

# Valuing alternative resource management practices to improve ecosystem services in the upstream and downstream communities of the Bale Eco-Region



## Background

The Bale Eco-Region (BER) represents the largest area of Afro-alpine habitat on the African continent. It is endowed with high biodiversity resources resulting in the designation of its central areas as national parks, called the Bale Mountains National Park. Around 12 million people both in the BER within Ethiopia and beyond (Somalia and Kenya) are directly or indirectly depending on several ecosystem services of the BER. However, driven by growth pressure of both people and livestock, the BER is degraded and its ecosystem functions are extremely disturbed. Its forests are experiencing high rates of deforestation; between 2010 and 2014, its total forest cover was reduced by about 2.3% (Farm Africa, unpublished data). Its deforestation and forest degradation are caused by conversion of forests into farmland, recurrent fires, livestock overgrazing, and timber extraction, all in a context of poor law enforcement leading to loss of biodiversity, acceleration of soil erosion and flooding, shortage of fodder, decline in quality and quantity of water resources, decline in the value of timber and non-timber forest products and increase in emission of greenhouse gasses. Interventions such as reforestation, exclosures, and Soil and Water Conservation (SWC) measures have been going on for the past decades and have made a considerable impact on reducing soil erosion, conserving biodiversity, increasing carbon sinks, stabilizing and cleaning of water flow and availability of fodder, and improving timber and non-timber value, etc. However, these interventions

Boy showing his catch of the day from a river in the lowlands of the Bale Eco-Region.

## Summary

The Bale Eco-Region in South-Eastern Ethiopia is an important region as it is considered a biodiversity hot spot, and as it provides several other ecosystem services including fertile soils, forests and water. These natural resources are at risk of degradation. A study was carried out to provide insights into the extend to which communities value required interventions to minimize future degradation of natural resources. It was found that people are quite aware of the adverse impact of human activities on the health and functions of the ecosystems, and that they are willing to contribute to alternative resource management practices (interventions) that improve ecosystem services in the area. Since communities, particularly those who live in areas downstream and outside of the Bale Eco-Region, are expected to benefit from conservation efforts it is important to facilitate compensation schemes for upstream communities. One way of doing this is through development of a payment scheme for ecosystem services. For effective implementation of such a scheme, concerned bodies should jointly discuss and develop such a scheme and tailor it to the conditions of the area.



in the area were not as successful as expected. This is because the communities have not been involved in the process, and therefore the opinions and preferences of the communities living in the area have not been considered. Thus, this study seeks to analyze community preferences to select the most suitable interventions for improved ecosystem benefits of BER and estimate their Willingness To Pay (WTP) using a choice modelling approach.

## Methodology

The study was conducted in Harena Buluk District in the BER, specifically in two *Kebeles* known as: Kumbi (midland, i.e., 1,300-2,300 meters above sea level [masl]). These *kebeles* were selected based on their agro-ecological representativeness and interconnectivity with regards to ecosystem service flows and Melka Arba (lowland, i.e., 272-1,300 masl). In each *Kebele*, 100 households were selected randomly. A structured questionnaire was used to gather primary data from these households.

A so-called choice modelling approach was used to estimate the non-market values of BER ecosystem benefits. In this regard, respondents were presented with a series of alternatives, differing in terms of attributes and levels, and they were asked to choose their preferred option. The first step of the experiment was identifying the choice attributes of ecosystem services in BER and defining their levels.

An extensive literature review was carried out so as to ensure selecting meaningful and important attributes and levels. Moreover, Focus Group Discussions (FGDs) and Key Informant Interviews (KII) were conducted with communities and experts from zonal and district-level agricultural offices and local development agencies. Based on information gathered from the literature review and fieldwork, three interventions (reforestation, exclosures and SWC) were selected. Altogether five attributes were chosen related to each of these interventions (see Table 1).

The next step was the construction of choice sets via experimental design using fractional factorial design and presenting these to the respondents to collect primary data. The Mixed Logit Model (MXL) was estimated using the statistical package of Stata version 12.

Following mixed logit outputs, Marginal Willingness To Pay (MWTP) and Compensating Surplus (CS) were calculated. MWTP is the amount of money respondents are willing to contribute to improved ecosystem services. It is calculated as the ratio of the coefficient for a certain attribute to estimated monetary coefficient. CS is the average WTP of respondents for changes from the status quo to alternative improved scenarios. It is estimated by calculating the difference between the Value of the Improved alternative options ( $V_i$ ) from the Value of the Status Quo ( $V_0$ ) and multiplying this by the negative inverse of the coefficient for the payment attribute.

## Key findings

### 1. Importance of biodiversity in valuing reforestation interventions

Biodiversity is not considered or prioritized as an important attribute in the midlands. This is because midland farmers expect that protecting

biodiversity might reduce their current resource consumption. The other reason for giving it low importance is the limited awareness, particularly of households on their future direct and indirect benefits. Many argued that in their area is high. In contrast, biodiversity is low in the lowlands; hence, respondents gave it more importance. Improving carbon dioxide ( $\text{CO}_2$ ) sequestration also received a significant WTP value, implying that they might expect measures which increase forest coverage in the area that would positively impact  $\text{CO}_2$  storage that, in turn, would increase their benefits from carbon markets.

### 2. Soil and water conservation choice

Contrary to what is expected, the midland respondents care less about improvements made on the runoff and sediment load in the SWC choice experiment (CE). This is likely because they did not consider runoff and sediment as a serious problem since the area is relatively well covered by forests. On the other hand, lowland respondents give high value to all attributes, i.e., increasing soil moisture and fertility, reducing runoff, reducing sediment load and stabilizing water flow.

### 3. Valuing all attributes associated with exclosures

Respondents in the lowland area value all attributes associated with exclosure area namely: biodiversity enrichments, reducing soil erosion, improving livestock feed, and construction of water points presented in the choice experiment. Furthermore, they place higher value on livestock feed availability followed by improving exclosures with watering points, expecting that improvement on both attributes would improve the productivity of their livestock.

### 4. Estimated Marginal Willingness To Pay (MWTP)










The MWTP for improvements in reducing soil erosion,  $\text{CO}_2$  storage and harvesting non-timber forest products for midland respondents was estimated at Ethiopian Birr (ETB) 35, 33 and 32 per year, respectively. The MWTP to reduce soil erosion, improve biodiversity and availability of livestock feed and set up exclosures with watering points for lowland respondents was ETB 24, 11, 280 and 129 per year, respectively. The MWTP was not reported for all SWC attributes presented in the CE for midland and lowland respondents. This is because it is usually accepted that the estimated MWTP from the highly insignificant monetary attribute might be incorrect and irrelevant.

### 5. Estimated Compensating Surplus (CS) under Two Scenarios

The estimated CS for midland reforestation program increases as the status of ecosystems is improved, particularly the attributes of soil erosion,  $\text{CO}_2$  storage and Non-Timber Forest Products (NTFP). Midland respondents mean WTP for low impact improvement scenario is ETB 1,827 (\$87)/year, and under the medium impact improvement scenario it is as high as ETB 2,517 (\$120)/year. The Bale midland communities' average WTP in terms of labor and money for the reforestation program increases to ETB 3,053 (\$145)/year for the attributes scenario related to higher level of reforestation (Figure 1).

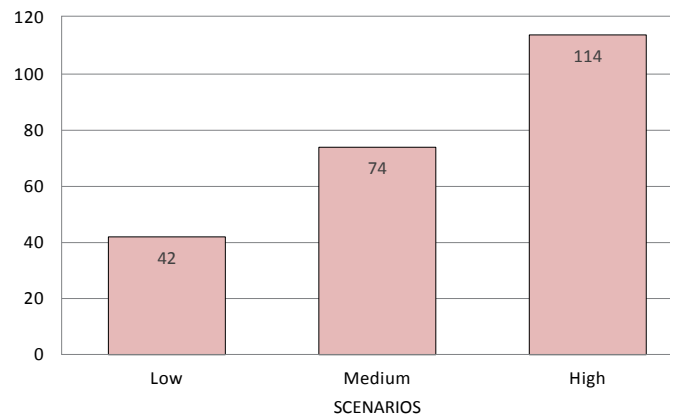
The lowland respondents' mean WTP for the exclosure program also

**Table 1. Attributes and scenarios by intervention designed for midland and lowland communities.**

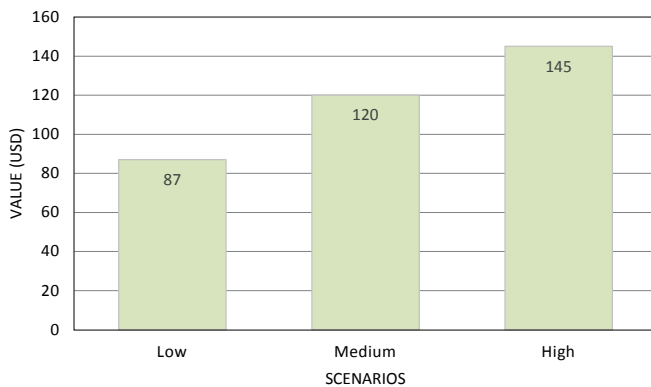
Attributes		Intervention			Scenarios	
Name	Illustration	Reforestation midlands	Exclosures lowlands	SWC midlands and lowlands	Improvement	Status quo
Biodiversity					Number of flora and fauna species will be conserved	No change
Soil erosion					Level of soil erosion will be reduced	No change
CO <sub>2</sub> storage					Level of CO <sub>2</sub> storage will increase	Current CO <sub>2</sub> storage
Non-timber forest products					Level of non-timber value will increase	No change
Availability of livestock feed					Level of livestock feed improvement	No change
Watering points					Increased number of watering points	No change
Soil moisture and fertility					Improvement in soil moisture and fertility	No change
Runoff/flooding					A) Peak flow reduced B) Sediment load reduced	No change
Stabilizing water flow					Improvement in groundwater and surface water	No change

increases as the status of ecosystem services related to the exclosure program is improved. Respondents are willing to pay ETB 882 (\$42), 1,558 (\$74), and 2,383 (\$114) annually for low, medium and high impact scenarios, respectively (Figure 2).

CS estimated from insignificant payment level (associated with SWC choice experiment) is not reported here since the value likely to be incorrect.



**Figure 2: CS for Exclosure Attributes Improvement Scenario (EAS); Low, medium and high represent impact improvement scenarios.**



**Figure 1: CS for Reforestation Attributes Improvement Scenario (RAIS).**

### Conclusions and policy implications

The study confirmed that across the BER most households are aware of the adverse impact of human activities on the health and functioning of the ecosystem. Communities are willing to contribute to alternative resource management practices (interventions) that improve ecosystem services in the area. Management strategies that fully involve local communities at all stages of implementation (starting from preferred

attributes selection) may help development planners and practitioners to address the problems associated with ecosystems.

The survey results also showed that midland respondents are not willing to pay for the improvement of biodiversity, which may be due to a lack of awareness of its benefits. Another explanation could be that farmers expect their current consumption to be perceived negatively by those who try to preserve biodiversity in the BER. Therefore, governmental and nongovernmental organizations need to create awareness on the direct and indirect future importance of biodiversity to the people in the BER.

Since the downstream communities living inside or outside the BER, i.e., within and outside Ethiopia (e.g., Somalia and Kenya) are expected to benefit from the ecosystem conservation, it is important to facilitate compensation schemes for upstream communities, for example, through development of a Payment for Ecosystem Services (PES) scheme. For effective implementation of this scheme, concerned bodies should jointly discuss and develop a specific PES strategy tailored to local conditions. Moreover, hydroelectric power and carbon payments are potential financing mechanisms for improved watershed management that should be explored further.

## About the SHARE Bale Eco-Region project

Conservation of Biodiversity and Ecosystems Functions and Improved Well-being of Highland and Lowland Communities within the Bale Eco-Region (BER) is one of the European Union (EU)-funded projects that stands for Supporting Horn of Africa Resilience (SHARE). In Ethiopia, the project covers 16 districts (*Woredas*) in West Arsi and Bale Zones of Oromia Regional State, with around 22,000 km<sup>2</sup>, comprising a population of about 3.3 million. The life span of the project is 42 months starting in July 2014 and ending in November 2017. Five partners are implementers of the project, which are: Farm Africa, SOS Sahel, International Water Management Institute (IWMI), Frankfurt Zoological Society (FZS) and Population Health and Environment (PHE).



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