosystem-Based Adaptation: the Global Mountain EBA Programme in Nepal, Peru and Uganda*, New York.

[6] The term 'no regrets' measures was used to refer to autonomous measures by communities which do not worsen vulnerabilities to climate change, or which increase adaptive capacities, as well as measures that will

- **Undertaking vulnerability and impact assessments as part of the planning stage helps to frame EbA options in an adaptation context.** Conducting VIAs gave communities and government stakeholders the necessary knowledge to validate or redesign early 'no regrets' measures into evidence-based EbA measures. They also enabled the adoption of a landscape scale approach and long-term planning of EbA measures.
- **A watershed or catchment was found to be an effective scale for planning and implementing EbA measures.** This scale was appropriate in particular when making the case for landscape scale approaches to district level governments and protected area managers. Working at catchment level also ensured the attainment of EbA benefits in a comprehensive and sustainable manner, especially with regards to ecosystem provision and regulating services.

The Mountain EbA Programme was also successful in embedding EbA approaches in government planning at various levels, ensuring sustainability of actions in target landscapes, and supporting their replication and scale-up in other parts of the pilot countries. Project activities built on existing structures such as Forest User Groups and Women´s Groups in Nepal, Water and Pasture Committees in Peru. In Uganda, Parish Adaptation Plans were developed in collaboration with district government to prioritise adaptation activities at parish level, after which household level and use plans were developed. Capacity building was provided on adaptation planning, implementing EbA measures and monitoring. EbA measures have strengthened local natural resource management governance structures, which are essential in continuing to champion EbA measures and secure the benefits provided for the long term. A success factor for sustainability is the inclusion of EbA in plans and policies, from local level natural resource management plans to district and national level plans and policies.

District level agencies are critical, especially where measures are implemented across landscapes or outside clearly defined boundaries such as those of protected areas. Implementing EbA at e.g. watershed scale will require planning and oversight beyond community level, and across sectors, making district or regional level a relevant scale. Local level budgeting is often also decided at municipal or district level. In addition to collaboration with line agencies such as agriculture, forestry or water, it is relevant to consider broader land use planning and engagement of infrastructure and works sectors to avoid maladaptation[7] and explore opportunities for hybrid grey-green infrastructure solutions, for example.

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always have positive impact on livelihoods and ecosystems, regardless of how the climate changes. The IUCN Paper *'Ecosystem based Adaptation: Building on No Regret Adaptation Measures',* (Rizvi et al. 2014), further discusses different definitions and how the concept has been used by the Mountain EbA Programme.

[7] Maladaptation, as defined by the IPCC: *"any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead."* IPCC, 2001 (Third Assessment Report, Glossary).

Water security in Mongolia in the face of climate change

Another example of an EbA project involving landscape-level planning is the project "Ecosystem Based Adaptation Approach to Maintaining Water Security in Critical Water Catchments in Mongolia", funded by the Adaptation Fund and supported by the Government of Mongolia and UNDP. The ongoing project aims to support the government and local communities to maintain water provisioning services supplied by mountain and steppe ecosystems by internalising climate change risks within land and water resource planning and management regimes. The project has established multi-stakeholder coordination structures at landscape level to lay the groundwork for ongoing co-management of ecosystems for adaptation, supporting the integration of ecosystem resilience into land use and water resource planning and management at the landscape level.[8]

Case Study: Ecosystem-based Adaptation Approach to Maintaining Water Security in Critical Water Catchments in Mongolia

Mongolia is a land-locked nation covering 1.564 million km^2, sharing extensive borders with Russia and China. It has several major eco-regions, and is a globally important watershed with three major water systems. Unsustainable agriculture and development practices already inflate Mongolia's natural resource use beyond sustainable limits. If current trends continue and unsustainable management practices persist, the vulnerability of Mongolia's rural communities will increase in tandem with the deterioration of land and water resources and associated ecosystem services. As such, the additional impacts represented by climate change will be very problematic for Mongolia's already vulnerable ecosystem services.

In the grassland landscapes of the Altai and Eastern Steppe regions, both part of the 'Global 500 Ecoregions' 7internalizing by unique ecosystems and biodiversity, the older generations have witnessed clear environmental changes over recent decades. Wildlife numbers have decreased significantly and the pasture conditions are much poorer. Many streams and lakes have dried up. The proximate cause of pasture degradation is overgrazing, resulting from a doubling of livestock numbers in the last 30 years, spurred by the transition from communism to a market-oriented economy in 1990. Fewer herders practice traditional rotational grazing (consisting of moving seasonally in search of good pasture, thereby leaving time for other pasturelands to recover).

Herders have noticed a marked change in rainfall patterns and an increase in temperatures. The hydrological regime has also changed, altering the volume and timing of river flow and flood regimes. The soil infiltration rate and water storage capacity have declined, resulting in deteriorating pasture quality and quantity, and vice versa. In addition, the occurrence of summer droughts and extremely severe winter weather events called 'dzud' has increased. The 2010 dzud killed more than 25% of the entire country's livestock, impacting 700,000 people. Changes in climatic patterns are already having noticeable impacts on herders, exacerbating serious land degradation problems.

[8] UNDP (2015) Ecosystem-based Adaptation Mapping Report, p.49

For people living in this landscape, there can be no livelihood if the surface water and pasture disappear. And for these resources to continue to be available for present and future generations, it is essential to ensure that the ecosystems in these remain healthy and resilient enough to cope with climate change. The project, funded by the Adaptation Fund and supported by the Government of Mongolia and UNDP, addresses this by supporting the government and local communities to maintain water provisioning services supplied by mountain and steppe ecosystems by 8internalizing climate change risks within land and water resource management and planning regimes.

Two eco-regions are targeted: the Altai Mountain/Great Lakes Basin and the Eastern Steppe. The Altai Mountain/Great Lakes Basin covers nearly 288,000 km^2. The Eastern Steppe covers nearly 445,000 km^2. Local level interventions are targeting two watersheds within these broader eco-regions, representing a significant portion of Mongolia's water resources. The specific project locations were selected because they are: (1) distinct, offering two very different ecological zones for establishing EbA practices; (2) representative of key climate change challenges; (3) appropriately scaled, both in terms geographic size and population, to allow for substantial, landscape level improvements within budget constraints; and, (4) strategic in that the locations are priorities for government action and allow for building upon and/or coordinating with ongoing programming.

Working with communities, local and national governments, and NGOs in the Altai and Eastern Steppe landscapes, the project supports the integration of ecosystem resilience into land use and water resource planning and management at the landscape level. It supports evidence-based decision-making through improved knowledge and understanding of ecosystem dynamics, and resilience and impact of different land uses. The project also assists community actions to implement EbA principles and practices for the long-term sustenance of their livelihoods. At the national level, the project supports mainstreaming of the EbA approach in the country's adaptation framework and related sector policies.

For links to a full set of resources on this project, visit https://www.adaptation-fund.org/project/ecosystem-based-adaptation-approach-to-maintaining-water-security-in-critical-water-catchments-in-mongolia

2. Monitoring and evaluating the implementation of ecosystem-based adaptation

Measuring impact and effectiveness of EbA is essential to make the case for EbA to a range of stakeholders from local communities and planners to national level decision-makers, donors and global fora. The experience of the Mountain EbA programme in developing EbA indicators to measure impact and effectiveness shows that a holistic approach is needed, which considers social, economic, ecosystem and ecosystem service indicators, in addition to including cross-cutting climate variability and change indicators. Including and monitoring this full set of indicators has proven challenging in the Mountain EbA project, but is nonetheless seen as optimal, in order to be able to measure all impacts of EbA measures in the context of climate exposure and adaptive capacity. Challenges included the fact that this was a pilot programme and few prior

experiences existed on which to build in the development of EbA indicators. Although many of the indicators were developed and adopted only at later stages of the programme, valuable lessons were learned and examples generated of indicators that can be replicated in future EbA projects.

The programme´s experience on the use of indicators is discussed in the following internal, unpublished documents. The processes described in these documents (available on request) were led by UNEP's specialist biodiversity assessment centre, the UNEP-World Conservation Monitoring Centre (UNEP-WCMC), and focus on the development of impact indicators, particularly using biophysical monitoring of indicators of ecosystem services:

- Dourojeanni, P (2013) *Taller para le identificación de indicadores de impacto para las medidas adoptada por el Proyecto EbA montana en la RPNYC, 10 y 11 de diciembre 2013, Memoria Descriptiva;* Global Learning & Technical Workshop, 27th April-1st May 2014, Pokhara, Nepal. Workshop report
- Rossing, T (2014) *Uganda Mountain EbA Pilot Project – Impact Indicators to Measure Changes in Adaptive Capacity*
- Munroe, R (2014) Impact and context indicators for adaptation intervention impact on ecosystem functioning for 3 ecosystem services, July 2014 Workshop results and UNEP-WCMC comments.

Example of a set of indicators developed in Peru

Ecosystem service: Supply of water for livestock production						
Ecosystem processes				**Structure of the ecosystem**		
Water cycling	**Mineral cycling**	**Solar energy flow**	**Biological growth**	**Vegetation structure**	**Soil structure**	**Food web**
Optimum infiltration. Low runoff. Good retention (storage). Low evaporation and evapotranspiration. Good water quality.	The cycling of minerals is relatively closed and rapid in the organic soil layer.	High capture of solar energy by the grass. Minor loss of solar energy by fires. Flow of the solar energy is optimum in the food chain. Good population of decomposer micro-organisms and	High growth of the natural grasses. The biological cycle of the plants is completed every year.	There is a high biological diversity of grasses, bogs, waterside species, shrubs. Good vegetation cover. Little old grass present (to reduce the probability of fires). There are no invasive species which are indicators of over-	Low compaction. Adequate porosity. High composition/ concentration of organic matter/ available nutrients. Increasing depth of organic soil horizon. Presence of decomposer soil micro-organisms. Presence of	Balance between the vegetation population, herbivores, predators, and decomposers. Goo d coverage and good productivity of the vegetation. Cattle are well distributed and within the carrying capacity of the

		herbivorous insects.		grazing. Predominance of native grasses. Presence of mulch.	mulch.	vegetation and its cycle. Protection zones and corridors for free access of wild animals.

Monitoring and evaluation takes on a particular importance in the context of results-based payments to farmers for ecosystem services maintained or restored through undertaking EbA measures on their land. An example of this can be seen in the Mountain EbA Programme where UNDP Uganda initiated a Payment for Ecosystem Services (PES)[9] facility through the Environmental Conservation Trust of Uganda (ECOTRUST), an environmental non-governmental organization specialized in conservation finance. The scheme works through bundling of ecosystem services and providing payments to farm households for EbA measures that provide watershed services and carbon sequestration services. The scheme aims to incentivize the adoption of EbA measures, and is part of a broader set of supporting activities.

Case study: Indicators for Payments for Ecosystem Services in Uganda

The PES facility established by the Ministry of Water and Environment, together with district government, provides upfront funding to farmers to initiate adaptation activities and uses the market to increase cash flow and invest in the expanding number of participating farmers. Performance-based payments administered by ECOTRUST cover both watershed and carbon services generated by the adaptation measures. Bundled credits of carbon which include watershed functions are sold on the international carbon market, to buyers such as Myclimate, through ECOTRUST´s Trees for Global Benefits programme, which adheres to the Plan Vivo standard.

Credits are sold *ex ante* through the Trees for Global Benefits programme, meaning that they are financed before a farmer enters into contractual agreement with ECOTRUST. The price received for the sale of carbon credits as offsets at a given time ($6 per ton of CO2 for the first pilot) is the basis for the payment defined in the agreement with a given farmer. The price the farmer receives remains constant throughout the contract, although the instalments and payments can vary based on the performance and results achieved by the given farmer. The generation and trading of the PES credit sold in tons of CO_2 offsets is divided so that the farmer gets 60 percent of the sales, while the remaining sum covers administrative, monitoring and verification costs.

The payment a given farmer receives is based on the amount of carbon sequestered on

[9] PES can be defined as voluntary transactions where a well- defined ecosystem service (ES) (or land-use likely to secure that service) is 'bought' by at least one ES buyer from at least one ES provider, if and only if the ES provider secures ES provision (conditionality). The term covers payments for sustainable management of water resources and/or agricultural land, biodiversity conservation and storage and/or sequestration of carbon in biomass.

their land (calculated according to land area, number and type of trees). For soil and water conservation measures, this is paid by the acre of land under management. The price is based on a carbon proxy, marking up the price received by a farmer in an area of land where soil and water conservation measures are adopted alongside tree planting, by e.g. $2 per ton of CO2. The first five years' payments are for both watershed and carbon services, and final payments for carbon sequestration. The price received by farmers varies, based both on when they start the contract (and the price of carbon at that time) as well as their set targets in the land use plan and rate of achievement. The first payments were disbursed in September 2015.

A monitoring plan has been developed for the PES facility. Main indicators being monitored are the technical specifications provided by ECOTRUST for tree planting and soil and water conservation, and the agreed management practices set out in the land use plans. Monitoring is undertaken over a period of five years for soil and water conservation measures and 10 years for tree planting. Progress on soil and water conservation measures, for example, contour trenches, is measured in the first year, and then in following years the target is the maintenance of these trenches. For tree planting, for the first year a 50 percent survival rate of saplings is expected, then 100 percent by the second year, moving onto diameter breast height targets in later years.

Initially, ECOTRUST piloted the use of community monitoring. Groups of farmers were trained to undertake monitoring of each another. However, it was noted that the monitoring results generated were not reliable, as it was unrealistic to expect a farmer to be "penalizing a neighbour". ECOTRUST remained interested in building capacity to monitor at local level, so they decided to partner each farmer with an ECOTRUST staff member for monitoring visits. Results are monitored annually by these staff members together with farmers for soil and water conservation measures. For tree planting, this is done in accordance with the timeline for the agreed payment schedule.

Indicator milestones are set based on conservative estimates, so as to make them achievable for farmers. If targets are not achieved, farmers receive a letter explaining the corrective actions they need to take, and clarifying that payment will only be processed once these actions have been undertaken. In practice, this is likely to lead to payments being paid later than originally scheduled, once corrective actions have been undertaken.

Full case study available at http://www.undp.org/content/undp/en/home/librarypage/poverty-reduction/making-the-case-for-ecosystem-based-adaptation.html pages 127-130.

In EbA work involving afforestation or restoration of ecosystems, a major challenge for indicator development is the long time-frame in which benefits accrue, as vegetation becomes established. Because of this, there can sometimes be a tendency to monitor only outputs and outcomes of EbA work, as these fall within the project implementation period. Even where project M&E requirements seek only output and outcome indicators, however, there is great value in including indicators to monitor the eventual impact of EbA interventions on ecosystem functioning and the delivery of services that help communities adapt to climate change – in order to evaluate progress, to practise adaptive management, and to generate evidence for the effectiveness of EbA. For example, an

intervention on restoring mangroves for coastal protection might commit itself to monitoring plant survivorship, plant vigour, rate of growth, soil/sediment chemistry (where applicable) and water chemistry. Where feasible, monitoring of the following could also be included: stream flow, sedimentation, erosion, groundwater volume, wave energy, size of storm surges, and supply of non-timber forest products.

Monitoring may often need to be guided by scientists, but should maximise potential community participation in data gathering, using available technologies such as mobile phone apps to track measurements of indicators. The long-term data sets created can be used for adaptive management of project interventions both through the duration of a project and to inform future EbA investments beyond the life of the project. The full socio-economic and ecological benefits of EbA investments are often maximised a decade or more after the time of intensive ecosystem restoration. For this reason, long-term data sets from projects need to be owned and housed by national research institutions, and the long-term monitoring systems need to be embedded into mandates and budgets of national institutions.

3. Tools for assessing the benefits of mitigation and adaptation to enhancing resilience and emissions reductions that ecosystem-based adaptation provides

A number of existing tools were applied in the Mountain EbA Programme. A participatory assessment was carried out by IUCN in Sanzara Parish, in Mount Elgon, Uganda to develop social baselines. The Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) [10] and Climate Vulnerability and Capacity Assessment tool (CVCA)[11] were used to carry out rapid assessments of potential climate impacts and to see what adaptation measures communities were already undertaking. Five-year timelines and trends were developed based on available, national level climate data. A problem and solution matrix put forward main challenges linked to climate change – flooding and drought were the two prioritized problems. The matrix showed how these affected livelihoods and different categories of people. A list of 'no regrets' activities was identified based on the assessment and ongoing activities. Based on the list, pro-poor activities were prioritized. The PROFOR-IUCN Poverty-Forests Toolkit[12] was used to identify livelihood dependency on natural resources. Water shortage was identified as a key challenge for local livelihoods and resilience. IUCN will likely report into the NWP in more detail on the use of these tools.

[10] CRiSTAL is a project-planning tool that helps users design activities that support climate adaptation at the community level. A full overview of CRiSTAL is provided at https://www.iisd.org/cristaltool/

[11] CVCA, developed by CARE, is a community-level analysis tool that integrates climate change into a wider participatory vulnerability assessment. It can be accessed at http://careclimatechange.org/tool-kits/cvca/

[12] The PROFOR toolkit provides a framework, fieldwork methods and analytic tools to understand and communicate the contribution of forests to the incomes of rural households. http://cmsdata.iucn.org/downloads/profor_iucn_toolkit_overview.pdf

Vulnerability and Impact Assessment as a tool

The Mountain EbA Programme included as an output the development of a new tool for Vulnerability and Impact Assessment (VIA), integrating ecosystem considerations into the assessment approach. The details of this tool will likely to be reported into the NWP process by UNEP, as it was developed through UNEP's specialist biodiversity assessment centre, UNEP-WCMC.[13] VIAs provide a methodology for determining and quantifying, to the extent practicable, how vulnerable a particular area is to the impacts of climate change. At the outset of any adaptation initiative, an assessment of climate change implications for the composition and functioning of ecosystems, as well as the different aspects of human society (e.g. social well-being, economic activities) is required to determine whether, and the extent to which, climate change will have an impact. Once a determination has been made that climate change poses significant risks and that adaptation is needed to manage those risks, assessments are carried out to provide essential information to inform the subsequent components of the adaptation process: planning, implementation, and monitoring and evaluation.

The three VIAs conducted for the mountain programme are as follows, and are available upon request:

- Dixit, *A, Karki, M and Shukla, A (2015) Vulnerability and Impacts Assessment for Adaptation Planning in Panchase Mountain Ecological Region, Kathmandu*
- *Dourojeanni, D, Giada, S, and Leclerc, M (2014) Vulnerability and Impact Assessment of the Climate Change in the Nor Yauyos Cochas Landscape Reserve and its Buffer Zone. Technical Summary. Mountain EbA Programme in Peru.*
- *NaFORRI (2013) Ecosystem Based Adaptation in Mountain Elgon Ecosystem: Vulnerability Impact Assessment (VIA) for the Mt Elgon Ecosystem.* Republic of Uganda Ministry of Water and Environment, Kampala

Cost benefit analysis as a tool

Anther tool that was used in the Mountain EbA Programme, though not a new one, was the use of Cost Benefit Analysis to evaluate potential EbA interventions in comparison with other potential public sector investments, as part of making the case for EbA approaches. A number of economic tools and methodologies are available to evaluate, rank or prioritise EbA options, or compare them with non-EbA options.

Cost Benefit Analysis (CBA) can be used when the costs and benefits of an EbA option are measurable in monetary terms and the value placed on investing in the EbA option can be quantified. However, in certain cases it may be possible to attach monetary value only to the costs of a project, but not to the benefits. In this case, a cost-effectiveness analysis can be a useful tool. Multi-criteria analysis can be useful to decision-makers when environmental or social impacts cannot be assigned a monetary value. It can be

[13] Munroe, R, Hicks, C, Doswald, N, Bubb, P, Epple, C, Woroniecki, S, Bodin, B, & Osti, M (2015) *Guidance on Integrating Ecosystem Considerations into Climate Change Vulnerability and Impact Assessments to Inform Ecosystem-based Adaptation,* UNEP-WCMC, Cambridge, UK.

used to consider a full range of criteria, e.g. social, environmental, financial, economic and technical.

The Mountain EbA Programme decided to use CBA as its methodology for making the economic case for EbA, as it is a widely used methodology accepted by decision-makers, especially in the Ministries of Finance and Planning. Compared to other methods, it provides an objective way of ranking alternatives. For example, the Ministry of Economy and Finance in Peru uses CBA for appraising projects and only accepts CBA as a project appraisal tool. Given that the Ministries of Finance were key partners of the project and a target audience for whom to make the case for EbA, the use of CBA was deemed particularly relevant for this programme.

The programme also considered targeted scenario analysis (TSA), which uses socio-economic indicators to compare the pros and cons of continuing with business as usual (BAU) or following in which ecosystems are more effectively managed (sustainable ecosystem management/ SEM). This approach can also be applied to compare a BAU scenario with an EbA scenario. It is conducted for a particular productive or consumptive sector, with a specific decision- maker in mind who has the mandate to make policy or investment decisions that could bring about a shift from a BAU path to a SEM/EbA path. Although a full TSA approach was not applied in any of the three programme countries, the methodology influenced the way that the results from assessing costs and benefits were presented in the three countries.

Case Study: Targeted Scenario Analysis (TSA)

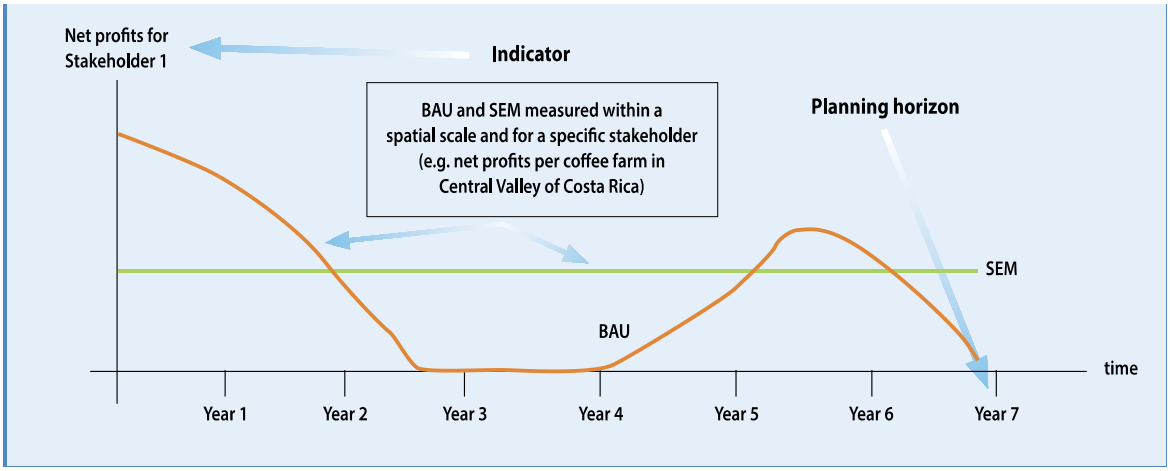
TSA compares the implications of two contrasting management strategies on the basis of relevant socioeconomic indicators (both quantitative and qualitative) for a specific productive or consumptive sector. It draws from all available information, from existing or newly generated data to expert opinions. TSA is a balanced presentation of evidence, weighing the pros and cons of continuing business as usual (BAU) or following a sustainable development path in which ecosystems are more effectively managed (SEM). A TSA is conducted with a specific decision-maker in mind (e.g. government official or business). The appeal of the TSA approach in making a case for EbA is its graphical presentation of results. Information on a specific decision and/or management practice is presented as a continuous, long-term analysis, showing relative change over time.

The five steps of a TSA are: i) defining the purpose of the analysis; ii) defining the BAU baseline and SEM intervention; iii) selecting criteria and indicators; iv) constructing the BAU and SEM scenarios; v) making an informed policy or management recommendation.

The main product generated using the data amassed during a TSA is a set of graphics, with time on the horizontal axis and a measurable indicator, such as revenues or number of jobs, on the vertical axis. In the graph there are two curves, one capturing and depicting BAU and one the SEM (or EbA) scenario. A TSA graphic should be accompanied by a narrative that explains whom it is for (stakeholders), how it was generated (assumptions, data sources) and levels of confidence and uncertainty, among other things. This complementary text will both rationalize the graphs and also act as the

bridge between the graphs and policy decisions.

Targeted Scenario Analysis: changes over time



The TSA guidebook can be downloaded from http://www.undp.org/content/undp/en/home/librarypage/environment-energy/environmental_finance/targeted-scenario-analysis.html

Results and lessons from Cost Benefit Analysis

The results from the CBA carried out in the three countries have been written up and are available on request. The CBA for the project in Nepal showed that planting broom grass as an EbA measure to control soil erosion and provide drought-resilient livelihoods was more beneficial than business-as-usual grassland management. Constructing gabion walls with anchoring vegetation was also found to be a beneficial EbA investment.

The CBA from Peru shows that the adoption of EbA measures around sustainable grassland, livestock and vicuña management in the community of Tanta is economically preferable to current management practices.

The results of the cost-benefit analysis from Uganda showed that EbA farming practice was not only viable compared to non-EbA farming practice, but also that the viability can be sustained in the long run. The Uganda analysis also suggests that EBA practice should be linked to strong commodity value chains to enhance the monetary income that farmers earn.

General lessons learnt from the process of undertaking CBA in the Mountain EbA programme were as follows:

- **Cost-benefit analysis provides an objective, widely accepted methodology for quantifying EbA costs and benefits.** CBA can be used to guide decision making on EbA. This can be done with regards to assessing whether EbA is a beneficial investment as such; whether it is more beneficial than not taking action or a 'business as usual' scenario; or in comparison to other adaptation options (e.g. infrastructure-based options).
- **Challenges for doing CBA for EbA include conceptualizing and assessing the**

multiple benefits provided by EbA, for example with regards to climate change adaptation and ecosystem functioning. This affects both how the scope of the CBA is framed, as well as the inclusion of interlinkages and benefits of e.g. pasture management, water regulation and soil conservation functions into CBA calculations. Measuring such benefits can require both time and scientific expertise. Lack of data can lead to undervaluing EbA benefits, while the time needed to gather data can be too long in relation to the need for quick CBA results to guide specific decision-making processes. Proxy data from other sites can sometimes be used for carrying out CBA for EbA, for example, transferring data for assessing broom grass yields and soil erosion control capacity from other similar sites.

- **CBA results can be used to make the economic case for EbA to public investors, such as local governments or Ministries of Finance, or to private investors such as individual farmers or private companies.** The hard quantified data provided by CBA can be particularly relevant when reaching out to new sectors, such as Ministries of Finance or Planning, and when making the case for the value of hybrid green-grey approaches to adaptation over approaches based only on grey infrastructure interventions. Ministries of Finance and private sector investors are key players for providing sustainable financing for EbA.

- *Download here a Learning Brief that highlights how cost-benefit analysis (CBA) can be used to make the economic case for EbA. Proving the cost effectiveness of EbA measures is essential to making the case for EbA to stakeholders, ranging from local communities and planners to national level decision-makers and donors.* *http://www.undp-alm.org/resources/project-brief-fact-sheet/learning-brief-3-making-economic-case-ecosystem-based-adaptation*