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Investigation of the Modalities for an Innovative Financing Mechanism for Participatory Natural Resource Management in the Bale Eco-region, Ethiopia

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IWMI International Water Management Institute

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CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

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Project

Conservation of Biodiversity and Ecosystem Functions and Improved Well-being of Highland and Lowland Communities within the Bale Eco-region (BER) is one of the European Union (EU)-funded projects that stands for Supporting Horn of Africa Resilience (SHARE) initiative, which started in July 2014 and ended in November 2017. Five partners were implementers of the project: Farm Africa; SOS Sahel Ethiopia; Frankfurt Zoological Society (FZS); International Water Management Institute (IWMI); and Population, Health and Environment (PHE) Ethiopia Consortium.

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Contents

Acronyms and Abbreviations

BER	Bale Eco-region
BoA	Bureau of Agriculture
CBFM	Community-based Forest Management
CBO	Community-based Organization
CDM	Clean Development Mechanism
CO_2	Carbon Dioxide
DA	Development Agent
EEP	Ethiopian Electric Power
EPI	Environmental Policy Instrument
ES	Ecosystem Services
FFW	Food-for-Work
FONAFIFO	Fondo Nacional de Financiamiento Forestal (Costa Rica)
FONAG	Fondo para la Protección del Agua (Ecuador)
FZS	Frankfurt Zoological Society
GEF	Global Environment Facility
GHG	Greenhouse Gas
GPS	Global Positioning System
IPCC	Intergovernmental Panel on Climate Change
IWMI	International Water Management Institute
KII	Key Informant Interview
LULA	Land Use and Land Administration
M&E	Monitoring and evaluation
MoANR	Ministry of Agriculture and Natural Resources
MoEFCC	Ministry of Environment, Forest and Climate Change
MoWIE	Ministry of Water, Irrigation and Electricity
NGO	Nongovernmental Organization
NRM	Natural Resource Management
NTFP	Non-timber Forest Product
OFWE	Oromia Forest and Wildlife Enterprise
OIAR	Oromia Institute of Agricultural Research
PES	Payments for Ecosystem Services
PESP	Payments for Environmental Services Program
PFM	Participatory Forest Management
PSNP	Productive Safety Net Programme
PWSM	Participatory Watershed Management
R&D	Research and Development
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SFA	State Forestry Administration (China)
SHARE	Supporting Horn of Africa Resilience
SLCP	Sloping Land Conversion Program (China)
SWC	Soil and Water Conservation
WLRC	Water and Land Resource Centre
UMAT	Unidad de Medio Ambiente y Turismo
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market

Summary

This study reviewed the status of natural resources and the driving forces for change, as well as past and ongoing approaches in natural resource management at the watershed scale in Ethiopia. First, we reviewed established environmental policy tools and the legal and policy framework, and determined whether innovative financing mechanisms are working in other areas with a similar context. We undertook stakeholder analyses and mapping to identify key stakeholders, and to assess their possible roles in the implementation of a sustainable financing mechanism for watershed rehabilitation. We also determined whether opportunities exist for financing mechanisms involving hydropower and urban water supply in payments for ecosystem services (PES), and the global community in the Clean Development Mechanism (CDM) in the context of the Bale Eco-region. The study identified major constraints to designing an appropriate financing mechanism. Finally, the study drew important conclusions and key policy implications that are relevant for Ethiopia and perhaps other areas in a similar context.

INTRODUCTION

Soil erosion, nutrient depletion and deforestation are common environmental problems in the Ethiopian Highlands (Hagos et al. 1999; Desta et al. 2000; Awulachew et al. 2008), not least in the Bale Eco-region (BER). Hurni et al. (2010) reported evidence of the high incidence of vegetation degradation in the past and the present. Gebreselassie et al. (2016) indicated that over 85% of the land in Ethiopia is moderately to very severely degraded.

The highlands of the BER are under strong anthropogenic pressure caused by rapid population growth and consequent interrelated forms of land degradation, mainly overgrazing, soil erosion and deforestation (IWMI 2016). FAO (1986) reported rates of soil loss in the range of 51-200 t ha^{-1} yr^{-1} in the Bale highlands.

The proximate drivers of land degradation in Ethiopia, in general, and BER, in particular, include forest clearance and soil surface exposure (high removal of vegetative cover); detrimental cultivation practices with an emphasis on small-seed crops that require fine tillage; and overgrazing (IWMI 2016). Due to land shortage and lack of alternative livelihoods, farmers cultivate lands and grow annual crops on slopes exceeding 30%. According to the latest Ethiopian Policy on Land (FDRE 2005d), slopes steeper than 30% should not normally be used for agricultural purposes, but rather allocated to natural vegetation or forestry. However, strong local land use directives with supporting land use maps are absent, and meticulous implementation of the land policy does not occur.

Several factors act as driving forces for land degradation, including poverty, land fragmentation, tenure security, weak extension and lack of credit services, as well as high human and livestock population pressure (Hagos et al. 1999). Pressure from human and livestock populations leads to the removal of large areas of vegetation cover to meet the increasing demand for crops, grazing and fuelwood. Policies and strategies related to securing tenure rights, building the capacity of land users through access to extension services, and improving access to input, output and financial markets should be considered as incentives to sustainable land management (Gebreselassie et al. 2016).

One of the major efforts made to address land degradation, since the 1970s, is the implementation of soil and water conservation (SWC)[1] measures, both physical and biological measures, through mass mobilization campaigns, including incentive-based programs such as the Productive Safety Net Program (PSNP) and/or Food-for-Work (FFW) (Gebregziabher et al. 2016). In the early 2000s, community-based integrated watershed development was introduced to promote watershed management, with the aim of achieving broader integrated natural resource management and livelihood improvement objectives within prevailing agroecological and socioeconomic environments (Gebregziabher et al. 2016). However, many of the watershed management programs undertaken in Ethiopia in the past were ineffective in either triggering voluntary adoption of conservation practices among farmers or conserving the structures constructed (Tesfaye et al. 2014). The factors that contribute to the success of watershed management are multidimensional (for details, see Gebregziabher et al. 2016) and benefits require a long time to materialize. However, farmers focus more on short-term gains than the long-term investments in land and water management (Gebreselassie et al. 2009).

The on-site effect of soil erosion is the removal of essential plant nutrients with the sediments (Lal 1998), with an attendant loss in land productivity and subsequent farmers' income. Based on data from selected watersheds in the Blue Nile Basin, Erkossa et al. (2015) estimated the on-site

[1] Studies by Gebremedhin et al. (1999) showed the benefit of these measures on crop productivity and profitability. Another study by Kassie et al. (2008) indicated that the performance of stone bunds varies by agroecology, suggesting the need for designing and implementing appropriate site-specific technologies.

financial costs to be equivalent to over half of farmers' average annual income. Reliable country-level estimates are lacking.

Off-site impacts of land degradation include enhanced productivity downstream, sedimentation of waterways and reservoirs, deterioration of water quality, and increased risk of flooding with adverse effects on property as well as human lives and health. Sediment generated from the highlands shortens the lifespan of reservoirs, thereby reducing irrigation land and hydropower generation capacity. For instance, Haregeweyn et al. (2006) reported that reservoirs in the northern part of Ethiopia lost 0.18-4% of their total capacity per year due to sedimentation. Extreme sedimentation has reduced water availability from the Angereb Reservoir, thereby undermining water supply to Gondar Town (in the Lake Tana sub-basin), after only half of the design life of the reservoir (Haregeweyn et al. 2012). The storage capacity of the Rosaries Reservoir on the Blue Nile in neighboring Sudan has reduced by nearly 40% over a period of 30 years because of sedimentation (Bashar and Khalifa 2009).

Within a given watershed, there are landholdings under individual (private) use rights and land which is collectively owned (so-called *common property resources*). A study by Awulachew et al. (2008) in the Blue Nile reported that about 66% of eroded soil emanates from non-cultivated land. However, another study, indicated that rain-fed fields are one of the main contributors to land degradation, with an average sediment concentration of up to 45 kg m^{-3} in Ethiopia's highlands, where rain-fed agriculture dominates (Guzman et al. 2013). In recent years, low-cost land certification has increased tenure security and enhanced investment in conservation, because farmers have incentives to conserve land under (not fully) private use (Holden et al. 2009; Hagos 2012). Designing pragmatic incentives for users of land under collective ownership is not straight forward and requires innovative financing mechanisms.

There is a major gap in available literature: identifying options for financial mechanisms for sustainable watershed management in Ethiopia. The focus of this study was to explore possible financing mechanisms for undertaking watershed management, where land is collectively owned, to minimize sedimentation of reservoirs used for both hydropower and urban water supply, and to promote better forest management as carbon sinks to reduce greenhouse gas (GHG) emissions.

The main objective of the study was to explore sustainable financing mechanisms for participatory natural resource management in the BER. The research questions addressed in this study are as follows:

1. How well have past and present financing mechanisms worked and what can be improved?
2. What innovative and sustainable finance mechanisms 'are working' in other areas with a similar context?
3. What opportunities exist for piloting payments for ecosystem services (PES) in the context of BER?
4. What policy framework is needed to enable these finance mechanisms to be effectively tested (and implemented)?

This paper is split into nine parts. The *Introduction* section provides a brief explanation of why, compared to financing mechanisms in the past, innovative and sustainable watershed financing is necessary. This is followed by a *Description of the Study Site and Study Approaches*. The section on *Overview of Environmental Policy Instruments* provides details of the policy framework in Ethiopia, followed by a presentation of the *Legal and Institutional Requirements for PES*. The *Results and Discussion* section presents stakeholder analysis and mapping in the BER, and this is followed by the section providing an outline of *Global Experiences in PES* and carbon offset schemes. A

Suitable Financing Mechanism for the BER is suggested in the next section, and this is followed by pinpointing the *Major Challenges in Institutionalizing Market Financing Mechanisms in Watershed Management in the BER*. Finally, the *Conclusions and Policy Implications* are presented.

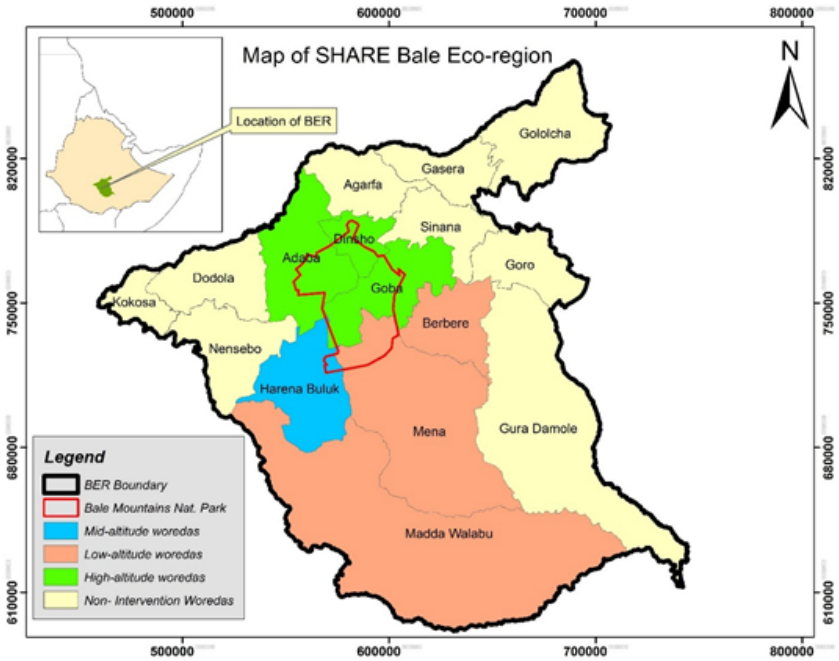
DESCRIPTION OF THE STUDY SITE AND STUDY APPROACHES

The BER is in Bale and West Arsi zones of Oromia Region, southeastern Ethiopia. The BER consists of 16 districts (locally called *woredas*[2]) and some 980,000 people live within the area, which encompasses an estimated 500,000 ha of natural forest (Farm Africa and SOS Sahel 2008). The BER is the major source of water-related ecosystem services (ES) that benefit about 12 million people in Ethiopia and in downstream areas of Somalia and Kenya.

The BER covers a total land area of 38,036 km^2. Geographically, the region lies within the coordinates of 38°51'18.21"N and 5°33'2.5E to 41°23'3.9"N and 5°23′39E. The BER consists of three distinct traditional agroecological zones: highland, midland and lowland (see Figure 1). As indicated in Figure 1, the Supporting Horn of Africa Resilience (SHARE) project operates in selected districts (called intervention districts), where lessons learned in these districts will be disseminated to the non-intervention districts during the lifetime of the project and beyond. The non-intervention districts are also envisaged to be used as a control so that it will be possible to measure the relative impact of the interventions.

The altitude of these agroecologies is as follows: (i) highland - exceeding 2,300 meters above sea level (masl), including a cool climate locally called *Wurch* exceeding 3,200 masl; (ii) midland - between 1,500 and 2,300 masl; and (iii) lowland - below 1,500 masl (Chamberlin and Schmidt 2011).

FIGURE 1. Location of the Bale Eco-region in Ethiopia, including *woredas* and altitude.



Source: Farm Africa unpublished.
Note: Nat. – National

[2] Second smallest administrative unit next to *kebele* (or peasant association), which is the smallest administrative unit in Ethiopia.

The Genale and Wabi Shebelle rivers originate in the BER, and are the main sources of water, and water for hydropower, irrigation and other ES in upstream and downstream areas, with important implications for people's livelihoods.

In the highland and midland districts of the BER, mixed crop-livestock farming systems and lowland agropastoralism are the dominant sources of livelihoods. From a recent survey conducted by Wenni consult (2015), it was identified that 45.7% and 47.5% of the households practiced mixed farming and agropastoralism, respectively. Due to increasing population and livestock pressure, converting forestland into agricultural land, overgrazing and migration of livestock from the lowlands to the highlands and the midlands aggravate the reduction in vegetation cover and soil erosion. Activities such as deforestation, conversion of forestland to cropland, overgrazing, natural factors (e.g., fire), unsustainable harvesting of fuelwood, timber and non-timber forest products (NTFPs), and unplanned and unrestricted settlement are the major threats to the BER, and this is exacerbated by the lack of a land use management plan and control of resource use (Wenni Consult 2015). Livestock production is the major source of livelihoods in the lowland areas of the BER. Therefore, the shortage of feed and water is reported to be very critical in these areas. Due to overgrazing and high runoff (because of high forest clearance in the highland and midland areas of the region), flooding and soil erosion have become very serious. Increasing soil erosion in the BER reduces crop and livestock productivity, and thereby exacerbates household food insecurity and poverty. More severe flood events have been reported particularly in the lower sections of the Wabi Shebelle Basin, causing major emergency situations (IWMI 2016). Another consequence of soil erosion could be high siltation rates in water bodies and reservoirs, leading to a reduction in water infrastructure functions (Wolancho 2012; Guzman et al. 2013).

Various measures are promoted by government organizations and nongovernmental organizations (NGOs), primarily through mass mobilization and FFW programs, to minimize the effect of these land degradation problems. A recent study conducted by Kefale (2016) in Harena Buluk District of the BER, comprising midland and lowland *kebeles*, reported that 93% of the respondents participated in ongoing interventions in natural resource management (NRM) (physical and biological SWC measures, reforestation/afforestation, exclosure, etc.), potable water supply, road development and expanding electricity services. The same study reported that 17.5% of the households in the midland area practiced physical SWC measures such as soil/stone bunds, terraces and cut-off drains on their private farms, 10% practiced biological SWC measures such as tree planting, agroforestry and grass planting, 53.5% practiced both and the remaining 19% practiced none. Of the respondents, 76% claimed that reforestation/afforestation was practiced in their area, and 34% and 42% of respondents suggested that reforestation took place using the growing of single species and diverse species, respectively. In the lowland areas, 88% of the respondents indicated that area exclosures[3] are practiced, and only 47% of respondents confirmed area exclosures being practiced with enrichment, by planting trees such as *Moringa oleifera*, Nim (*Melia azedarach L.*), Wachu (*Acacia seyal Del.*), etc. The same study indicated that 98% of the households, in both midland and lowland areas, still think that NRM interventions are necessary to conserve ecosystem services in BER.

There is enormous potential in the BER for development in many sectors. In food security, a high potential exists for agricultural intensification and expansion. There is also a large potential to promote and expand tourist attractions in which local communities can be involved. Promoting

[3] Exclosure involves excluding livestock from degraded sites to allow native vegetation to regenerate as a means of providing fodder and woody biomass, to reduce soil erosion, and to increase rainwater infiltration. Enclosure is closing, confining, restricting or keeping objects, usually animals, inside a given area (see Aerts et al. 2009).

NTFPs, such as honey production and forest coffee, provide other opportunities for the local population. Moreover, conserving water and forest resources in the region could enhance water-related ES that could benefit both upstream and downstream populations, and this is closely linked to the sharing of benefits and costs between the two groups. Thus, exploring alternative financing mechanisms for sustainable rehabilitation of the watershed is important in the BER.

The study was mainly qualitative focusing on a literature review and analysis of secondary data from the Ministry of Water, Irrigation and Energy (MoWIE), stakeholder analysis and mapping, and in-depth key informant interviews (KIIs) with experts previously and currently involved in watershed management or broadly in NRM.

OVERVIEW OF ENVIRONMENTAL POLICY INSTRUMENTS

Sterner (2003), Kerr et al. (2007) and OECD (2007) outlined the environmental policy instruments (EPIs) and their features that are applied to address different environmental problems. Table 1 outlines the essential elements of EPIs that are emphasized in various national policy documents such as the environmental policies (FDRE 2002a, 2002b), the land use and land administration policy (FDRE 2005a), integrated watershed guideline (Desta et al. 2005), and water resources management policy and regulations (FDRE 1999, 2000, 2005c). OECD (2007) indicated that a mix of instruments is important to effectively address specific environmental problems because many of these issues are of a multi-aspect nature and, if properly designed and implemented, different instruments can complement each other. A study conducted by Hagos et al. (2011) examined the type of EPIs chosen to address major land, water and environmental pollution issues, and their effectiveness in addressing major environmental problems in Ethiopia. This study concluded that all EPIs emphasized the traditional strategy of command and control regulation[4] rather than the use of economic or market-based instruments. The emphasis in the policy documents is on collective action and management of watersheds. This focus on command and control instruments (e.g., awareness creation, enforcement of regulation/environmental standards, public mobilization including FFW) is a major challenge in suggesting sustainable financing mechanisms for integrated watershed management. Only the Green Economy Strategy of Ethiopia (FDRE 2012), which aims to foster development and sustainability while limiting GHG emissions, indicates that incentives, without listing the types, are important for conservation, including watersheds.

This study paid most attention to economic instruments, mainly PES and global market mechanisms. These instruments are potentially the most relevant and sustainable financing mechanisms, since incentives are given for upstream stewards to maintain ecosystems through effective land management, with the intention that they generate benefits for people and ecosystems downstream (Greiber 2009) or the global community at large. PES are innovative, direct and promising compensation mechanisms, intended to create economic incentives that enable the transfer of financial resources from the beneficiaries of ES to those who provide them (FAO 2011). The compensation is generated by downstream users or society as a whole. Under the right circumstances, PES can be an appropriate tool to internalize externalities, both positive and negative. Externalities are internalized, if individuals are made accountable for the effects of their actions on others. Imposing costs on others requires compensating them, and providing benefits

[4] Command and control regulation refers to non-market environmental policy instruments that focus on setting standards and regulating this is properly implemented. In this paper, command and control is loosely coined to include awareness creation, sensitization, mass mobilization and public action to undertake rehabilitation, besides setting standards and regulating the actors.

for others requires being compensated for them (Sterner 2003; Kerr et al. 2007). Further details of PES, the global experiences and the carbon mechanism are given below.

TABLE 1. Main policy instruments in environmental (land and water) management.

Policy instruments	Description	Challenges	Environmental issues
Information and education	Labels, awareness creation and education	Labels and capacity building measures	Energy efficiency, SWC
Direct regulations/ standards	Set regulations based on environmental standards	Regular monitoring and evaluation (M&E)	Environmental pollution
Economic instruments: Subsidies/taxes, charges and penalties	Optimize farm input use, pollution tax, pollutant technologies and subsidies for the adoption of clean technologies or undertaking clearance	Market conditions, elasticity of demand of policy instruments	Farm inputs, energy (carbon) tax, waste collection, forest management
Economic instruments: Tradable permits	Emission permit, marketable mechanism of transfer of costs and benefits	Baseline data – forest cover, monitoring (recording) changes over time	PES, carbon trading (e.g., REDD+)
Patenting and certification (property rights)	Defining property rights of resources, innovation	Costly	Research and development (R&D), cadastral (low cost) land registration and certification, innovation
Public programs (Productive Safety Net Program, Food-For-Work, Cash-For-Work/Free labor contribution, etc.)	Mobilizing people to annual SWC	Not sustainable	Conservation of cultivable land, watershed management

Source: Adapted from Awulachew et al. 2012.

Note: REDD+ = Reducing Emissions from Deforestation and Forest Degradation

LEGAL AND INSTITUTIONAL REQUIREMENTS FOR PAYMENTS FOR ECOSYSTEM SERVICES

A PES scheme can only work with good governance in place, comprising an effective political, legislative as well as institutional system. PES may work either in a country (Greiber 2009) or transboundary context (Tesfaye and Brouwer 2016).

What makes PES successful is that, in any payment arrangement, those who pay are aware that they are paying for ES that are valuable to them or to their constituencies. Those who receive the payments engage in meaningful and measurable activities to secure the sustainable supply of ES in question (Greiber 2009). In terms of legal framework, PES schemes could be private (self-organized) or they could be trading (public-private) or public (government-driven) schemes. To be successful, the legal character of the parties involved in the PES deal, the objective behind the use of PES as an instrument and the scale at which the PES scheme is established have to be well formulated and established in law (Greiber 2009).

Public-private partnerships and public PES schemes are relevant to Ethiopia and the BER (see Table 2 for details). Experiences in the BER show that, so far, schemes have mostly evolved on an ad-hoc basis due to initiatives by NGOs and overseas development corporations, which brought together different parties. One example is a project initiated by two NGOs, Farm Africa and SOS Sahel Ethiopia, which engaged in reducing emissions from deforestation and forest degradation, and enhancement of carbon stocks (called REDD+) to protect forests in the BER. Such schemes can be highly fragmented and are mainly limited to the local-scale, micro-watersheds.

Greiber (2009) indicated the importance of a legal framework that regulates PES in a comprehensive and coherent way. This increases the potential of PES as an innovative instrument that might be applied more often, more efficiently and at a larger scale. A clear and coherent legal framework will ensure that good governance is taken seriously in public PES schemes (Greiber 2009). This is entirely appropriate, since a public entity participating as a purchaser or seller of ES either invests public funds or uses public goods (land or natural resources held by the public authorities as custodian) (Greiber 2009). PES-related legislation is a means to create legal certainty and consequently trust among the parties. An appropriate legislative framework which regulates public PES schemes has the potential to stimulate the development of trustworthy markets and ensure good governance (Greiber 2009).

TABLE 2. Types of PES schemes and related legal frameworks.

Type of PES scheme	Need for legal frameworks	Importance of legal frameworks
Private PES scheme	Medium to low	Promote a nested approach Upscale from local to national/regional level
Public-private partnership	High	Create a trading scheme that is a partnership between the public and private sectors Regulate complexity of the trading system 'Control' the market
Public PES scheme	High	Promote PES development Create legal certainty Ensure good governance

Source: Adapted from Greiber 2009.

The adoption of specific laws related to PES has advantages and disadvantages. It can draw the attention of the government as well as the public to the institutionalization of PES as a policy instrument to ensure the future provision of water-related ES. However, establishing a specific law related to PES potentially risks fragmenting or complicating the existing environmental legal framework. Hence, if PES is regulated in a specific PES law, attention must be paid to its integration into the existing legal and institutional frameworks, particularly those laws that regulate the different ecosystems (Greiber 2009).

World Bank (2008) indicated that the following organizations could be involved in PES: (a) public institutions responsible for environmental management, (b) community-based organizations (CBOs) and NGOs involved in the management of natural resources, and (c) public/private financial institutions providing resources for the improvement of natural resource management. The institutional framework should be inclusive, with broad engagement of local communities in the design and implementation of the plan.

Moreover, the legal framework for the implementation of a PES instrument should clarify land and resource tenure, provide specific rules and transaction mechanisms, and determine compliance and

enforcement mechanisms. These requirements include the (a) rights over the resources in terms of ownership and access, (b) payment of fees, and (c) use and sharing of benefits among the stakeholders (Greiber 2009).

A review of policy and legal frameworks in the Mekong and Volta basins is provided by de Silva (2014). This study highlights where ES are explicitly recognized, incorporated into policy and regulatory frameworks, and put into practice. According to de Silva (2014), in the legal and policy framework in the Volta Basin countries, practices are extensively and explicitly dealt with, although support to human well-being remains largely unrealized. This probably indicates that more is needed beyond setting an appropriate policy/regulatory framework.

RESULTS AND DISCUSSION

Results from the Key Informant Interviews and Group Discussions

Major stakeholders in the BER are Bureaus of Agriculture (BoAs), land use and land administration (LULA) office, Oromia Institute of Agricultural Research (OIAR), hydropower operators in the Wabi Shebelle and Genale Basins, urban water supply authorities, local communities, Oromia Forest and Wildlife Enterprise (OFWE), and NGOs. Key informant interviews were conducted with the Malka Wakana Hydropower Plant (potential buyer), BoA and LULA in West Arsi zone (capital Adaba) and Bale zone (as potential intermediaries), Goba Urban Water Supply Authority (potential buyer) and OFWE (potential intermediary). The local communities are envisaged as potential sellers.

Group interviews were carried out with members of the Wesha Watershed Committee (potential seller). Wesha micro-watershed is part of the Malka Wakana catchment. The interviews aimed to: (i) understand the severity of ecosystem problems in BER; (ii) identify past and current watershed interventions; (iii) identify the roles of important stakeholders in the eco-region; and (iv) identify whether the existing land and water policies adequately addressed incentives of the local community and the prospects for market policy instruments, such as PES, to be institutionalized in the BER.

Potential Intermediaries in Bale Zone

In the Bale Zone, which is part of the BER (Figure 1), the main ecosystem problems reported are deforestation caused by agricultural expansion and illegal settlement in the forest area by those coming from other areas (from Harar, Sidama, etc.), cultivation of cash crops in the forest area and overgrazing, especially in the lowland areas.

The following interventions were implemented in the BER to reduce the problems: reforestation and afforestation, prohibiting people from clearing existing forest, SWC (both physical and biological measures mentioned previously) in degraded areas, area exclosures and range management, especially in the lowland areas. Area exclosures are reported to be most successful in rehabilitating the environment and supplying feed for livestock. Through training and awareness creation, support was provided to extension agents and a segment of the local population on the importance of area exclosures.

One of the major issues reported in the Bale Zone, in relation to watershed management, is that the BoA, LULA and OFWE do not work together. Collaboration between BoA and LULA exists only in theory; the land use office focuses on distributing land certificates to users. The offices have just started working together in delineating watersheds and preparing maps thereof, including enclosed areas, etc., which will hopefully foster more effective collaboration in the future. Forest fire protection and management is entirely the responsibility of BoA. Moreover, OFWE provided seeds for seedling development.

Lack of incentives to the local community to sustainably rehabilitate watersheds is a major challenge. Free grazing and destruction of SWC structures by livestock is a critical challenge in

the region. There is also conflict of interest on sharing benefits in the area exclosures between members of communities.

To improve the quality and quantity of interventions in the area, the following recommendations were made: support the physical SWC measures by biological measures; starting from the regional office, the government should give attention to watershed management; creating awareness; protection of the existing forest from the risk of fires; illegal settlement; encroachment; provision of training and material support for communities participating in watershed management; and strengthening CBOs, such as forest dwellers' associations, to protect illegal settlement in the forest areas.

Future interventions are planned in the areas of SWC and gully rehabilitation, strengthening forest guarding through training and material support, training of members of Participatory Forest Management (PFM) (a local forest management group) on leadership and financial management, legal settlement, forest fire management, and promoting the cultivation of fruit and fodder trees.

Potential Intermediaries in the West Arsi Zone

The major ecosystem-related problems in the West Arsi side of BER are soil erosion, deforestation and water shortage causing recurrent food insecurity. The proximate causes of these ecosystem problems are lack of awareness of the local population about the use of natural resources and consequences of ecosystem degradation, and the lack of materials, finance and technical expertise to undertake required NRM measures. The absence of incentives is the underlying factor for failure to implement conservation interventions in a sustainable manner. Current policy instruments to ensure that the local population undertakes NRM measures are focused on mass mobilization, experience sharing and awareness creation.

There are ongoing watershed management interventions in eight *kebeles* in Adaba District (as indicated in Figure 1). These interventions focus on area exclosure, physical and biological SWC, and reforestation/afforestation. However, data are missing on the areas of reforestation and exclosures, the specific SWC measures that are being implemented, and the status and impact of these measures on the ecosystems. The specific measures were implemented through mass mobilization, training of experts - development agents (DAs), and providing support and seedlings to farmers.

Interviewees reported that the District BoA works closely with the district office of LULA and OFWE. Support is also provided by Farm Africa, SOS Sahel Ethiopia and Frankfurt Zoological Society (FZS).

The challenges of watershed management in the area could be addressed, if the ecosystem problems were clearly identified, attitudes of farmers towards the benefit of watershed management changed, physical and biological SWC measures implemented, farmers were trained on how to sustain forests, incentives were provided for the community (compensating farmers) through FFW programs, and rules and regulations of OFWE were changed, etc. The roles and responsibilities of OFWE are given below.

Interviews with staff from the Adaba District office of LULA revealed that their role is to identify the major problems in the district, recommend interventions, develop land use maps of selected watersheds and conduct M&E of the interventions, and provide feedback to the implementer, the district BoA.

According to the district office of LULA, the main causes of deforestation is agricultural expansion due to population pressure. The office indicated that there are ongoing interventions such as SWC and reforestation/afforestation by PFM to address these problems through community mass mobilization. The REDD+ project, responsible for reforestation and better forest management, is implemented in three *kebeles* in the district. They indicated that there are watershed technical teams at both the district and *kebele* levels. These teams comprise staff from LULA, BoA, pastoral and livestock bureau, cooperatives and OIAR. The main responsibilities of

these technical teams are creating awareness, providing technical support, M&E of the activities and assessment of their impact.

To improve the quality and quantity of the interventions, staff from the district office of LULA suggested improving the community's awareness of the importance of watershed management, changing current land use practices, providing training to agricultural experts and some members of the community, compensating farmers by means of FFW programs, creating public goods (by expanding infrastructure, such as roads, and social facilities, such as schools and medical centers), among others. Provision of technical equipment to agricultural experts (such as laptops, global positioning system (GPS), etc.), provision of financial support, and involving farmers in training are important to enhance the success of the interventions. Finally, LULA understands that providing incentives to farmers in the form of FFW programs (since many people in the area are food insecure) and by expanding infrastructure could sustain watershed interventions.

Group Discussion with Potential Sellers and Stakeholder Analysis in the Bale Eco-region

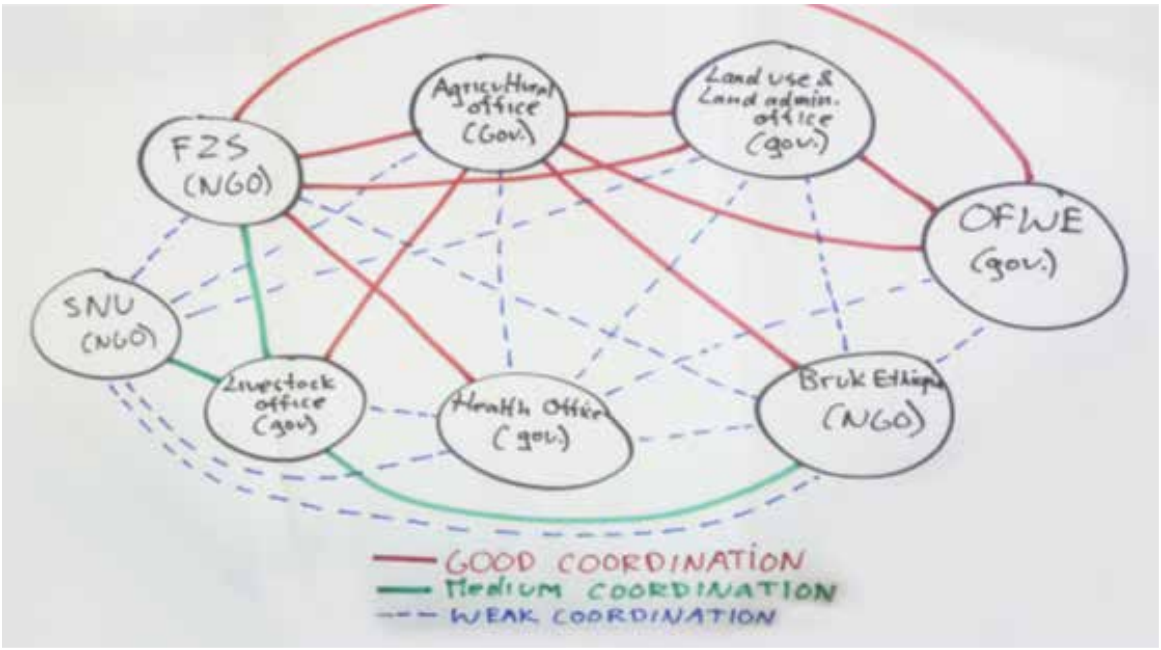
The interviews were followed by focus group discussions in Wesha *kebele*. In this *kebele*, a watershed committee was established in 2015 after a training in participatory watershed management (PWSM) was conducted by the Water and Land Resource Centre (WLRC), Farm Africa and the International Water Management Institute (IWMI) during the period November 23-December 4, 2015. Seven Wesha watershed committee members participated in the focus group discussions; three women and four men. We asked how the committee was organized. According to the focus groups, the committee was selected by the community and they participated in training. The total number of members in the Wesha *kebele* watershed committee is 14 (comprising 10 men and four women). The main responsibilities of the committee are as follows:

1. Creating awareness in the community on the importance of participating in watershed rehabilitation.
2. Identifying people who participate and do not participate in the watershed program.
3, Protecting the forest from being cleared.
4. Reporting on the work carried out to the concerned bodies.
5. Planning and monitoring watershed management work.

Members of the committee indicated erosion and deforestation as the main features of ecosystem degradation in their *kebele*. Deforestation increased (through the illegal clearing of forest) during the recent political instability in the area. Productivity of land is reported to be very low due to high soil erosion in the area. They reported that there are ongoing interventions such as SWC and reforestation/afforestation through community mass mobilization to reduce problems in the area, even if it is perceived to be insufficient. The focus groups reported that the impact of those interventions is high following the implementation of the current Wesha watershed management committee. However, there is no tangible evidence on the ground to substantiate this assessment. Nonetheless, it is a good first step for watershed management in the catchment.

Moreover, the focus groups suggested that the quality and quantity of watershed management could be improved if all institutions worked together, incentives are provided, awareness and training programs are offered for the watershed committee, etc. In Figure 2, the group showed the size, importance and interrelations of institutions and organizations providing services in the area using a Venn and flow diagram.

FIGURE 2. Stakeholder involvement in the Wesha watershed.



Note: SNV is an NGO supported by the Dutch government and Bruk is a livestock-related NGO.

Accordingly, BoA, LULA, OFWE, livestock office, health office, and NGOs such as FZS and Bruk Ethiopia have a stronger link, all working on watershed management and agricultural development. FZS, SNV, Bruk Ethiopia, livestock office and health office have weak links among each other. Other relevant institutions, such as OIAR, Ethiopian Electric Power (EEP) and urban water supply authorities, were not mentioned as they are perceived to have only a very small role to play in watershed management.

Discussion with Malka Wakana Hydropower Station - Potential Buyer

MoWIE has an institutional structure which integrates the areas of water and sanitation, irrigation development, basin management and electricity. This is a good institutional basis for promoting PES as a financial mechanism for sustainable watershed management, considering EEP and urban water supply authorities as potential buyers. However, the integration is more structural than functional, as shown below.

Discussions were held with the head of operation and maintenance at EEP (in the central office) on its scope and role in watershed management. The head indicated that EEP generates and sells power to consumers mainly from hydropower plants, but does not "own" the dams it uses to generate energy. The dams are owned by MoWIE and they are responsible for their safety. MoWIE collects data related to inflow, including sediment load, and is responsible for maintenance of the dams. However, watershed management and NRM, in general, are the responsibility of the Ministry of Agriculture and Natural Resources (MoANR) (FDRE 2005b). Although EEP is keen to be involved in a PES scheme, this could pose a problem because MoANR is responsible for undertaking watershed rehabilitation and MoWIE is responsible for dam safety.

In the Malka Wakana scheme, we conducted a KII with the engineer of a hydropower plant and his deputy. The Malka Wakana hydropower plant, which is located in the upper part of the Wabi Shebelle River Basin of Ethiopia, is a single purpose scheme (Bosona and Gebresenbet 2010).

Although the hydropower potential of the Wabi Shebelle Basin is estimated at 5,400 gigawatt hours (GWh)/year, the Malka Wakana scheme is the only existing hydropower plant under operation in the river basin (Bosona and Gebresenbet 2010). This hydropower plant was commissioned in 1988 to produce 153 megawatts (MW) of hydroelectric power. The plant has four units of 38.25 MW, designed to produce annual firm energy of 434 GWh and annual average energy of 543 GWh.

The total capacity of the dam is 763 million cubic meters (Mm^3) with a live storage capacity of 606 Mm^3 (Bosona and Gebresenbet 2010). The design life of the Malka Wakana hydropower scheme is 50 years. Currently, the dam has been operational for 30 years. The Malka Wakana watershed has a catchment area of 5,300 km^2 with five tributaries flowing into the dam. The sediment load entering the dam and its effect on the dam life is not known (in the section *Introducing PES in Malka Wakana watershed*, a quantification of sediment load based on secondary data is presented). In terms of design, a bottom structure is in place to flush sediments accumulated. However, the outlet has never been opened due to the fear that it would not close again. There are concerns now for more sediments, including those sourced from the buffer zone set up to protect the dam, entering the dam as more households are settling in and cultivating the area. Farmers demand land compensation from the government. Land in Ethiopia is not privately owned. The government can confiscate land being used by farmers when it is needed for developing infrastructure with or without the provision of adequate compensation. The development of the Malka Wakana scheme in the 1980s was carried out in this way. The legal framework for rural land compensation was developed later (FDRE 2005d). Discussions are ongoing right now to explore whether land could be acquired from a neighboring state farm. The Malka Wakana scheme has started to address part of the farmers' demands by providing electric power to social institutions such as schools, clinics and mosques. During the discussions, it was understood that sediments have little impact on the wear and tear of blades of turbines, because mesh wire below the dam and above the powerhouse is used to filter water before it enters the turbines.

Nonetheless, the authorities in Malka Wakana understood the importance of watershed management in reducing sediment inflow to the reservoir. To make this effort sustainable, a PES scheme could be designed in the Malka Wakana watershed, involving all the relevant stakeholders, including EEP. EEP is also operating another dam in the BER (Genale Dawa III) and could be a partner in exploring the viability of PES, since the reservoir may experience high siltation rates that are typical for most reservoirs in Ethiopia (Guzman et al. 2013). High siltation rates may reduce storage capacity and associated operational power generation capacity of the dam and revenues for EEP. Given this scenario, EEP may be interested in initiatives in the catchment on conservation that would increase the financial returns in their dam operation. They argued that protecting the dam from siltation is the responsibility of MoWIE, and there are ongoing interventions by this ministry in providing money to another close ministry, MoANR, responsible for watershed management. However, as far as EEP, in general, and Malka Wakana are concerned, there is no budget to finance watershed programs. The head of the power generation and operation department must forward this additional responsibility of EEP, which MoWIE and higher bodies would need to endorse.

Discussion with Goba City Water Supply Authority - Potential Buyer

The main source of water supply for Goba town (indicated on Figure 1) is water diverted from the Togona River and stored in reservoirs. After treatment (using the sand filter system and chemicals), water is distributed to the community in the town which currently has an estimated population of 43,000. The reservoir holds 2,000 m^3 at a time, and 1,555 m^3 of water is delivered to consumers daily. Three additional deep wells have been dug to cater for the growing water demand of Goba town, while water supply from Togona River is becoming more unreliable due to siltation caused by deforestation and climate change.

Togona River emerges from the Togona watershed located in the Bale highlands. The Garbra Gurach Lake, which lies at 6°52'01.7N, 39°49›17.3"E at 3,950 masl, occupies a glacial cirque at the head of the northeast-facing Togona valley, and is the source of Togona River (Kebede 2013).

The head of Water Supply Authority indicated that successful watershed management is very important for the improvement of water supply to the town. In the past, siltation was not a serious problem because the upper watershed feeding the Togona River was well protected by forest. However, siltation is becoming serious due to high rates of deforestation in the upper Togona watershed. To overcome the emerging problem of siltation of the reservoir, and to maintain a stable and reliable flow in the Togona River, which in turn is affected by climate change and variability, sustainable watershed rehabilitation is important. Besides, increasing and stabilizing the water supply, and maintaining or rehabilitating forest cover in the watershed reduces the cost of water treatment (Stolton and Dudley 2007; TNC 2015). Therefore, Goba town water supply authority may contribute to watershed rehabilitation in the Togona watershed, being a potential buyer in a PES scheme. This may require overcoming the institutional hurdles described below.

Discussion with Oromia Forest and Wildlife Enterprise (OFWE) - Potential Intermediary

According to OFWE, the BER has 450,000 hectares of forest excluding woodland[5]. OFWE was established to conserve forests in the region. It is managed by the management board and has nine branches. The main activities of OFWE are aimed at conserving the forest for future generations. Activities include teaching the community how to use the forest (how the community lives with the forest), engaging in reforestation/afforestation programs and enriching plantations, and distributing seedlings to the community. Moreover, OFWE supports the local community in organizing and empowering CBOs. Finally, OFWE protects against the clearing of, and combats illegal settlement in, forest.

OFWE is an independent organization. There is no budget provided by the government for the enterprise. The source of finance for the enterprise is through legally harvesting timber and hunting wildlife. They harvest exotic species and replace it with local plant varieties.

According to OFWE, the major ecosystem problems in the BER are agricultural expansion due to population growth, illegal settlement in the forest by people coming from Harar, Sidama and other districts within the BER, and increasing forest clearance and soil erosion due, partly, to limited awareness of people on how to live with the forest.

OFWE works closely with communities through PFM, a local forest management group, to conserve forest in the BER. PFM (also called community-based forest management [CBFM]) are expected to create the incentives and behavioral changes required for appropriate forest management. Forest area is demarcated and enforcement measures are devised to punish people who clear forest in demarcated areas. OFWE works closely with local communities, government organizations and NGOs such as Farm Africa via a project engaged in reducing emissions from deforestation and forest degradation, and enhancement of carbon stocks (called REDD+). REDD+ is a mechanism being developed by parties of the United Nations Framework Convention on Climate Change (UNFCCC), which seeks to reward developing countries for reducing emissions from deforestation and forest degradation through better management of forest areas. REDD+ projects are also expected to deliver significant eco-benefits, such as improved hydrological functioning, support for forest-dependent livelihoods and the control of soil erosion. However, monitoring of these eco-benefits is still lacking (Watson et al. 2013).

[5] Forests have close canopy while woodlands have open canopy, where the latter allows full sunlight to enter the woodland limiting shade and moisture.

The role of REDD+ in watershed management is training of farmers, improving benefits from forests (honey, coffee, etc.), supporting farmers in credit availability, promoting multipurpose trees/crops, strengthening initiatives in introducing fodder trees (in Dinsho and Chamo watersheds), scaling up experiences by PFM in selected watersheds, and water harvesting in the lowlands to minimize outmigration of livestock to the forest area.

To protect natural resources in a sustainable manner in the area, OFWE sees many activities that can work well. Some of these activities include implementing projects such as REDD+ (especially in the forest area), promoting NTFPs such as honey and forest coffee, facilitating credit for farmers, strengthening and empowering forest dwellers' association, expanding water harvesting technologies, especially in the lowland area, increasing productivity using modern technologies, and working with stakeholders such as Madda Walabu University.

GLOBAL EXPERIENCES IN PAYMENTS FOR ECOSYSTEM SERVICES

Successful PES Schemes in Latin America and Asia

From a watershed perspective, various forms of land degradation have (as indicated in the *Introduction* section) on-site and off-site effects. To minimize those effects and promote water-related ES, it is critical to undertake sustainable watershed rehabilitation measures, which may need some financing mechanism such as PES. Through these mechanisms, benefits of the rehabilitation measures, as positive externalities, to service users (e.g., hydropower plant, water supply authority, biodiversity institute, pharmaceutical companies, global community, etc.) are generated. PES aims at internalizing these benefits and channeling them to the service providers (e.g., the upstream communities) as an incentive to pursue sustainable watershed management practices.

Nowadays, there are various global experiences in PES and climate financing projects which could provide useful lessons that help to understand what is important in designing new schemes.

According to Wunder (2005, 2015), the specific features of PES are as follows:

a. Transaction is voluntary and legally binding.

b. Ecosystem services and/or land use changes that need to deliver the intended services are well-defined/valued.

c. Minimum of one service buyer/user.

d. Minimum of one ecosystem service seller/provider.

e. Payments are conditional on continued provision of the ecosystem service by the seller/provider.

The scale of the project, how benefits will be measured, the stakeholders, the drivers and the payment structure dictate the ways in which an effective payment scheme for water-related ES are structured (Greiber 2009).

PES schemes have been successfully implemented in Latin America and Asia, and there are some cases of such schemes in Africa (e.g., carbon market-related scheme - Water Fund in Nairobi, Kenya [TNC 2015]). Various examples of PES for water-related ecosystem services in Latin America and Asia for improvement of hydrological services, protection of biodiversity, the landscape, carbon sequestration and other reasons have been documented (Porras et al. 2013; Kauffman 2014; Li et al. 2011).

From the review of experiences of payment mechanisms, the system structure and scale of application are heterogenous. PES can be implemented at micro-watershed or basin scale. It can be initiated by the government (see Box 1), private sector (see Box 2) or other stakeholders (see Box 3). Governments could, therefore, be supporters of PES schemes (e.g., by generating revolving funds).

The interventions required to rehabilitate ES must be clearly defined, and changes due to the rehabilitation process regularly monitored. All PES actors, suppliers, buyers and intermediaries clearly know their roles, and information flow between those actors are coordinated. Successful PES requires ensuring that implementation of the necessary interventions is carried out, thereby enabling service providers to make the necessary land use changes. Maintaining and monitoring data are critical. Thus, sound data management and data infrastructure are requirements of a PES scheme.

Another fundamental lesson for a successful PES scheme is the presence of supporting legislation, be it forest law or land and water law (PES experiences in Costa Rica in Box 2 and Ecuador in Box 3). These legislative supports are necessary in enforcing the obligation of appropriate land use, follow the conditions recommended and agreed upon, and grant incentives to ecological service providers. An equally important requirement for a PES scheme is the presence of clear property regimes, land or forest ownership. In Costa Rica and Ecuador, forest owners are the ES providers whereas private or parastatal hydropower plants and municipalities are the ES users. In China, the landowners are millions of smallholders who have land use rights while the (local) governments are supporters of PES.

Since a watershed financing mechanism requires the involvement of various stakeholders, ES providers and service users (buyers), looking beyond agriculture is necessary. In successful PES schemes, private or parastatal hydropower plants, municipalities and the global community have been key stakeholders. Moreover, the availability of sufficient financial benefits to farmers and the distribution of these benefits are important to ensure that land users will gain from the benefits and have incentives to actively participate in the maintenance of ES (Chamma and Asale 2014; de Silva 2014; Dirix et al. 2016). Key requirements of a PES scheme are summarized in Table 3.

TABLE 3. Summary of requirements of a workable PES scheme.

Scale of application	Information flow	Definition of the services	Role of actors	Conditionality	Establishment of watershed fund
Micro-watershed, watershed, national or basin	Coordinated	Interventions and targets clearly defined and monitored	Clear definiton of role: Seller, buyer and intermediaries	Service sellers have to make sustainable investments (including land use changes) so that the ES are provided and buyers will pay for the services Technical capacities of the service provider (or third party) and service user	Involvement of many stakeholders; Prudent financial management

Box 1. Experiences in China.

China's experience is also unique in the region being more endogenous than driven by external intervention, and perhaps explains the adaptation of the conventional PES approach into the country's 'eco-compensation' method, which accommodates a diverse range of mechanisms such as PES and other market and non-market mechanisms, all with the unifying objective of conserving and enhancing specific ecosystem types as providers of ES (de Silva 2014). We particularly review China's Sloping Land Conversion Program (SLCP).

The similarity in legal and policy frameworks, particularly the dominance of the state in the economic affairs, land property regimes and implementation approaches in watershed rehabilitation, between China and Ethiopia is the reason for including the revision of SLCP.

The most notorious example of PES to combat land degradation is China's SLCP. It was initiated by the central government in 1999 with the goal of reducing water and soil erosion, by converting agricultural land on steeply sloping and marginal lands into forest. SLCP is one of the largest PES schemes in the world (Li et al. 2011). This experience is relevant to the BER because SLCP was a public scheme created to combat land degradation. In the BER, farmers use steep sloping and marginal lands as cropland, contrary to the existing land policy, and underlining the importance of the government's high involvement in watershed management and expected role in PES in Ethiopia.

The Chinese government initiated the SLCP in 1999 to limit water and soil erosion through afforestation in three provinces. The program was formally launched nationwide in 2002. The SLCP was designed to convert 14.67 million hectares of farmland to forestland or grassland (4.4 million hectares of which is on land with slopes above 25 degrees), and an additional "soft" goal of afforesting a roughly equal area of denuded mountains and wasteland by 2010 (Liu 2014). The program is a public scheme, as compensation of farmers is fully paid for by the central government. However, the economic incentives of PES schemes were well designed to ensure sustainability and avoid 'leakage' (i.e., trade-offs) of the negative effects to other regions. Therefore, besides direct compensation of the farmers, the Chinese government has also created favorable tax conditions for forest products to make the conversion of farmland to forestland economically sustainable (Li et al. 2011).

The State Forestry Administration (SFA), charged by the State Council, and provincial and sub-provincial forestry bureaus, are primarily responsible for targeting areas of land for enrollment in the SLCP as well as in setting and distributing enrollment quotas to the local government (Zuo 2002). Local governments oversaw evaluating land plots. Households whose land plots fell into the planned project area were eligible to be involved in the program. The participant households were granted seedlings as well as technical guidance for planting, and they received subsidies on the condition that the survival rate of the planted trees on the sloping land reached 70% (Liu 2014). The Chinese government made some adjustments in 2007 focusing afforestation on barren mountains and wasteland (Liu 2014).

The impact of SLCP on increasing the forest cover is well documented, although its sustainability is questioned (Song et al. 2014).

Box 2. Experiences in Costa Rica.

Costa Rica's PES program is one of the best-known examples of its kind. The program was created in 1996, along with the initial governance structure allocating responsibilities and funding (Porras et al. 2013). In Costa Rica's Payments for Environmental Services Program (PESP), forest owners are compensated for the following services: protection of water for rural, urban or hydroelectric use; mitigation of greenhouse gases; and protection of biodiversity for conservation and landscape beauty for tourism.

PES have been predominantly financed by receiving 3.5% of revenues from a sales tax on fossil fuels (there are voluntary deals from private and semi-public companies, and global funding from the World Bank through the Global Environment Facility (GEF) and individual countries such as Norway), but the objective is that all beneficiaries of environmental services eventually pay for the services they receive. The relevance of this example to the BER is that the government's role in the provision of seed money, whatever the source is, is important to kick-start selected schemes and gradually involve all the relevant stakeholders.

There has been some success in charging water users for upstream watershed management services, although there has been limited success in charging for biodiversity and carbon (Porras et al. 2013).

Outdated and ineffective laws and policies, such as the Forestry Law 7575 in 1996 and Biodiversity Law 7788 in 1998 were changed by Presidential Decree. This made conversion of established forests punishable by prison sentences, and introduced the offer of payments for reforesting, protecting forest or managing existing forest in private properties outside national parks (Porras et al. 2013). The Forestry Law also provided the institutional framework required to implement the PES program, as well as the initial funds needed to kick-start the process. Promulgating a new law in forest, land and water, and establishing the required institutional framework could be necessary in the case of BER, also another important lesson learned from PESP.

Costa Rica's PES program acknowledges that owners of forests are entitled to apply for payments for the vital services that these ecosystems provide. A detailed framework defines these ecosystem services. The program is a mix of rules, regulations and rewards that invite stakeholders to respond to incentives and disincentives (Porras et al. 2013). This mix is a combination of policy instruments, which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors. The legal underpinning establishes the structure by which the PESP secures funding, how it is managed and who is eligible to participate. Fondo Nacional de Financiamiento Forestal (FONAFIFO), the National Forestry Financing Fund, is the primary intermediary, another lesson for the BER to identify organizations that could serve as intermediary, charged with administrating the PES program. It signs legal contracts agreeing land use with forest owners, and monitors their compliance through local forestry technical facilitators (*regentes forestales*). In exchange for the payments, the landowners transfer the 'rights' of the ecosystem services to FONAFIFO, where they make up the wider portfolio of approved ES credits. FONAFIFO then sells some of these credits to its buyers.

Since its inception, the program has had concrete positive impacts on forests through protection, reforestation and agroforestry systems (TEEB 2009; Porras et al. 2013). Looking forward, the program managers expect to increase its environmental effectiveness by defining and using 'priority criteria' for allocating payments, and targeting the areas that most need protection and/or regeneration. Other challenges include managing trade-offs, and attempts at using better indicators for monitoring ecosystem services (Porras et al. 2013), other important lessons for BER and beyond in Ethiopia.

The experiences in Costa Rica show that PES evolves over time as new requirements and challenges emerge. For examples, see Porras et al. (2013).

Box 3. Experiences in Ecuador.

The PES experience in Ecuador is relevant for the BER because the problems are similar, i.e., there is high deforestation as a result of agricultural expansion. However, the use of a combination of government funds and innovative, voluntary and decentralized financing mechanisms for watershed management, the financial security achieved therein, the introduction of a drinking water fee and management of the water fund as a trust could be good lessons for Ethiopia when designing a PES scheme. A brief description of the experience in Ecuador is given below.

Deforestation and burning of high Andean grassland (páramo) to expand agriculture, and the use of agrochemicals were major ecological problems in Ecuador. Conservation and sustainable use of forests and páramo in the upper areas are crucial to ensuring there is an adequate quantity of water that is of good quality available to downstream users (Kauffman 2014). This section summarizes the experiences in two pioneering models: Pimampiro's payments for environmental services (called the Pimampiro model) and Quito's water trust fund (Fondo para la Protección del Agua [FONAG]).

Rather than turning to private markets or relying on the central government, in the Pimampiro model, the Ecuadorian community developed an innovative, voluntary and decentralized mechanism for financing watershed management. This independence, contractual arrangement, sustainable revenue stream and long-term horizon provided a level of political and financial security present in the water trust fund model, which is in contrast to typical payments for environmental services, where service users 'buy' these services from the 'providers', who enact land use practices to ensure that the services continue. In the FONAG model, the principal government acts as "buyer" of environmental services on behalf of the city's water users. In the Pimampiro model, the municipal government acts as "buyer" of watershed environmental services on behalf of the city's water users. The municipal Environment and Tourism Unit (Unidad de Medio Ambiente y Turismo [UMAT]) manages the program, which negotiates voluntary agreement with farmers in the catchment to conserve and sustainably manage the forest on their land in exchange for cash compensation. The payment to farmers is made through an ordinance levying a 20% fee on drinking water.

On the other hand, in Quito's water trust fund, where it is one of Ecuador's water funds, is managed as a trust by financial institutions that are independent. As Kauffman (2014) indicated, this has several advantages: (i) The trust managers invest the fund's assets, i.e., money collected from watershed users, in financial markets and distribute the resulting interest income to service providers. This money could be used to finance a variety of watershed management and conservation activities specified in the contract; (ii) decisions on how to use the interest income is made by the fund's board of directors; (iii) water trust funds are contractual arrangements that define the role of the stakeholders and how the money should be used; (iv) water trust funds benefit from a wider variety of funding sources for watershed management activities; and (v) water trust funds have contracts which are of long time planning horizon, e.g., 80 years in FONAG.

One of the achievements of the water trust fund is developing participatory institutions incorporating a greater number of stakeholders involved in identifying needs to developing and implementing projects financed through the funds, monitoring and providing oversight. The details of the institutional arrangements and their modalities are given in Kauffman (2014).

Through the fund, more than 65,000 ha of watersheds are now under improved management. Upstream farmers receive support in watershed management activities as opposed to cash payments. It is estimated that more than 1,800 people are receiving increased economic benefits associated with watershed management and conservation.

FONAG and its later developments in the water trust fund have served to inspire the development of similar schemes elsewhere in Latin America and beyond. For example, in South Africa, where water forms one of the greatest constraints on development, a recently-launched initiative in the Maloti Drakensberg Mountains aims to implement a payment for watershed services program with support from the United Nations Environment Programme (UNEP) and the BASF Stiftung (UNEP 2010). This initiative will use payments from downstream users to support the restoration of dongas, improvement of grazing and veld fire management regimes to reduce sedimentation, and increase the quality and quantity of water flows. In doing so, employment will be generated for local households and the productive potential of agricultural activities should increase.

These experiences reviewed could provide lessons for the BER in designing finance mechanisms such as PES by targeting the local community upstream and water infrastructure downstream, the main actors involved in the provision of drinking water and hydropower generation, involving the development of PES supporting legal and political framework and, probably, the introduction of revised water and energy fees.

Carbon Offset Schemes

Widespread concern about global climate change has led to an interest in reducing emissions of carbon dioxide (CO_2) and, under certain circumstances, considering the additional carbon absorbed in soils and vegetation as part of the emission reduction (UNFCCC 2015). One option for slowing the increase of GHG concentrations in the atmosphere, and thus possible climate change, is to increase the amount of carbon removed by and stored in forests (Gorte 2009).

Carbon sequestration has been the focus of substantial controversy in international negotiations subsequent to the Kyoto Protocol[6]. Protecting forests in developing countries to earn credits has already started under the Kyoto Protocol. Mitigating climate change by enhancing forest carbon sequestration may be a relatively low-cost option and would likely yield other environmental benefits. However, forest carbon sequestration faces challenges, including difficulties in measuring the additional carbon stored (over and above what would naturally occur); monitoring and verifying the results; and preventing leakage[7] (Gorte 2009). As trees and other woody plants become established, carbon stored on the site increases as woody biomass increases and as annual vegetation (e.g., tree leaves and herbaceous plants) typically grows faster than it decomposes (see Table 4). Carbon sequestration and release vary substantially by forest. Nonetheless, some generalizations are possible (Gorte 2009).

TABLE 4. Average carbon stocks for various biomes (in tons per acre[*]).

Biome	Plants	Soil	Total
Tropical forests	54	55	109
Boreal forests	29	153	182
Croplands	1	36	37
Tropical savannas	13	52	65
Wetlands	19	287	306
Weighted average[**]	14	59	73

Source: Intergovernmental Panel on Climate Change (IPCC) (cited in Gorte 2009).

Note: * 1 acre = 0.404686 hectares.

** The weighted average takes into account other biomes including temperate and tundra (Gorte 2009).

We can draw lessons from the experiences in Ethiopia, such as REDD+ (Watson 2013) and growing of wild forest coffee and wild honey in the BER, and forest-based PES under the Clean Development Mechanism (CDM) in Humbo. Several challenges were reported in the experience in Humbo, including the management of local community expectations as the income generated by carbon sales was lower than expected; the CDM registration process took a long time to complete;

[6] In the Kyoto Protocol, developed nations agreed to specified reductions in the emission of GHGs and initiated global carbon trading. To this effect, the Paris Agreement under the UNFCCC was signed in 2016.

[7] Reforestation and better forest management in one area (covered in a project) could lead to additional pressures, i.e., deforestation in other areas.

the project costs were beyond the means of the local community (and thereby requiring external assistance); and complications in the land tenure system and land fragmentation which meant that part of the area had to be dropped, thereby reducing the size of the forest and the emission reduction credits significantly (Chamma and Asale 2014).

SUITABLE FINANCING MECHANISM FOR THE BALE ECO-REGION

Introducing PES in Malka Wakana Watershed

Evidence on rates of soil erosion in the study area is relatively scarce, with most data generated in northern Ethiopia and the central highlands (Haregeweyn et al. 2015). In relation to the effect of siltation on the dam, the management of the Malka Wakana hydropower plant suggests that sediment from the upstream areas may not pose a major problem, although there are no data to support this. No quantified effect of siltation on power generation of the dam is currently available. There was no bathymetric survey to quantify the volume of the dam occupied by sediments.

We calculated soil erosion rates, as indicated in Table 5, based on data from the Wabi Shebelle Basin Master Plan. The figures indicate that about 0.73 Mm^3 of the dam is filled by sediments per year. This amounts to about 0.15% of the live storage capacity. If the annual sediment load entering the dam remains the same throughout the dam's life span, it implies that about 4.5% of live storage capacity is occupied by sediments by the end of its 30^{th} year, i.e., 2016. The results indicate that the estimated sediment load is not significant to affect the dam's life and energy generating capacity (Darde 2016). It is important to note that this estimate does not account for the degree of change in erosion status over time, the effects of ongoing interventions (if any) in the watershed, and the current effect of people's settlement and cultivation within the buffer zone.

TABLE 5. Mean annual suspended sediment load transported at selected sites in the Wabi Shebelle Basin.

River	Location	Watershed area (km^2)	Annual suspended sediment load transported (million tons)	Volume (S = 1.5) (Mm^3)	Volume per unit area (m^3/km^2)	Tons per km^2 *Calculated*
Wabi Shebelle at Malka Wakana	Longitude, 39,4, Latitude, 7,2166,	4,388	0.11	0.073	17	25
Wabi Shebelle at Hamero Hedad	Longitude, 42,28333, Latitude, 7,36666	63,644	8	5.33	83	126
Dakata at Hamero Hedad		15,188	5	3.33	220	329
Wabi Shebelle at Gode		127,300	15	10	78	118
Wabi Shebelle at Burkur		144,000	0.75	0.5	3	5
Fafen at Kebri Dahar		25,600	2.5	1.66	65	98

Source: Data from MoWIE 2005.

It is believed that watershed management is necessary to minimize the sediment inflow to the dam, not only for Malka Wakana. This may entail designing a financing mechanism to ensure that watersheds are rehabilitated and protected in the future. This may require introducing a new price regime of energy per kilowatt hour to the consumer by accounting for the cost of watershed management. It is possible to imagine that energy consumers will be willing to be part of a PES scheme provided that the watershed intervention alleviates their problems, there is less siltation and more reliable energy availability. Once that is assured, a mechanism will have to be created for resource transfer from EEP to the umbrella ministry, MoWIE, and then to MoANR or another intermediary agency. The latter, or a research organization, could be responsible for establishing the baseline and regularly monitoring the changes due to interventions planned to improve ES, as necessary. Regular monitoring of the sediment load transported by all tributaries of the Malka Wakana Dam is important. In this respect, establishing a sediment monitoring station at key points in the watershed is essential.

REDD+ Project and Forest Management

Forest degradation is severe in Ethiopia and recent figures (World Bank 2015) indicated that forest cover reduced 28% from 167,350 km^2 in 2007 to 120,144 km^2 in 2012. In the BER, the average annual deforestation rate was estimated at 0.25%, based on remote sensing imagery (Farm Africa and SOS Sahel 2008). More recent data show a reduction in forest area (forest, woodlands, Erica forest) of about 2.3% during 2010-2014 (IWMI 2016; FAO 2016).

Proposals were developed in Bale to reduce emissions from deforestation and forest degradation, and enhancement of carbon stocks (REDD+), focusing on conservation, sustainable management and forest enhancement activities. Voluntary carbon markets (VCM) are the main platform through which emission reductions from forestry are currently traded (Diaz et al. 2011). The environmental integrity of REDD+ requires the generation of real, permanent and verifiable emission reductions (UNDP 2009).

In the BER, the REDD+ project emerged from a participatory forest management project which started in 2007 by two NGOs, Farm Africa and SOS Sahel Ethiopia. The participatory forest management project ended in 2012, with the REDD+ component of the project due to start in 2013. However, the new REDD+ project was designed to cover 500,000 ha surrounding the Bale Mountains National Park, which is one of the 34 global biodiversity hot spots. The project is expected to run for 20 years. According to the project feasibility study, an estimated 18 million tons of CO_2 emission reductions will be achieved, along with wider co-benefits such as the protection of biodiversity and provision of support to livelihoods dependent on NTFPs.

Some studies indicate that there were uncertainties in the amount of emission reductions, because substantial uncertainty of forest carbon stock estimates (Watson et al. 2013) affecting revenue estimates. This basically shows the importance of having reliable baseline data and properly monitoring the changes that occur because of reforestation and improved management.

Introducing PES in Goba Urban Water Supply

Now, local people are involved in clearing up the silt from reservoirs. However, no data are available on the number of people involved, frequency of clearance (number of times per year) and the amount of silt cleared from the reservoir. Such data will help to quantify the costs of silt clearance. Moreover, besides the general statement of water shortage, no data are available on how many times a year and the period for which water is not delivered.

To improve the quality of interventions, the following points were raised during the KII: watershed management through mass mobilization is very important; protecting forest from

deforestation by the community; creating awareness of the community about the impact of deforestation; and providing incentives to the community for sustainable watershed management.

About PES for urban water supply, there are experiences in the world (New York, Quito, Nairobi, etc.) where the catchment of the water source is treated sustainably through a PES scheme, and the urban consumers also contribute to the cost of watershed management through payment of increased water fees (see Box 3). We believe that PES could be applied in Goba[8], because the idea could be attractive to consumers, and the intervention will improve the quality and quantity of water. The challenge will be in identifying the source and quantifying the siltation load in the reservoir. In general, it requires an estimate of the cost of intervention versus the benefits that would arise (i.e., return on investment). Monitoring the impact of the intervention is necessary because effective implementation of PES is dependent on the principle of conditionality. It is possible to imagine that water consumers will be willing to pay for a PES scheme provided that the watershed intervention alleviates their problems, there is less siltation and limited water shortage. The head of the water supply authority reiterated that it will be actively involved in a PES scheme. However, the head indicated that the Goba Urban Water Supply Authority is accountable to the Regional Bureau of Energy and Water, which is linked with MoWIE at the federal level. These offices must endorse the idea first before the local authority can allocate any budget and incorporate costs into water bills for consumers. If such a scheme involving the municipality and the local community failed to work, because of the structural barrier just indicated, another option could be envisaged. Like the experience in the Upper Tana-Nairobi Water Fund (TNC 2015), a fund could be established by a consortium of "buyers" by combining hydropower, municipalities and payment for carbon, so that together there is sufficient money to pay providers for a bundle of services. The absence of large industries/large farms in the BER should not rule out the possibility of establishing a water fund.

MAJOR CHALLENGES IN INSTITUTIONALIZING A MARKET FINANCING MECHANISM FOR WATERSHED MANAGEMENT IN THE BALE ECO-REGION

Although NRM and watershed rehabilitation have been practiced in Ethiopia since the mid-1970s, there are limitations in the policy environment, implementation and control, lack of cross-sectoral collaborations and general gaps in capacities across government institutions responsible for the management of natural resources. The technical capacity of the experts interviewed is lacking. The availability of guidelines is important (e.g., Hurni et al. 2016 and others) to ameliorate limitations of regional and district-level experts.

A financing mechanism for sustainable watershed management in the BER should go beyond agriculture. This point is important in the light of thinking in introducing PES or participating in global climate finance schemes.

Another observation is the lack of data on biophysical processes at the watershed level (soil erosion), hydrological processes and its impact on siltation rates in the reservoir. Data on deforestation rate, area deforested, erosion rates of rehabilitated and degrading landscapes, inflow data to water reservoirs, etc., are not easily available. Existing data are not adequate to support the sustainable rehabilitation of the watershed through designing appropriate financing

[8] The cities mentioned previously with successful PES schemes are much larger, wealthier and probably have a greater economic interest to secure water supply than Goba.

mechanisms that minimize the siltation of reservoirs or participating in global climate financing schemes. Existing data may not support the establishment of PES in hydropower generation, water supply, carbon trading, etc. Continuous monitoring of the off-site impacts of land degradation on hydrological processes, siltation of water bodies such as hydropower plants, urban water supply, irrigation reservoirs and other ES may require the establishment of hydro-sediment monitoring stations at key river sites, and this is a prerequisite for an information-based watershed financing scheme. Moreover, incentives mean lack of direct material rewards, wage in kind on FFW programs, to participate in watershed rehabilitation. However, it could go beyond direct material rewards, for instance, establishing a well-defined and secure property system, not necessarily private holding, and establishing public infrastructure that could benefit the community. This could be important in the light of institutionalizing PES and participating in global climate financing schemes.

Scanning the institutional framework in Ethiopia highlights the importance of institutional reforms to support PES. The policy framework should stipulate the importance of incentives and market mechanisms for sustainable financing and organizational structures that are conducive for undertaking interventions in watershed rehabilitation. The regulatory organ, the environment agency, now within the Ministry of Environment, Forest and Climate Change (MoEFCC), has an important role to play in enforcing what is stipulated in the land and water (generally the environment) policy.

Establishing a PES scheme in the BER or elsewhere requires addressing the institutional gaps just indicated, clearly defining service providers and their roles, commitments and the type and level of compensation, buyer's role and contribution (payment) to PES, and intermediary's role in data monitoring and fund management. Clear definition of the PES actors is crucial alongside establishing a favorable policy and legal framework for market mechanisms in watershed management.

CONCLUSIONS AND POLICY IMPLICATIONS

Land degradation, taking forms of soil erosion, nutrient depletion and deforestation, has been a growing policy and academic concern in Ethiopia for the past five decades or so. Many research outputs have been developed in relation to land degradation. However, most of the literature published focuses on investigating factors for the adoption of conservation measures (World Bank 2007), impacts on crop yield (Kassie et al. 2008), and the impact of watershed interventions on the hydrology, vegetation and people's livelihoods (Gebregziabher et al. 2016). In contrast, exploring alternative financing mechanisms for sustainable watershed management, and quantifying the on-site and off-site effects of land degradation have been given little attention to date.

Past NRM and watershed management interventions were carried out using mass mobilization and FFW programs. Designing financing mechanisms requires looking beyond these mechanisms and just the agriculture sector (e.g., hydropower, urban water supply, global climate financing, etc.). If it is to be sustainable, it requires the introduction of market mechanisms (such as water-based PES/forest-based PES not necessarily through the involvement of climate finance). However, institutionalizing these market mechanisms requires establishing the baseline data and evidence of changes (requiring regular monitoring) due to the interventions. Establishing hydrological and sediment monitoring stations in the main rivers feeding water reservoirs, sources of irrigation, hydropower and water supply is, thus, essential.

When considering the existing policy framework, it seems that EPIs have largely focused on command and control mechanisms instead of incentives and market mechanisms for ensuring sustainable watershed management. This study does not discount the role of collective management in watershed rehabilitation. However, it argues that collective action is necessary, but not a sufficient condition for sustainable watershed rehabilitation. New water and forest policies are recommended that make conversion of established forests into agricultural land punishable by law, introduce the offer of payments for reforesting, protecting forest or managing existing forest, and conservation of land through required land use changes. Involving the community through a forest management platform (Robinson et al. 2013) is in the right direction, but awarding formal land titles on forests to local communities can advance forest conservation (Blackman et al. 2017), providing additional incentives to local communities in the BER.

EEP uses water infrastructure to draw benefits (such as producing and selling power), but it is not directly responsible for the safety of its dams. MoWIE owns the water infrastructure and is responsible for its maintenance. However, MoANR is responsible for NRM and watershed rehabilitation in the country, which are directly important for the safety of dams. Dam safety requirements and promotion of future PES schemes in selected watersheds call for fostering a stronger partnership between MoWIE and MoANR. It is crucial to undertake the required institutional/policy changes to create a more conducive environment for successful implementation of a PES scheme in the BER.

Finally, MoEFCC could be an important stakeholder, together with MoWIE and MoANR, in water-based or forest-based PES schemes in Ethiopia. PES schemes can work in the long run, provided that hydrological and sediment monitoring capacities are in place, so that data provide the necessary evidence for (positive) changes due to land use changes or watershed rehabilitation. Water-related or forest-based PES may also require developing business models that relate to the impacts of such investments on water quantity and quality, increase in energy generation and crop productivity, on-site long-term investments in watershed conservation and management, and action plans which detail the key steps to be undertaken to move towards the next stages. Developing these action points and the necessary steps to be taken for water-related or forest-based PES in the BER is thus important. Once the action points are clearly defined and undertaken, it will be necessary to pilot the PES scheme in selected micro-watersheds. However, piloting PES in the BER, in the current institutional environment, is not possible.

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