A Report

On

Assessment of Payments for Ecosystem Services (PES) in three selected CLM Watersheds

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EXECUTIVE SUMMERY

Land degradation in Ethiopia has led to biodiversity loss and a decline in ecosystem services, affecting smallholder farmers and the economy. Implementing sustainable land management (SLM) interventions is essential for reversing this trend and restoring ecosystem services, particularly in watershed regions. While SLM practices have been gradually implemented, sustaining the flow of ecosystem services to downstream areas requires the implementation of a payment for ecosystem services (PES) scheme. Effective implementation involves identifying marketable ecosystem services, potential buyers, and determining willingness to pay and accept within specific geographical boundaries.

Data collection from three selected CLM micro-watersheds involved stratification into upstream and downstream areas, with Community Watershed User Cooperative (CWUC) members representing ES sellers from upstream and ES beneficiaries from downstream. Various methods, including field surveys, 9 focus group discussions (FGDs), and 51 individuals as key informant interviews (KIIs), were used to collect data from a total of 90 respondents, facilitating a comprehensive understanding of PES implementation dynamics. Accordingly following key findings were presented:

Identification of marketable ESs - Through various data collection methods, several marketable ESs were identified, such as honey production, food production, and fuelwood under provisioning ESs. However, market linkages for regulation, supporting, and cultural ecosystem services pose challenges. Payment for ecosystem services (PES) emerges as a solution to compensate for regulating ESs' value. SLM practices in micro-watersheds have notably mitigated flooding, soil erosion, and sedimentation, enhancing water availability and resilience to climate change. Upstream dwellers in all three watersheds, organized as Community Watershed User Committees (CWUCs), are potential sellers of ESs, owning rehabilitated land and forests critical for downstream benefits. However, they lack adequate compensation for their contributions, despite receiving revolving funds. Optimistically, additional potential buyers may emerge, enabling CWUCs to receive incentives comparable to other managed nature regeneration projects.

Potential buyers of marketable ESs- Identifying potential buyers for ecosystem services (ESs) is paramount for ensuring ecosystem sustainability within a specific area. Both public and private buyers of ecosystem services (ESs) show a preference for receiving Payment for Ecosystem Services (PES) in the form of social and infrastructure developments, while downstream farmers in the Madoye micro-watershed express a willingness to contribute their labor as part of the PES scheme. For example, these farmers aim to construct soil bunds (65% coverage) and fanyaa juu (35% coverage) using their free labor and estimated their annual contribution would amount to 2,790,000.00 ETB. Of this sum, 918,430.00 ETB could cover the opportunity cost for constructing soil bunds and fanyaa juu on their lands.

Similarly, the Boloso Bombe Woreda Water and Sanitation office emerges as a potential ES buyer. By implementing an additional charge of 1 Birr/m3 of water to users, the town could

generate 48,888.00 Birr per year[1] annually, which could fund SLM interventions in the upstream area of the watershed. This revenue could increase to 97,776.00 Birr/year with a charge of 2 ETB/m3 and to 146,664.00 Birr/year with a charge of 3 ETB/m3, thus incentivizing non-tradable ESs for potential buyers.
BGI Beer Industry in Tigray actively sought ESs like water supply and sediment control from upstream areas. They engaged with upstream farmers to address sedimentation issues and invested in afforestation and sediment control structures to ensure sustainable freshwater supply. Today, the industry provides incentives to local farmers, including job opportunities, animal feed, and small-scale irrigation facilities, showcasing an active role in securing ecosystem services.

Willingness to pay (WTP) and willingness to accept (WTA) - Understanding the dynamics of WTP and WTA is crucial for successful negotiation in ESs markets. Assessing market context, including regulations and pricing mechanisms, is vital for executing PES schemes effectively. Factors influencing WTP include voluntary participation, perceived ES value, buyer needs, and ecosystem service status. For instance, the BGI beer industry's 6,000,000.00 ETB investment in controlling upstream soil erosion and flooding demonstrates buyers prioritizing services like freshwater access. Aligning buyer needs with sustainable practices ensures preservation and equitable compensation of ESs. Meanwhile, entities like Mercy Water Bottling Industry offer non-monetary compensation to upstream farmers for clean water and reduced flood risks, highlighting the role of government and partner organizations in facilitating negotiations and ensuring fair compensation for ecosystem services.

Value chain for marketable ESs- Establishing markets for ESs is challenged by the absence of direct market pricing, prompting the implementation of Payment for Ecosystem Services (PES) schemes. These function as market-driven tools to incentivize natural resource conservation, addressing environmental market failures. For instance, in the Madoye micro-watershed, measures like flood risk mitigation and sediment retention require compensating CWUCs members for their role in resource management. The value chains in Madoye encompass sellers, buyers, intermediaries, and payment methods, ensuring equitable compensation for ecosystem services.

Upstream CWUCs play a vital role in meeting diverse economic, social, and environmental needs across micro-watersheds like Madoye, Mlihay, and Temba. Beneficiaries include entities such as the Municipal Water and Sanitation Office, Ethiopian Electric Power (EEP), and downstream communities. Similarly, in Mlihay, major buyers like the Mercy Water Bottling Industry and Tekeze Sub-basin Authority rely on upstream ESs, emphasizing the importance of compensating sellers for their contributions.

Furthermore, in Temba, potential buyers such as municipal water and sanitation offices and the Ministry of Agriculture are identified, underscoring the widespread applicability of market-

[1] This is the additional amount of money collected from water users per a year. The amount of money collected from the sale of water becomes low because of a smaller number of water users as well as less water unit price.

based PES schemes. These findings highlight common ESs across micro-watersheds, providing opportunities for uniform PES designs. Ultimately, market-based approaches offer a pathway to sustainably manage ecosystem services while meeting the diverse needs of both buyers and sellers across watershed regions.

Effective negotiation facilitated by intermediaries and brokers, such as government and partner organizations is essential for a successful PES scheme. Output-based PES payments, timed according to the maturity level of ESs or the satisfaction level of buyers, are recommended, ensuring that all seller costs are covered. Regular monitoring, verification, and evaluation between buyers and sellers further enhance the sustainability of ecosystem service flows between upstream and downstream dwellers. Access to verified guidelines for PES scheme preparation, awareness creation, government leadership, and positive reinforcement of existing buyer systems are crucial for effective implementation. Assigning responsible institutions to oversee negotiation, monitoring, evaluation, and positive reinforcement between sellers and buyers is paramount for successful PES implementation.

CHAPTER ONE: INTRODUCTION

1.1 Review of the general context

Land comprises a range of biophysical components such as soil, water, flora, and fauna, embedded in a landscape shaped by its geomorphology and subjected to a climate that is often under different forms of human manipulation. Land provides natural habitats and serves many purposes for agriculture, forestry, pastoralism, infrastructure development, mining, and tourism. Apart from these so-called economic uses, land provides a range of ecosystem services such as nutrient cycling, carbon sequestration, and water and air purification; it also fulfils social and spiritual needs (Vlek et al., 2017). According to MEA (2005), food, forage, fibres, fuel, and forest products derived from ecosystems have sustained an increasing population, but at a cost. As the demand for these products multiply, other ecosystem services are being degraded or used unsustainably (Vlek et al., 2017). Therefore, even if some ecosystem services such as food production has been increased globally due to technological usage while other services such as soil erosion control, flood risk mitigation, habitat/refugee, and other regulating ecosystem services have shown a gradual reduction. This means that land degradation is still a problem globally and in Ethiopia particularly.

Reversing land degradation and promoting the concept of land degradation neutrality (LDN) in Ethiopia requires stakeholder's commitment. Mainly, the collaborative works between farmers, government and development partners is believed to bring some positive practical as well as behavioural changes at the local level. Addressing land degradation in Ethiopia requires investment in SLM interventions. Initially, SLM was launched in 2008 to address two important developmental and environmental problems: agricultural productivity and land degradation (Hurni et al., 2010). Reducing land degradation and improving land productivity in selected watershed is the main targets of the current SLMP in Ethiopia. Ethiopian Strategic Investment Framework for SLM (ESIF1) has been guiding investment in SLM for the last 15 years and the second ESIF is currently under preparation. Following this guideline, Ethiopia has implemented different programs and projects, and gaining good experience out of them aimed at sustainable land management with the support of development partners. The Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ), has been supporting the different phases of the SLM program in Ethiopia.

As a result of SLM intervention in support of partners, reversing land degradation has been gradually realized and local ecosystem services have been improved. Such ecosystem service enhancement has contributed a positive impact on both the local environment as well as on the livelihood of the community. Although there are benefits collected from the ecosystem in the form of services such as water supply, payments for the benefits gained from ecosystem service were found almost rare in Ethiopia. However, the Ethiopian government has established a proclamation (proclamation nº 1223/2020) that could able to solve the above-mentioned problems and ensure sustainable ecosystem service benefits in the local area. The proclamation is used for the establishment of community watershed users' cooperatives (CWUCS). The main reason for the establishment of the proclamation is to prevent environmental degradation and natural resources depletion, biodiversity conservation, develop water resource, and reduce

greenhouse gas emissions in order to maintain the productivity of the land for the future generation with a view to creating suitable conditions for crop and livestock development. Moreover, the proclamation is further having the potential to play an important role in the facilitation, planning and implementation of community-based land management (CBLM) interventions and sustaining ecosystem service in the local area. This further ensures sustainable management of natural resources by the community and improves sustainable livelihood income generation options and mechanisms for the community. Development of payment for ecosystem service (PES) could serve as a sustainable solution to these concerns.

The "Climate-Sensitive Innovations in Land Management" (CLM) is a technical cooperation (TC) module of the program "Sustainable Land Management and Food Security in Ethiopia" within the sectoral focal area of "Sustainable Use of Natural Resources, Agriculture and Food Security" of the German-Ethiopian Development Cooperation. GOPA Worldwide Consulting GmbH (GOPA) has been engaged by the Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ), to support the implementation of Output 2 of the project "Climate-Sensitive Innovations in Land Management" (CLM)**,** which is a technical cooperation (TC) module of the program "Sustainable Land Management and Food Security in Ethiopia". The objective of GIZ CLM project Output 2 is "The delivery capacities of agricultural advisory service providers for services regarding the establishment of efficient community based SLM organizations are strengthened". The successful implementation of Output 2 of the CLM project is expected to capacitate local service provider institutions, extension experts and development agents, enable community watershed user Cooperatives (WUCs) to effectively use and manage watershed resources.

1.2 Assessment Objective

1.2.1 General objective

The general objective of the assessment was to identify potentials of Payments for Ecosystem Services (PES) in selected CLM watersheds and design the establishment of sustainable PES schemes.

1.2.2 Specific objectives

The specific objectives of the assessment include the following main points.

- Identify marketable ecological services created by the community watershed development (CWDP) in selected CLM watersheds.
- Identify potential market/buyers for the created ecological services in the area.
- Determine the ecological service buyers' willingness to pay for the improvement in the ecological services.
- Determine community watershed user cooperative' (CWUCs) willingness to accept payment for the ecological services to sustainably manage the natural resources.
- Determine the value chain in terms of market-based mechanisms.
- Design alternative market exchange mechanisms (incentive- or market- based mechanism) or schemes for the ecological service marketing.

1.3 Scope of the assignment

1.3.1 Specific location and activities

The scope of the assessment was to identify potentials of Payments for Ecosystem Services (PES) in selected CLM watersheds available in three regional states.

Table 1: List of selected Watersheds

№	Name of the Region	Name of the Zone	Name of woreda	Selected watershed
1	South Ethiopia Regional State	Wolaita	Boloso Bombe	Madoye
2	Benishangul-Gumuz Region	Assosa	Homosha	Temba
3	Tigray Regional State	Southern	Emba Alaje	Mlihay

1.3.2 Specific target groups of the study

The assessment of Payment for ecosystem services (PES) was conducted in three selected watersheds available in three regional states as mentioned in Table 1. The characteristic of each micro-watershed, including the potential buyers of ecosystem services are explained as follows.

Madoye watershed, located in Boloso Bombe woreda, Wolyita zone, South Ethiopia, covers 645.5 hectares. The Community Watershed Users Committee (CWUC) comprises 169 members, with 1,425 households in the watershed. Targeted buyers include individual farmers engaged in irrigation, downstream communities benefiting from flood control and water resources, Gibe-III dam for siltation protection, Boloso Bombe woreda municipality, and World Vision Ethiopia.

Mlihay watershed, found in Atsela Kebele of Emba Alaje Woreda, Southern zone, Tigray, covers 795 hectares. The CWUC consists of 200 members, with 233 households in the watershed. Potential buyers include individual farmers practicing irrigation, downstream water users, and industries such as Maitchew Particle Board and Mercy water bottling.

Temba watershed, located in Gumu Kebele, Homosha Woreda, Assosa zone, Benishangul Gumuz, covers 836.08 hectares. The CWUC comprises 101 members, with 62 households using irrigation in the watershed. Targeted buyers include individual farmers engaged in irrigation, downstream water users, and Homosha Woreda municipality water and sanitation office. In addition to the above points, the followings are the key features of the selected CLM micro-watersheds:

1. Traditional agroforestry systems in the upper stream of Madoye micro-watershed, featuring enset, coffee, fruit trees, and other vegetation. Apiary farming holds potential in this area.
2. Expansion of irrigation practices in the downstream areas of all three micro-watersheds.
3. Challenges related to soil acidity in Madoye and the proliferation of eucalyptus trees in the three selected CLM micro-watershed.

The detailed characteristic of each micro-watershed is presented under Annex I.

The assessment focuses on upstream and downstream areas within the micro-watersheds. Upstream communities implement sustainable land management (SLM) measures, while downstream households depend on ecosystem goods and services produced at upstream. Downstream dwellers are potential buyers, including private and public sector institutions. This approach aims to establish a framework for marketable ecosystem services, where buyers benefit from upstream conservation efforts while sellers receive compensation for their environmental stewardship. By identifying key stakeholders and their roles, the assignment seeks to promote sustainable resource management and equitable distribution of benefits within and across watersheds.

CHAPTER TWO: METHODS OF THE STUDY

2.1 Assessment Approach and Methodology

2.1.1 General approach and Work flow

For addressing the objectives of the assignment (marketable ESs, market/buyers for ES, data related to WTP, WTA, and value chain (VC) for ES marketing), cross-sectional survey design was used. A mixed method (qualitative and quantitative) was used for effectively addressing the goals of the assignment. Since the assessment demands the perspectives of different individuals and groups, participatory approach was employed. More specifically, the following individuals or groups of the societies were the main target for the implementation of participatory approach in each selected watershed:

- Community Watershed Users Cooperatives (CWUCs) leaders and their members,
- Head Woreda office of agriculture/ Woreda Administrator,
- Woreda cooperatives organizing expert,
- SLM focal persons,
- Kebele leaders,
- Potential buyers of ecosystem service such as public sector institutions, private sector, local NGOs, downstream farmers and international agencies,
- NRM professionals from the nearby University and research sites,
- Regional NRM expert/ SLMP coordinator,
- Development agents (two DAs, who have involved in NRM or cooperative organization).

2.1.2 Types of data and their Sources

A combination of primary and secondary sources used - Primary data collection methods included field transect walks, personal interviews, focus group discussions (FGDs), and key informant interviews (KIIs) conducted in the selected watersheds. Secondary sources were utilized to triangulate and supplement the primary data, enhancing the validity of conclusions drawn. These secondary sources comprised project documents, analyses of existing studies in the selected watersheds and surrounding areas, as well as publications, government reports, and documentation.

2.1.2.1 Primary data sources, methods, and sampling for interview, FGD, and KII

Survey questionnaires gathered general data on Community Watershed Users Cooperatives (CWUCs) members in the three watersheds. Semi-structured interviews collected primary data from CWUCs members, with sample members chosen via simple random sampling. The woreda Sustainable Land Management (SLM) focal person facilitated respondent selection. Each watershed was divided into upstream and downstream sections, with respondents chosen from both to ensure diverse data. Then, from each micro-watershed community, 30 representative samples were selected. A total of 90 individuals were selected from the three micro-watersheds. Furthermore, a total of 9 FGD and 51 individuals were targeted for KII from the sample micro-watersheds. Annex II explained the detailed Data types, source, methods, and sampling for interview, FGD, and KII.

2.1.2.2 Literature and desk review as a secondary data source

Secondary data sources, including published and unpublished documents, reports, and domestic and international experiences, were reviewed to supplement primary data collection. The literature review concentrated on essential concepts relevant to the study, drawing insights from various sources such as documents from watersheds, woredas, regions, and other countries. This desk review aimed to enrich the study by providing additional quantitative and qualitative data while not substituting for primary data collection efforts.

2.1.3 Determining WTP, WTA, VC, and scheme for PES

In this study, the variables considered for implementing payment for ecosystem services (PES) in the selected micro-watershed include ecosystem services (ESs) buyers' willingness to pay (WTP) for improved ecological services, Community Watershed Users Cooperatives (CWUCs) willingness to accept (WTA) payment for ESs, value chain (VC) for ESs marketing, and the establishment of a scheme for sustainable PES.

Willingness to accept (WTA) in economics refers to the minimum monetary amount a person is willing to accept to sell ESs or bear a negative externality, such as pollution. Identification of the ESs to be valued is followed by assessing potential buyers, such as downstream farmers, industries, municipalities, and other relevant stakeholders, to determine their willingness to pay (WTP). WTP serves as a tool to measure the positive changes resulting from interventions in the micro-watershed, particularly for beneficiaries of the change (Ureta et al., 2022).

2.1.3.1 Parameters used to identify ESs buyers

Identifying ecosystem service buyers can be complex, varying depending on the service provided. For instance, water utility companies may lead projects to improve water quality, facilitating buyer identification. However, for services like carbon sequestration, finding suitable buyers is challenging and often requires support from government, development partners, or research institutions.

In this assignment, potential buyers in the selected CLM micro-watersheds were identified based on specific parameters:

- Proximity to the micro-watershed: Buyers were considered both within and outside the micro-watershed, including the larger watershed it belongs to.
- Beneficiaries of ecosystem services: CWUCs members were recognized as service users but not buyers.
- Types of ecosystem services: Buyers were categorized based on the type of service, ranging from local to international.
- Motives for investment: Organizations like Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU) have incentives to invest in upstream land management to mitigate soil erosion and sedimentation, benefiting from improved water quality for electricity generation.

Successful PES implementation requires identifying such incentives and engaging relevant stakeholders effectively.

2.2 Data quality assurance

To ensure high standards of the data collection process and ultimately to ensure the reliability of the data collected, we adopted three main strategies. **First,** all filled out questionnaires were checked by the supervisor daily and centrally administered by the lead consultant. **Second,** there were a random back-checking of data collectors work by the field supervisor to make sure that the quality of the data is not compromised. **Third**, the supervisor was also in charge of checking all the filled questionnaires and interview results on spot at the field level. Therefore, lead consultants examined questionnaires completeness, accuracy, and consistency of responses and make appropriate corrections before leaving the selected micro-watershed site. With the preliminary quality control at the field level by lead consultant, rigorous data validity and consistency checks such as editing, coding and the data cleaning exercises were employed as part of the data quality control exercises before starting the analytical work by the data manager at the office level.

2.3 Data Analysis

As far as data analysis is concerned, the consultant employed different analytical approaches to analyse information obtained through quantitative and qualitative methods.

2.3.1 Quantitative Data Analysis

Quantitative analysis of the information was generated using a database created in IBM SPSS Version 20. The analysis of quantitative data was carried out using descriptive statistics (mean, frequency, percentage, etc.).

2.3.2 Qualitative Data Analysis

The qualitative method of data analysis includes among others, content analysis, transcription, synthesis, narration, and thematic presentations. To that effect, all audio-recorded interviews or field notes were translated from the local language into English and transcribed during and after data collection. Emerging themes was developed from the interviews, FGD and KII from each micro-watershed. Considering both quantitative and qualitative data types, the data analysis and reporting were taking the following paths as illustrated by Figure 1.

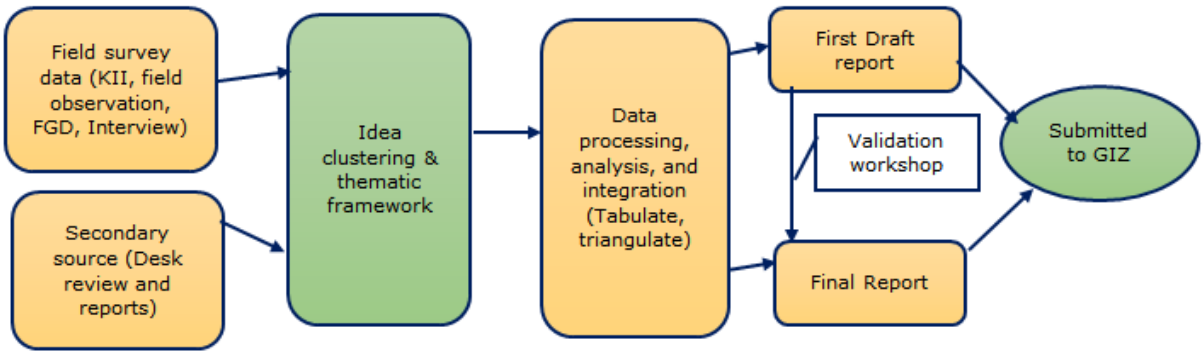

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Figure 1: Flow path of data analysis in the selected watershed.

CHAPTER THREE: LITERATURE REVIEW

3.1 Payment for ecosystem services

Payments for ecosystem services (PES) represent a mechanism wherein buyers compensate land managers for implementing sustainable land management (SLM) practices that support restoration and ecosystem services (Besacier, 2021). PES can offset economic incentives for deforestation by making restoration activities more profitable long-term. Key elements of PES include involving both buyers and sellers voluntarily, defining specific ecosystem services tied to land use, and ensuring continuous service provision monitored over time. Payments typically involve cash, although other benefits may be considered. PES addresses services lacking market value, necessitating new compensation systems. This model fosters partnerships between local, regional, and global communities, emphasizing mutual benefit and ecological sustainability. Therefore, PES schemes require a supporting institutional infrastructure. They must be enabled **by laws** which allow payments to be charged and channelled to ecosystem managers (be the communities, private landholders, government authorities or non-governmental organizations). Secure and clear resource and land tenure regimes are essential. Systems also need to be in place for monitoring (and enforcing) both the provision of ecosystem services, and the functioning of PES schemes. Finally, it is also important that both buyers and sellers have access to accurate and sufficient information on the ecosystem service that is being provided. For PES to be effective, PES Scheme/framework is required. So, PES scheme/framework is a tool used to enable ESS buyers and seller sustainably live in an agreement for PES. The following figure (Figure 2) illustrates the connections between seller and buyers for the improvement of ecosystem goods and services in a particular watershed.

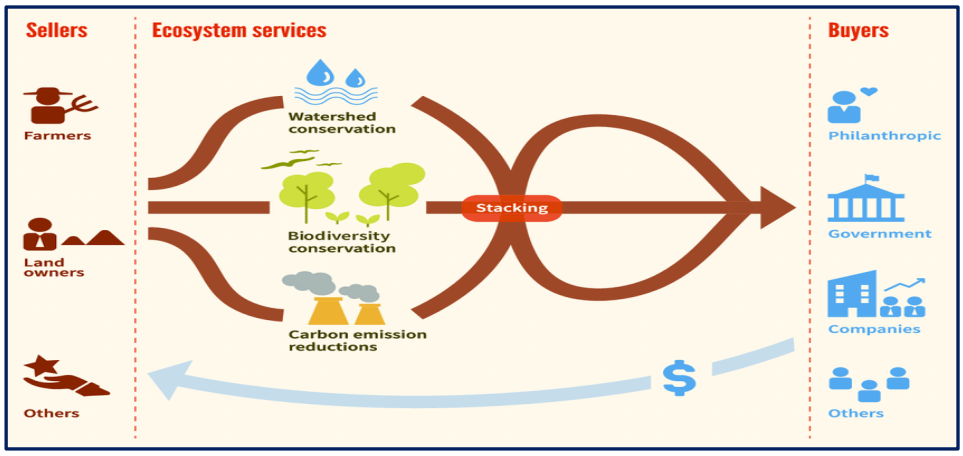

Figure 2: Payments for ecosystem services scheme
Source: Besacier *et al*. (2021)

3.3 PES opportunities & its applications

Countries use Payment for Ecosystem Services (PES) due to various reasons, as outlined by USAID (2018). These include recognizing the high economic value of ecosystem services, the willingness of beneficiaries to pay for these services, and landholders' readiness to accept compensation for altering their land practices. PES is seen as a policy tool with multiple advantages, including incentives for ecosystem management, meeting societal demands for

non-marketed forest services, and providing flexibility in decision-making. While the voluntary nature of PES can be both a weakness and a strength, it allows for negotiation between stakeholders without restrictions, encourages previously uninvolved actors to participate in conservation, and promotes behavioural changes through positive incentives rather than coercion, potentially leading to transformative outcomes (USAID, 2018).

3.4 Countries experience in PESs including Ethiopia

3.4.1 Experience from Costa Rica: *Hydrological ecosystem service*

Costa Rica's innovative Payment for Ecosystem Services (PES) program has been instrumental in reversing deforestation trends and promoting forest recovery. With forest cover declining drastically from 70% in 1950 to 20% in 1987, Costa Rica implemented the Forestry Law 7575 in 1996, establishing one of the world's first nationalized PES programs. This initiative, administered by the National Forestry Fund, compensates landowners for transferring ecosystem service rights. Initially targeting hydropower producers and water users, PES agreements gradually expanded to cover biodiversity conservation, greenhouse gas mitigation, and recreational value.

By 2005, adjustments to water tariffs generated US$19 million annually, with US$5 million allocated to watershed conservation and the rest supporting environmental initiatives. This success showcases PES's potential to finance conservation efforts while stimulating sustainable development. Costa Rica's approach not only protects critical ecosystems but also delivers socio-economic benefits to local communities and stakeholders (Fallas, 2006). This case highlights the viability of innovative financing mechanisms in incentivizing conservation and fostering holistic environmental management. Annex III presents the Payment for ecosystem service for Costa Rica for hydrological services.

3.4.2 East African country experience (Brundi, Kenya, Rwanda, and Uganda)

Countries worldwide recognize the economic significance of ecosystem services and advocate for the implementation of Payment for Ecosystem Services (PES) frameworks. In Burundi, it's highlighted that many businesses benefit from ecosystem services without contributing to their maintenance, necessitating remedial action (Nzigidahera, 2014). Kenya justifies mainstreaming PES into forest planning and management due to its high economic value and cost-saving potential across sectors (UNEP, 2012). Tanzania identifies PES as a means to finance and incentivize the conservation of catchment forest reserves (Malimbwi & Ngaga, 2005). Rwanda sees PES as a tool to alleviate poverty among smallholder farmers and ensure essential services like water regulation (Ruhweza & Masiga, 2016). Uganda recognizes PES's potential to improve sustainable land management, biodiversity conservation, and rural livelihoods, given the current imbalances in benefit distribution for environmental services (Ruhweza & Masiga, 2016).

3.4.3 Domestic experience: Ethiopia

In Ethiopia, PES is found at infant stage but there are efforts made by government, NGOs and partner organizations towards making incentives for farmers for their activities in conservation of natural resources in different part of the country (Wubua Mekonnen, 2020).

Experience from Amhara, Ethiopian Somalia, SNNP and Oromiya

In Ethiopia, diverse regions, including Amhara, Somali, SNNP, and Oromiya, have faced resource degradation issues, exemplified by the demise of Lake Alemaya due to overuse. To address these challenges, UNDP initiated a project from 2015 to 2019 aimed at integrating incentives for biodiversity conservation. Focused on biodiversity hotspots like Choke Mountain, Hadew, Diga Forest, and Arjo Diga Forest, the project introduced Payment for Ecosystem Services (PES). Notable outcomes included the revival of water sources and increased crop yields in Choke Mountain, leading to its designation as a Community-Based Protected Area. In SNNP, PES agreements facilitated wildfire control in Diga Forest and restoration efforts in Kulfo and Hadew, generating over 7 million ETB (approximately 244,000 USD) through 20 voluntary agreements. This success spurred discussions on a national PES strategy, although challenges persist in institutionalizing PES and incorporating diverse ecosystem services into policy frameworks. Nevertheless, PES adoption represents a significant stride toward sustainable biodiversity conservation and economic growth in Ethiopia (UNDP, 2019).

Experience from Humbo Assisted Natural Regeneration project

The Humbo Ethiopia Assisted Natural Regeneration project exemplifies successful ecosystem restoration efforts in Southern Ethiopia's Wolayita zone. Covering 2,728 hectares in the Humbo District, the project targets the rehabilitation of a previously degraded forest due to human activities like tree cutting and charcoal production. Interventions include protecting live stumps for natural regeneration, planting indigenous trees, and implementing forest management practices. Expected to sequester 880,296 tonnes of CO2 equivalent over 60 years (Table 2), the project received a gold standard rating from the Climate, Community, and Biodiversity Alliance.

Table 2: Humbo farmers managed natural regeneration (FMNR)

Fiscal Years	FMNR Cooperative	Round	Amount in USD	Ex. Rate	Amount in ETB
2013	Humbo FMNR Project (7 FMNR Primary Cooperatives)	1st	17,030.27	34	579029.11
2014		2nd	23,373.53	37	864820.7
2015		3rd	30,902.70	38	1174302.7
2016		4th	69,083.04	41	2832404.65
2017		5th	28,683.45	44	1,262,071.86
2018		6th	38,798.76	45	1745944.2
2019		7th	38,000.00	49	1862000
2020		8th	38,000.00	51	1938000
2021		9th	65,000.00	52	3380000
2022		10 & 11th	158,698.95	53	8411044.18
2023		12th	65,000.00	54.4	3537105
	Total		572,570.70		27,586,722.40

Source: World Vision, Soddo ADP

The World Bank, supported by the Government of Canada, purchases carbon credits, with revenues totalling approximately US$572,570.70 (27,586,722.40 ETB) from 2013 to 2023. This initiative, recognized by the UN, marks a significant step in carbon sequestration efforts in Africa.

In Soddo, severe degradation prompted World Vision Ethiopia to collaborate with the government on a regeneration project. Successful restoration efforts made the area eligible for a carbon credit project, resulting in significant earnings. Buyers worldwide, including private institutions, participated in purchasing carbon sequestration services. World Vision Ethiopia reported revenue of approximately US$393,806.51 (20,063,405.59 ETB) from carbon sales, as detailed in Table 3, underscoring the project's financial impact.

Table 3: Soddo Farmers managed natural regeneration (FMNR)

Fiscal Year	Cooperative	Round	Amount in USD	Ex. Rate	Amount in ETB
2017	Soddo FMNR Project (5 Primary Cooperatives)	1st	29,000.00	44	1,276,000.00
2018		2nd	29,032.85	45	1,306,478.25
2019		3rd	56,106.76	49	2,749,231.24
2020		4th	56,656.00	51	2,889,456.00
2021		5th	56,656.00	52	2,946,112.00
2022		6th & 7th	109,698.90	53	5,814,041.70
2023		8th	56,656.00	54.4	3,082,086.40
	Total		**393,806.51**		**20,063,405.59**

Source: World Vision, Soddo ADP

3.5 Key success factors and barriers to PES scheme

Experiences from various countries offer valuable insights into the identification, design, and implementation of Payment for Ecosystem Services (PES) schemes. According to USAID (2018), several key factors contribute to the success or barriers of PES initiatives:

1. Iterative process: PES schemes often undergo multiple iterations and may face initial failures before achieving success.
2. Review and reflection: Continuous assessment and evaluation are necessary for effective PES implementation.
3. Ecosystem value versus PES potential: High ecosystem values do not automatically translate into viable PES opportunities.
4. Causality and impact evidence: Demonstrating the causal relationship and impacts of PES interventions is crucial.
5. Participation, negotiation, and trust: Developing functional PES models relies on active engagement, trust-building, and effective negotiation among stakeholders.
6. Financial feasibility and sustainability: PES designs must ensure financial viability and long-term sustainability.
7. Capacity building: Effective PES implementation requires building capacity in design, management, enforcement, and evaluation. Supportive regulatory and institutional frameworks are essential for enabling payments, protecting rights, and ensuring compliance.
8. Neutral mediation: PES initiatives benefit from the involvement of neutral and independent third-party mediators or coordinators to facilitate negotiations and resolve conflicts.

Ensuring these factors is addressed to enhance the effectiveness and sustainability of PES schemes, contributing to their successful implementation and positive outcomes.

CHAPTER FOUR: FINDINGS OF THE ASSESSMENT

4.1 Results from Primary Data Sources

This assessment has used different primary data sources through application of different data collection techniques. This section utilized various data collection methods to assess socio-economic attributes, marketable ecosystem services, prospective buyers, willingness to pay and accept incentives for ecosystem services reaching the downstream area. It also examined value chains for market-based ecosystem service and outlined frameworks for sustainable Payment for Ecosystem Services (PES) in each micro-watershed.

4.1.1 Socio-economic characteristics

In a study conducted with 90 smallholding farmers from both upstream and downstream areas, it was found that 57.8% were male heads of households, while 42.2% were female heads of households, reflecting the prevalent gender dynamics in Ethiopian agriculture (Mengesha Tadesse, 2023). Majority of the respondent's age group is found in a range between 41 and 50 years (Figure 3). However, both genders actively engage in sustainable land management (SLM) initiatives within CLM micro-watersheds (Tesso et al., 2012). Farming systems vary across micro-watersheds, with mixed farming predominant in Madoye and Temba, and mono-cropping in Mlihay (see Annex IV for detail understanding).

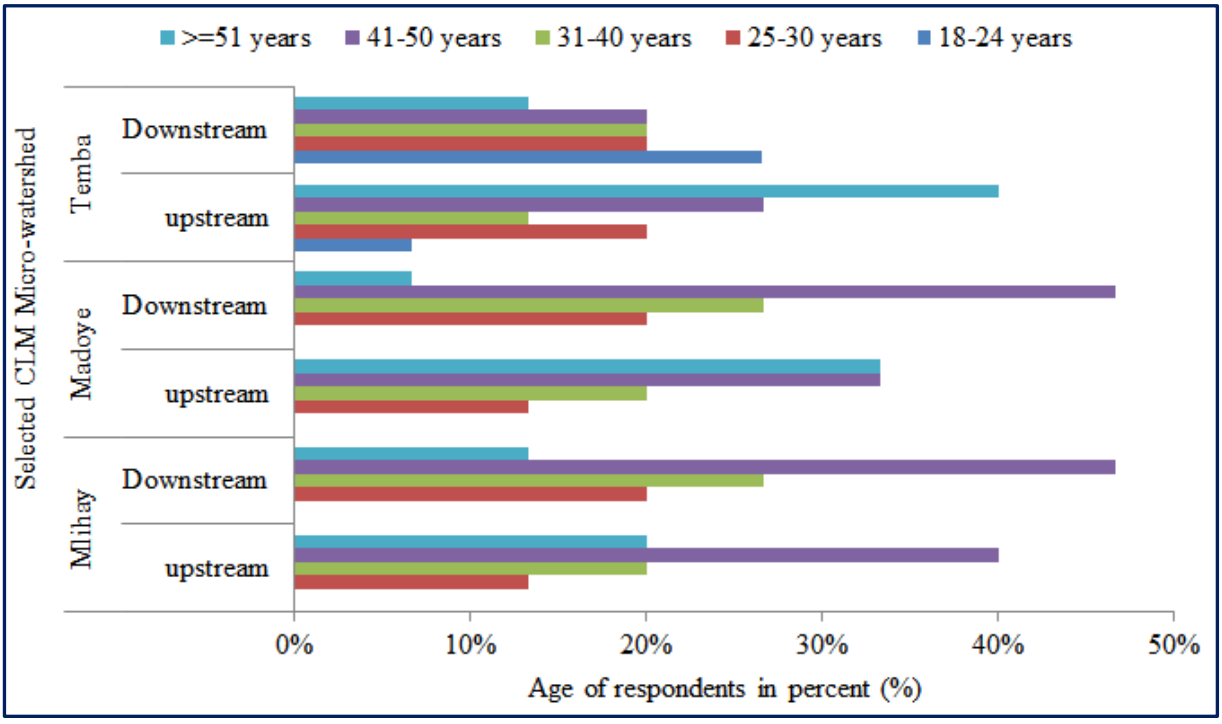

Figure 3: Age distribution of respondents in percentage along the micro-watersheds

The majority of interviewees, over 80%, were married with family sizes typically ranging from 7 to 9 members, exceeding the national average of 5.76 people per household (Figure 4). Despite large family sizes, their farm sizes in Mlihay and Madoye were relatively small, ranging from 0.25 ha to 1 ha for nearly half of the respondents (48.88%) (Figure 4).

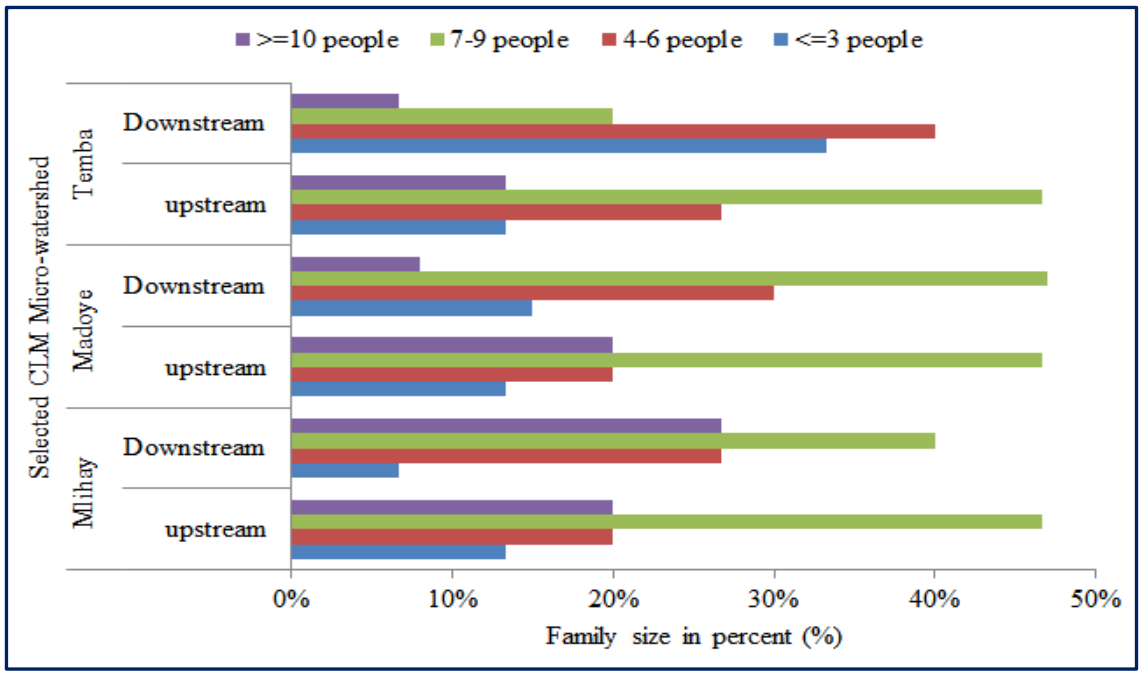

Figure 4: Respondent's family size in percentage along the micro-watersheds

The size of cultivated land reflects the farmer's impact on local natural resources like forests, influencing ecosystem service flow downstream. Many farmers extract local resources for additional income, impacting ecosystem services. Women's involvement in fuelwood collection supports family income, a rational choice in rural livelihoods dominated by agriculture and natural resources (Bedilu et al., 2017). However, rising human populations contribute to resource degradation, driven by poverty. Given this, alternative livelihoods must be explored, especially in the upstream micro-watershed, to sustain ecosystem services amidst high energy demands. Alternative energy sources are crucial for maintaining ecosystem service availability in the watershed.

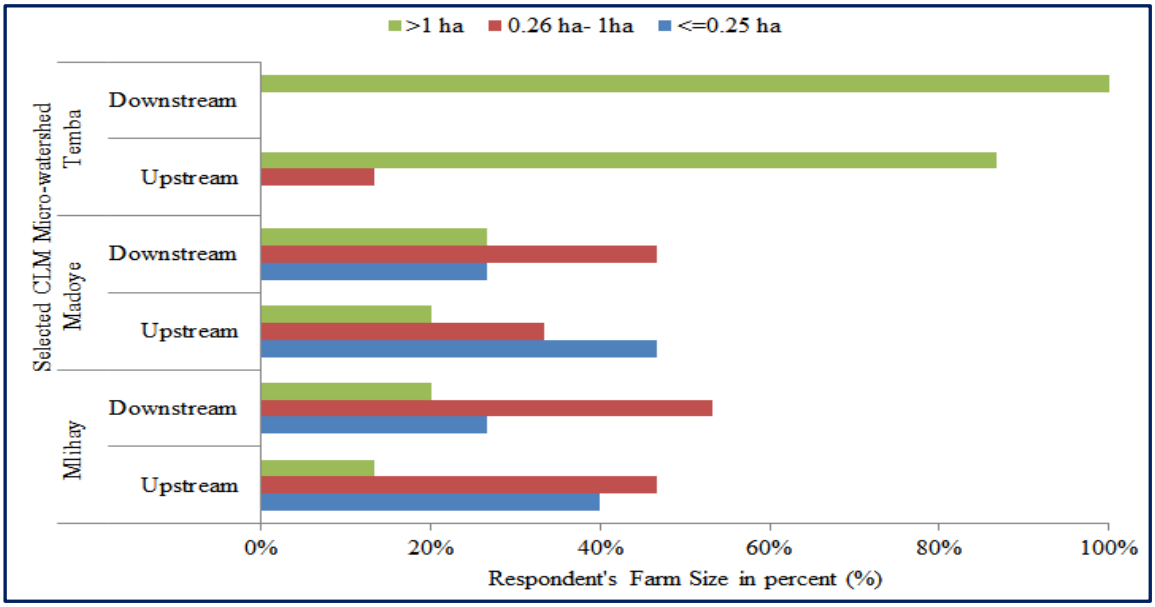

Figure 5: Farm size holding of the respondents in percentage along the micro-watersheds

Since the size of the farm plot is not enough to produce adequate products to the levels of the household's satisfaction, the farmers are forced to search alternative income sources such as fuelwood selling and planting eucalyptus trees on fertile soils. Off-course, CWUCs is the main solution for the above-mentioned problems in relation to economy. The members are the users of the goods and services produced by each micro-watershed.

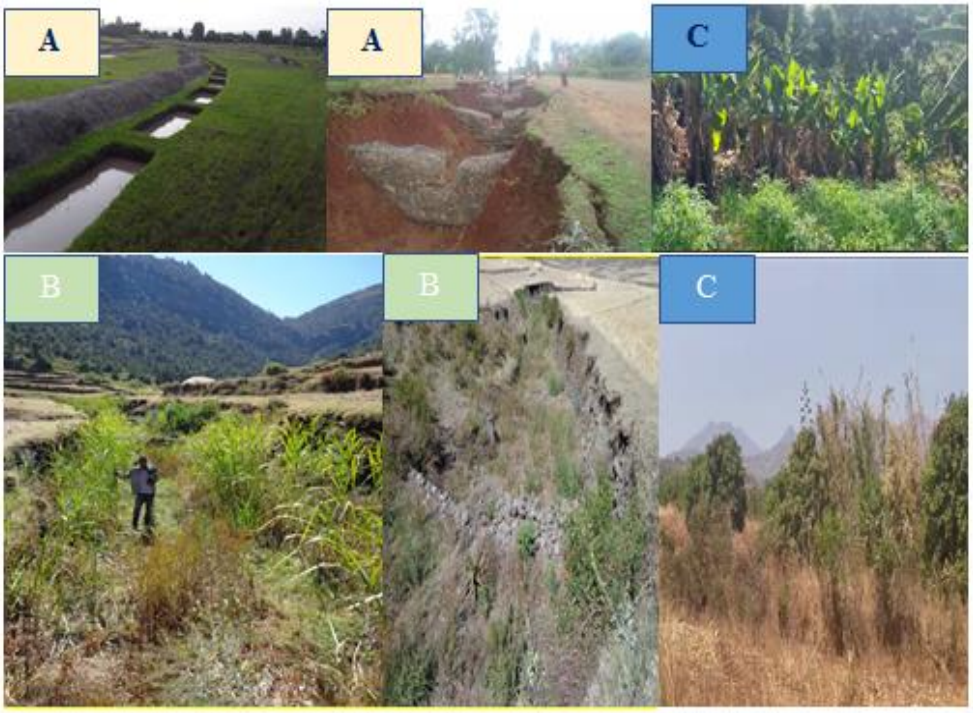

Figure 6: SLM practices implemented in Madoye (A), Mlihay (B), and Temba (C) micro-watershed.

As shown in Figure 6, CWUCs members in the upperstream usually engaged in watershed development works such as SWC (physical and biological) measures, tree plantation, enclosure area and others. They protect the downstream part of the watershed from flooding and contribute to higher volume of purified water in the form of spring for the downstream users. Therefore, for the provisioning and regulating ecosystem services to the downstream users, service providers need to get some payments using different modalities. The details of activities implemented in the three micro-watersheds are presented under Annex V.

4.2 Ecosystem services of the watersheds

4.2.1 Identification of marketable ESs in the micro-watersheds

The assignment initially focused on assessing marketable ecosystem services within selected CLM micro-watersheds but was expanded to include areas near to the micro-watersheds. The micro-watershed was stratified into upstream and downstream areas. From each category, major and conspicuous marketable ecosystem services were identified. Each micro-watershed available in the three regional states had different potential of marketable ESs. Some of the available marketable ESs are directly aligned with the agroecology of the micro-watershed.

Some of the identified ecosystem services already have market accessibility in the area. Noticeably, ecosystem products such as honey, food, animal feeds, coffee, fuelwood, and

construction materials are among those ecosystem services with existing market linkages. However, creating market linkages for regulating supporting, and cultural ESs of each micro-watershed was a major challenge, as these are often overlooked and negatively impacted by the utilization of provisioning ESs. In terms of regulating ESs, all the three micro-watershed have been providing similar ESs (Annex VI). Despite their similarities in terms of regulating ESs, all the three micro-watersheds have differences in terms of ES's quantity and quality in the area. Such differences were occurred due to the variation in the management of each micro-watershed. Each micro-watershed has potential of marketable ESs, but the level of utilization and even recognition to these ESs varies. This study tried to prioritize the major marketable ESs available in each micro-watershed based on the information gathered through FGD, KII, and field survey.

In Madoye micro-watershed, water supply (drinking and irrigation), flood risk mitigation, and cultural ESs such as spiritual values have received a major attention (Annex 2). More than 155 households access irrigation water from the micro-watershed. In addition, the watershed community and the people living in the town (Bombe) accessed drinking water from the micro-watershed. According to central statistics service (CSS, 2021), around 2,716 people lives in the Bombe town, which entirely depend on the water resources coming from the upstream of Madoye micro-watershed. Mitigation of flood risks is another marketable ESs available in the upstream of Madoye micro-watershed. Due to availability of SLM measures (deep trench, soil bund, hillside terraces and others) in the upstream implemented by CWUC members, flooding risks have been highly reduced in the downstream area (farmer's witness). With this ESs, the downstream smallholder farmers as well as Ethiopian Electric power (EEP) and Utility (EEU) were the direct beneficiary of the ES. The upstream part of the micro-watershed also provides spiritual values/services to the local people. Spiritual people use the peak of the Madoye Mountain for meditations, prayers, and contemplative practices.

In Mlihay micro-watershed, the major identified marketable ESs were traditional plant medicine (*Thymus serpyllum*), water supply for drinking and irrigation, flood risk mitigation, and construction material (pole, fuelwood, and stone). The micro-watershed is characterized by highland types of agroecology where *Thymus serpyllum* (Tosign) medicinal plant species tremendously available as a provisioning ecosystem services. This plant species is a perennial herb with woody at the base and considered as endemic to Ethiopia. This medicinal plant species however is not available in Madoye and Temba micro-watersheds. The plant played a great role in conserving the soil and creating income for the CWUCs members. The local farmers in the micro-watershed prefer *Thymus serpyllum* (Tosign) than eucalyptus trees. This is because *Thymus serpyllum* (Tosign) plant could be harvested two to three times per a year. However, CWUCs members have complained about the negative impacts of eucalyptus on this plant species. This is because *the* plant cannot grow under the canopy of the eucalyptus trees. The water resources generated from the upstream could be used for drinking as well as irrigation purpose. The downstream people accessed both drinking water and irrigation (117 households have been using irrigation on 10 ha of land) water from the micro-watershed.

In Temba micro-watershed, flood risk mitigation and water supply were the major marketable ESs identified during FGD, KII, and field survey (Annex 2). Around 62 household are using irrigation on 10 ha of land.

SLM practices implemented in each upstream micro-watershed have shown tangible progress in terms of producing marketable ESs (Figure 7) such as mitigating flood risks, controlling soil erosion, trapping sediments, and enhancing availability of water for drinking and irrigation purpose. Respondents from all three micro-watersheds have confirmed the importance of these ecosystem services. SLM practices have also contributed to increased resilience of local communities to climate change, with stakeholders in downstream areas reporting a significant reduction in the risk of flooding, soil erosion, and sediment deposition in water sources and cultivated lands.

In the designated CLM micro-watersheds and surrounding areas, Community Watershed User Cooperatives (CWUCs) residing upstream emerge as promising vendors of ecosystem services. These cooperatives own rehabilitated land, forests, enclosure areas, and other vital components crucial for enhancing downstream benefits. The unequivocal ownership of these ecosystem services forms the cornerstone for the feasibility of Payment for Ecosystem Services (PES) schemes. Despite their concerted efforts to enhance these services, CWUCs have yet to receive commensurate benefits or rewards corresponding to their investments. Although they have received revolving funds from entities such as GIZ, the current payments fail to adequately acknowledge their contributions to restoring lost ecosystem services. However, there remains optimism that additional potential buyers will surface, thereby enabling CWUCs to receive incentives comparable to esteemed projects like the Humbo and Soddo Farmers managed nature regeneration initiatives.

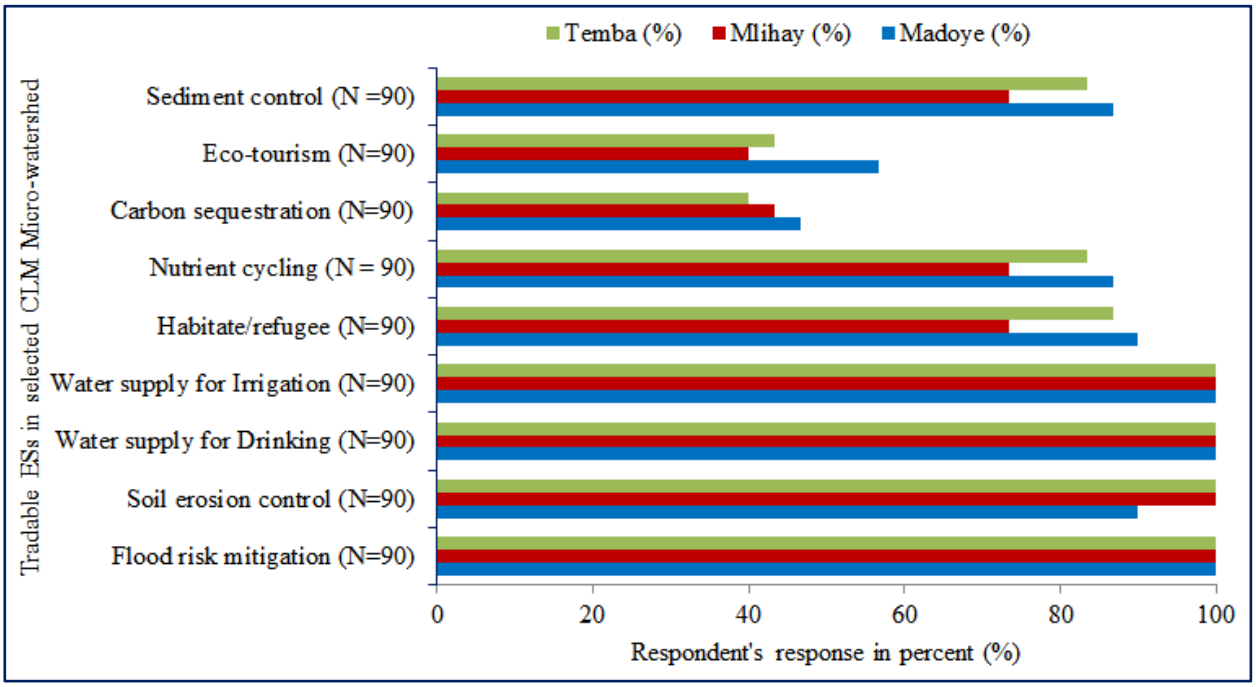

Figure 7: Marketable ESs and respondent's votes.
Source: Consultant field survey

4.2.2 Potential buyers of marketable ESs

Identifying potential buyers for ecosystem services (ESs) is crucial for ensuring the sustainability of ecosystem functioning in a specific area. Without buyers for specific ESs, sellers struggle to invest time and resources in establishing products or services to sell. In the three micro-watersheds, the study identified different potential buyers of ESs with different interests. For ease of discussion, the potential buyers were categorized as public and private institutions.

In Madoye micro-watersheds, potential ESs buyers were identified and the services they want to buy are listed under Annex VII.

- Under public institutions:
  - Boloso Bombe woreda Water and Sanitation office,
  - Ethiopian Electric Power (EEP)-Gibe-3 Dam,
  - Ethiopian Electric Utility (EEU),
  - Omo basin authority,
  - Ministry of agriculture/Ethiopian environment and climate authority,
- Under private institutions:
  - Downstream Farmers irrigation water user association

As stated in Annex VII, Bombe town municipality is interested in purchasing drinking water from the Madoye micro-watershed. Although the office aims to incentivize upstream ecosystem service providers, no action has been taken yet. Incentivizing through monthly water tariffs could encourage CWUC members to manage the micro-watershed sustainably. Additionally, Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU) could purchase sediment retention ESs from the upstream watershed. Despite un-estimated sediment conservation amounts, the local community believes their efforts in implementing SLM measures have reduced sediment flow into the Gibe-3 hydroelectric dam, expecting compensation or incentives from EEP and EEU.

In Mlihay micro-watershed, the followings are the main buyers of ESs produced by CWUCs and the services they want to buy are listed under Annex VII.

- Under public institutions:
  - Amba Alaje woreda Water and Sanitation office,
  - Ethiopian Electric Power (EEP)-Tekeze Dam,
  - Ethiopian Electric Utility (EEU),
  - Ministry of agriculture/Ethiopian environment and climate authority,
  - Tekeze Watershed authority,
- Under private institutions:
  - Mercy-water bottling industry
  - Maitchew Particle Board industry

In the Mlihay micro-watershed, private institutions like the BGI beer brewing industry and Mercy water bottling industry exemplify the role of incentivizing local farmers for watershed services. Despite being located 12km away, BGI incentivizes upstream farmers for water resource protection, while Mercy supports community infrastructure development. However,

the Maitchew particle board industry, although present in the watershed, has not compensated CWUC members for their investments in sustainable land management (SLM). Farmers express concerns about the negative impact of eucalyptus globulus trees on water resources and crop production. While industry leaders plan future incentives for SLM, the absence of binding agreements and oversight in Payment for Ecosystem Services (PES) implementation is noted, with payments being largely goodwill-based.
According to the KII and field survey, potential buyers of ESs could be accessed through two approaches.

1) CWUC members who are designated as ESs sellers can independently search for potential buyers. In this case, government or other partner organization can represent the CWUC members and assess potential of ESs providing benefits to beneficiaries. Evaluating the technical and biophysical capabilities of ecosystem service provision is essential for attracting potential buyers. Additionally, assessing the monetary value of ESs enables sellers to negotiate with potential buyers willing to pay for the benefits received from the ecosystems.

2) Potential buyers may independently identify the ecosystem services (ESs) they wish to procure.

In this assignment, Community Watershed User Cooperatives (CWUCs) serve as sellers of ecosystem services (ESs) in each upstream of the micro-watershed. Potential buyers include individuals, public sector institutions, and private sector institutions in the downstream part of the micro-watershed and its surroundings. Based on FGD, KII, and field survey, Annex III outlines potential buyers of ESs available in each selected CLM micro-watershed. The consultant delved into the interests of potential buyers, which stem from their institutional strategies. For example, the Woreda Water and Sanitation Office aims to provide drinking water for the town's residents, leading to their interest in fresh water supply, sediment control, flood risk mitigation, groundwater recharge, and water purification ecosystem services. These interests are not theoretical but based on genuine institutional desires, as gathered during the FGD.

4.2.3.Willingness to pay (WTP) and willingness to accept (WTA)

Willingness to Pay (WTP) signifies the maximum amount an individual is willing to expend on a good or service from a seller, while Willingness to Accept (WTA) indicates the minimum sum a person is willing to receive in exchange for relinquishing a good or service to the beneficiaries (Table 4, Table 5, and Table 6). In the study area, ES buyers have shown interests towards incentivizing CWUC members for the identified and prioritized ecosystem services. Especially, private organizations such as Mercy water bottling industry have willingness to incentivize or compensate CWUC members for their upstream investments. Even though the industry is currently using deep wells for its water source, it is difficult to certainly predict the sustainable flow of the water if the upstream part of the watershed is not managed. Table 4 indicates both public and private institutions that have shown interest in compensating CWUC members in Mlihay micro-watershed for SLM investments undertaken in the upstream.

Table 4: Willingness to pay for Mlihay Micro-watershed and its surroundings

Types of buyers	ESs buyers*	ESs they received	WTP	Mode of payment
Mlihay Micro-watershed and its surroundings				
Public Institutions	Amba Alaje woreda Water and Sanitation office	• Fresh water supply for drinking • Sediment control to save water points • Water purification • Ground water recharge	Yes	Collecting tariffs from urban water users and investing back to upstream area in terms of water point development but require decisions.
	Ethiopian electric power (EEP)-Tekeze Dam	• Sediment control • Water flow regulation	Yes	-
	Ministry of agriculture/Ethiopian environment and climate authority	• Climate regulation due to Carbon sequestration • Soil erosion control • Flood risk mitigation	Yes	-
	Tekeze Watershed authority	• Sediment control • Flood risk mitigation	Yes	- Providing farm inputs for upstream farmers
Private Institutions	Mercy-water packing Industry	• Fresh water supply • Ground water recharge • Flood risk mitigation • Sediment control	Yes	- Involved in school building, church, and electric power line, They also helped poor people in cash
	Maitchew Particle Board industry	• Climate regulation • Raw material for the industry (eucalyptus) • Soil erosion control • Flood risk mitigation	Yes	- They are willing to help the local farmers but needs decision to select the mode of payment by the executive body of the industry.
Community	Individual farmers at downstream area	• Irrigation water supply • Drinking water supply • Traditional medicine (eucalyptus globules, thymus serpyllum) • Eco-tourism • Soil erosion control • Sediment trapping	Yes	Free labour contribution for the implementation of SLM measures on the upstream area. - For example: in SLM, 50 birr is their daily wages. If they work 20 days, they would contribute 1000 birr for the upstream services.
International institutions	World Bank, GIZ, World Vision	• Climate regulation: carbon credit	Yes	- Cash payment for different IGA works in the watershed in the form of revolving funds. - Provisioning of capacity building trainings for the CWUC members

** Potential buyers of ESs are not necessary found in the CLM selected micro-watershed. The consultant considered potential buyers available outside of the micro-watersheds but found in the larges macro-watershed that contributes towards the same outlets. A typical example for this is BGI beer brewing industry. The industry is available outside of the Mlihay micro-watershed but found within the largest macro-watershed that contributes water towards Tekeze hydro dam similar with Mlihay micro-watershed.*

To understand the willingness to pay of ES buyers, the study used different indicators, among which the followings are the main ones.

- **Voluntary Participation**: WTP typically involves voluntary participation of buyers in negotiations. For instance, Mercy water bottling industry is voluntarily participated in incentivizing the local farmers. The participation was not in providing cash but involved in construction of road, school and other amenities based on the needs of local farmers.
- **Value of ES:** The perceived value of the ecosystem service influences WTP status. For instance, Gibe-3 and Tekeze hydroelectric dams highly value the controlling of sediments by the SLM measures undertaken in the upstream part of each micro-watershed.
- **Buyer Needs:** Identifying the buyer need is essential and failure to meet buyer needs can lead to withdrawal from negotiations. For instance, Gibe-3 and Tekeze hydroelectric dams as potential ES buyers, they need soil erosion control and sediment retention regulation ecosystem services. Similarly, Mercy water bottling industry needs a continuous flow of water for the industry.
- **Status of ESs**: Beneficiaries are more likely to consider WTP agreements if they anticipate problems with a particular ecosystem service. For instance, the BGI beer industry is a company found a bit far from Mlihay micro-watershed, invested around 6,000,000.00 ETB in controlling sediment deposition into water points coming from upstream area. This was done after realizing the status of the ESs by the industry.
- **Yearly plan**: Some entities include WTP in their yearly plan. Off-course, during the field survey, the consultant asked organization whether they have plan for incentivizing CWUC members for their SLM investment. Unfortunately, public institutions do not have any plan so far (for instance, municipality for their drinking water usage) but they are willing to incorporate the issues in their future planning. However, Mercy water bottling in Mlihay micro-watershed had yearly plan for incentivizing local farmers for their upstream land rehabilitation efforts. Similarly, leaders of Maitchew particle board industry are also promised to incorporate the issues of incentives or compensations of CWUC members in the yearly plan of the industry.

These indicators underscore the importance of understanding buyer needs and ecosystem service value in negotiation processes, particularly in garnering attention from buyers and ensuring sustainable management of ecosystem services.

In Madoye micro-watershed, the downstream farmer's irrigation water user association has shown their interest to contribute their free labor for constructing SLM measures in the upstream part of the micro-watershed (Table 5). They have shown their interest to provide their free labor for one month each year. Off-course, such condition also works for Mlihay and Temba micro-watersheds. Similarly, public institutions such as woreda water and sanitation office available near the three micro-watersheds have also shown their interest for incentivizing or compensating CWUC members for their investments in the upstream area.

To establish prices for ecosystem services (ESs), buyers (WTP) and sellers (WTA) should adhere to key pricing conditions:

1) Negotiation: Price settlement relies heavily on mutual agreement between buyers and sellers. For example, a water packaging company like Mercy may specify the price they're willing to pay upstream farmers for services such as clean water, reduced sedimentation, and minimized flood risks. Although Mercy may offer non-monetary compensation based on willingness, without enforcement mechanisms, government and partner organizations

facilitate negotiations, with monitoring and verification crucial during Payment for Ecosystem Services (PES) talks.

Table 5: Willingness to pay (WTP) for Madoye Micro-watershed and its surrounding

Types of buyers	ESs buyers	ESs they would receive	WTP	Mode of payment
Madoye Micro-watershed and its surroundings				
Public Institutions	Boloso Bombe woreda Water and Sanitation office	• Fresh water supply for drinking • Sediment control to save water points • Water purification • Ground water recharge	Yes	Collecting tariffs from urban water users and investing back to upstream area in terms of water point development, but require decisions.
	EEP, EEU, Gibe-3 Dam	• Sediment control • Water flow regulation	Yes	Tariff collection from power users
	Ministry of agriculture/Ethiopian environment and climate authority	• Climate regulation due to Carbon sequestration • Soil erosion control • Flood risk mitigation	Yes	carbon credit
	Rift-Valley Lake basin authority	• Soil erosion control • Sediment control	Yes	-
Private Institutions	Downstream Farmers irrigation water user association	• Irrigation water supply • Soil erosion control • Sediment control • Flood risk mitigation	Yes	- Free labour contribution. For example: in SLM, 50 birr is their daily wages. If they work 20 days, they would contribute 1000 birr for the upstream services. - They contribute 600 birr per annum for the irrigation association
Community	Individual farmers	• Irrigation water supply • Drinking water supply • Ecotourism • Soil erosion control • Sediment trapping • Flood risk mitigation	Yes	Free labour contribution for the implementation of SLM measures on the upstream area. - For example: in SLM, 50 birr is their daily wages. If they work 20 days, they would contribute 1000 birr for the upstream services.
International institutions	World Bank, GIZ, World Vision	• Climate regulation: carbon credit	Yes	- Cash payment for different IGA works in the watershed in the form of revolving funds. - Provisioning of capacity building trainings for the CWUC members.

2) Market Influence: Establishing market prices for most ecosystem services (ESs) is challenging, particularly those like carbon credits influenced by international markets. In CLM micro-watersheds, the WTP and WTA situations of public and private sector institutions, as well as individual farmers benefiting directly from upstream ecosystem services, are detailed in tables (Table 4, Table 5, and Table 6), are shedding light on valuation dynamics.

Findings from FGD, KII, and field survey with upstream CWUC members and committee leaders reveal their preferences for payment modes from potential ESs buyers. This reality in the upstream part of the watershed is illustrated in Figure 8.

Table 6: Willingness to pay for Temba Micro-watershed and its surroundings

Types of buyers	ESS buyers	ESs they would receive	WTP	Mode of payment
Temba Micro-watershed and its surroundings				
Public Institution	Homosha Woreda Water and Sanitation office	• Fresh water supply for drinking • Sediment control to save water points • Water purification • Ground water recharge	Yes	Collecting tariffs from urban water users and investing back to upstream area in terms of water point development but require decisions.
	Ministry of agriculture/Ethiopian environment and climate authority	• Climate regulation due to Carbon sequestration • Soil erosion control • Flood risk mitigation	Yes	
	Assosa University	• Education and research service	Yes	Capacity building trainings, improved inputs in the form of community service.
Community	Individual farmers	• Irrigation water supply • Drinking water supply • Ecotourism • Soil erosion control • Sediment trapping • Flood risk mitigation • Raw material supply such as fuelwood and pole (Bamboo)		Free labour contribution for the implementation of SLM measures on the upstream area. - For example: in SLM, 50 birr is their daily wages. If they work 20 days, they would contribute 1000 birr for the upstream services.
International institutions	World Bank, GIZ, World Vision	• Climate regulation: carbon credit		- Cash payment for different IGA works in the watershed in the form of revolving funds. - Provisioning of capacity building trainings for the CWUC members

According to Figure 8, infrastructure development (such as water supply, irrigation, and roads) and social infrastructure have been rated as the top priority by members of the CWUC, leaders, and individual farmers residing in the upstream area of the micro-watershed. Cash payments or revolving funds were ranked second, followed by training, education, and extension services in third place. Provisioning of improved inputs and free labour contributions were ranked fourth and fifth, respectively. However, despite the preference of many farmers for cash payments or revolving funds, buyers are less inclined towards cash payments for the benefits they would receive from potential sellers (CWUCs).

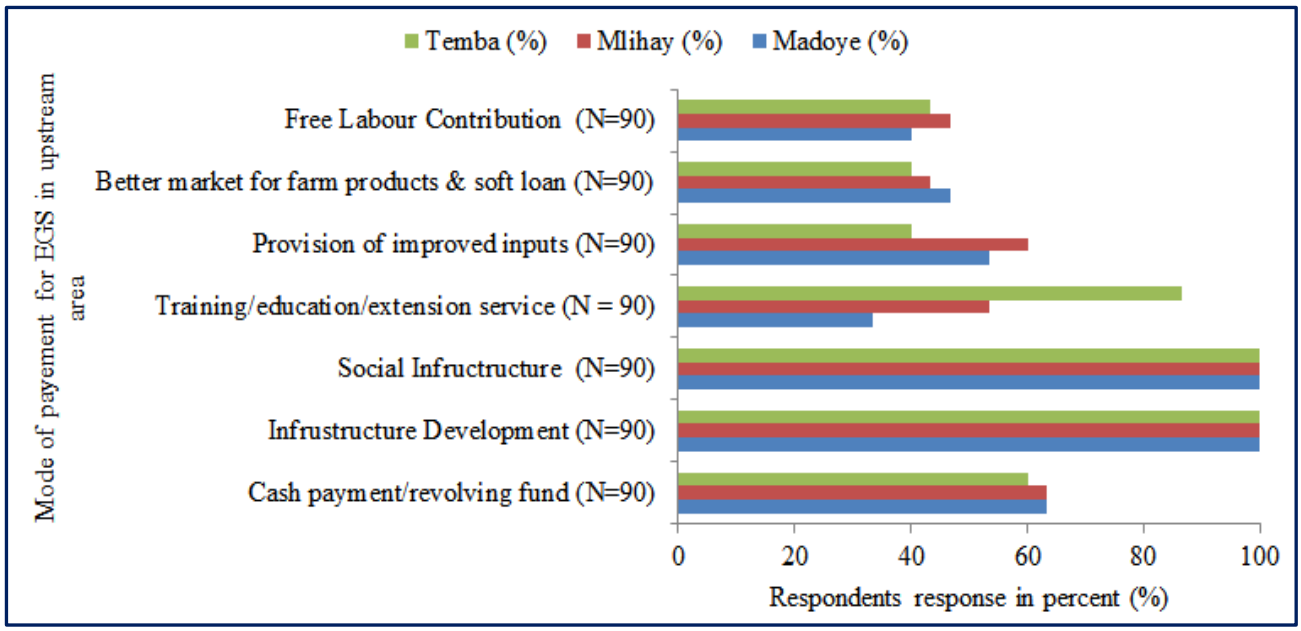

Figure 8: Mode of payment for ecosystem services delivered to beneficiaries

4.2.4 Value chain for marketable ESs: Market-based mechanisms

Establishing markets for ecosystem services is challenging due to the absence of market prices. Payment for Ecosystem Services (PES) functions as a market-driven tool, akin to subsidies and taxes, encouraging natural resource conservation to tackle environmental market failures. For instance, sediment retention lacks direct market pricing, prompting PES to compensate landowners for their service value.

In Madoye micro-watershed, flood risk mitigation, water supply and sediment retention ESs are the main products with high opportunity of having PES through market-based mechanisms. Determining the actual size or volume of these ESs will help the sellers (CWUCs) and the buyer to negotiate based on evidence. However, for this study, the actual size or volume of ESs was not determined and off-course, it is out of the scope of the assessment.

The CWUC members have implemented different SLM measures for ensuring the continuous flow of the above-mentioned ESs and establish value chain in the watershed. Among the different SLM measures, the followings are the main ones.

- Planting different species of trees in the upstream part of the micro-watershed
- Constructing deep trenches for collecting water for ground water percolation
- Establishing, maintaining, and managing enclosure area
- Constructing hillside terraces, soil bund, fanyaa juu, half-moon, and grass strips
- Reduce tree cutting and hunting
- Controlled grazing/apply stall feeding
- Agroforestry practices and others

For further understanding of the marketable ESs value chain in the Madoye micro-watershed, see Annex VIII.

CWUC members should be compensated for their role in watershed management to safeguard the watershed, preserve biodiversity, and sequester CO_2.

In Mlihay micro-watershed, Flood risk mitigation, water supply, sediment retention, and the medicinal plant Thymus serpyllum (Tosign) represent the primary marketable ecosystem services (ESs) in the Mlihay micro-watershed. Flood risk mitigation is crucial for the Tekeze hydroelectric dam and downstream communities, with CWUC members' sustainable land management efforts upstream reducing flood risks and sediment deposition downstream. Additionally, the micro-watershed serves as a source of Tosign, harvested by CWUC members and local youths, with an established value chain. To enhance Tosign production and unlock the value chain potential of other ESs in the micro-watershed, strategies for improvement are being explored. CWUC members have been practicing different SLM measures such as:

- Planting of tree species that are compatible with the Tosign (*Thymus serpyllum) such as Grevillea robusta* trees.
- Reducing the expansion and number of eucalyptus globulus trees in the upstream part of the micro-watershed. The CWUC members have understood the negative environmental impacts of eucalyptus globulus trees including high water competition with Tosign and shedding effect. During FGD with members of the CWUC, the quality of Tosign available under *Eucalyptus globulus* and *Grevillea robusta* trees is quite different. As they explained, the Tosign (*Thymus serpyllum)* harvested from *Grevillea robusta* trees dominated land is more preferable in terms of quality.
- Constructing different SWC measures including biological measures such as enclosure area,
- Reducing tree cutting and uncontrolled grazing

For further understanding of the marketable ESs value chain in the Mlihay and Temba micro-watershed, see Annex XI and Annex X, respectively.

Based on field data, several ecosystem services are commonly identified across the three micro-watersheds, presenting opportunities for market-based or incentive-driven value chains. The identified ecosystem services are also crucial for designing Payment for Ecosystem Services (PES) schemes that can be applied uniformly across the three micro-watersheds. The following ESs holds particular significance for establishing value chains and market-based PES schemes.

- Carbon sequestration
- Flood risk mitigation
- Soil erosion control
- Sediment retention
- Biodiversity conservation
- Water purification
- Eco-tourism ecosystem services

4.3 Establishing scheme or framework for PES

The Millennium Ecosystem Assessment (MEA, 2005) identifies four types of ecosystem services crucial for human well-being. These services—provisioning, regulating, supporting, and cultural—are essential for human existence and form the basis for Payment for Ecosystem Services (PES) schemes. Fripp (2014) explains that PES occurs when beneficiaries of ecosystem services make payments to providers. This transaction requires voluntary participation, well-defined environmental services, at least one buyer, and at least one provider.

PES scheme is found at infant stage in Ethiopia. Off-course, there are experiences in Humbo and Soddo area but compared to the size of the country and available conservation practices in the country, the existing practices are not enough. Therefore, more ESs delivered by different ecosystems has to be promoted and get buyers. As a principle, for establishing PES, it is must to understand the seven key principles stated by Fripp (2014). Firstly, participation must be voluntary, with beneficiaries paying directly for ESs. Payments should be additional to expected actions and conditional on service delivery. Permanence and avoidance of leakage are crucial to ensure ongoing benefits without loss elsewhere.

In addition, for establishing PES scheme, there are prerequisites. These are:

- There should be valuation of ESs.
- Legal frameworks: there must be an institutions that monitor, evaluate, and verify the agreement between seller and buyers
- Stakeholder organization
- Clear demand by the potential buyers for ESs that are ready for market-based value chain

Following the above mentioned approach would foster sustainable resource management through aligning economic incentives with environmental conservation goals as well as livelihood improvements in the micro-watershed and its surroundings.

4.3.1 Designing and implementing PES schemes

For establishing PES scheme, the consultant followed a phase approach as described by Smith et al. (2013). According to smith et al. (2013), there are four phases in order to design and implement PES for selected ESs in each micro-watershed and its surroundings.

Phase 1: Identify marketable ecosystem service(s) and prospective buyers & sellers:

4.3.1.1 Identifying marketable ecosystem services

For this assignment, the consultant has selected three important ESs provided by the three selected CLM micro-watersheds. The selected ecosystem services are common to all micro-watersheds namely:

- Irrigation and drinking water supplies ecosystem services
- Sediment/flood control ecosystem service

In order to establish PES scheme for the above selected ESs, there are three questions to consider. The ability to answer "yes" to all three is a prerequisite for the development of any PES scheme.

1. ***Are there specific land or resource management actions that have the potential to secure the continuous flow of ESs or an increase in supply of the ecosystem services?***

For this particular question, the answer is "yes". Considering the three selected CLM micro-watershed, there are specific SLM practices that have the potential to secure the continuous flow of ecosystem services towards the beneficiaries or the potential buyers. In order to provide over and above what is already being provided, there must be means to increase the supply of the service in question. The followings are the main SLM practices undertaken in each micro-watershed for securing the continuous supply of ESs to the potential buyers.

- Tree planting, grass strips and area closures,
- Forest protection and management,
- Implementation of physical SWC structures such as deep trench, hillside terracing, fanyaa juu and others,
- Implementation of biological SWC measures such as having plantation sites
- Reducing tree cutting and hunting
- Controlled grazing/apply stall feeding
- Agroforestry practices and other conservation agricultural practices in the micro-watersheds.

2. ***Is there a clear demand for the service in question and is its provision financially valuable to one or more potential buyers?***

Yes, there is a clear demand for the selected ESs by potential buyers in the selected CLM micro-watershed and its surroundings. Beneficiaries such as the Municipal water and sanitation office, Ethiopian Electric Utility (EEU), and Ethiopian Electric Power (EEP) from public institutions have demanded drinking water supply and sediment/flood control ESs, respectively. In addition, Mercy water bottling companies from private institutions have also demanded drinking water supply ESs from the Mlihay micro-watershed and its surrounding area. Moreover, downstream individual farmers and their irrigation use association have also shown their demands for irrigation water supply ESs emanating from each micro-watershed.

4.3.1.2 Identifying potential buyers and sellers

If the questions specified under sub-section 4.3.1.1 are satisfied, it is an indication that shows the potential for a PES scheme to be established. However, it will also be important to identify other actors, particularly intermediaries and knowledge providers, relatively early in scheme design as they can play a key role in facilitating scheme emergence. The four principal groups important for PES establishment are: **buyers, sellers, intermediary, and knowledge providers.** Specific to CLM selected micro-watersheds, there are organization identified as sellers (CWUCs), potential buyer (primary, secondary and tertiary ESs buyers), brokers (intermediary), and knowledge providers. For detail understanding, see the following table (Table 7).

Table 7: Potential seller and buyers of ESs in the micro-watersheds and its surroundings

№	Marketable ESSs	Potential sellers	Potential buyers and their types**	"Honest brokers" & knowledge providers
Madoye Micro-watershed & its surroundings				
1	Irrigation water supply ES	CWUC	Downstream farmers irrigation users association, **primary buyers**	Ministry of water and energy and partners organization such as GIZ and World Vision. University such as Wolayita Soddo and Areka Research Centre are used as knowledge providers
2	Drinking water supply ES		Municipal water and sanitation office, **2ndary buyer**	
3	Sediment control ES		EEP and EEU, **tertiary buyer**	
4	Flooding risk mitigation			
Mlihay Micro-watershed & its surroundings				
1	Irrigation water supply ES	CWUC	Downstream farmer irrigation users**, primary buyers**	Ministry of water and energy and partners organization such as GIZ. University such as Raya and Mekelle University are used as knowledge providers
2	Drinking water supply ES		Adi Shu Town Municipal water and sanitation office, **2ndary buyer**, Mercy water packing industry, **primary buyer**	
3	Sediment control ES		Tekeze sub-basin authority, EEP and EEU, **tertiary buyer**	
4	Flood risk mitigation			
Temba Micro-watershed & its surroundings				
1	Irrigation water supply ES	CWUC	Downstream farmers irrigation users association, **primary buyers**	Ministry of water and energy and partners organization such as GIZ. University such as Raya and Mekelle University are used as knowledge providers
2	Drinking water supply ES		Municipal water and sanitation office, **2ndary buyer**	

** **Primary buyers**, including private organisations and individuals who benefit directly from, and pay directly for, improved ecosystem service provision. **Secondary buyers**, including organisations that buy improved ecosystem service provision on behalf of sections of the general public and **Tertiary buyers** who purchase improved ecosystem service provision on behalf of the wider public, i.e. the government.

3. Is it clear whose actions have the capacity to increase supply of the service in question?

The upstream part of the micro-watersheds managed by the CWUC members (Enclosure area and lands with different SLM measures) has the proven capacity to increase the supply of the three selected ESs. A clear change in ES supply is observed and witnessed by the ES users (local farmers) after the implementation of SLM measures in the upstream part of each micro-watershed.

Despite the implementation of the different SLM measures, it is mandatory to ensure the sustainability of ecosystem service supply in each micro-watershed using appropriate PES scheme. Specific to the CLM selected micro-watersheds; let's look at the following data for establishing PES schemes for Madoye micro-watershed.

- Area of the watershed 645.5 ha ha
- Number of households using irrigation are 155 households
- Mode of payment is labour contribution

Payment for ecosystem service (PES) considering SWC:

For this scheme, the consultant considered the downstream farmer's incentives or compensations for the upstream CWUC in the form of free labour contributions. For establishing PES scheme, the consultant took deep trench, soil bunds, and fanyaa juu SWC structures. These structures are selected because they are commonly available in the three selected CLM micro-watershed and are among the common structures that local farmer's free labour contributions is applied.

- If they work for one month as per the Ethiopian government watershed management campaign held between January and March, with SLM farmers wage estimation of 50 ETB per day, they will have 1,500.00 ETB per month per one farmer and 233,500.00 ETB will be collected from the whole households in the watershed.
- If they want to construct deep trench (3 m length *1 m depth *1 m width = 3 m^3) in the upstream area, they can be able to construct, 77.5 m^3 of deep trench or 25.83 number of deep trench.
- One farmer can construct 0.5 m^3 of deep trench or 6 farmers construct 3m^3 deep trench (1 deep trench), 50 ETB per person *6 = 300 ETB per one deep trench.
- The total amount of money considered from households will construct 775 deep trenches in the upstream part of the watershed (232,500 total ETB/300 single deep trench = 775 deep trench).

If the downstream farmers want to construct soil bund in the micro-watershed, the work norm is shown as follows:

- One km of soil bund is constructed by 150 farmers and 155 households will construct at least more than 1 km per day. If they work for one month (30 days), they will construct more than 30 km soil bund in the micro-watershed. In terms of contribution, 1km is constructed by 7,750 ETB per day and they will contribute 232,500.00 ETB per month 2,790,000.00 ETB per year.

If they want to construct fanyaa juu, the following work norm will be applied:

- One km of fanyaa juu is constructed by 200 farmers. In a given household, more people are expected to live. So, 155 households available in the downstream part of the micro-watershed will construct 0.775 km per household per day. In one month, they will construct 23.25km of fanyaa juu. In term of money contribution per day, they will contribute 7750.00 ETB per day per 155 households and they will contribute 232,500.00 ETB per month to the upstream part of the micro-watershed. Similarly, plantation pits, stone bund, terrace, and bench terrace have similar working norms and calculated similar with the above mentioned SWC structures.
- In one year, they will contribute around **2,790,000.00** ETB per year.
- The total area available for soil bund and fanyaa juu is around 43.3 ha. If 65% of the upstream area has soil bund (average distance between soil bund is 6m) and 35% is covered by fanyaa juu (average distance between soil bund is 3.5m), the area considered as loss or

opportunity cost as a result of constructing these SWC structures could be calculated as follows:

- Width of soil bund = 50 cm
- Width of berm = 20 cm

-Total width that is considered as loss (area opportunity cost) = **70 cm (50 cm + 20 cm)** and this is estimated as **11.67% (0.7/6*100),** where 0.7 m is the total width and 6m is the space between two soil bunds. **11.67%** is the proportion of opportunity costs incurred as a result of constructing soil bund in the upstream part of the micro-watershed.

- Area lost out of production due to soil bund = **28.15 ha (0.65*43.3ha)*0.1167 = 3.29 ha** of land is an already forgone land area due to soil bund.

-For fanyaa juu**, 0.7/3.5m*100 = 20%,** where 0.7 m is the total width and 3.5 m is the space between two fanyaa juu SWC structure.

-Area lost out of production due to fanyaa juu = **15.16 ha (0.35*43.3 ha)*0.2 = 3.03 ha** of land is an already forgone land area due to fanyaa juu. Considering soil bund and fanyaa juu SWC structures, **6.32 ha (3.29 ha + 3.03 ha)** of land is become out of production.

- If we deduct from **6.32 ha out of 43.3 ha of land, there will be 36.98 ha**. Therefore, the difference shall be the opportunity cost and out of 2,900,000.00 ETB per year. The upstream CWUC members incur different costs during their free labour contribution as PES scheme. Among the different costs, the followings are the main one:

  - Opportunity cost
  - Design and implementation cost
  - Monitoring and evaluation cost

These costs must be included in the establishment of PES scheme and the following calculations cover the different costs incurred during implementation of SWC structures in the upstream part of the micro-watershed.

Therefore, out of **2,900,000.00** ETB per year,

- 918,430.00 ETB is for covering the opportunity cost of the farmers as a result of construction of soil bund (338,430.00 ETB) and fanyaa juu (580,000.00 ETB).
- 136,605.33 ETB is for design and implementation cost for soil bund and fanyaa juu.
- 1,844,964.00 ETB is for covering the monitoring, evaluation, verification, and transaction cost of implementing soil bund and fanyaa juu.

For public institutions such as Boloso Bombe Woreda Water and Sanitation office, the following PES scheme is proposed.

In the case of Boloso Bombe Woreda Water and Sanitation office, they have shown their WTP in the form of tariff collection from the water users available in the Bombe town.

- The population size of the Boloso Bombe woreda, Bombe town 2716 people (CSS, 2021).
- According to Growth and Transformation Plan 2 of Ethiopia, the per capita daily water use rate is considered as 50 litres per day (Yadeta, 2022). If 2716 people (CSS, 2021) are

multiplied with 50 litters per day, it will be 135,800 litters per day (135.8m^3/day, 4074 m^3/month, 48,888m^3/year, 342,216 m^3 for the coming 7 year up to 2030).

- Average price of water charged by the town = 8.91 ETB/m^3
- If the town charges an additional 1 Birr/m3 of water to its users, it could generate about 48,888.00 ETB per year, which could be used to finance SLM interventions on the upstream area of the micro-watershed. The revenue could increase to about 97,776.00 ETB per year if the charge increases to 2 ETB/m^3 and to 146,664.00 ETB per year if the charge is 3 ETB/m^3. Therefore, Out of 146,664.00 ETB per year:
  - 46,448.49 ETB is for covering the opportunity cost of the farmers
  - 100,215.51ETB is for covering monitoring, evaluation, verification, and transaction costs.

Phase 2: Establish PES scheme principles and resolve technical issues

To build trust among ESs seller (CWUC members) and buyer for the marketable ESs in each micro-watershed, it is mandatory to follow guiding principles and solving technical issues including:

- Delineating PES schemes' geographical coverage. In this case, this PES scheme will cover the three CLM selected micro-watersheds with a size of 795 ha, 645.5 ha, and 836.08 ha respectively for Mlihay, Madoye, and Temba micro-watersheds.
- Establishing the baseline; this is important for assessing performance SLM measures implemented in the upstream area and results in terms of provisioning ESs throughout the agreement period between ES buyers and sellers.
- Undertaking opportunities and risk assessments;
- Identifying appropriate interventions;
- Determining the mode of payment: In this case, the mode of payment is free labour contribution by the downstream farmers in each micro-watershed.
- Establishing arrangement for monitoring, evaluation and review.
- Building trust among the different parties will be critical for resolving these issues

As an important step towards effective implementation of PES in each micro-watershed, the followings are very important.

- Establishing steering committee to oversee scheme development and implementation
- Building scientific advisory panel to provide confidence in the scheme's capacity to deliver additional ecosystem service provision.
- Gathering of a primary evidence for the sake of convincing the potential buyers of ESs
- Consultation with stakeholders and the public at large
- Undertaking monitoring and verifying ecosystem service benefit

Phase 3: Negotiate and implement agreements

Under this phase, for effective negotiation to happen, four important tasks can be considered in each selected CLM micro-watershed namely: nature of payment, level of payments, timing of payments, and drawing up of agreement.

Nature of payment

In each selected micro-watershed, the selected payment model for established PES scheme is free labour contribution by downstream farmers. Moreover, use of revolving funds collected from town drinking water users through putting additional tariffs. In this case, using the experience of GIZ in providing revolving fund for CWUC members to use it for income generating activities in each micro-watershed is very essential.

Level of payments

The price paid for an ecosystem service will be the result of a negotiation between the buyer(s) and seller(s), facilitated by intermediary or brokers. However, in each micro-watershed, fixed level of payment is not available and some of the payments are based on buyer's self-willing. This voluntary based payment in the micro-watershed (Mlihay) does not include any of the opportunity costs incurred by the upstream CWUC members.

Timing of payments

The time of payment can be agreed between the seller (CWUC) and buyer. However, during KII with Mercy water bottling industry manager, they are experienced in paying one time per year as per the local community demand. Actual delivery of the ecosystem service (a 'payments-by-results' approach) can be considered as a successful way of delivering payment for the desired ecosystem service outcome. However, performance-based payments may not be appropriate, particularly given the potential up-front investment on the part of sellers and/or the time lag between the implementation of the relevant intervention and the provision of the ecosystem service, which could be decades in some cases. An alternative approach is to make payments on the basis of specified actions or the implementation of particular agreed measures, a pragmatic approach which can be agreed to by both buyers and sellers is highly necessary.

Draw up agreements

Legal agreement are drawn up and signed to formalise the scheme. In our case, in all micro-watershed, the seller (CWUC) and buyers (for example Mercy water bottling industry near Mlihay micro-watershed) do not have legal agreements. During KII, the industry manager said *"incentivizing local farmers for their watershed management through voluntary participation do not need/require legal agreement"* However, they vow to continue their help without having legal agreements.

Phase 4: Monitor, evaluate and review implementation

Undertaking monitoring PES scheme is to ensure:

- the contracted interventions or ESs outcomes are being delivered;
- If payments are based on inputs, that interventions are in fact enhancing ecosystem services;
- Adverse trade-offs are not taking place between valuable ecosystem services; and
- Relevant regulatory requirements are being complied with.

At this point, third **party verification** would increase the level of buyer's confidence. Moreover, certification may also be required to ensure the scheme is delivering on its goals and so provide buyers

with the necessary assurance. Besides, the PES scheme should be periodically evaluated and subsequently reviewed to ensure that its objectives are met.

In addition to what have been mentioned in the above, the following points are necessary for PES scheme appraisal.

- Establish a baseline for the marketed ecosystem services: Using secondary (existing) data where possible, supplemented by primary data collection where necessary
- Choose and design monitoring and verification methods: Direct measurement, Modelling, Proxies or indicators
- Monitor and verify
- Review and adapt
- Evaluation and review: Periodically evaluated the PES scheme in light of the data collected through monitoring.

4.4 Experience and lesson learned about PES

Based on extensive literature reviews and practical experiences, particularly in East Africa, it is evident that Payment for Ecosystem Services (PES) holds significant relevance for Ethiopia, especially in the selected CLM micro-watersheds located in Tigray, Benishangul Gumuz, and South Ethiopia. Lessons learned and experiences gained from PES assessments in these regions can be extrapolated to other parts of the country, highlighting the potential for broader application and impact.

- The selected CLM micro-watersheds and its surrounding with SLM measures contains a wide range of natural and modified ecosystems which generate services (flood risk mitigation, sediment retention, water supply, food production, carbon sequestration and others) that are of immense importance for EEP, EEU, municipal water and sanitation office, downstream farmers and other buyers of ESs produced by upstream part of the micro-watershed. Moreover, ESs produced have impacts to the local livelihoods and income, agricultural production and even to national, regional and global economies;
- Local Population pressure is the major factors in making the ESs produced by each CLM micro-watershed to be threatened seriously in one hand as a result of weak legal frameworks. This would compromise the supply of economically valuable ESs. In addition to proclamations declared by the national government, it is good to have local bylaws prepared by local farmers on the basis of their local culture and experience. On the other hand, the increased local population can be considered as a resource to implement different SLM measures in the micro-watersheds.
- Multiple stakeholders including potential buyers (EEP, EEU, Mercy water bottling industry, municipal water and sanitation office, and other institutions) and sellers (CWUCs) can get considerable benefits as a result of improved ESs in the upstream part or incur considerable costs and damages if ESs are degraded or lost;
- Both government conservation offices such as ministry of agriculture and other partner organizations such as GIZ and others are critically under-funded and farmers are currently have few incentives or compensations or financial rewards for implementing SLM measures so as to generate different ESs with high amount of opportunity costs.
- Many ecosystem services such as provisioning, regulating, supporting, and cultural ESs are received free or at minimal cost, often by public, private and individual person that make considerable money or avoid significant losses from them, and are well-able to afford to pay for them (and may also be willing to do so).

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The rate of land degradation is quite pervasive in Ethiopia and in return, the loss of ecosystem services has occurred causing economic as well as environmental consequences. Reversing land degradation using sustainable land management in the selected CLM micro-watersheds and their surroundings become an optionless option that requires strong commitment of stakeholders. Since all ecosystem services cannot be tradable in the market and do not have direct market prices, they were highly exposed to degradations. The implementation of sustainable land management (SLM) intervention with the support of partners, have started to gradually reverse land degradation and local ecosystem services started to boom in some SLM intervene areas. Therefore, SLM intervention using PES scheme is a win-win solution for addressing the problems and creating additional co-benefits.

Since market do not accommodate all ecosystem services, understanding the market price under failed market is difficult. Payment for ecosystem service (PES) a tool used to fill the gaps created by market in terms of incentives or compensation for ecosystem services that have no market price. Using semi-structured interview, FGD, and KII, tradable ES, sellers, buyers, Willingness to pay (WTP), willingness to accept (WTA), and market-based mechanism value chain were identified and determined in each selected CLM micro-watershed and its surroundings. Individual farmers understanding towards ecosystem services produced in the upstream part of the watershed is quite spatially different between upstream and downstream. Upstream farmers are relatively awarded about ESs than downstream since they are organized in the form of association (CWUCs) where opportunities of training and other capacity building engagements are highly practiced. Upstream farmers are implementing SLM measures not only for the benefits of themselves but also for others. However, these contributions are not yet acknowledged by the downstream beneficiaries. Downstream farmers mostly considered the services coming from upstream part of the watershed as natural free gifts so any one can use it. Such attitude was also reflected in other public institutions, considering the ESs such as drinking water supply as a free natural gift, ignoring the contributions of upstream CWUCs in keeping the flow of ES towards downstream.

Marketable ecosystem services were identified that are common to all the three micro-watershed. CWUCs in the upstream are the seller while irrigation user farmers, public, and privates institutions found at the downstream are potential buyers of ESs. Since the market do not have values for these ESs, valuing in terms of incentives or compensation is quite important. For incentives/compensation, all stakeholders available in the downstream have WTP for the services they are using. There are industries that are already started using incentive/compensations such as BGI beer brewing industry. However, they do practically their WTP based on their willing. There is no institution that can monitor, evaluate, and verify the actions undertaken by the industry. The potential buyers have different means of PES payments. However, they highly prefer building social and infrastructure such as school, health centres, water facilities and roads. But they hesitate for cash payments except government partner organization such as GIZ who provided revolving fund in cash for the CWUC's IGA.

The study identified the scheme for financing SLM intervention through free labour contributions of downstream farmers (constructing fanyaa juu and soil bund), and urban drinking water supply for the case of Boloso Bombe town. Downstream farmers use ESs coming from upstream area such as water resources, flood risk mitigation, and sediment retention. Their WTP was in the form of free labour contribution. Within that area, there are 155 households and if they want to construct soil bund and fanyaa juu in the upper part of the micro-watershed, they contribute 2,790,000.00 ETB per a year. Out of this amount of money, 918,430.00 ETB shall be used for cover the farmer's opportunity cost of constructing soil bund and fanyaa juu on their lands. The rest 1,981,569.33 shall be used for covering the costs of design and implementation cost, monitoring cost, evaluation cost, verification cost, and other transaction costs. Similarly**,** Boloso Bombe Woreda Water and Sanitation office is among the potential buyers of ESs. If the town charges an additional 1 Birr/m^3 of water to its users, it could generate about 48,888.00 Birr per year, which could be used to finance SLM interventions on the upstream area of the watershed.

For the PES, intermediary and brokers are important. Part of government such as Ministry of Agriculture and its subsidiaries can act as intermediary for the negotiation of buyers and seller. Partner organizations such as GIZ can be used as knowledge providers through consultation and capacity building trainings. Out-put based PES payment is more recommended, and the time of payment is as per the maturity level of the ESs or at the level where the buyer satisfied with the level of available ESs. During the negotiation between buyers and sellers, all cost of the seller must be covered. Regular monitoring, verification, and evaluation of PES must be applied between buyer and sellers.

5.2 Recommendations

Lack of market values for some ecosystem services has contributed for their degradations. Developing PES scheme in the form of incentives/compensations plays a vital role in minimizing ES degradation in the watershed. For effective PES scheme, the following recommendations are forwarded.

- Establishing PES requires verified and acceptable guidelines. Therefore, we recommend guidelines for preparing a near to perfect PES scheme.
- Awareness creation about values of ecosystem services has to be done in order to improve the understandings of farmers. This is especially works soundly for those individual farmers who are not the member of CWUCs.
- Local, regional, and central government have to take the lead in implementing PES in the watershed, and assign responsible institutions that can follow, monitor, evaluate, verify, negotiate and positively re-enforce sellers and buyers to reach agreement for PES.
- Encouraging or positively re-enforcing companies already started in PES such as BGI beer brewing industry and mercy water bottling industry in the form of tax reduction and providing certificate for undertaking their corporate social responsibility in the local area.

- Scaling up the Humbo and Soddo experience of carbon credit to these CWUCs managed watershed
- Stakeholder Engagement and establishing consortiums of steering committee following the government structures (local, regional, federal level) that can able to search potential buyers, play intermediary role, verify ESs as per the demand of the buyers, and enforce amendments if problems are created.
- Capacity Building and awareness creation is mandatory for buyers

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ANNEXES

Annex I: Characteristics of the selected CLM micro-watersheds

Characteristics	Milhay micro-watershed	Madoye micro-watershed	Temba micro-watershed
Watershed Size (ha)	795 ha	645.5 ha	836.08 ha
Altitude m asl	2800- 2600 m asl	2,300-3,200 m asl	1350-1405 m asl
Mean annual T (^{o}c)	15-18 ^{0}c	27-30^{0}c	28^{0}c
Mean annual RF (mm)	500 mm	1500 mm	1050 mm
Rainfall pattern	Bimodal	Bimodal	Bimodal
Agroecology	Dominantly Dega	Woina Dega (Tepid humid mid highland)	Wet Kolla
Farming system	Crop cultivation, animal husbandry,	Crop cultivation, animal husbandry, and agroforestry system	Crop cultivation, animal husbandry, and agroforestry system
Population density	156.1 people per square kilometre	1315.7 people per square kilometre	40.31 people per square kilometre
CWUCs members	Yes, 316 members	Yes, 169 members	Yes, 101 members
HH number in watershed	232 households	1,425 households	62 households
Average land size in ha	0.5 ha	0.25 ha	2 ha
Number of Landless	58 households	Zero	-
Irrigation situation	Yes, 8.5 ha land is irrigated using gravity from springs, benefiting 117 HHs in the downstream	Yes, 84 ha of land is irrigated using the water pump, benefiting 155 HHs in the downstream	Yes, 10 ha of land is irrigated using gravity in the canal, benefiting 62 HHs in the downstream

Annex II: Data types, source, methods, and sampling for interview, FGD, and KII.

Data type	Data sources	Collection methods	Sampling techniques	Number of respondents
- Tradable ESS - market/buyer of ESS - ESS buyers - ' WTP	- CWUCs member - Women and youths are part of the interview	Semi-structured interview	Simple random sampling technique (lottery system was applied)	From each micro-watershed community, 30 representative samples were selected. A total of 90 individuals were selected from the three micro-watersheds.

- CWUCs WTA - VC for the ES marketing	- Member of the CWUCs (old men, youths, and women) with active participation in watershed development works and available in the upper stream part of the watershed. - Women group Farmers available in the downstream of the watershed (irrigation users).	FGD: Selection was done together with CWUC leaders and SLM focal person	Availability sampling techniques	**In all micro-watershed** • CWUC members= 2 FGD (1 mixed and 1 only women). • 1 FGD with downstream irrigation users • Member of the FGD varies from 8-12. • A total of 9 FGD was done in the whole selected micro-watershed.
	- CWUC leaders - Kebele leader - Woreda agricultural office - Cooperative experts - SLM focal person - NRM expert - University and research centres - DAs - Potential buyers (public, private, and farmers)**	KII - Selection was done together with CWUC leaders and SLM focal person		• From 1 to 2 respondents from each group. • 17 KIIs were carried out in each micro-watershed. A total 51 individuals were targeted for KII from all micro-watersheds.

***the potential buyers were identified using the following criteria: proximity to the micro-watershed, user of the watershed ecosystem services, and found within the larger watershed contributing towards the same out lets.*

Annex III: Payment for ecosystem service for Costa Rica country for hydrological services.

Company name	*Type of user/buyer of ES*	*Area covered by contract (ha)*	*Actual area enrolled as of end 2004 (ha)*	*Contribution to payment to participating land users[a],[b] (US$/ha/yr)*	*Administrative costs*	*Comments*
Energía Global	Hydropower producer	2,000	1,493	12	0	Signed 1997, renewed 2002
Platanar S.A.	Hydropower producer	750	750	45	5% of payment	Signed 1999, renewed 2004; addendum on non-titled land users signed 2000 for 10 yrs
CNFL	Hydropower producer	10,900	7492	120	$13/ha yr 1 $7/ha yrs 2-5	Umbrella agreement signed 2000, with addendums covering specific watersheds
Florida Ice & Farm	Bottler	1000	440	45	$29/ha yr 1	Signed 2001, later modified to use CSA
Heredia ESPH	Municipal water supply	1000	440	22	$4/ha yr 1	Signed 2002 using CSA
Azucarera El Viejo	Agribusiness (irrigated)	550	0	40	7%	Signed 2004 using CSA
La Costeña SA	Agribusiness (irrigated)	100	0	45	7%	Signed 2004 using CSA
Olefinas	Agricultural supplies	40	40	45	7%	Signed 2004 using CSA
Exporpac	Agribusiness (irrigated)	100	0	45	7%	Signed 2004 using CSA

Hidroeléctrica Aguas Zarcas	Hydropower producer	1666	0	30	7%	Signed 2004 using CSA
Desarrollos Hoteleros Guanacaste	Tourism	925	0	45	7%	Signed 2004 using CSA

Source: Pagiola, (2006)

Annex IV: Socioeconomic characteristics of households (HHs)

Socio-economic variables	Category	Mlihay		Madoye		Temba	
		Up stream	Down stream	Up stream	Down stream	Up stream	Down stream
Sex	Male	60%	73.3%	66.7%	60%	40%	46.7%
	Female	40%	26.7%	33.3%	40%	60%	53.3%
Age	18-24 years	0	0	0	0	6.7%	26.6%
	25-30 years	13.3%	20%	13.3%	20%	20%	20%
	31-40 years	20%	26.7%	20%	26.7%	13.3%	20%
	41-50 years	40%	46.7%	33.3%	46.7%	26.7%	20%
	>=51 years	20%	13.3%	33.3%	6.7%	40%	13.3%
Marital Status	Divorced	0	0	0	0	0	0
	Married	89%	95%	86.7%	91%	80%	80%
	Single	11%	5%	13.3%	9%	13.3%	13.3%
	Widow	0	0	0	0	6.7%	6.7%
Family size	<=3 people	13.3%	6.7%	13.3%	15%	13.3%	33.3%
	4-6 people	20%	26.7%	20%	30%	26.7%	40%
	7-9 people	46.7%	40%	46.7%	47%	46.7%	20%
	>=10 people	20%	26.7%	20%	8%	13.3%	6.7%
Farm size	<=0.25 ha	40%	26.7%	46.7%	26.6%	0	0
	0.26 ha- 1ha	46.7%	53.3%	33.3%	46.7%	13.3%	0
	>1 ha	13.3%	20%	20%	26.7%	86.7%	100%
Education	Illiterate	0	0	33.3%	20%	73.3%	26.7%
	10+	20%	13.3%	20%	26.7%	0	20%
	Primary school	46.7%	60%	33.3%	46.7%	33.3%	46.7%
	Secondary school	33.3%	26.7%	13.4%	6.7%	0	6.7%
Occupation	On-farm based	100%	100%	100%	100%	100%	100%
	Off-farm based	0	0	0	0	0	0
	Non-farm based	0	0	0	0	0	0
Source of Energy for cooking	Electricity	0	0	0	0	0	0
	Biogas	0	0	0	0	0	0
	Solar	0	0	0	0	0	0
	Fuelwood	100%	100%	100%	100%	100%	100%
Source of Fuelwood	Communal Forest	0		0	0	0	0
	Own Farm	100%	100%	100%	100%	100%	100%
	5000-15000	33.3%	20%	6.7%	13.3%	0	0
	15000-25000	53.3%	40%	40%	26.7%	0	0

Household annual income level in birr	>25000	13.3%	40	53.3%	60%	100%	100%

Annex V: Overview of work reports at each micro-watershed

According to the reports shown by the SLM focal person in each selected woredas, different SLM activities have been conducted in each selected CLM micro-watershed since the start of SLM implementation. The following table illustrates the overall SLM works carried out in each selected micro-watershed (Madoye, Mlihay, and Temba) and its surrounding.
Overall works implemented in each selected SLM Micro-watershed.

Specific works implemented in each micro-watershed ***	Mlihay micro-watershed	Madoye micro-watershed	Temba micro-watershed
Physical SWC measures on hillsides • Hillside terrace construction • Hillside terrace + trench construction • Bench terrace construction • Deep trench construction • Micro basin construction • Percolation-pit construction • Different moisture harvesting structures	√	√	√
Biological SWC measures on hillsides • Grass Planting on terrace • Forage tree seedling planting along terrace • Forage sowing along terrace (Sesbania, etc) • Tree and shrub planting	√	√	√
Gully rehabilitation			
Existing Community Forest Management			
Afforestation / reforestation of degraded-land			
Farmland and Homestead Development • Stone faced soil bund construction • Soil bund construction • Water collection trench construction • Bench terrace construction • Grass planting on terrace • Forage planting along bund e.gsesbanin • Compost making • Crop residue management (on farm land use)	√	√	√
Water-harvesting technology promotion • Community pond construction • Household pond construction • Spate irrigation and diversion construction • Roof-water harvesting technique demonstration	√	√	Not available
Climate Smart Agriculture(CSA) • Mulching/permanent soil cover • Road water harvesting	√	√	√

• Micro-irrigation- shallow wells and springs • Improved compost making (manure management-bio digester) • Lime application to acidic soils • Agroforestry practices(tree-crop-livestock systems) • Crop rotation • Legume intercropping • Crop residue use • Green manuring /Cover crop • Minimum and zero tillage			
Livelihood Diversification and Connection to Value Chains • Apiculture promotion (HH managed) • SHG based apiculture promotion • Poultry promotion (HH managed) • Sheep and goat fattening (HH managed) • Managed milk processing (HH managed) • Plant temperate fruit tree seedlings (eg. Apple) • Plant tropical fruit tree seedlings (eg. Mango, Orange, etc.) • Root and tuber crop promotion (Enset, etc) • Spices Planting • Promote improved vegetable production • Coffee & Tea plantation • Others	√	√	√

*** Activities implemented are subjected to spatio-temporal variation between micro-watershed. The degree of implementation varies between micro-watershed.

Annex VI: Identified marketable ESs in the selected CLM micro-watersheds

Identified marketable ESs	Mlihay micro-watershed		Madoye micro-watershed		Temba micro-watershed	
Provisioning ESs	Up stream	Down stream	Up stream	Down stream	Up stream	Down stream
Fresh water for drinking	√	√	√	√	√	√
Fresh water for irrigation	X	√	X	√	X	√
Biodiversity (e.g. *Thymus serpyllum)*	√	X	√	X	√	X
Traditional plant medicines	√	X	√	X	√	X
Regulating & Supporting ESs	Up stream	Down stream	Up stream	Down stream	Up stream	Down stream
Water purification/filtration	√	√	√	√	√	√
Soil erosion control	√	√	√	√	√	√
Sedimentation control	√	√	√	√	√	√
Flood risk mitigation	√	√	√	√	√	√
Carbon sequestration or climate regulation	√	√	√	√	√	√
Aquifer recharge/water storage	√	√	√	√	√	√

Nutrient cycling	√	√	√	√	√	√
Habitat/refugee	√	X	√	X	√	X
Cultural ESs	Up stream	Down stream	Up stream	Down stream	Up stream	Down stream
Landscape beauty (ecotourism)	√	X	√	X	√	X
Spiritual value	X	X	√	X	X	X
Education and knowledge system (training, demonstration site, and research site)	√	√	√	√	√	√

Types of buyers	Potential buyers of ESs	ESs they want to buy
Madoye Micro-watershed and its surrounding		
Public Institution	Boloso Bombe woreda Water and Sanitation office	• Fresh water supply for drinking • Sediment control to save water points • Water purification • Ground water recharge
	Ethiopian electric power (EEP)-Gibe-3 Dam	• Sediment control • Water flow regulation
	Ministry of agriculture/Ethiopian environment and climate authority	• Climate regulation due to Carbon sequestration • Soil erosion control • Flood risk mitigation
	Omo basin authority	• Soil erosion control • Sediment control
	Wolayita Sodo University and Areka research centres	• Education and research service
Private Institution	Downstream Farmers irrigation water user association	• Irrigation water supply • Soil erosion control • Sediment control • Flood risk mitigation
	Spiritual institutions	• Spiritual values
International institutions	World Bank, GIZ, World Vision	• Climate regulation: carbon credit
Mlihay Micro-watershed and its surrounding		
Public Institution	Amba Alaje woreda Water and Sanitation office	• Fresh water supply for drinking • Sediment control to save water points • Water purification
	Ethiopian electric power (EEP)-Tekeze Dam	• Sediment control • Water flow regulation
	Ministry of agriculture/Ethiopian environment and climate authority	• Climate regulation due to Carbon sequestration • Soil erosion control • Flood risk mitigation
	Tekeze Watershed authority	• Sediment control • Flood risk mitigation
	Raya University	• Education and research service
Private Institution	BIG Ethiopia Beer Industry (formerly called Raya Beer Factory)	• Fresh water supply • Flood risk mitigation • Sediment control • Climate regulation-carbon sequestration
	Mercy-water bottling Industry	• Fresh water supply • Ground water recharge • Flood risk mitigation • Sediment control
	Maitchew Particle Board industry	• Climate regulation: carbon sequestration • Raw material for the industry (eucalyptus)
International institutions	World Bank, GIZ, World Vision	• Climate regulation: carbon credit
Temba Micro-watershed and its surrounding		
Public Institution	Homosha Woreda Water and Sanitation office	• Fresh water supply for drinking • Sediment control to save water points • Water purification
	Ministry of agriculture/Ethiopian environment and climate authority	• Climate regulation due to Carbon sequestration • Soil erosion control • Flood risk mitigation
	Assosa University	• Education and research service
International institutions	World Bank, GIZ, World Vision	• Climate regulation: carbon credit

Annex VII: Potential ESs buyers and their interest

Marketable ESs	Sellers and their responsibility (Madoye)		Buyers and their responsibility		Intermediary & knowledge providers	Method of payment
	ESs seller	Responsibility	Buyers	Responsibility		
Drinking water supply	CWUCs	• Planting trees to decrease overland flow • Preparing deep trench • Maintaining area closures • Construction hillside terraces, soil bund, fanyaa juu, and half moon • Managing the plantations like thinning and replanting • Monitoring, measuring, and verification of ESs together with buyers • Securing the continues flow of ESs and increasing the confidence of buyers • Maintaining the eco-tourism sites	Municipal water and sanitation office	• Collect tariff from users and pay for CWUCs • Plan, verify and negotiate with CWUCs	NGOs such as World vision, GIZ and other gov't partners play also a key role in building the capacity of sellers and buyers to negotiate. - Universities (Wolayita Sodo) and research centers as knowledge providers, measure, monitor, and verify each ESs provided by sellers in a way it can convince and satisfy the buyer's demand.	-Out-put based payment in the form of revolving fund/cash, social and infrastructure buildings -providing improved variety of plant species and seeds for ESs providers
Irrigation water supply			EEP and EEU	- Measurement, monitor, and verification of retained sediments - Collect tariff and pay for CWUCs with negotiation		
Flood risk mitigation			Gibe basin authority	- Verification of flood controlled and Sediment trapped		
Sediment retention			Ethiopian environment protection authority	- Verifying the project area and carbon sequestration service volume in CO2e		
Carbon sequestration			World vision World Bank GIZ			
Eco-tourism			Local community, and others such as youth associations using the plant as income source	- Allocate certain amounts of money from their profit to the management of the *site*		Free labor contribution for managing the area allocated for eco-tourism

Annex VIII: Market based mechanism for marketable ESs (Madoye micro-watershed)

Annex IX: Market based mechanism for marketable ESs (Mlihay micro-watershed)

Annex X: Market based mechanism for marketable ESs (Temba micro-watershed)

Marketable ESs	Sellers and their responsibility (Mlihay)		Buyers and their responsibility		Intermediary & knowledge providers	Method of payment
	ESs seller	Responsibility	Buyers	Responsibility		
Drinking water supply	CWUCs	• Planting trees to decrease overland flow • Preparing deep trench • Maintaining area closures • Construction hillside terraces, soil bund, fanyaa juu, and half moon • Managing the plantations like thinning and replanting • Monitoring, measuring, and verification of ESs together with buyers • Securing the continues flow of ESs and increasing the confidence of buyers • Maintaining the eco-tourism sites	- Municipal water and sanitation office - Mercy-water bottling Industry - BGI Beer brewing company	• Collect tariff from users and pay for CWUCs • Allocating money from their revenue to the ESs sellers (CWUC) • Plan, verify and negotiate with seller	-Government plays the lion share in bringing buyers and sellers together to negotiate. -NGOs such as World vision, GIZ and other gov't partners play also a key role in building the capacity of sellers and buyers to negotiate. -Universities (Mekelle, Raya) and research centers as knowledge providers, measure, monitor, and verify each ESs provided by sellers in a way it can convince and satisfy the buyer's demand.	-Out-put based payment in the form of revolving fund/cash, social and infrastructure buildings -providing improved variety of plant species and seeds for ESs providers
Irrigation water supply			-EEP and EEU -Maitchew Particle board industry	- Measurement, monitor, and verification of retained sediments - Allocate money from collected tariff for service provider (CWUC)		
Flood risk mitigation			Tekeze basin authority	- Verification of flood controlled and Sediment trapped		
Sediment retention			Ethiopian environment protection authority	- Verifying the project area and carbon sequestration service volume in CO2e - Negotiate with CWUCs		
Carbon sequestration			World vision, World Bank, GIZ and others			
Eco-tourism			Local community, and others such as youth associations using the plant as income source	-Allocate certain amounts of money from their profit to the management of the *Thymus serpyllum* plant species sustainability.		Free labor contribution for managing the area allocated for eco-tourism as well as for Thymus serpyllum plant
Biodiversity (Thymus serpyllum)		• Managing the area occupied by Thymus serpyllum plant • Reduce the negative impact on the plant stemming from eucalyptus globulus tree				

Marketable ESs	Sellers and their responsibility (Temba)		Buyers and their responsibility		Intermediary & knowledge providers	Method of payment
	ESs seller	Responsibility	Buyers	Responsibility		
Drinking water supply	CWUCs	• Planting trees to decrease overland flow • Preparing deep trench • Maintaining area closures • Construction hillside terraces, soil bund, fanyaa juu, and half moon • Managing the plantations like thinning and replanting • Monitoring, measuring, and verification of ESs together with buyers • Securing the continues flow of ESs and increasing the confidence of buyers	Municipal water and sanitation office	• Collect tariff from users and pay for CWUCs • Plan, verify and negotiate with sellers	Government plays the lion share in bringing buyers and sellers together to negotiate. -NGOs such as World vision, GIZ and other gov't partners play also a key role in building the capacity of sellers and buyers to negotiate. -Universities (Assosa) and research centers as knowledge providers, measure, monitor, and verify each ESs provided by sellers in a way it can convince and satisfy the buyer's demand.	-Out-put based payment in the form of revolving funds/ cash, social and infrastructure buildings - providing improved variety of plant species and seeds for ESs providers
Irrigation water supply			-Ministry of rural and agriculture together with partners (project) -Ethiopian environment protection authority	- Measurement, monitor, and verification of retained sediments		
Flood risk mitigation				- Verification of flood controlled and Sediment trapped		
Sediment retention				- Verifying the project area and carbon sequestration service volume in CO2e		
Carbon sequestration			World vision, World Bank, GIZ			
Biodiversity		• Managing the area occupied by different plants Reduce the negative impact of other species on important medicinal plants	Local community, and others such as youth association	-Allocate certain amounts of money from their profit to the management of the sites to ensure species sustainability		Free labor contribution