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Agricultural Water Management – Making a Business Case for Smallholders

Research Report

Exclosures for Landscape Restoration in Ethiopia: Business Model Scenarios and Suitability

Wolde Mekuria, Gebrehaweria Gebregziabher and Nicole Lefore

Research Reports

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Project

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Collaborators

International Water Management Institute (IWMI)

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Contents

Acronyms and Abbreviations

AAPC	Average Annual Production Cost
ADLI	Agricultural Development Led Industrialization
AFR100	African Forest Landscape Restoration Initiative
AGP	Agricultural Growth Project
AIBP	Agro-industrial By-product
BoA	Bureau of Agriculture
BoANR	Bureau of Agriculture and Natural Resources
CBA	Cost-benefit Analysis
CGL	Communal Grazing Land
COMESA	Common Market for Eastern and Southern Africa
CRGE	Climate-Resilient Green Economy
CSA	Central Statistical Agency
CSE	Conservation Strategy of Ethiopia
CWT	Community Watershed Team
EAB	Ethiopian Apiculture Board
EHBPEA	Ethiopian Honey and Beeswax Producers and Exporters Association
EHPEA	Ethiopian Horticulture Producer Exporters Association
EIAR	Ethiopian Institute of Agricultural Research
ESAS	Ethiopian Society of Apiculture Science
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization of the United Nations
FFW	Food-for-Work
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HMF	Hydroxymethylfurfural
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRAF	World Agroforestry
IDA	International Development Association
IGAD	Intergovernmental Authority on Development
IRR	Internal Rate of Return
ISO	International Organization for Standardization
IWMI	International Water Management Institute
LDN	Land Degradation Neutrality
LMA	Livestock Marketing Authority
LULC	Land Use and Land Cover
MFI	Microfinance Institution
MoALR	Ministry of Agriculture and Livestock Resources
MoANR	Ministry of Agriculture and Natural Resources
MoARD	Ministry of Agriculture and Rural Development
MoEFCC	Ministry of Environment, Forest and Climate Change
MoIT	Ministry of Industry and Trade
MSEP	Multi-Stakeholder Engagement Process
NGO	Nongovernmental Organization
NPP	Net Primary Productivity
NPV	Net Present Value
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PES	Payments for Ecosystem Services
PSNP	Productive Safety Net Program
RDPS	Rural Development Policy and Strategies
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SDG	Sustainable Development Goal
SDPRP	Sustainable Development and Poverty Reduction Program
SLM	Sustainable Land Management
SNNPR	Southern Nations, Nationalities, and People's Region
SNV	Netherlands Development Organisation

SOC	Soil Organic Carbon
SSA	Sub-Saharan Africa
SWC	Soil and Water Conservation
SWOT	Strengths, Weaknesses, Opportunities and Threats
UNCCD	United Nations Convention to Combat Desertification
USAID	United States Agency for International Development
USD	United States Dollar
WHO	World Health Organization
WLRC	Water and Land Resource Center

Summary

Land degradation is a critical problem around the world. In many places, the practices associated with intensive rain-fed and irrigated crop and livestock systems have contributed to the degradation of land and natural resources. Degraded land makes it difficult for farmers to achieve the level of intensified agricultural production necessary to meet projected food demand, particularly in developing countries. Numerous institutional and socioeconomic challenges complicate attempts to reverse land degradation, including the lack of short-term incentives for investment; low investment by communities in natural resources management that offers little immediate financial reward; failure of public sector institutions to invest sufficiently in natural resources management because of low, immediate political rewards; and sectoral fragmentation, among others.

Furthermore, in poor communities, the incentive to extract short-term economic returns from land and natural resources often outweighs perceived benefits from investing in long-term environmental restoration, and related economic and ecosystem returns. Thus, investment in land and natural resource restoration requires a balance between short-term economic returns and longer-term sustainability and environmental goals. Individuals, households and communities are more likely to accept or invest in activities that enable land rehabilitation over a long period of time, if there are immediate economic incentives to invest.

The complex challenge requires an integrated approach to effective, sustainable investments in land restoration that go beyond current public investments. This report proposes and applies an adapted business model to explore the feasibility of exclosures – areas that are excluded from woodcutting, grazing and agricultural activities – for land restoration. The report aims to identify short-term revenue streams from activities that can be carried out within exclosures, such as beekeeping, harvesting fodder for livestock fattening, and cultivating high-value plant species, including fruits and herbs. These are feasible, sustainable economic activities that could allow for the restoration of ecosystem services over the long term. Mobilization of financial resources, engagement of local communities, provision of training and continuous follow-up, as well as facilitation of market opportunities in the value chain for local communities and enterprises (e.g., creating market linkages and establishing innovation platform to engage with market actors) could support the sustainable implementation of the revenue streams.

Exclosures for Landscape Restoration in Ethiopia: Business Model Scenarios and Suitability

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Background

Land Degradation: Extent, Causes and Impacts

Land degradation – defined as the long-term loss of ecosystem services – is a major problem around the world (Nkonya et al. 2016). Hot spots of land degradation cover about 29% of global land area and approximately 3.2 billion people are currently affected (Le et al. 2016). Although the drivers of land degradation vary from region to region, major causes across different regions include the conversion of (i) forests to grazing lands, (ii) grassland to barren land and shrublands, and (iii) grassland to cropland (Eswaran et al. 2001; UNCCD 2013; Mirzabaev et al. 2016; Nkonya et al. 2016).

Land degradation takes many forms and affects forests, soils, water, biodiversity, and economic and social services that are derived from the ecosystem (Nachtergaele and Petri 2008). For example, MacDicken et al. (2016) estimated a global loss of approximately 129 million hectares (Mha) of forest between 1990 and 2015, representing an annual net loss rate of 0.13%. According to the Food and Agriculture Organization of the United Nations (FAO), erosion has removed nearly one-third of the world's arable land from production over the past 40 years (Fischer et al. 2011). Estimates of the annual loss of fertile soil range from 24 billion tons (UNCCD 2011) to 75 billion tons (Eswaran et al. 2001; Gnacadja and Stringer 2012) at a global cost of approximately USD 400 billion per year (GSP 2016). UNCCD (2016) estimated that the global cost of land degradation due to land use and land cover (LULC) change was approximately USD 300 billion per year, or about 0.36% of world gross domestic product (GDP) of USD 84,374.78 billion (in 2018 US dollar values).

Land degradation occurs in almost all terrestrial biomes and agroecologies, as well as in all economies (i.e., in low-, middle- and high-income countries). However, the impact is particularly severe on the livelihoods of poor people, who depend heavily on natural resources. There is evidence that Africa is particularly vulnerable to land degradation and is the most severely affected region in the world (Lal 1995; Nellemann et al. 2009; Obalum et al. 2012). Of the 80 countries substantially affected by land degradation, 36 are situated in Africa (WHO 2015, p. 38). Land degradation affects up to two-thirds of the productive land area in Africa (UNCCD 2013; Jones et al. 2013), and affects at least 485 million people, or 65% of the entire African population (ECA 2007). In particular, sub-Saharan Africa (SSA) has experienced the most severe land degradation in the world, accounting for the largest share (at 22%) of the total cost of land degradation. Placing this in perspective, the region's land area and population account for only 18% and 13%, respectively, of global land area and population (Nkonya et al. 2016).

As in other SSA countries, land resources in Ethiopia are facing intense degradation due to deforestation, soil erosion, agricultural land expansion and overgrazing (Tekle 1999; Dubale 2001; Nyssen et al. 2004). Underlying drivers for this degradation include weak regulatory context and institutions, demographic growth, unclear user rights to land, low empowerment of local communities, and poverty (Kirui and Mirzabaev 2014). According to recent estimates, the area of degraded land in Ethiopia is more than one-quarter of the total land area of the country, and this affects nearly one-third of the population (Chirwa 2014; Gebreselassie et al. 2016). Annual deforestation (percentage change) in Ethiopia was reported at 0.6% in 2015, according to the World Bank collection of development indicators, compiled from officially recognized sources. The average rate of soil erosion in the Ethiopian Highlands has been estimated to be between 6 and 33 t $ha^{-1}yr^{-1}$, depending on land cover type (Hurni et al. 2015), and nutrient depletion has been reported as 30 kg ha^{-1} of nitrogen and 15-20 kg ha^{-1} of phosphorus (UNDP 2002). The estimated rate of loss of fertile topsoil in the highlands also varied between 941 million t y^{-1} and 1.5 billion t y^{-1} (Tamene and Vlek 2008; Hurni et al. 2015).

Land degradation is particularly severe in the north and northwestern parts of Ethiopia. Steep slopes have been cultivated for many centuries in these areas, which, as a result, are subject to serious soil erosion (Mekuria et al. 2007, 2009, 2011a). For example, about 2.6 Mha of the Amhara region (15.3%) are considered as degraded, with about 200,000-300,000 ha of land covered by gullies (Desta and Adugna 2012). About 70% of the region experiences moderate (> 15 t ha^{-1} yr^{-1}) to very high erosion rates (> 30 t ha^{-1} yr^{-1}) (Meseret 2016). The afroalpine and sub-afroalpine vegetation, high and dry Afromontane forests, bamboo forests and the woodlands faced remarkable shrinkage in area, structure and species composition (Wassie 2017).

LULC change is responsible for massive environmental degradation in Ethiopia (Eyasu 2003). This has important impacts on household livelihoods, for example, through lowering crop yields with the accompanying effects on

income and nutrition (Gebreselassie et al. 2016). Land degradation in the form of soil erosion and resultant siltation that block water storage structures, such as irrigation systems and hydropower dams, reduces the life span of structures and curtails the services they provide. For example, sediment deposited in Koka Dam in south-central Ethiopia over a period of 40 years reduced water storage volume by 481 million cubic meters (Mm^3) and resulted in a financial loss of USD 7.5 million a year (Eyasu 2003). It is estimated that the Gilgel Gibe I Dam, whose primary purpose is to produce hydroelectric power, will be completely filled with sediment within 24 years unless remedial measures are taken (Wolancho 2012). Many of the small and micro-dams constructed for irrigation and rural and urban water supply face similar problems (Zeleke et al. 2013). According to one study, sedimentation will reduce the operational life of most of Ethiopia's reservoirs by over 50% (Tamene 2005). Predicted annual deposition in the Grand Ethiopian Renaissance Dam, which is currently under construction, ranges from 250 to 319 million tonnes (Hurni et al. 2015).

The estimated cost of land degradation associated with LULC change in Ethiopia is about USD 4.3 billion per year (Gebreselassie et al. 2016). The cost of many interventions to reverse or mitigate land degradation, including the establishment of exclosures, is lower than the cost of inaction by about 4.4 times over a 30-year horizon. This implies that USD 1 spent to rehabilitate degraded lands returns about USD 4.4 to Ethiopia (Gebreselassie et al. 2016).

The Concept of Land Degradation Neutrality

Evidence indicates that the overall health and productivity of land is declining while, at the same time, the demand for land resources is increasing (Orr et al. 2017; Cowie et al. 2018). In recognition of the multiple benefits of both halting and reversing land degradation, the United Nations General Assembly adopted the concept of Land Degradation Neutrality (LDN). The United Nations Convention to Combat Desertification (UNCCD) defines LDN as "a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems" (UNCCD 2016). The aim of LDN is to maintain or enhance land-based natural capital and its associated ecosystem services (Cowie et al. 2018). Framing and addressing the environmental challenge of land degradation in terms of 'neutrality' fills an earlier gap in land degradation management policy by providing decision-makers with a framework to support processes that enhance integrated land use planning at landscape level and assessment at national level.

Monitoring LDN status involves quantifying the balance between the areas of gains (significant positive changes in land degradation indicators) and losses (significant negative changes in land degradation indicators) within each land type across the landscape. The indicators (and associated metrics) are land cover (physical land cover class), land productivity (net primary productivity [NPP]) and soil organic carbon (SOC) stocks (UNCCD 2016; Orr et al. 2017; Cowie et al. 2018).

Measures to Restore Degraded Lands in Ethiopia

The Ministry of Agriculture in Ethiopia together with FAO initiated soil and water conservation (SWC) measures beginning in the 1970s and 1980s, notably with the Food-for-Work (FFW) program in the country's highlands (Humphrey 1999; Tamene and Vlek 2008; Merrey and Gebreselassie 2011). Since that time, several national programs, including the Sustainable Land Management (SLM) program, phases I and II, and the Productive Safety Net Program (PSNP), have supported the implementation of SWC measures in the country. Farm households contribute unpaid labor to these programs.

The SLM program was initiated in 2008 — phase I (2008-2013) and phase II (2013 -2019)— to address two of Ethiopia's most significant developmental and environmental problems: agricultural productivity and land degradation. The International Development Association (IDA), Global Environment Facility (GEF), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the World Bank provide funding for the SLM program. The total cost of the SLM program (phases I and II) is about USD 123.65 million. The objectives of the program include reducing land degradation, improving agricultural productivity of smallholder farmers, and protecting or restoring ecosystem functions and diversity in agricultural landscapes. It consists of four components: (i) integrated watershed and landscape management; (ii) institutional strengthening, capacity development, and knowledge generation and management; (iii) rural land administration; and (iv) project management (MoFED 2010).

During the period 2010-2015, more than 15 million people contributed their unpaid labor (equivalent to USD 750 million each year) to the SLM program (Seyoum 2016). During this same period (i.e., 2010-2015), SWC measures have been introduced in more than 3,000 watersheds, and more than 12 Mha of land have been rehabilitated by implementing physical and biological conservation measures, including exclosures (Lemenih and Kassa 2014; Seyoum 2016).

Land Restoration through Exclosures

Exclosures are common land areas, which are traditionally 'open access', where wood cutting, grazing and other agricultural activities are forbidden or strictly limited in order to promote the restoration and natural regeneration

of degraded lands (Muys et al. 2006; Mekuria et al. 2011a; Seyoum et al. 2015). Restoring degraded ecosystems through the establishment of exclosures has become a common practice in the Ethiopian Highlands (Mekuria et al. 2017). Exclosures range from 1 ha to 700 ha in size (Nedessa et al. 2005). They are usually established in steep, eroded and degraded areas that have been used for grazing in the past (Descheemaeker et al. 2009). Natural features, such as large gullies, and man-made features, such as roads, usually demarcate the boundaries of an exclosure. Because they are not fenced, guards are often hired by the local administration on a FFW basis (Yayneshet et al. 2009). Exclosure management and protection have proven to be effective when the local community plays an active role under the overall authority of the local government (Descheemaeker et al. 2006; Yami et al. 2013).

The use of exclosures has gained widespread acceptance as a method to restore degraded rangeland ecosystems in many of the world's semi-arid rangelands (Verdoodt et al. 2009). For example, Yong-Zhong et al. (2005) showed that excluding grazing livestock is an option for restoring vegetation in the semiarid Horqin sandy grassland of northern China. The rehabilitation of degraded rangelands has also been fostered by establishing exclosures in Tanzania (Barrow and Shah 2011), Kenya (Wilkerson et al. 2013; Mureithi et al. 2014), South Africa (Siebert et al. 2010), the Tibetan Plateau (Ma et al. 2002), and Pakistan (Qasim et al. 2017).

There are two strategies – biological and assisted – for using exclosures in land rehabilitation (Lemenih and Kassa 2014; MoEFCC 2017). The biological strategy simply protects an exclosure against livestock and human interference, with no additional management required. Ecological succession arises from buried or dispersed seeds. The assisted strategy, which is more common, involves planting seedlings (exotic or indigenous species), aerial seeding, and the construction of soil and water conservation structures, such as hillside terraces, stone bunds and micro-basins, to speed up succession by modifying microclimatic and soil conditions (Asefa et al. 2003). Grass harvesting is normally restricted in exclosures in order to restore the soil seed bank (i.e., increase the seeds buried in the soil). Grass is harvested for fodder once a year, using a cut and carry system. This usually begins about 2 or 3 years after the establishment of the exclosure, once the grass has regenerated sufficiently. Honey production and the collection of medicinal plants are also allowed.

Numerous studies provide evidence of the multiple benefits of exclosures, as outlined in Table 1. The Government of Ethiopia responded with a commitment to restore more than 7 Mha of land by 2030 through the establishment of exclosures.

A Business Model Approach to Exclosures

The Government of Ethiopia, together with its development partners, has forged a restoration agenda that promotes the establishment of exclosures on degraded communal grazing lands, often without consideration of the impact on livelihoods (Lemenih and Kassa 2014). Indeed, local communities often question the value of exclosures because of the lack of focus on their potential economic benefits (Mekuria et al. 2017). Without clear evidence of such benefits, local communities have no real incentive to support government efforts on establishing exclosures, putting their success at risk. Business models can provide an effective approach to bridging the gap between public interest in restoring landscapes and ecosystem services and perceived short-term economic losses at the local level.

This report proposes a business model approach to identifying opportunities to improve both livelihoods and the environment through the establishment

Table 1. Benefits of exclosures.

Benefits	Sources
Increasing vegetation cover and biodiversity	Asefa et al. 2003; Mengistu et al. 2005; Mekuria and Veldkamp 2012
Enhancing ecosystem carbon stocks	Mekuria et al. 2011a, 2015; Aynekulu et al. 2017
Reducing soil erosion	Mekuria et al. 2009; Girmay et al. 2009
Restoring soil fertility	Descheemaeker et al. 2009; Damene et al. 2013; Mekuria and Aynekulu 2013; Mekuria et al. 2017
Increasing dry-season water flow	Aynalem et al. 2016
Decreasing runoff and sediment load	Descheemaeker et al. 2006; Girmay et al. 2009; Anwar et al. 2016
Increasing groundwater recharge	Anwar et al. 2016
Increasing incomes and improving the livelihoods of smallholder farmers over the medium to long term	Tilahun et al. 2007; Babulo et al. 2009; Mekuria et al. 2011b

of exclosures. The authors recognize that business models are most commonly used to optimize profitable returns on investments by private sector investors, and as such, this study represents a new application of the business model approach. However, we assert that business models have potential in the context of development to amplify the entry points for the 'triple bottom line' of people, profit and planet (Elkington 1999). We propose an adapted business model framework to identify and outline a sustainable investment and revenue ratio that will contribute to increasing the short-term economic benefits of exclosures. Such an approach will be critical to ensuring the sustainable and effective implementation of exclosures in Ethiopia.

The aim of this report is to provide government organizations, nongovernmental organizations (NGOs) working on natural resources management, private sector actors and communities with a business model that suggests how to enhance the economic benefits of exclosures, while maximizing the ecological benefits. It proposes a business model framework that is illustrated using three potential revenue streams. It provides guidance on application of the business model within exclosures, and how to ensure environmental, social and financial feasibility, and notably, promote local ownership and engage communities in implementation.

This report is structured as follows. The section *Methods* presents the methods used for developing the business model framework. The section *Development of the Business Model Components* highlights the key components included in the framework. The section *Value Chains, Finance and Economic Viability* discusses value chains of the three revenue streams, finance and financing mechanisms, and financial feasibility analysis. The section *Conclusions and Recommendations* summarizes the business model framework, results from the financial feasibility analysis, and recommendations and set of actions to guide future public investment in exclosures. Definitions of some of the terms used in this report are given in Annex 1.

Methods

A Business Model Framework for Exclosures

This report recognizes that development investments are often not sustainable, particularly those in communally managed natural resources. Adapting a business model to a developing economy context could help to attract much-needed, long-term financing for natural resources management and restoration initiatives. A widely used framework is the Business Model Canvas (Osterwalder and Pigneur 2010), which focuses on design and innovation. Fielt (2014) suggested that a business model usually includes four key dimensions: (i) customer interface (segments, relationships and channels); (ii) product (the 'value proposition'); (iii) infrastructure management (activities, resources and partners); and (iv) financial aspects (revenues and costs). The value proposition is central to the Business Model Canvas. Financial aspects address both revenues and costs but, importantly, can also include non-financial considerations. Together these dimensions cover the basic who, what, why and how questions about creating and capturing value (Fielt 2014).

This report uses a business model that is adapted to the context of communal natural resources management and economic development. The adapted model in Figure 1 includes the following:

- A value proposition (e.g., revenue streams that can be integrated within an exclosure).
- Key resources (natural, human and financial) needed for proper functioning of the business.
- Key activities in which the business entity has a competitive advantage.
- Key stakeholders, partnerships and multi-stakeholder approaches to managing communal resources and facilitating financing.
- Cost-benefit analyses of revenue options to ensure economic viability.
- Markets and channels through which products and services are delivered.

In a development context, a sustainable business model includes elements that are not always considered in business planning. For exclosures, this includes an analysis of the enabling laws and policies for community participation in revenue-generating activities, incentives for sustainable management of exclosures by different actors at multiple levels, and the opportunities to support value addition through identified revenue streams inside of exclosures.

Our adapted business model draws on a suitability mapping, which considers potential areas where exclosures could be established, the distribution of these areas throughout the country, and the location of land degradation hot spots. The analysis also assesses whether existing biophysical conditions (e.g., soil, biodiversity and climate) favor other income-generating activities that could be integrated within exclosures.

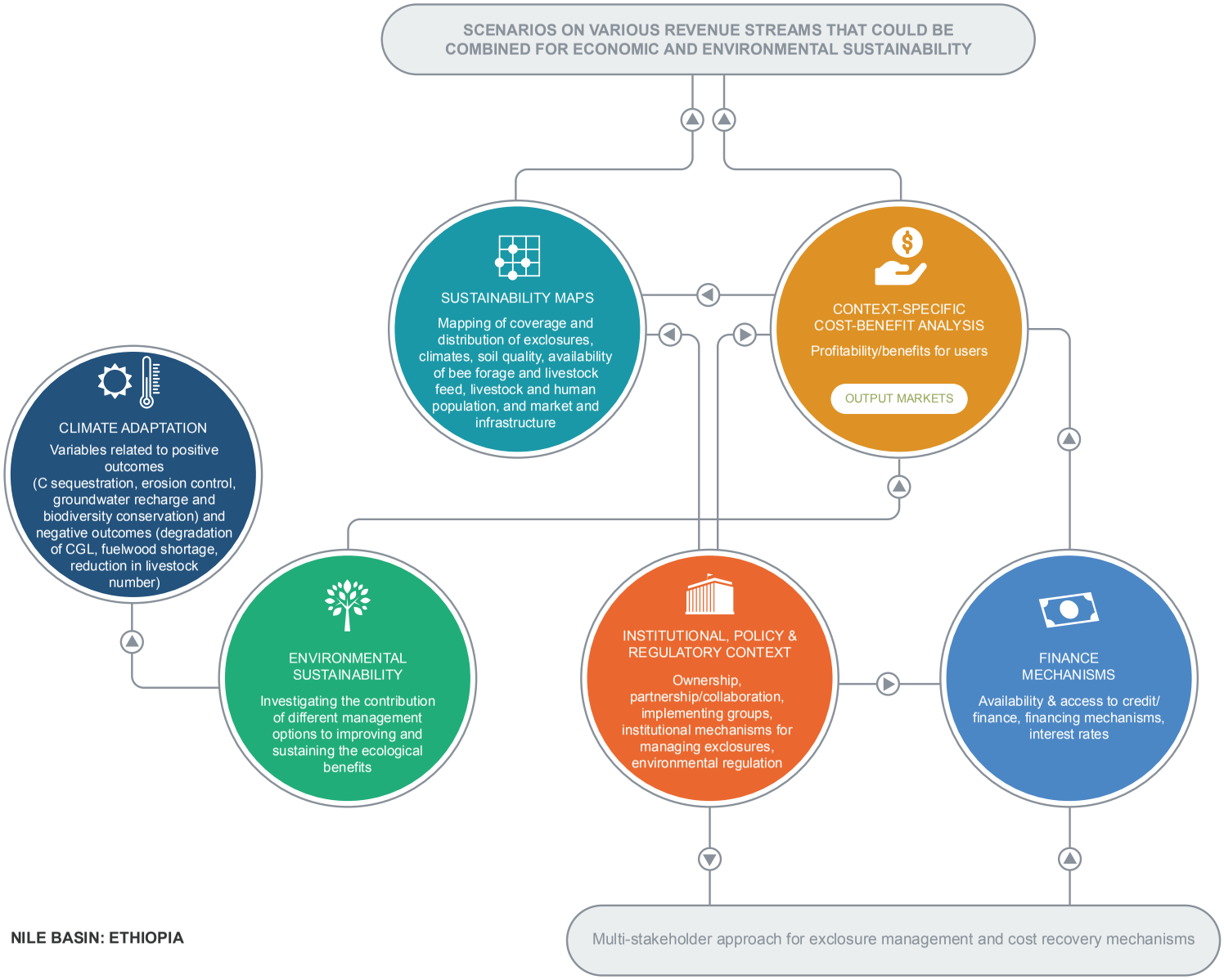

Figure 1. Framework for the development of business models for the establishment of exclosures.

Notes: C - Carbon; CGL – Communal grazing land; ECON – Economic;

The ***environmental sustainability*** component of the business model focuses on the contribution of different income-generating activities to improve and sustain the ecological benefits of exclosures while enhancing livelihoods over time. This component also assesses the contribution of the revenue streams to adapt to climate change or variability. Further, this component investigates the perception by communities of the benefits and drawbacks that might result from the establishment of local exclosures. Finally, the environmental sustainability component analyzes the factors and preconditions needed to enable the various revenue streams to enhance and sustain ecosystem services.

The ***institutional, policy and regulatory context*** component of the business model looks at the processes of establishing and managing exclosures. This component describes the key policies, strategies and proclamations related to environmental management, and analyzes how these might support or hinder the success of the proposed exclosure-based revenue streams. It describes ownership and use rights, and access and tenure systems, and assesses how these might affect the management of exclosures. It also investigates existing formal and informal institutions related to the management of exclosures, such as government institutions, bylaws and churches, and considers incentives for investing in the suggested revenue streams.

The governance of common-pool resources is complex and particularly apt to fail. Garrett Hardin's thesis on 'the tragedy of the commons' emphasizes that communally managed resources could be overexploited by individual free riders (Hardin 1968). However, growing evidence suggests that some communities have been able to avoid the overexploitation of communal resources, and have enhanced equitable benefit sharing by using self-governing mechanisms and practices, including formal and informal institutions (Ostrom 1990; Agrawal and Gibson 1999). Agrawal (2001) highlighted a lack of consensus among members of a community or stakeholders on a single set of institutions that could oversee the sustainable management of communal resources. However, institutions that enhance equitable benefit sharing, enable joint decision-making, and prevent the degradation of the communal resources are often considered as highly relevant to sustainable management of common-pool resources by beneficiaries and stakeholders (Yami et al. 2009). Thus, the multi-stakeholder component of the business plan is concerned with collaboration among the various actors involved in managing exclosures. This section of the business plan details the roles and responsibilities of stakeholders at village, district, regional and national levels, and proposes stakeholder engagement strategies. Finally, this component outlines possible interactions between the different stakeholders at multiple levels.

The ***finance mechanisms*** component of the business plan examines value chains for the proposed revenue-generating activities, and considers potential sources of finance and financing mechanisms. Context-specific cost-benefit analyses help determine the economic viability of suggested revenue streams. This element of the framework also describes the strengths, weaknesses, opportunities and threats (SWOT) of the suggested revenue streams (see Annex 2).

Data Source and Information for Business Model Development

The exclosure business model is based on action research conducted by the International Water Management Institute (IWMI) and its partners, including local communities and their representatives (e.g., community watershed teams), universities, agricultural research systems and local administrative bodies. Action research consists of research in parallel with social intervention (Fisher 2004; Elliott 2011). This approach helps to ensure the engagement of the users of research results from the start of the project. It provides an opportunity to analyze the needs and priorities of different stakeholders, including farming communities, and relevant policy and development organizations.

IWMI's research focused on the northwestern part of Ethiopia. In addition to gathering data in the field, the researchers reviewed the results of similar studies conducted in the highlands of Ethiopia. Researchers also looked at government documents, including a wide range of policies, strategies and proclamations. Information obtained from a review of published and grey literature was used to strengthen the analysis of each component of the business plan. In addition, case studies, secondary data collected from government organizations, published literature and local communities were consulted to gather the information needed for cost-benefit analyses (e.g., inputs, outputs, market prices, etc.). However, since information on revenue streams from exclosures is relatively scarce, the business models will need to be tested and validated.

Stakeholder Analysis

The study employed a stakeholder analysis to investigate the relationships between different stakeholders involved in the management, use and protection of exclosures. The analysis employed four steps: identifying, analyzing, mapping and prioritizing. The stakeholders were categorized into four groups based on expertise, willingness and value.

Development of the Business Model Components

The business model consists of five main components: suitability mapping; environmental suitability (includes climate adaptation); institutional, policy and regulatory context; financing mechanisms; and economic analysis (i.e., cost-benefit analysis). In this section, the first three components of the model are discussed in detail. The last two components are discussed in the next section (*Value Chains, Finance and Economic Viability*) to have a better link with the financial analysis.

Suitability Mapping

Suitability of exclosures for restoring degraded landscapes in Ethiopia

Land degradation is a major problem in Ethiopia, with more than 85% of the land degraded to some degree (Gebreselassie et al. 2016). Recent estimates based on satellite imagery show that land degradation hot spots cover about 23% of land area (Chirwa 2014). The use of exclosures to restore degraded landscapes is suitable in the north, northwestern and central highlands of Ethiopia, as well as in most pastoral communities in the lowlands (e.g., the Borena lowlands, Afar region and the Somali region) (Reubens et al. 2011; Chirwa 2014; Gebreselassie et al. 2016; Yirdaw et al. 2017). Several studies (e.g., Yayneshet et al. 2009; Angassa et al. 2012; Aynekulu et al. 2017; Mekuria et al. 2017) have shown that exclosures can reverse land degradation, and improve ecosystem services and livelihoods in both the highland and lowland areas.

Regional states are expanding the area under exclosures. For example, in the Amhara Regional State, the area covered by exclosures had increased to 1.55 Mha by the end of 2013, about 12% of the total area of the regional state (Lemenih and Kassa 2014). In Tigray region, approximately 1.5 Mha of land are covered by exclosures (Lemenih and Kassa 2014; Tesfaye et al. 2015). In the Southern Nations, Nationalities, and People's Region (SNNPR), the area covered by exclosures reached 751,864 ha by the end of 2016 (personal communication with experts in the Bureau of Agriculture [BoA]). Ethiopia recently pledged to rehabilitate 15 Mha of degraded land by 2030 (Tesfaye et al. 2015; Seyoum 2016; MoEFCC 2017), and according to the government's plan, about 50% of the land – over 7 Mha – will see the establishment of exclosures (Seyoum 2016). However, studies have found that, at the current rate, the area under exclosures is expected to increase by just 2% per year, reaching a total of around 5 Mha in 2033 (MoEFCC 2017). This indicates that a stronger effort is needed to increase the rate of expansion of exclosures, if Ethiopia is to achieve its goal.

There are huge opportunities to expand the use of exclosures in Ethiopia. For example, approximately 56 Mha

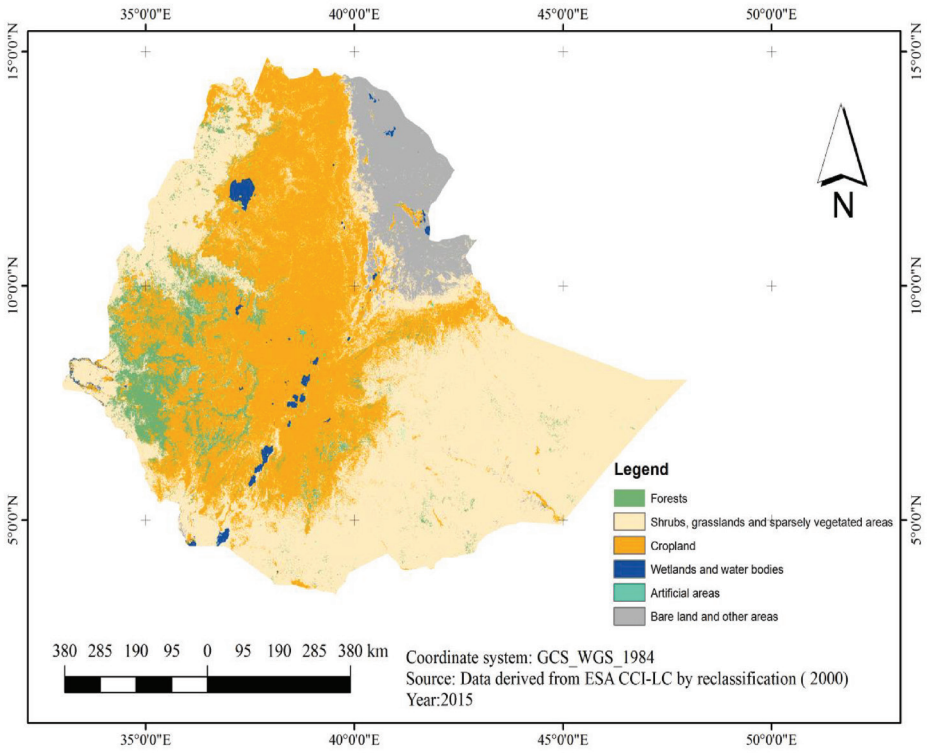

Figure 2. Distribution of the six land cover classes in Ethiopia, 2010.

Source: FDRE 2015.

(49.6%) of the country are covered by shrubs, grasslands and sparsely vegetated areas distributed across the highlands and lowlands (see Figure 2), all of which can be considered as potential areas for exclosures (FDRE 2015). The report identified about 14.3 Mha of degraded lands in Ethiopia that could be considered as potential locations for the establishment of exclosures.

The Environmental Policy of Ethiopia (1997) encourages the restoration of degraded landscapes through forest development and the establishment of exclosures on eroding and/or eroded hillsides. In this regard, Ethiopia has approximately 4 Mha of land with a slope greater than 30% (see Figure 3; Table 2), making these suitable locations for exclosures.

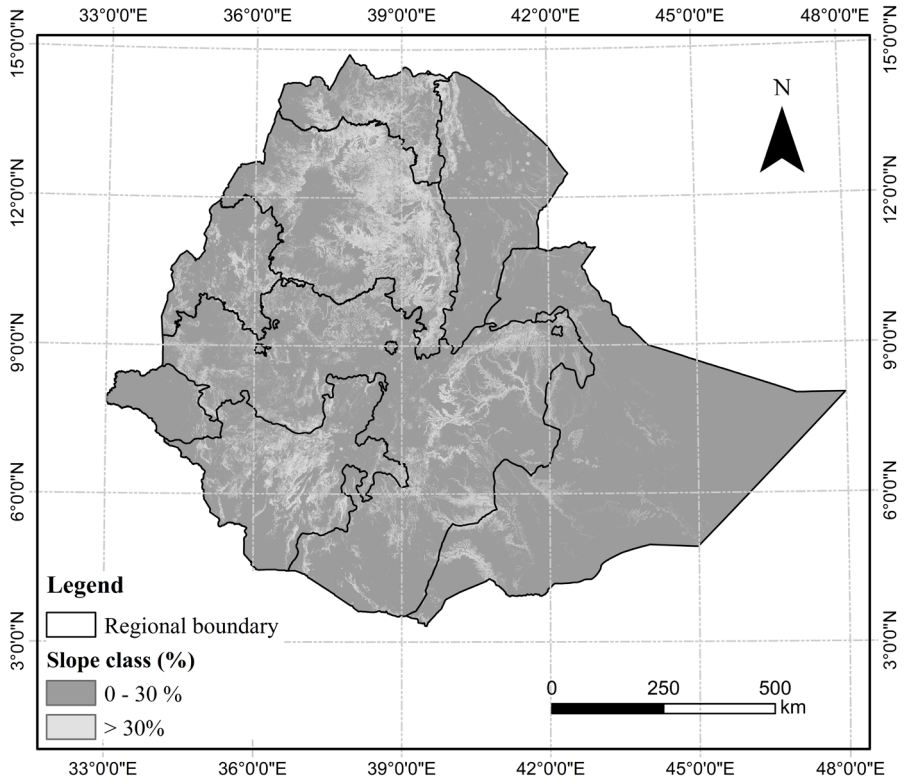

Figure 3. Slope map of Ethiopia.

Table 2. Land area with a slope greater than 30%.

Slope class (%)	Estimated area (000's ha)								
	Ethiopia	Afar	Amhara	Benshangul	Gambela	Oromia	SNNPR	Somali	Tigray
0-30	109,353.8	9,436.9	13,684.4	4,771.6	2,549.9	34,493.7	11,169.9	27,783.9	5,199.4
> 30	3,932.5	85.3	1,658.9	11.7	13.3	1,043.6	55.3	14.3	44.5
Total	113,286.3	9,522.3	15,343.2	4,888.2	2,536.3	35,537.3	11,723.3	27,798.2	5,644.5
% > 30	**3.5**	**0.9**	**10.8**	**2.4**	**0.5**	**2.9**	**4.7**	**0.1**	**7.9**

This report proposes activities that can be used to simultaneously establish exclosures and also enhance the livelihoods of local households and communities. The activities were selected because they can be carried out in exclosure areas without compromising ecological processes. In some cases, the activities may have further objectives for the restoration of ecosystem services beyond only closing off the area. The proposed activities include beekeeping, forage harvesting for livestock fattening, and cultivating selected high-value plant species. The exclosure suitability mapping, therefore, includes an assessment of suitability of the proposed revenue-generating activities.

Beekeeping

Integrating beekeeping can be an option for diversifying livelihoods while maintaining the natural environment (Gibbon 2001; Jacobs et al. 2006). Admassu et al. (2012) demonstrated that households engaged in beekeeping

grew and conserved more plants for their honeybees and other economic uses more than households that were not engaged in beekeeping.

Beekeeping is a long-standing practice in Ethiopia and, at present, accounts for 1.3% of agricultural GDP (Yemane and Taye 2013; Akessa 2016). Honey and beeswax are collected after the end of the rainy season, from October to December, and again during May and June. Currently, one out of 10 rural households rear honeybees; the activity makes a substantial contribution to rural income. Ethiopia is the leading honey producer in Africa and among the top ten producers worldwide. Annual honey production increased from 28,000 tons in 2001 to 54,000 tons in 2015 (Akessa 2016). Annual production varies between 5 and 33 kg per hive, depending on management and the honey production system (see Table 3). According to the Central Statistical Agency (CSA) of Ethiopia, the major honey and beeswax producing regions are Oromia (41%), SNNPR (22%), Amhara (21%) and Tigray (5%) (CSA 2016). Establishing exclosures enhances the potential for honey production in these regions. The potential of the Amhara region can be increased considerably, due to the existence of approximately 5.8 Mha of degraded areas (FDRE 2015) and approximately 11% of the region has a slope greater than 30% (see Table 2).

Ethiopia possesses approximately 6,500 melliferrous plant species, of which more than 1,500 are identified as bee forage. There are 58 National Forest Priority Areas in the country that are suitable for beekeeping. The southwestern part of the country, which is renowned for its organic coffee and spices, has the potential to produce honey and other bee products that can fetch premium prices in the international market (Adgaba 2007). Ethiopia is able to export highly sought-after organic honey to Europe, assuming the quality can fulfil strict European regulations and standards (Gallmann and Thomas 2012). Indeed, a review by Legesse (2014) showed that most Ethiopian honey meets the standards set by many different countries (see Table 4). Akessa (2016) observed that the country has developed honey and beeswax standards (ES 1202 and ES 1203), which comply with standards set by the International Organization for Standardization (ISO) and CODEX Alimentarius Commission[1]. As a result, Ethiopia has been permitted to export honey and beeswax by the European Commission since 2008 (Akessa 2016).

Table 3. Honey production systems and productivity.

Production system	Average honey yield (kg/hive/year)	Total production ($t\ y^{-1}$)		Proportion (%)	
		Honey	Beeswax	Honey	Beeswax
Traditional	5.5	34,650	4,290	64	85.8
Transitional	15	3,150	387	6	7.7
Box (frame) hive	33	16,170	323	30	6.5
Total production		53,970	5,000		

Sources: Serda et al. 2015; Akessa 2016.

Table 4. Comparison between the quality of Ethiopian honey with national, regional and international standards.

Country/ organization	Moisture content (%)	Total reducing sugars (%)	Sucrose content (%)	Acidity (meq/kg)	Mineral content (%)	HMF	Diastase activity in a Gothe's scale
European Union	21	65	5	40	1	40	3-10
FAO/WHO	21-23	65	5-10	40	0.61	80	3-10
Spain	22.5	70	3	5	0.6	-	
Canada	20	60	8	-	0.25	-	
Latin America Codex	20	-	8	54	0.8	-	
Argentina	18	-	8	54	0.4	40	
Mexico	-	63.9	9	8-52	0.25	-	
Test samples (Ethiopia)							
Range	15-32	59-77	0.01-13	17-95	0.01-1.16	0.96-96	1.5-21.4
Mean	20.6	65.6	3.6	39.9	0.23	32.4	6.3

Source: Adgaba 1996 cited in Legesse 2014.

Note: HMF refers to Hydroxymethylfurfural content

[1] Joint FAO/World Health Organization (WHO) Food Standards Programme.

A considerable number of districts have the potential for beekeeping (see Figure 4). Of the total 638 districts in Ethiopia, approximately 262 (41.1%) are suitable for beekeeping. To this end, communities and households could invest in planting the vegetation preferred by bees in exclosures on degraded landscapes (Babulo et al. 2006; Gebremedhn et al. 2017). Gebremedhn et al. (2017) observed that exclosures in Tigray support the successful regeneration of one of the most important honeybee flora (i.e., *Hypoestes forskaolii* or Vahl).

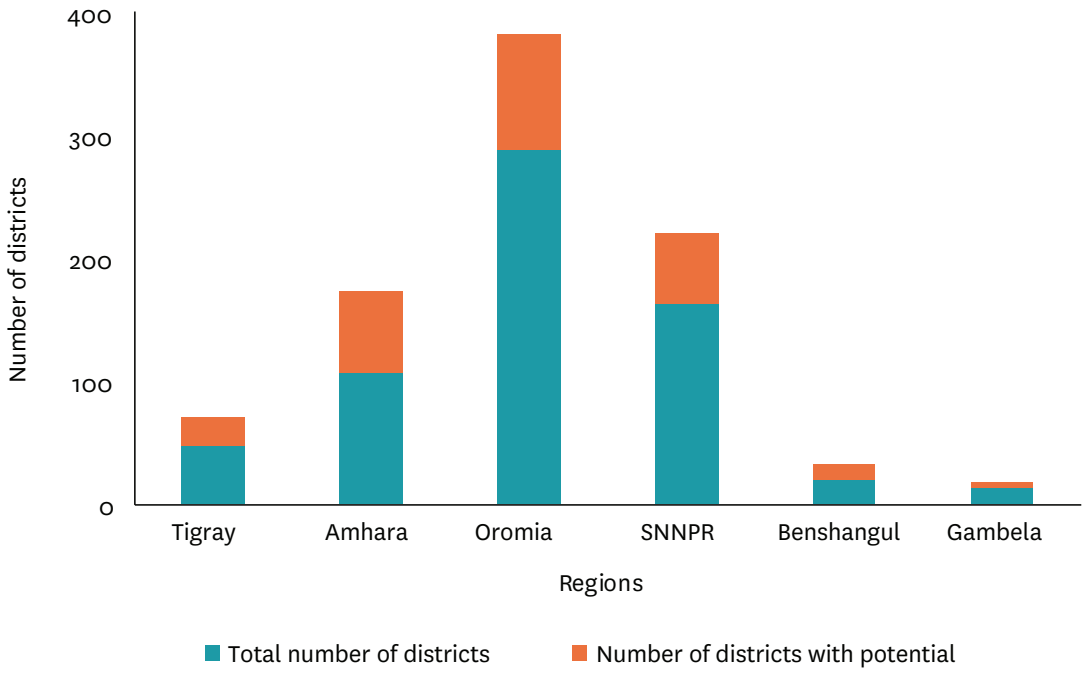

Figure 4. Summary of districts with potential for beekeeping by region.

Source: Adapted from MoARD 2009.

Livestock fattening: Forage harvesting

Cattle production is an integral part of mixed crop-livestock farming, agropastoral and pastoral production systems in Ethiopia (Alemayehu et al. 2016). The livestock subsector contributes 12% and 33% to overall GDP and agricultural GDP, respectively. It also accounts for 12-15% of total export earnings (second following coffee), and contributes to the livelihoods of 65% of the population (LMA 2001). Livestock production ensures the availability of food and income to farming communities throughout the year (Eshete 2002).

However, there are numerous constraints to livestock production in Ethiopia that prevent supply from fulfilling demand in both domestic and international markets (Gebremedhin et al. 2009; Tschopp et al. 2010; Fikru 2015; Ahmed et al. 2016; Amistu et al. 2016; Alemayehu et al. 2016; Mekuria 2016; Amare et al. 2017). A key constraint is the limited practical experience of farmers, experts and development agents in livestock production and marketing. Other constraints include: (i) lack of adequate livestock feed; (ii) inefficiencies in livestock input and output markets; (iii) disease and parasites; (iv) lack of initial capital; (v) shortage of labor; (vi) shortage of grazing lands; (vii) inadequate animal health services; and (viii) drought.

Smallholder livestock fattening is emerging as an important source of income in both rural and urban areas (Anteneh et al. 2010). Livestock fattening practices in Ethiopia are based on three major systems: traditional, by-product based, and Hararghe[2] (Tolera and Abebe 2007). These systems vary by feed source, origin of cattle and market conditions (Fikru 2015). All three systems usually depend on locally available feed resources, including grasses, natural pasture, crop residue (e.g., from maize, sorghum, tef, wheat, barley), hay, false banana, local beverage by-products (e.g., Atela, a by-product of local beer), and industrial by-products (e.g., molasses).

[2] Hararghe is a fattening system that is largely based on cut and carry feeding of individually tethered animals. Grazing is rare (Wolde et al.2014).

Exclosures can help support livestock fattening by providing space to increase the quantity and quality of feed (Ibrahim 2016; Hailu 2017). Exclosures without mitigation measures effectively decrease access to livestock feed by reducing the grazing land area, which in turn forces farmers to reduce the size of their livestock herd (Mekuria et al. 2017). Therefore, the integration of improved feed harvesting in exclosures would encourage local community support for exclosures, and provide at least a short-term economic incentive to reduce free grazing and support land restoration measures (Tekalign 2010; Mekuria et al. 2017). However, improved fodder has the most significant impact on the productivity of improved livestock breeds. Therefore, interventions to introduce improved cut and carry fodder varieties in exclosures should also include the introduction of improved livestock breeds in the area.

Exclosures can contribute to conserving soil moisture and recharging groundwater, both of which are important for livestock feed production. Descheemaeker et al. (2010) demonstrated that exclosures could also contribute to improving livestock water productivity, defined as the ratio of beneficial outputs from livestock to the water depleted in producing them.

According to MoARD (2009), about one-third of the country is suitable for practicing livestock fattening with improved feed (see Table 5), suggesting that there is good potential for integrating forage production in exclosures.

Table 5. Summary of potential areas for livestock investment by region.*

Regions	Potential areas								
	Cattle fattening			Sheep and goat fattening			Dairy production		
	TD	PD	%	TD	PD	%	TD	PD	%
Afar	30	15	50.0	30	15	50.0	30		0.0
Amhara	108	86	79.6	108	73	67.6	108	37	34.3
Benshangul	20	7	35.0	20	12	60.0	20		0.0
Gambela	13		0.0	13	3	23.1	13		0.0
Oromia	288	63	21.9	288	64	22.2	288	52	18.1
SNNPR	162	28	17.3	162	36	22.2	162	26	16.0
Somali	93	25	26.9	93	25	26.9	93		0.0
Tigray	47	10	21.3	47	17	36.2	47	11	23.4
Total	**761**	**234**	**30.7**	**761**	**245**	**32.2**	**761**	**126**	**16.6**

Source: * Adapted from MoARD 2009.

Notes: TD - Total number of districts; PD - Potential number of districts (or districts suitable for livestock production); % - Percentage of potential districts.

Cultivating selected high-value plant species

Tree and plant species can benefit both the environment and ecosystem services, while also delivering economic returns. High-value plant species are sources of food and feed, and provide inputs for industrial products, including, for example, fruit trees and cosmetic or medicinal plants, such as moringa. Ethiopia has a comparative advantage in the production of horticultural commodities, such as fruits, due to its suitable climate, availability of adequate water (e.g., the country's groundwater potential varies between 2.6 and 13.5 billion cubic meters [Bm^3]/year) (Awulachew 2010) and suitable soils, proximity to European and Middle Eastern markets, and relatively inexpensive labor (EIA 2012).

According to CSA (2017), more than 7.92 million kilograms (kg) of fruit were produced during the period 2016/2017 (Table 6). Nevertheless, less than 1% (0.76%) of the total land area under cultivation during this period was devoted to fruit production (see Figure 5). Current fruit production is about 14% (i.e., 107,890 ha) of the potential of 767,300 ha, as summarized by region in Table 7.

Table 6. Production of fruits during the period 2016/2017.

Fruits	Production (kg millions)	Production (%)
Banana	5.14	64.94
Mango	1.05	13.21
Avocado	0.65	8.2
Papaya	0.50	6.36
Orange	0.21	2.61
Others	0.37	4.68
Total	7.92	100

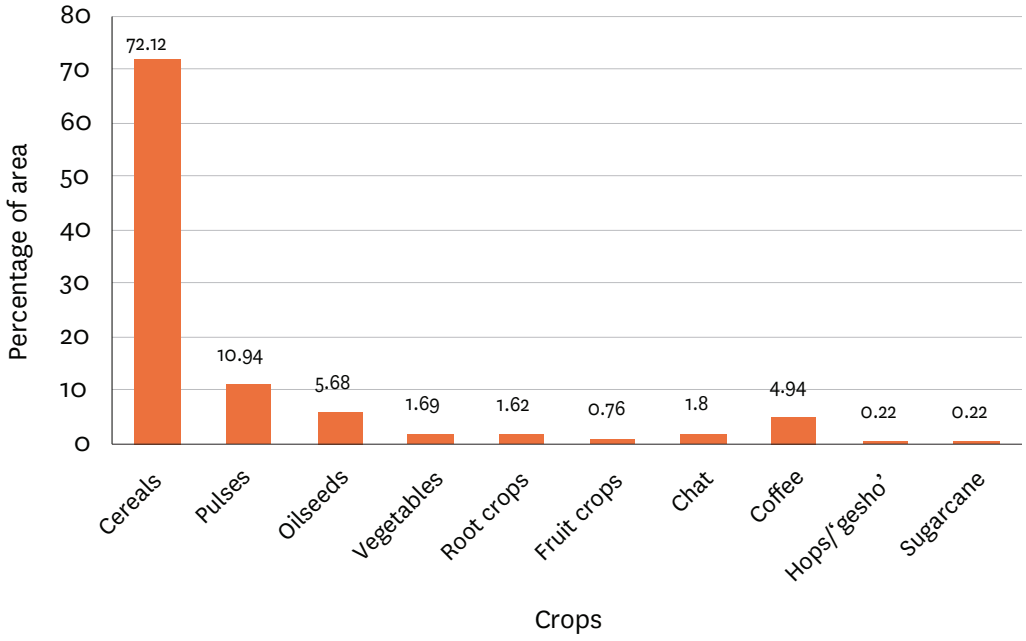

Figure 5. Percentage of area under major crops in 2016/2017.
Source: CSA 2017.

Table 7. Estimated potential area suitable for investment in horticultural production.

Region	Area (ha)	Remark
SNNPR	346,300	Rain-fed and irrigation (Gibe, Omo, Sala and Woito rivers are sources of water for irrigation)
Oromia	150,000	Rain-fed and irrigation (Awash, Wabe, Dabus, Guder, Didessa)
Amhara	270,000	More than 200,000 ha are supported by Lake Tana and Abay River
Dire Dawa	1,000	Dependent on groundwater

Source: MoARD 2009.

Exclosures can be used to increase the production of high-value fruit species. Exclosures reduce grazing pressure, contribute to the recharge of groundwater, improve soil moisture content and moderate local climate, which would increase the potential for fruit production, especially when SWC structures such as terraces, trenches, bunds and micro-basins are built (Anwar et al. 2016). Experience from the Amhara, Tigray and Oromia regions of Ethiopia shows that farmers are producing high-value irrigated crops and fruits in a watershed where exclosures are established (Gebregziabher et al. 2016). Cultivating fruit species in exclosures will have multiple benefits, such as diversifying local livelihoods, producing high-quality fruits for local and export markets, stabilizing SWC structures and, ultimately, ensuring that exclosures are sustainable by increasing the short-term economic benefits they deliver.

Environmental Suitability: Revenue Streams and Ecosystem Services

Morelli (2011) defined environmental sustainability as the quality of "meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them." More specifically,

> "...as a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity" (Morelli 2011, p. 5).

Humans and animals alike depend heavily on the continued availability of ecosystem services (Morelli 2011). Such services include the following:

(i) **Provisioning services**: the products obtained from ecosystems, including food, fiber, genetic resources, biochemicals, natural medicines, pharmaceuticals, ornamental resources, freshwater and all forms of energy resources.
(ii) **Regulating services:** the benefits obtained from the regulation of ecosystem processes, including air quality regulation, water purification and waste treatment, pest regulation, disease regulation, climate regulation, water regulation, erosion regulation, pollination, and natural hazard regulation.
(iii) **Supporting services**: including soil formation, photosynthesis, primary production, nutrient cycling and dispersal, seed dispersal, and water cycling.
(iv) **Cultural services**: the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences.

Using exclosures for income-generating activities helps to improve ecosystem services. Gemechis et al. (2012) indicated that integrating beekeeping with exclosures has no negative impact on the environment, rather it stabilizes fragile areas, increases biodiversity and improves ecosystem services. Integrating beekeeping with exclosures also plays a significant role in increasing agricultural productivity (a provisioning service) through pollination. Studies conducted in Ethiopia (Admassu et al. 2006; Alemberhe and Gebremeskel 2016) and elsewhere (Bartomeus et al. 2014; Sharmah et al. 2015) demonstrated that honeybee pollination increases agricultural production by up to 84%. Similarly, integrating the cultivation of high-value plant species with exclosures can increase provisioning services such as food for human consumption, and enhance regulating services by reducing pressure on natural resources.

Implementing livestock fattening using a cut and carry system can enhance the benefits of exclosures in increasing provisioning services such as feed for livestock and food for human consumption, by avoiding free grazing on exclosures and reducing pressures on land assigned to these areas. Also, this activity helps to enhance regulating services such as carbon sequestration and control of soil erosion/sedimentation, and improve supporting services, including nutrient cycling and vegetation regeneration.

Institutional, Policy and Regulatory Context

Policies, strategies and proclamations related to environmental management, agriculture and sustainable development

The Government of Ethiopia has increased its focus on sustainable environmental management and development in recent years. This is reflected in the adoption of various policies, strategies and proclamations related to agriculture, the environment, natural resources and sustainable development. Relevant policies include: (i) Rural Development Policy and Strategies (RDPS) (2003); (ii) Environmental Policy of Ethiopia (1997); (iii) Forest Development, Conservation and Utilization Policy (2007); and (iv) Water Sector Policy (2001). Other relevant regulatory approaches include the (i) Climate-Resilient Green Economy (CRGE) Strategy (2011); (ii) Conservation Strategy of Ethiopia (CSE) (1994); (iii) Rural Land Administration and Land Use Proclamation (No. 456/2005); and (iv) Proclamation on Institutional Arrangement for Environmental Protection (No. 295/2002).

Ethiopia emphasizes the establishment and management of exclosures in the national agricultural, environmental and natural resources policy frameworks. As such, the proposals in this report align well with the existing policies. Under Ethiopian policy, exclosures are categorized under 'communal holdings' and defined as rural land that is given by the government to local residents for the purposes of common grazing, forestry and other social services (FDRE 2005).

The Rural Development Policy and Strategies (2003) notes the importance and urgency of restoring degraded landscapes, and protecting the environment through physical and biological conservation measures that include exclosures. The strategy targets food security and calls for the active involvement of local communities. The policy also underlines the need to generate economic benefits for rural communities in the short, medium and long term:

> Forest development interventions and interventions implemented for restoring degraded landscapes (e.g., exclosures) should not be carried out simply as development exercises done for its own sake.

> As trees are planted and degraded landscapes are restored, tangible benefits should accrue to the communities where such forests are developed or restoration activities have taken place … Such interventions should be managed as income-generating activities in which farmers produce and sell wood, fruits and other forest products (pages 28 and 41).

The Environmental Policy of Ethiopia (1997): (i) encourages the restoration of degraded landscapes through forest development and the establishment of exclosures on eroding and/or eroded hillsides; (ii) promotes the use of soil and water conservation measures; and (iii) encourages the use of the cut and carry system to allow revegetation on grazing lands and the reduction of soil erosion. Likewise, the Ethiopian Water Sector Policy (2001) promotes efficient and appropriate watershed management practices to enhance the sustainable management of water resources. The Conservation Strategy of Ethiopia (1994) considers the development of forestry and/or the establishment of exclosures on eroding and/or eroded hillsides as a strategy for increasing the stock of trees for fuelwood and construction material.

The Forest Development, Conservation and Utilization Policy (2007) supports investment in forest development through the establishment of exclosures and woodlots under the category of 'private forests'. The policy recognizes the role of local communities in forest management, and emphasizes the need to develop a management plan through a participatory decision-making process. Similarly, the Rural Land Administration and Land Use Proclamation (2005) highlights the importance of exclosures to address land degradation:

> "Rural land of any slope which is highly degraded shall be closed from human and animal interference for a given period of time to let it recover, and shall be put to use when ascertained that it has recovered. Unless the degradation is caused by the negligence of the peasant farmers, semi pastoralist and pastoralists, the users shall be given compensation or other alternatives for the interim period." (Proclamation No. 13, page 3142).

Notably, the CRGE Strategy (2011) emphasizes the protection and rehabilitation of forests and degraded landscapes. For example, one of the statements on forestry stresses the need to: "increase afforestation, reforestation, and forest management to increase carbon sequestration in forests and woodlands" (p. 24). The strategy also promotes the rehabilitation of degraded grazing lands and farmlands by establishing exclosures to enhance soil fertility, and emphasizes the economic and ecosystem services provided by exclosures, such as carbon sequestration.

The Proclamation on Institutional Arrangement for Environmental Protection (2002) provides support for the establishment and management of exclosures by facilitating multi-stakeholder engagement processes, and assigning responsibilities among environmental protection authorities at the federal and regional levels. The proclamation seeks to avoid possible conflicts of interests among the different actors and to reduce duplication of efforts.

Formal and informal institutions for the management of exclosures

The implementation and management of Ethiopia's policies on exclosures involve a number of formal and informal actors and organizations. In the Ethiopian Highlands, the management of exclosures involves local institutions, such as government organizations (e.g., *kebele* administrators, and district agricultural and natural resources offices), local and international NGOs, and the community watershed team (CWT). Community members, government agencies and NGOs jointly develop local bylaws for the management of exclosures. Bylaws are the agreements and rules established by users to structure the management of exclosures. These are essential to avoid 'free riders' and illegal users of the natural resources inside the exclosures; to motivate the local community to take part in the management of exclosures; to reduce overexploitation and degradation of the communal resources; define the beneficiaries of the exclosures; and to avoid conflicts. Bylaws include criteria for violation of the rules; the type and amount of fine to be paid for rule violation; membership conditions; roles and responsibilities of members; conditions for hiring guards to protect the exclosures; and benefits and benefit-sharing arrangements. Several bodies, including the CWT, *kebele* administrators and district agricultural and natural resources offices, are normally involved in the enforcement of the bylaws.

Managing communal resources, such as exclosures, in a sustainable manner requires designing and establishing relevant informal institutions[3], in addition to the formal institutions cited above. Informal institutions are important for facilitating collective action by exclosure users, who might have varied access to, and control over, the exclosure and different expectations of the benefits arising from its use (Poteete and Ostrom 2004; Ribot 2014). Agarwal (2009) generally underlined the need for informal institutions that give due consideration to heterogeneity in user communities. More specific to exclosures, Yami et al. (2013) found that informal institutions supported the success of exclosures in restoring degraded ecosystems, by facilitating common goals and resolution of conflicts among users. Mekuria et al. (2017) also observed that understanding the different perceptions of local community members around

[3] Institutions are devised to shape political, economic and social interactions (North 1991). They consist of both informal constraints (sanctions, taboos, customs, traditions and codes of conduct) and formal rules (constitutions, laws, property rights). Institutions that are not codified by law are often regarded as informal institutions. A discussion on institutions in the context of Ethiopia can be found in Yami et al. (2009).

exclosures helps the government and development partners to target interventions that enhance equitable benefit sharing.

Investment incentives

In addition to providing an institutional base for exclosures, the Ethiopian government has also given priority to agricultural development more generally through its policy on Agricultural Development Led Industrialization (ADLI) (EIA 2012). The policy focuses on the development of agriculture, both as a source of food production and for raw material inputs for industrial processing. Among others, the production and processing of horticultural crops, vegetables and fruits, and honey and beeswax have been identified as important priority areas. The government provides incentives to invest in these subsectors, including favorable custom duties and income tax exemptions, according to EIA (2012).

Institutional context for potential revenue streams

Beekeeping

As has been noted, there is an increasing demand for honey in the domestic and international markets. In response, the Government of Ethiopia is making an effort to develop the honey sector (Tezera 2013; Akessa 2016). A key policy related to such efforts is the Apiculture Resources Development and Protection Proclamation, No. 660/2009, which promotes the development and protection of apiculture resources. In addition, the government has established the Ethiopian Apiculture Board (EAB) to coordinate professional associations and other stakeholders in the implementation of policies and development activities along the honey value chain. The government provides material and technical support for associations such as the Ethiopian Society of Apiculture Science (ESAS) and the Ethiopian Honey and Beeswax Producers and Exporters Association (EHBPEA).

In collaboration with public agencies, development partners, including the Netherlands Development Organisation (SNV) and ACDI/VOCA[4], are working towards building synergies between public and private stakeholders. The government and its development partners provide technical and financial support for landless youth to adopt beekeeping practices. In addition, they organize farmers into groups and link them with local carpenters who can produce modern beehives. Low-cost, modern hives are produced using locally available materials by artisans trained in hive construction.

The rich culture and tradition of beekeeping in Ethiopia, availability of suitable environments with diverse agroecologies, and government support for sector development are among the favorable conditions that ensure this as a viable revenue stream for exclosures (Tezera 2013; Akessa 2016; Dong et al. 2016).

Livestock fattening: Forage harvesting

Government and nongovernmental organizations in Ethiopia are supportive of emerging small-scale and commercial fattening farms, both in cooperative and private forms (Ahmed et al. 2016). Current policies and strategies for the livestock subsector focus on: (i) genetic improvement of sheep and cattle, (ii) animal feed production, and (iii) provision of incentives for improving livestock production and marketing (Aklilu 2008; MoARD 2009).

For example, one of the approaches promoted in Ethiopia's Rural Development Policy and Strategies (2003) is the introduction of improved animal breeds (MoA and ILRI 2013). In particular, it focuses on the selection and multiplication of high-yielding local breeds and breeds from neighboring countries. Increasing animal feed production (both in terms of variety and quality) by improving environmental protection and watershed management (e.g., establishing exclosures), as well as through agroforestry programs, is another priority area of the RDPS. Private investors are encouraged to participate in setting up animal feed factories. Where private investment proves to be difficult, the regional governments may invest in animal feed production factories.

The RDPS stresses the critical importance of developing and disseminating relevant technologies, and improving market access to benefit from the global comparative advantage Ethiopia has in livestock production. Similarly, the Agricultural Growth Project (AGP) (2011-2015) focused on enhancing the delivery of animal health services and improving livestock breeds. The AGP has helped to equip regional animal health laboratories, *woreda* veterinary clinics and *kebele* animal health posts; and has enhanced the skills of professional veterinary staff and trained community animal health workers. The AGP has also worked to upgrade the genetic potential of livestock (especially dairy cattle) in the *woredas* and beyond.

An increasing number of donors (United States Agency for International Development [USAID] and European Union, in particular), FAO and NGOs are also engaged in supporting livestock marketing through the Livestock Marketing Authority (LMA), which falls under the Ministry of Agriculture and Rural Development (MoARD) (Aklilu 2008). Some of these programs have been implemented through regional organizations such as the Common Market for Eastern and Southern Africa (COMESA) and the Intergovernmental Authority on Development (IGAD).

[4] Formerly, the acronym represented the combination of the two entities 'Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance', but today its legal name is solely the acronym.

Cultivating selected high-value plant species

The main bottlenecks slowing the cultivation of high-value plant species in exclosures are the lack of public infrastructure (e.g., storage facilities), weak institutional service delivery (e.g., extension system, research institutes, cooperative promotion offices), weak market chains (both input and output) and unfair relationships (e.g., middlemen benefit more than farmers, due to poor market access), and a lack of the managerial and technical knowledge needed to develop and gain from investing in, for example, fruit trees.

The Government of Ethiopia gives high priority to the development of the horticulture sector. In 2008, the Horticultural Development Agency was established under the Ministry of Agriculture to promote and support further development of the sector (Wiersinga and de Jager 2009). The Ethiopian Horticulture Producer Exporters Association (EHPEA) was established in 2002 to facilitate horticultural exports – including fruits – by the private sector. EHPEA represents the horticulture sector in the country as well as internationally, and organizes trade fairs.

A number of agencies in the Ministry of Industry and Trade (MoIT) are also working to further develop, promote and control the quality of horticultural products. Some donors (e.g., USAID and SNV) have identified the potential for further development of the horticulture sector in Ethiopia, both for the domestic and export markets. For example, the Ethiopian-Netherlands Horticulture Partnership provides technical support to development of the sector, while the Embassy of Israel supports fruit tree nurseries for mango, avocado and other fruits in the southern part of Ethiopia. Other donors support activities on production technology, postharvest handling, and ensure compliance with international standards.

In recognition of the role of the private sector in Ethiopia, the government has revised the investment law three times over the past 20 years to make it more transparent, proactive and competitive (Ashebre 2015). Investment Proclamation No. 280/2002 and Regulation No. 84/2003 introduced major changes to attract foreign investment, including the move to "remittance of funds" and "one-stop shop services" (Berihun 2010). The expansion of production and export in the floriculture, fruits and vegetables subsectors is a stated priority for Ethiopia's Sustainable Development and Poverty Reduction Program (SDPRP) and Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (Joosten 2007). As a result, agricultural and industrial production, investment, and export trade are experiencing steady growth, both in terms of variety and volume (EIA 2012).

Governance of Exclosures

Multi-stakeholder approach needed for exclosure management

The importance of collaboration

Sustainable exclosure management is a multidimensional and multi-institutional engagement that demands collective analysis, design and implementation (Amede et al. 2007). It requires support from a wide range of stakeholders, including community level institutions (e.g., the CWT, village-level administrative bodies), government agencies, local and international NGOs, national and international research institutes, and private sector actors (Mekuria et al. 2017; Rossiter et al. 2017). No single agency can effectively implement any of the different activities presented in this business model on its own.

Different stakeholders have different roles and mandates, so it is critical to ensure that they can work together effectively (Amede et al. 2007). In addition, they must be able to agree on the revenue streams that are most relevant or best suited to different areas. For example, hosting beekeeping will only work in exclosures that generate sufficient bee forage. In many locations, no management option will fully address a local community's needs and therefore a suite of options is required. The goal is for all stakeholders to contribute their specific expertise to implementing a business model that best serves the community's livelihood aspirations while reversing environmental degradation.

Stakeholder roles and responsibilities

The management of exclosures calls for support from stakeholders at all levels (Amede et al. 2007; Mekuria et al. 2017). What follows is a brief description of the roles and responsibilities of the stakeholders at different levels.

i. National level

The Ministry of Agriculture and Livestock Resources (MoALR) and the Ministry of Environment, Forest and Climate Change (MoEFCC) are the key stakeholders at the national level. MoALR provides recommendations and technical support for activities to enhance the short-term economic benefits of exclosures. The technical support mostly takes the form of capacity development for district-level experts, development agents and farmers on improved agricultural and grazing land management practices, such as livestock fattening and dairy production, beekeeping, and controlled and rotational grazing. MoEFCC can help communities to develop a strategic management plan for exclosures and

to formulate related bylaws and standards. The Ministry can also organize training to facilitate the monitoring and evaluation of exclosure management, and identify the effectiveness of the revenue streams in improving livelihoods.

ii. Regional level

Regional Agriculture and Natural Resources Bureaus and Land Administration Bureaus are the key stakeholders at the regional level. The Bureau of Agriculture and Natural Resources, in collaboration with district Agriculture and Natural Resources Offices, has a mandate to establish landless youth and women's groups, which are the main intended beneficiaries for the proposed revenue streams. The bureau can also play a critical role in coordinating efforts to establish revenue streams within exclosures. For its part, the Bureau of Agriculture and Natural Resources coordinates the efforts of NGOs (by initiating joint planning) to mitigate some of the negative implications of exclosures for livelihoods (e.g., limited short-term economic benefits and reduction in the availability of fuelwood). The regional Land Administration Bureaus can play a critical role in designing policies and strategies related to the distribution of communal land to landless youth and women's groups.

iii. District level

Stakeholders at the district level include the Agriculture and Natural Resources Office, the Environment, Forest and Climate Change Office, and the Land Administration Office. Each office has a particular role to play. For example, the Agriculture and Natural Resources Office raises seedlings of high-value plant species (e.g., fruit trees, fuelwood, timber, medicine, fodder production), which can be used to establish woodlots in exclosures. The Environment Forest and Climate Change Office, and the Land Administration Office help to administer the exclosures and design strategies to open these to landless youth and women's groups.

iv. Village level

The key village-level stakeholders include the *kebele*/village administrative bodies. According to Desta et al. (2005), each community should have a planning team – the CWT – to deal with watershed planning and interact with other communities as needed. As a general rule, the CWT includes the community leader (who represents the community at *kebele* level), four male household heads representing different social groups, four female household heads representing different social groups, one youth representative, one religious representative, and others as required by the community (e.g., innovative farmers, respected people, women's groups, etc.) (Desta et al. 2005). While literacy should not be a requirement for participation, communities may want to identify at least one male and one female representative that is literate.

The hosting communities are mainly responsible for oversight of developing business enterprises, as well as for developing and implementing informal institutions and bylaws to govern the management of exclosures. The CWT and *kebele*/village administrative bodies typically raise awareness about exclosures; identify and provide information to address the concerns of local communities; and support the implementation of the revenue streams, the informal institutions and bylaws. The CWT serves as a permanent contact between development agents and the communities. It liaises with other communities within the same watershed, collects baseline data (income, livelihood mechanisms, status of natural resources), plans all sub-watershed interventions, and coordinates the selection of beneficiaries (Desta et al. 2005; GIZ 2015).

v. Stakeholders with supporting roles

Local and international NGOs, national and international research institutes, and higher academic institutes operate at all levels. NGOs often have technical expertise and experience with sustainable land management. They may be able to provide start-up money for the revenue streams in the form of long-term credit or revolving funds. They can also play a role in building the capacities of farmers and extension workers in modern agricultural practices relevant to the revenue streams. The Ethiopian Institute of Agricultural Research (EIAR) and international agricultural research institutes (e.g., IWMI, International Center for Agricultural Research in the Dry Areas [ICARDA] and World Agroforestry [ICRAF]) can contribute technical expertise and a range of management options for exclosures. Higher academic institutes can assist with capacity building for a range of stakeholders.

vi. Private sector

The private sector has an essential role to play in supporting the integration of livelihood activities with exclosures. It supplies inputs such as beehives, improved livestock breeds and seedlings of high-value plant species. The private sector can enhance the efficiency of markets through public-private partnerships (MoEFCC 2017). If provided with the proper incentives, private enterprises can help to lower the prices of essential goods (e.g., modern beehives, seedlings of fruit trees) through large-scale production, effectively increasing the real incomes of exclosure users (TAK-IRDI 2016). The private sector can also benefit from undertaking contract farming in the exclosures.

Stakeholder engagement strategies

Multi-Stakeholder Engagement Processes (MSEPs) are (structured) processes that are used to ensure participation on a specific issue and are based on a set of principles (UNDP 2006). They aim to ensure participatory equity, accountability and transparency, and to develop partnerships and networks among different stakeholders.

MSEPs create confidence and trust among actors and enable mutually acceptable solutions to common challenges (UNDP 2006). In this study, MSEPs were found to support the sustainability of exclosure-based economic activities. The inclusive and participatory nature of the processes also promotes a greater sense of ownership over its outcomes and, consequently, further contributing to sustainability.

Existing platforms, such as natural resources management committees (e.g., district, village), and existing learning watersheds (e.g., learning watersheds of the Water and Land Resource Center [WLRC]) can be used to strengthen collaboration among different stakeholders in the processes. These committees are usually led by agriculture and natural resources offices, with financial support from the government and local NGOs. The platforms bring relevant stakeholders together to define their common goals, and their particular roles and responsibilities for managing exclosures, based on their competencies and resources.

MSEPs stimulate transparent and inclusive decision-making, strengthen stakeholder networks, ensure accountability and empower participants (Hermans et al. 2017). MSEPs help stakeholders learn how to understand and address the concerns of local communities through interaction and the exchange of knowledge (Hermans et al. 2017). Such processes can also be used for stakeholder analysis by researchers and development workers seeking to investigate the stakeholders' collaborative, knowledge exchange and influence networks (Hermans et al. 2017).

Possible interactions between the different stakeholders

Possible interactions among the key stakeholders in exclosure management are summarized in Figure 6. Based on the analysis (see section *Stakeholder Analysis*), the key stakeholders were ranked based on expertise, willingness to engage and values (see Table 8). The analysis demonstrated that higher and lower level practitioners are more important in managing exclosures than national and international research systems and universities (see Table 8).

Exclosure establishment and management systems

A number of exclosures have already been established on communal grazing lands in Ethiopia (Lemenih and Kassa 2014; MoEFCC 2017). The process involves local administrative bodies, including *kebele* administrators, CWTs and the local community (Mekuria et al. 2017). According to Mekuria et al. (2017), there are a number of steps and procedures to follow when establishing exclosures on communal grazing lands. These include the following:

(i) Putting the idea on the government agenda (this can be done by any concerned body, including the local community, the government itself or NGOs).
(ii) Raising awareness of local communities on the importance of exclosures through formal institutions (e.g., district agricultural offices), church leaders and other local institutions (e.g., *Idir*[5]).
(iii) Consulting with the community (generally by the district agricultural office and/or CWT).
(iv) Requesting the community to submit a letter agreeing to the establishment of an exclosure.
(v) Demarcating the areas to be protected.
(vi) Physically establishing the exclosures.

The local communities generally carry out the last two steps.

Current management systems for exclosures range from 'government-communal-individual' to 'government-communal' (Lemenih and Kassa 2014), and are managed by the government, communities, individuals, or by joint management of the government and local communities. There are risks associated with individual management of exclosures, including habitat fragmentation, poor control over free grazing, lack of sufficient labor, and the exclusion of marginalized groups from obtaining lands for establishing exclosures.

Guards, recruited and paid by the government and the community, protect exclosures. Day-to-day management and use include the establishment of conservation structures such as hillside terraces, stone bunds and micro-basins. The CWT administers the day-to day distribution of benefits from exclosures, such as forage harvesting, honey production and collection of medicinal plants. The key condition for membership in the beneficiary group is willingness and the ability to participate in natural resources management interventions in the exclosures.

Several indicators can be used to monitor the performance and effectiveness of exclosures over time (Kassa et al. 2017). These include (i) improvement in vegetation cover and composition; (ii) regulation of soil erosion and sedimentation; (iii) improvement in soil fertility; (iv) contribution to groundwater recharge and spring development; and (v) livelihood diversification. These reflect and may be aligned with the indicators outlined in the LDN and relevant United Nations Sustainable Development Goals (SDGs), e.g., SDG 15.3 (by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world).

[5] *Idir* is an association established among neighbors or workers to raise funds that will be used during emergencies, such as the death of someone within these groups and their families.

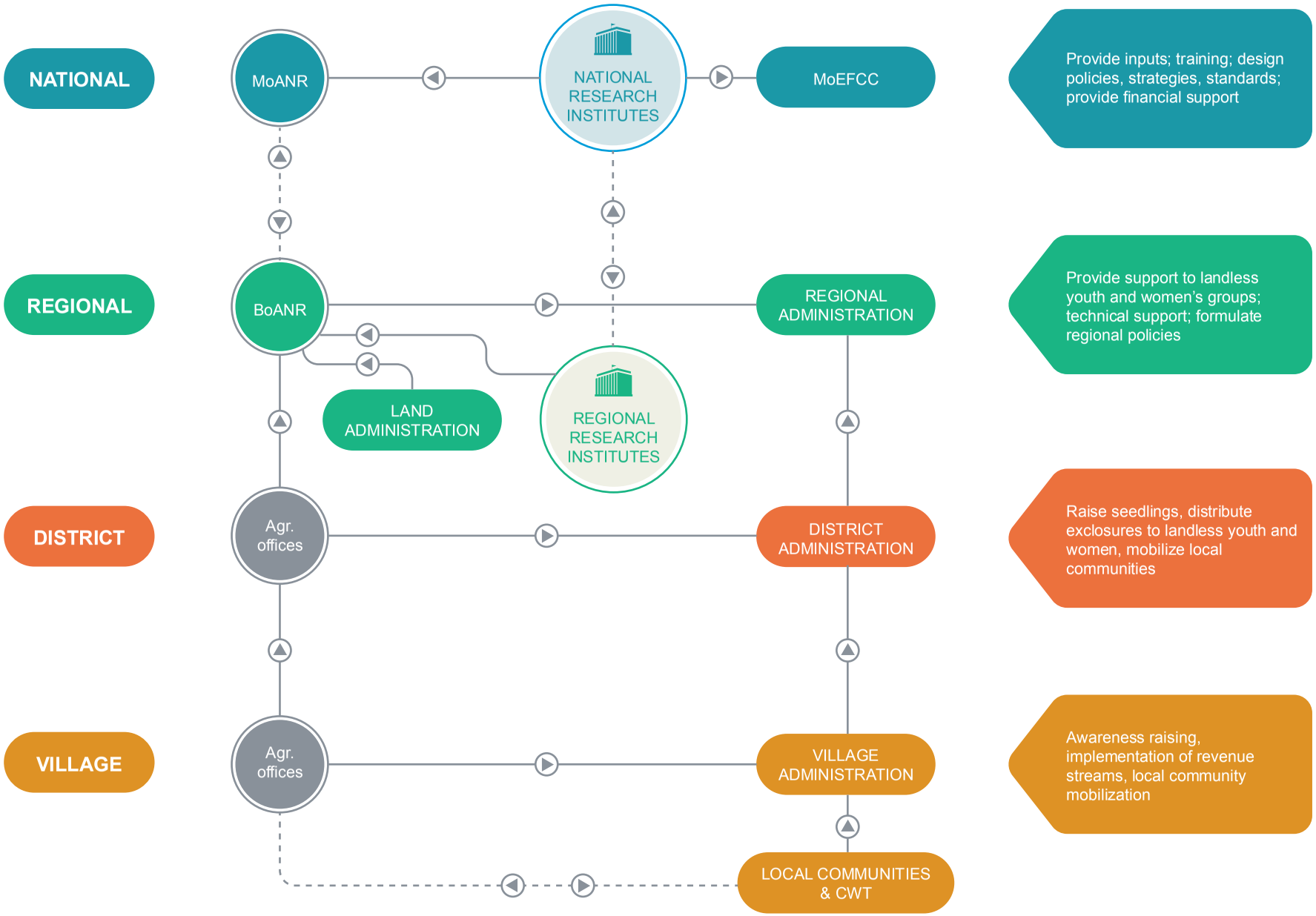

Figure 6. Illustration of the interactions among the different stakeholders in exclosure management.

Note: MoANR - Ministry of Agriculture and Natural Resources; CWT - Community Watershed Team; BoANR – Bureau of Agriculture and Natural Resources; MoEFCC - Ministry of Environment, Forest and Climate Change; Agr. - Agriculture and natural resources.

Table 8. Analysis, identification and prioritization of key stakeholders in exclosure management.*

Stakeholder	Expertise		Willingness to engage	Value		Rank	Score
	Contribution	Legitimacy		Influence	Necessity of involvement		
MoALR and MoEFCC	3**	3	3	3	3	1st	15
Regional bureaus	3**	3	3	3	3	1st	15
Regional research systems	3***	3	3	3	3	1st	15
District agricultural offices	2	3	3	3	3	1st	14
District administrative bodies	1	3	3	3	3	2nd	13
Local communities	1	3	3	3	3	2nd	13
International research institutes (e.g., IWMI)	3	2	3	2	3	2nd	13
Universities	3	2	3	2	3	2nd	13
National research systems	3	3	2	2	2	3rd	12
NGOs (e.g., GIZ, USAID, WLRC, etc.)	2	2	3	2	3	3rd	12
Private sector	1	1	2	1	2	4th	7

Notes:

* Values for scores are given as: *expertise* = contribution + legitimacy (L/M/H; L=1, M=2, H=3); *willingness to engage* (L/M/H or 1/2/3); and *value* = influence + necessity of involvement (L/M/H or 1/2/3);

** Technical knowledge of natural resources management is of high value.

*** Knowledge of research on land resources management is of high value.

Perception of local communities on revenue streams

Local communities in Ethiopia have reacted positively to the use of exclosures to improve their livelihoods (Amede et al. 2007). For example, local communities in the northwestern part of the country confirmed that the three revenue streams examined (beekeeping, livestock fattening and the cultivation of high-value plant species) have increased local participation in natural resources management; sustained the exclosures; improved the ecosystem services that can be obtained from them; and strengthened livelihoods (Mekuria et al. 2017). They asserted that integrating income-generating activities within exclosures increased their income and diversified livelihoods within 1 or 2 years, while reducing their dependence on natural resources, for example, by decreasing their engagement in charcoal production and the collection and sale of fuelwood (Mekuria et al. 2017). This, in turn, enhanced the long-term environmental benefits of exclosures by reducing soil erosion, restoring degraded native vegetation, improving soil fertility and enhancing water availability. Women in Birakat and Alikit Wenz watersheds in northwestern Ethiopia explained:

> "Before the provision of sheep to female-headed and poor households and integrating with exclosures, women and poor farmers sale (sic) their grass share (i.e., obtained from exclosures) to the relatively rich farmers at a cheap price. This has led to low interest among poor farmers in participating in exclosure management, as the establishment of exclosures on degraded lands benefits the rich farmers more than the poor ones. Following the integration of income-generating activities with exclosures, women and poor farmers stopped to sale (sic) grasses to rich farmers, as they need the grass to feed their livestock, which consequently ensured equity in benefit sharing. Also, such interventions motivated women and poor farmers to participate in the establishment and management of exclosures, as they realized the benefits."

Some communities experienced negative impacts from the exclosures, including reduced availability of fuelwood, and the degradation of land cover and soils in nearby communal grazing lands and forests (Mekuria et al. 2017). Such impacts were mostly due to increased livestock and human pressure on unprotected natural resources outside the protected zone of the exclosures. Providing/introducing alternative energy options to the local communities (e.g., solar power, biogas and energy-conserving stoves), encouraging stall-feeding and controlled grazing, and increasing the production of livestock feed from exclosures could help offset the negative impacts on surrounding areas.

Gender Considerations

Assuming a supportive economic infrastructure, there is high potential for women to benefit from exclosures. The number of women engaged in honey production in Ethiopia is growing (Belayhun 2014). For example, following interventions by the Oxfam project in the Amhara Regional State from 2009 to 2011, the number of female members of cooperatives increased by 25% and women now account for 17% of the total membership in the region. Women are often responsible for fodder markets in Ethiopia. Developing a cut and carry system in the exclosures presents an opportunity for women to increase their involvement in the fodder trade. Women are often responsible for animal products, such as milk. Improved feed could increase milk supply, benefiting their income. Women may also have a role to play in planting and harvesting high-value plant species, because rural women depend heavily on home-garden agroforestry systems for their family livelihoods (Gabiso et al. 2015).

Policies supporting the establishment of exclosures have not yet addressed the different needs and priorities of men and women in exclosure management. Both policies and institutions need to be gender responsive in order to ensure that women as well as men reap the benefits of exclosures equally. In general, women may benefit from some activities, but they tend to lack the power and status to benefit fully. At the local level, the involvement of women in decision-making about the use and management of exclosures has been limited, largely because they have little or no representation on the watershed development committees (Mekuria et al. 2017). Men, at informal all-male get-togethers, take most decisions, which further constrains the active involvement of women in decision-making (Yami et al. 2013). Nedessa et al. (2005) revealed that patriarchal cultures and the lack of representation of women resulted in gender imbalance in all aspects of exclosure management.

Financial policies lack mechanisms to enhance gender inclusiveness, let alone empowerment. The government and donors have long supported microfinance institutions (MFIs) to resolve the credit access problems of the poor. The outreach of services provided by MFIs increased by 22.9% from 2003 to 2007, but access by the disadvantaged, particularly women, remains limited; women comprise only 38% of the borrowers (Kereta 2007). IFAD (2001) highlighted that the proportion of women clients supported by rural-based government-supported MFIs is less than half of all their clients.

Both internal and external constraints limit women's access to credit. Women tend to need the approval of their spouses or male relatives to take loans (Kipnis 2013). Outside of the household, rural women in

Ethiopia have lower access to financial products from formal institutions and microfinance service providers. As Kipnis (2013) highlighted, unequal legal rights and inefficient financial infrastructure aggravate the social and economic position of women. This translates into an inability to meet requirements for loans due to, for example, lack of documented property rights. Women's limited access to financial resources is very likely to constrain their ability to invest in income-generating activities in exclosures, such as beekeeping and cattle fattening, using feed obtained from exclosures through a cut and carry system.

Value Chains, Finance and Economic Viability

Value Chains for Revenue Streams

Bee product value chains

In Ethiopia, average annual demand for honey products is predicted to grow from 54,000 tons in 2013 to 90,357 tons in 2022 (Assefa 2011). The total volume of Ethiopian honey sold in the international market increased from 275 tons in 2010 to 730 tons in 2012 (Assefa 2011; EEPA 2012). Around 95% of the honey produced is sold in domestic markets, with between 50% and 80% used for making mead, locally called *Tej* (Legesse 2014; Akessa 2016), and the remainder used as a sweetener or for other purposes (Assefa 2011).

The Ethiopian market price of honey is high in urban areas (ranging from USD 6 to USD 10 per kilogram) and relatively low in remote rural areas (ranging from USD 1.40 to USD 5 per kilogram) (Akessa 2016). Despite significant potential to export honey to the European Union and other markets, Ethiopia exports only a very small quantity to international markets. Currently, 30% of the annual total honey production is smuggled out of the country illegally (Akessa 2016), as most honey trading is informal and conducted without licenses. Similarly, only a small fraction of the beeswax produced in Ethiopia is exported to the global market, while the majority is consumed locally. The price of 1 kg of beeswax is in the range of USD 6.5 (in 2011) to 10.9 (in 2016) (Akessa 2016).

According to MoA and ILRI (2013), beekeepers, honey and beeswax collectors, retailers, *Tej* brewers, processors and exporters are the key actors in the honey value chain. This study by MoA and ILRI identified three principal channels in the value chain: *Tej* brewing, honey processing and exporting, and beeswax production. Dong et al. (2016) classified the honey market in Ethiopia into different categories based on end use of the honey sold (see Figure 7). Both studies demonstrated that the marketing of honey is complex and interconnected, but it lacks organized marketing channels and formal links among the actors. Development of the market linkages could increase the amount of honey available for sale.

While the potential for increasing honey production to meet domestic and foreign demand is high, producers generally face a number of constraints, including the lack of financing mechanisms, lack of skills in beehive management, limited access to information services, poor storage and postharvest management, inadequate research facilities, and poor institutional facilities and regulatory mechanisms (Kinati et al. 2012; Gemeda 2014; Dong et al. 2016; Tekle and Weldeyohanis 2016). Since lower amounts of agrochemicals are used in exclosures, exclosures offer healthy habitats for bees and beehives. Evidence from Ethiopia shows that an exclosure integrated with apiculture has resulted in environmentally friendly, income-generating activities. This is because, in addition to its contribution to household economy, apiculture promotes the production of bee forage, vegetation and pollination, leading to improved vegetation cover and biophysical stability (Gebregziabher et al. 2016).

Fodder and livestock fattening value chains

High market demand exists for livestock products in both domestic and international markets, and this creates a favorable environment for the production of livestock feed, such as crop residues or even irrigated fodder (Negassa and Jabbar 2008; Eshetu and Abraham 2016). The domestic consumption of meat in Ethiopia increased from 504,000 metric tonnes in 1993 to 683,000 metric tonnes in 2000 (an average annual growth rate of 1.3%). In addition, milk consumption increased from 585,000 metric tonnes to 905,000 metric tonnes (an average annual growth rate of 2.2%), and egg consumption increased from 61,500 metric tonnes to 65,800 metric tonnes (an average annual growth rate of 0.3%) (FAO 2004). The value of meat exports increased from USD 18.5 million in 2005/2006 to USD 63 million in 2010/2011 (USAID 2013; Eshetu and Abraham 2016).

There is a consensus that the marketing of livestock and livestock products in Ethiopia is underdeveloped (ESAP 2003). However, the past few years have witnessed a growing interest in the export of live animals and meat from Ethiopia by countries in the Middle East (Aklilu 2008). Considering the number of people that depend on livestock production for their livelihoods, the expansion of domestic and international markets could contribute significantly to alleviating poverty, raising revenues, and continuing the economic trend towards greater market orientation (Aklilu 2008; GebreMariam et al. 2010).

ESAP (2003) indicated that viable markets can serve as engines for the development of livestock production, processing and consumption, as well as for attracting investment. However, livestock markets are grossly underdeveloped, lacking basic infrastructure, such as water troughs, feed and market information (Tewodros 2008). Taking the lead, the private sector prompted the Ethiopian government to pay more attention to the potential of the livestock trade. The government responded by taking encouraging steps to promote the livestock markets, including increasing investments in animal health, infrastructure and processing facilities; establishing an export association; identifying potential export markets; and facilitating export procedures (Aklilu 2008).

The livestock market in Ethiopia is a three-tier system: traders, including butchers, meat-processing factories, fattening farms or live animal exporters, procure livestock in primary (where main sellers are producers), secondary (regional – where main sellers are traders) or terminal (national – where main sellers are traders) markets. Prices are usually determined through individual bargaining, and depend mainly on supply and demand; these are heavily influenced by the season, and proximity of religious and cultural festivals (Alemayehu et al. 2016). For example, prices for cattle are highest from February to June (reaching USD 800 at their upper limit) and lowest from September to January (USD 500).

Ethiopian meat and live animal value chains developed historically and are highly complex (AGP-LMD 2013). The key actors in the value chain are producers, collectors (i.e., individual traders based in rural areas), small private and cooperative fatteners/feedlots, middlemen, cooperatives for livestock trading, individual traders, exporters and consumers (see Figure 8). Halala (2015) demonstrated that the relationship among the different actors in this value chain is neither sustained nor reliable. This study shows that most of the relationships are casual and change often to suit the circumstances; the actors tend to ignore standard business principles.

Notably, the lack of adequate feed poses a major constraint to increasing the production of livestock for meat and other products (Gebremedhin et al. 2009; Tolera and Abebe 2007). Meanwhile, the demand for fodder appears to be growing because of the expansion in market-oriented livestock production (Gebremedhin et al. 2009; Dejene et al. 2014). Feed prices are rising in the domestic market. The export market for agro-industrial by-products (AIBPs) such as noug, linseed, cotton seed cakes and wheat bran has contributed to the shortage of AIBPs and increased their prices in the domestic market (Dejene et al. 2014). It seems clear that producing high-quality fodder for sale could help to fill an existing gap. Studies conducted in the central and northern highlands of Ethiopia indicate that cattle fattening can produce a gross profit ranging from USD 20 to USD 170 per head per rotation period (i.e., 90-120 days).

Studies (e.g., Gebremedhin et al. 2009; Dejene et al. 2014) point to several actors in feed markets, including both subsistence and market-oriented rural farmers, urban dairy producers and fatteners, commercial poultry producers, livestock and poultry traders, feed processors, abattoir operators, live animal exporters, and feed exporters. Most feed trading is informal and conducted without licenses. There seem to be few barriers to entry and exit, with traders exiting the business at will, and new traders getting into the business frequently. However, the licensed businesses, which are usually large, tend to stay in the business over time.

High-value plant species: Fruit production

EIA (2012) indicated that there is a large domestic market for fresh and processed fruits. Today, fruit processing is limited mainly to the extraction of fresh juice for sale in the local market. The domestic demand for fruit juice alone was around 8,122 tons in the 2012, and is projected to grow to 13,230 tons by 2022, a 63% increase (ATA and USAID 2016). The Ethiopian population is currently estimated at about 100 million, with an annual growth rate of about 2.5%, which could be a strong indication of continued growth in the demand for fresh fruit (https://data.worldbank.org/indicator/SP.POP.GROW). Some of this demand could be met through increased local supply, since current fruit production is far below potential.

A key limitation is the lack of market development. For example, the fresh fruit and juice market for domestic produce is underdeveloped, relying mostly on imported juice. Import of fruit juices increased from 2,000 tons in 2009 to 6,000 tons in 2011 (EIA 2012). There are many actors along the lengthy fresh fruit value chain, without significant value addition at every point (Worako 2015). An efficient marketing system is crucial for sustainable fruit production and to ensure a continuous supply for the markets (Nega et al. 2015). There are at least three supply chains for horticultural products: domestic, regional and European (EIA 2012; see Figure 9). Both government enterprises and private exporters are engaged in the export of fruits.

Sources of Finance and Financing Mechanisms

Potential sources of finance for the revenue-generating activities considered in this business model include NGOs, government agencies and private enterprises. NGOs can provide financial support to local communities in the form of credit or subsidies. Government agencies provide financial support in the form of subsidies or revolving funds for lending through cooperatives or MFIs. There are a number of interventions owned by the government, which can provide financing services, such as FFW, PSNP, SLM, AGP, CRGE, Youth Empowerment, and the African Forest Landscape Restoration Initiative (AFR)100 programs.

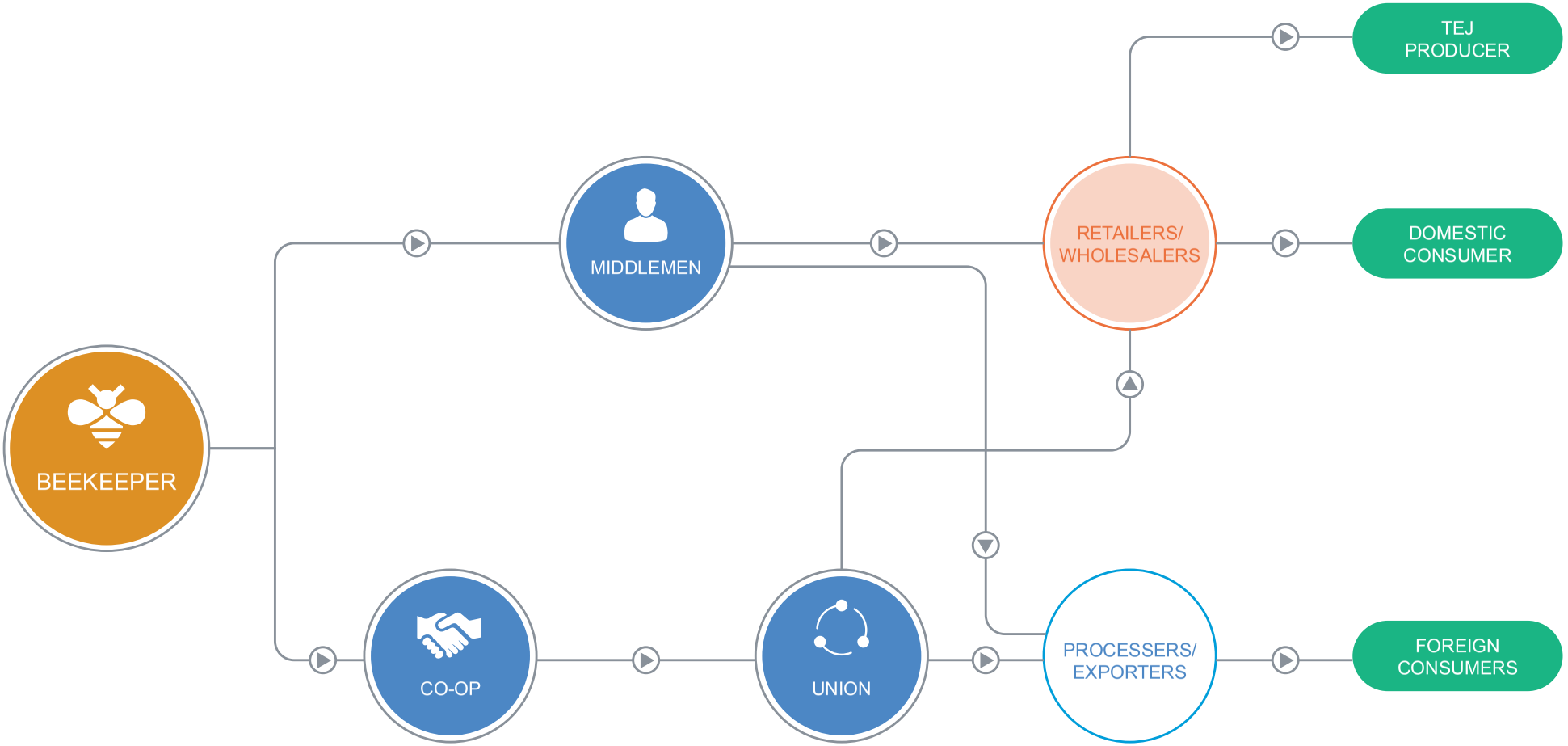

Figure 7. Smallholder honey value chain in Ethiopia.

Source: Dong et al. 2016.
Note: Co-Op - Cooperative.

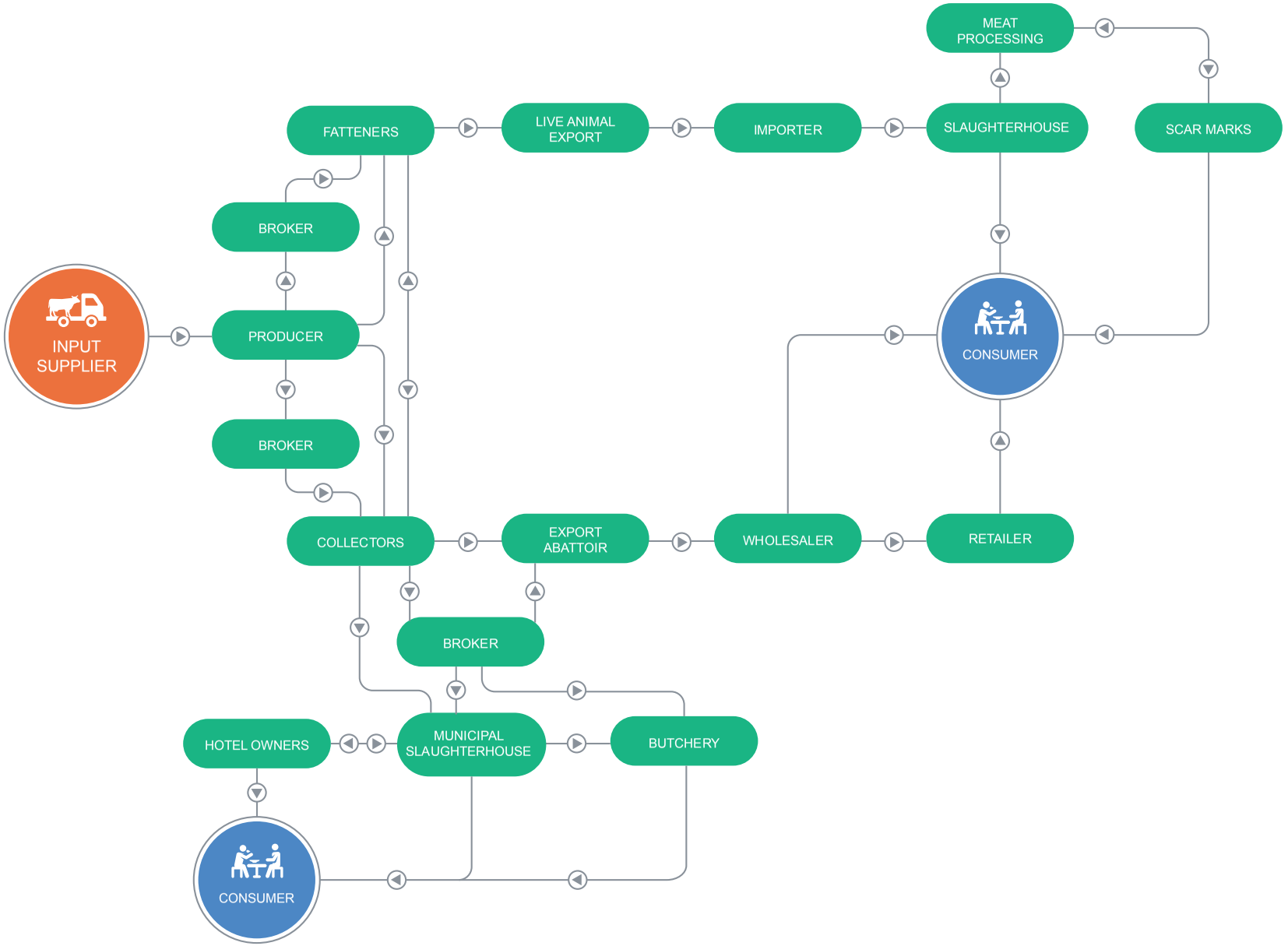

Figure 8. Value chain for meat and live animals.

Source: AGP-LMD 2013.

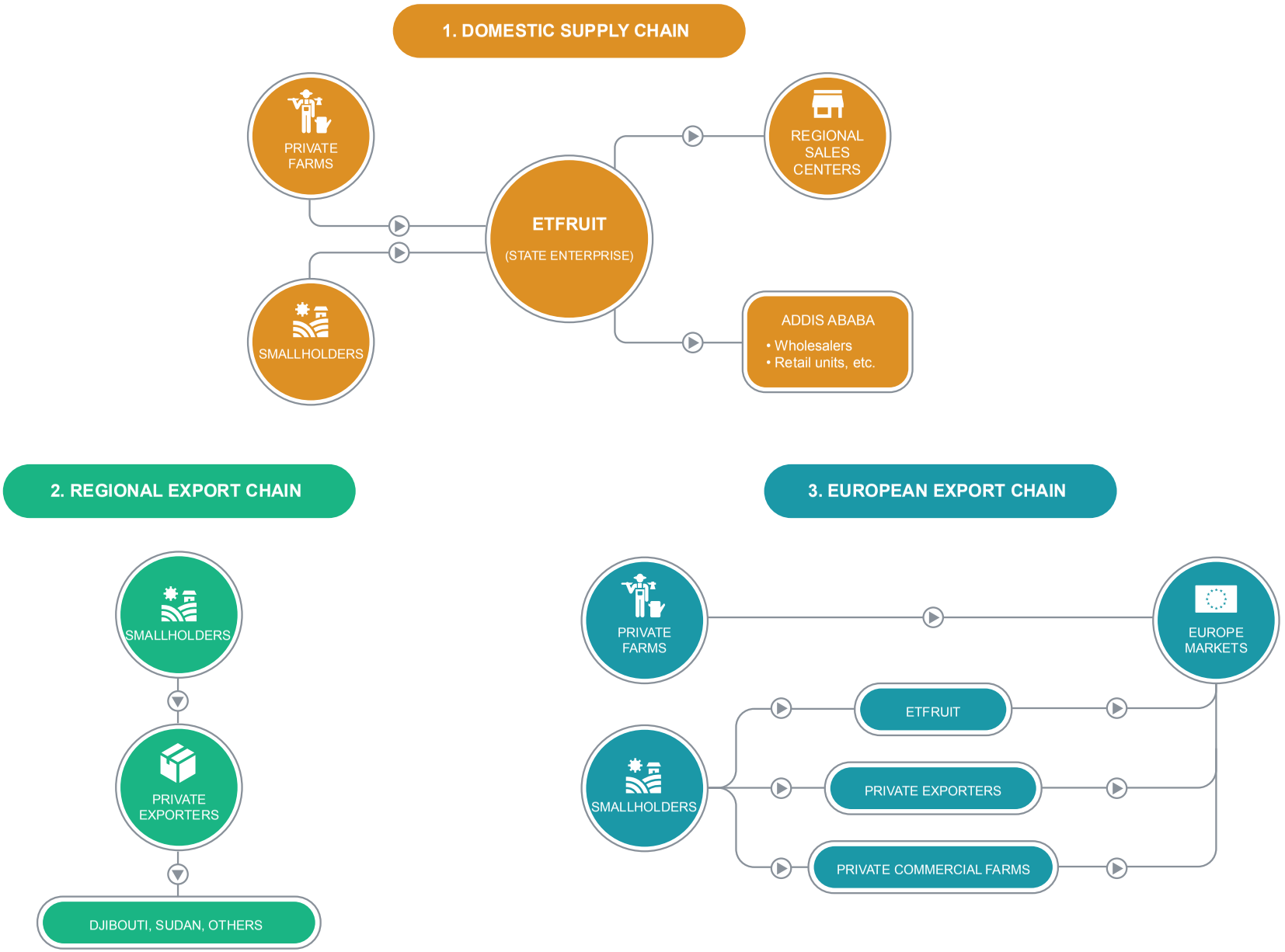

Figure 9. Fruit production value chains.

Source: EIA 2012.
Note: Etfruit - Ethiopian fruit and vegetable marketing share company.

Recently, the Global Mechanism of the UNCCD, in close collaboration with the UNCCD Secretariat, through a global program, established the Impact Investment Fund for Land Degradation Neutrality (otherwise known as the LDN Fund). The LDN fund aims to attract blended financial assistance to support large-scale efforts to restore or rehabilitate degraded land for sustainable and productive use with long-term private sector financing (Orr et al. 2017). While that mechanism may target larger, long-term investors, for the short- and medium-term, local private enterprises, such as microfinance, private nurseries and honey hive manufacturers, can provide financing through small loans or contract farming arrangements. Multiple financing mechanisms at different levels will be important to achieve broader aims related to LDN.

In another approach, payments for ecosystem services (PES) initiatives (e.g., reducing emissions from deforestation and forest degradation [REDD+]) and, for example, the Green Climate Fund (GCF) may provide financing. In recent years, the need to promote the conservation of natural resources and ecosystems has led to the development of PES schemes (Nordén 2014) that offer incentives to farmers or landowners in exchange for their agreement to manage their land in a particular way, or to maintain ecosystem services (Ferraro and Kiss 2002; Wunder 2005). There are many different mechanisms for PES, including direct cash payment and in-kind payment (e.g., by distributing beehives, fodder seeds, important tree seedlings) (Hangrove and Chandler 2004; Asquith et al. 2008). Projects that have attempted to implement PES have had varying levels of success.

PES could provide an additional revenue stream for exclosures, as they provide significant ecosystem services, such as watershed protection, soil and biodiversity conservation, carbon sequestration, and the minimization of climatic and financial risks by increasing the resilience of the environment to natural disasters (Seyoum et al. 2015). Introducing PES to exclosure users would open up additional routes to financing income-generating activities. In turn, that could promote more widespread implementation of exclosures and add value to existing exclosures. These approaches require more public sector support. However, depending on the scale of the scheme, NGOs can also facilitate PES and are often more suitable. Government agencies and NGOs would need to facilitate PES schemes by supporting activities such as helping local communities generate baseline information against which improvements could be monitored, placing values on ecosystem services, and organizing users into cooperatives (this helps to facilitate the verification and certification of added values). So, while PES offers a promising mechanism for funding exclosures, it should be considered complementary to the other revenue-generating activities described in this report.

Financial Feasibility Analysis

Ecological restoration through exclosures is viewed as an increasingly important measure for reversing degraded ecosystems in the highlands of Ethiopia (Mekuria et al. 2017). As previously noted, the integration of income-generating activities within exclosures is needed to compensate communities for the loss of communal space as well as to address the lack of short-term economic benefits and ensure the sustainability of exclosures. In principle, all present and future costs and benefits of the targeted land should be assessed in order to ensure that the land is put to the best use. However, since most ecosystem services are not exchanged in markets, it is methodologically difficult to calculate their value. The problem becomes more complicated in public resource allocation, such as for exclosures, because such decisions require a careful accounting of the social impacts of the investment (Babulo et al. 2009). An investment in exclosures is not purely based on potential economic returns. Yet, the short-term returns (e.g., returns within 1 to 2 years) to communities are critical to ensuring their cooperation in supporting conservation practices that will restore ecosystem services. The revenue-generating activities inside exclosures should be profitable enough to motivate the community to manage and protect the space.

This section of the report presents an analysis of financial feasibility to assess whether revenue-generating activities are profitable for communities. Further economic assessment would be needed to estimate the values of ecosystem services from exclosures, and then allocation of costs and benefits between public and private sectors. In our analysis, we considered exclosures established in steep, eroded and degraded areas that local communities, the government and NGOs jointly delineated, and we assumed that the alternative to the business models is no revenue.

Cost-benefit analysis (CBA) was used to investigate the financial viability/profitability of the proposed revenue streams. Net present value (NPV) calculated using the following equation (1) was used as a decision criterion.

$$NPV = \sum_{i=0}^{t} \left[\left(B_t - C_t \right) \left(1 + r \right)^{-1} \right] \qquad (1)$$

Where: NPV is the net present value of costs and benefits; B_t = benefit at time *t; Ct* = cost at time *t; r* = real discount rate; *t* = (0, 1, 2, 3. . .t), which is the project duration in years.

The analysis in this report is limited to financial feasibility, because it does not include some of the benefits and costs of exclosures due to lack of information and data. The CBA technique is used to estimate the present value of future benefits and costs of the income-generating activities, which can be used to compensate for the trade-offs involved in introducing exclosures as a restoration measure. CBA is widely used in public investment appraisal and often applied to natural resource conservation policy (Babulo et al. 2009).

In carrying out the CBA, we considered different scenarios for the various revenue streams (see Annex 3). In each case, we collected relevant information on the quantity and cost of inputs and outputs, average amount of labor required and daily wage rate, cost of initial investment, source of finance, interest rate, the time needed to start yielding returns and overall project duration. The sources of information were case studies, secondary data from government organizations, literature reviews, interviews conducted with local people, and direct observation of the local market.

Given the long-term project horizon, the costs and benefits arising at different times were discounted so that they could be compared. The interest rate employed by MFIs and private credit and saving institutions (see Table 9) were used as the discount rate. These institutions are the main sources of credit for smallholder farmers (Sebstad 2003; Kereta 2007; Ayele 2015).

Table 9. Potential financial sources and their interest rates available to rural smallholder farmers.

Name of microfinance institution	Interest rate (%)	Region
Dedebit Credit and Savings Institution (DECSI)	15.0	Tigray
Amhara Credit and Savings Institution (ACSI)	18.0	Amhara
Omo Microfinance Institution S.C.	18.0	SNNPR
Oromia Credit and Savings Institution S.C.	14.5	Oromia
Buusaa Gonofa Microfinance S.C.	24.0	Oromia

Source: Wiedmaier-Pfister et al. 2008.

Feasibility of beekeeping

Beekeeping has been practiced for centuries in Ethiopia, but it is still undeveloped. Most of the smallholder beekeepers own traditional hives and produce honey for home consumption, although there have been efforts to introduce modern beehives. The shortage of bee forage and water is an important constraint to beekeeping, and the ecological degradation of natural resources threatens honey production. Exclosures create favorable conditions for the restoration of vegetation (including those suitable for honey production), and revenue streams such as the integration of beekeeping within exclosures could boost the production of honey.

In many places, beekeeping is considered as an income-generating activity for resource-poor farmers, including women and young people. Most rural beekeepers cannot afford to invest in modern beekeeping inputs, processing and packaging, so the practice is still largely carried out using traditional[6] methods. We propose the establishment of modern hives to promote yield gains. As can be seen in Table 10, modern hives are more productive than traditional hives, producing an additional 13 kg to 18 kg of honey and therefore increasing revenue.

Therefore, in this analysis, first, we assume that each beekeeper in the targeted exclosures will receive modern hives. Second, we used data from CSA as a proxy of the national average of production and revenue per beehive. Third, we estimated the minimum number of beehives that farmers would need to ensure a return on their investment (see Table 11). We tried to determine how much time would be needed for the investment to become profitable. Finally, we used the lending interest rates of MFIs and private credit institutions (i.e., 18% for MFI and 24% for private credit institutions) as the discount rates in our calculation of cost-benefit analysis.

According to the feasibility analysis presented in Table 12, investment in beekeeping and honey production is profitable, although it takes some time to mature. Given discount rates of 18% and 24%, and considering the minimum number of beehives necessary (ten), investment in beekeeping and honey production will yield profits after 7 years. However, the maturity period can be reduced to 1 year by increasing the number of beehives provided to an enterprise (i.e., for a group of five individuals) from 10 to 25.

[6] A traditional (fixed comb) beehive is a hollow structure made of materials such as clay, straw, bamboo, false banana leaves, logs, tree bark and animal dung (CSA 2016). The honey can be taken out only by removing a wall of the hive and breaking or cutting out the honeycomb.

Table 10. Production and potential revenue per beehive per year.

Technology	Production amount in kilograms per year*	Unit price (ETB kg^{-1})**	Total revenue/year
Traditional (case study)	12.5	70	875
Intermediate/transitional[a] (CSA)	15.0	184	2,760
Modern (case study)	25.0	70	1,750
Modern[b] (CSA)	33.0	184	6,072

Notes:

* The production values for the same beehive vary depending on the source of information, whether case study or CSA data.

** Similarly, prices vary depending on the source of information. However, CSA data are used for the economic analysis.

[a] An intermediate (transitional) hive is a long trough-shaped box with sloping sidewalls covered by bars of a fixed width. There is an opening in the front wall to serve as an entrance (CSA 2016).

[b] A modern hive (hive with frames) is a brood (offspring) chambers with a fixed bottom board and a flight board. On the bottom board, there is a ventilation hole (15 cm x 30 cm) that can be covered with fine wire mesh or other suitable material. The brood chamber holds 10 frames, which are kept separately at the right distance by means of side bar or nails (CSA 2016). The brood chamber (usually in the bottom boxes of the hive) houses worker-made cells where the eggs, larvae and pupae develop. Some of the cells in this part of the hive also hold pollen, nectar or honey that is used to feed the developing larvae.

Table 11. Investment cost and annual average production cost.

Input	Quantity	Unit	Unit price (ETB)	Total cost (ETB)
Beehive				
Traditional	45	Number	1,104	49,680
Modern	50	Number	1,564	78,200
Bee colonies	95	Number	1,000	95,000
Protective equipment	5	Number	110	550
Cloth	5	Number	180	900
Protective shoes	5	Pairs	100	500
Water spray	3	Number	35	105
Torch	5	Number	25	125
Smoking equipment	5	Number	320	1,600
Wax melting equipment	2	Number	500	1,000
Labor	4	Person	50	24,000
Guard	4	Person	800	12,800

Notes: Assumptions for costs in the table: Wage rate is ETB 50/day. Therefore, the daily labor cost for four people is ETB 200, and ETB 24,000 for 4 months. Monthly wage payment for guards for the hives is ETB 800 * 4 = 3,200, and ETB 12,800 for 4 months. The basis for the analyses is beehives within exclosures having a minimum area of 5 ha.

Table 12. Financial feasibility analysis for integrating beekeeping with exclosures.

Scenarios	Minimum		Optimal	
Discount rate (%)	18	24	18	24
Number of beehives	7	8	25	25
Investment cost (ETB)	22,728	25,292	68,880	
Average annual production cost (ETB)	10,304	11,776	36,800	
Net Present Value (NPV)	2,906	18,066	447,940	354,533
Payback period (years)	8	4	1	1
Internal Rate of Return (IRR)[a]	22%	45%	167%	167%

Notes: Average Annual Production Cost (AAPC) includes costs of labor, transport, seed/seedling, feed, management, etc.

[a] Internal rate of return (IRR) is a discount rate that makes the net present value (NPV) of all cash flows equal to zero. IRR calculations rely on the same formula used to calculate NPV.

Feasibility of livestock fattening with fodder harvesting

In Ethiopia, livestock fattening as a source of income is not well developed. Due to a shortage of feed, farmers fatten an average of five or less sheep and/or cattle per cycle of 90-120 days. However, if feed production can be integrated within exclosures, fattening can be considered a business option; the added source of feed will enable farmers to fatten more animals. Accordingly, we set different assumptions as the basis for a feasibility/profitability analysis of livestock fattening.

First, we assume that the target groups for sheep and ox/cattle fattening are landless women and young people organized into enterprises with five members each. Second, since fattening can be considered an employment creation scheme, credit will be readily available from MFIs, cooperatives, and government employment and business start-up schemes. As we have seen, lending interest rates vary from 18% to 24% for loans from MFIs and private credit institutions, respectively. Third, as livestock prices fall during religious fasting periods, members of the enterprise will take advantage of the low prices to purchase their livestock. Finally, fattening will be integrated within exclosures (i.e., farmers keep the livestock at home, and fatten them with cut and carry fodder from the exclosures) 4 years after their establishment. In other words, livestock fattening cannot be done simultaneously with the setting up of an exclosure.

We estimated the costs and benefits of livestock fattening based on three to four rounds of 90-120 day cycles per year. Therefore, the results are interpreted on an annual basis (see Tables 13 and 14). The data used for this analysis were obtained from a case study in Birakat watershed in the Amhara regional state.[7] The cost of fixed investment does not change with the number of animals involved, but the production costs vary as can be seen in the following tables. The feasibility of livestock fattening depends on various factors, including discount rate, type of animal (i.e., ox or sheep) and the number of animals.

The estimated NPVs (see Table 15) revealed that the investment will be profitable if a minimum of five oxen and 42 sheep are fattened in one year. The project will payback its initial capital investment in 6 to 8 years for oxen and in 7 to 10 years for sheep, if they stick to the minimum number. However, increasing the number of livestock to 30 oxen and 300 sheep per year will reduce the payback period to 2 years for oxen and 1 year for sheep. This would mean a proportional increase in the average annual production cost, although the fixed investment remains constant (see Table 13) because of economies of scale.

Table 13. Investment, production cost and output of ox fattening per year.

Item	Number of oxen		Unit	Unit price (ETB)	Total cost (ETB)	
	Suggested by the case study	Minimum threshold for profitable investment			Case study	Minimum threshold
Investment						
House/shade	1	1	Number	24,000	24,000	24,000
Feed store	1	1	Number	6,000	6,000	6,000
Water tank/tanker	3	3	Number	300	900	900
Watering material*	1	1	Number	5,000	5,000	5,000
Feeding material	1	1	Number	5,000	5,000	5,000
Balance	1	1	Number	500	500	500
Production cost						
Oxen	30	5	Number	7,936	238,080	39,680
Roughages	19	Proportion	Tons/hay	3,000	57,000	9,500
Concentrates	43.2	Proportion	Quintal	600	25,920	6,221
Health	30	Proportion	Number	20	600	100
Water	270	Proportion	Barrel	5	1,350	225
Other	1	Proportion	Various	600	600	100
Output						
Sales of fattened oxen	30		Number	13,000	390,000	65,000
Sales of cow dung	30		Number	250	7,500	1,250

Note: * A material used to provide water for animals.

[7] CGIAR Research Program on Water, Land and Ecosystems (WLE) (2015-2017). *Sustaining land management interventions through integrating income generating activities, addressing local concerns and increasing women's participation*. Available at https://wle.cgiar.org/project/sustaining-land-management-interventions-ethiopia - accessed on October 20, 2019.

Table 14. Investment, production cost and output of sheep fattening per year.

Item	Number of sheep		Unit	Unit price (ETB)	Total cost (ETB)	
	Suggested by the case study	Minimum threshold for profitable investment			Case study	Minimum threshold
Investment						
House/shade	2	2	Number	24,000	48,000	48,000
Feed store	1	1	Number	6,000	6,000	6,000
Water tank/tanker	5	5	Number	3,000	15,000	15,000
Watering material	2	2	Number	3,000	6,000	6,000
Feeding material	2	2	Number	3,000	6,000	6,000
Balance	1	1	Number	500	500	500
Production cost						
Sheep	300	42	Number	1,100	330,000	46,200
Roughages	19	Proportion	Tons/hay	3,000	57,000	7,980
Concentrates	43.2	Proportion	Quintal	600	25,920	3,629
Health	300	Proportion	Number	10	3,000	420
Water	450	Proportion	Barrel	5	2,250	315
Other	2	Proportion	Various	600	1,200	1,200
Output						
Sales of fattened sheep	300		Number	1,925	405,000-750,000	577,500

Table 15. Feasibility analysis of livestock fattening.

	Fattening							
Scenarios	Oxen				Sheep			
Discount rate (%)	18	24	18	24	18	24	18	24
Number of livestock to be fattened	5	5	30	30	42	42	300	300
Investment cost (ETB)	41,400		41,400		81,500		81,500	
Average annual production cost (ETB)	53,925		323,550		58,712		419,370	
Net present value (NPV)	13,990	3,979	290,938	230,873	17,991	9,671	629,150	500,712
Payback period (years)	6	8	2	2	7	10	1	1
Internal rate of return (IRR)	27%		179%		24%		194%	

Cultivation of high-value trees/fruits

This analysis, first, assumes that the cultivation of high-value trees/fruits will principally employ landless youth (male and female) groups. Second, the demand for fruits will continue to increase because of the growing population and changes in consumer habits (i.e., consumption of fruits and fruit juice). Third, we assume that most raw materials and inputs needed to produce fruits are available locally at little or no cost (e.g., land). Moreover, seedlings can be raised in public/community nurseries at low or subsidized cost. Finally, we assume that credit will be made available as part of government schemes to increase employment among young people.

We estimated the costs and benefits of growing fruit trees on the basis of a hectare of land within an exclosure (see Table 16). The length of time before farmers achieve profits must take into account the fact that these trees take a number of years to mature (see Table 17).

Table 16. Input costs of high-value trees and fruits (ha^{-1}).

High-value trees and fruits	Quantities	Unit	Total cost (ETB/ha)
Investment cost			
Seeds			
Avocado	68	Kilograms	1,088
Apple	625	Seedling	25,000
Mango	40	Kilograms	640
Papaya	14	Kilograms	280
Banana	1,600	Sucker	16,000
Orange	5	Kilograms	1,000
Nursery preparation			
Compost	670	Kilograms	4,000
Sand	340	Kilograms	3,000
Local soil	670	Kilograms	500
Forest soil	670	Kilograms	10,000
Labor	200	Labor days	10,000
Seedling preparation			
Avocado	204	Seedling	81.6
Apple	500	Seedling	200.0
Mango	204	Seedling	81.6
Papaya	2,000	Seedling	800.0
Banana	1,600	Sucker	N/A
Orange	270	Seedling	108.0
Variable/production cost			
Labor cost			
Guard for nursery	1	Persons/year	9,600
Guard for plantation site	1	Persons/year	9,600
Transporting seedlings	40	Labor days/ha	2,000
Planting	40	Labor days/ha	2,000
Cultivation	20	Labor days/ha	1,950
Output/ha			
Avocado	7,360	Kilograms	147,200
Apple	20,000	Kilograms	300,000
Mango	7,900	Kilograms	118,500
Papaya	14,414	Kilograms	288,280
Banana	8,400	Kilograms	126,000
Orange	11,900	Kilograms	238,000

Note: N/A – not applicable

Table 17. Maturity period and life span of high-value trees and fruits.

High-value trees and fruits	Waiting period before first income (years)	Maximum production life span/duration (years)
Avocado	7	40
Apple	5	30
Mango	6	40
Papaya	2	5
Banana	2	15
Orange	5	40

The information presented in Table 17 is critical, as it enables us to estimate annual cash flow, profit and returns, which are good indicators for: (i) credit worthiness of the investment, and (ii) the most suitable financing and subsidy arrangements. These factors, in turn, have an implication for the sustainability of exclosures, because they determine whether the investment would compensate the trade-off and therefore be viable from a farmer's perspective. The feasibility of investment depends on additional factors, including discount rate, type of fruit and length of time before the trees start generating income. When we estimate the costs and benefits of growing fruit trees, we assume that there are negative annual cash flows during the period the trees need to mature.

We used two discount rates (18% and 24%) to estimate the feasibility of investment for each type of fruit tree. The estimated NPVs (see Table 18) revealed that investment in fruit trees is profitable, if sufficient time is given for the trees to reach maturity. However, it is important to note that depending on the type of fruit and discount rate, the time that a farmer will have to wait until their investment starts to provide a return ranges from 2 to 10 years, while the project duration tends to vary between 5 and 40 years. Therefore, the longer a tree takes to reach maturity, the higher the opportunity cost. In other words, farmers may not be willing to wait for long periods for their investments to payback, which, again, could have a negative implication for the sustainability of exclosures.

Table 18. Feasibility analysis of the cultivation of fruit trees.

Fruit trees	Discount rate (%)	Maturity (benefit return) time horizon (years)	Net Present Value (NPV)	Internal Rate of Return (IRR)
Avocado	18	9	13,376	32%
	24	10	1,833	
Apple	18	5	20,205	56%
	24	6	75,590	
Mango	18	8	113,949	33%
	24	9	3,919	
Papaya	18	2	144,512	205%
	24	2	126,654	
Banana	18	2	12,938	93%
	24	2	6,084	
Orange	18	5	17,196	58%
	24	5	285	

For example, considering the discount rates of 18% and 24%, investment in avocado trees will yield profit only after 9 and 10 years, respectively. Similarly, investment in mango will take 8 and 9 years at the rates of 18% and 24%, respectively, before it generates profit. However, only 2 years are needed for papaya and banana trees to start generating profits, at the discount rates considered. Trees that take longer to mature raise risks for smallholders with few resources, and reduces the likelihood that they will invest in the cultivation of fruit trees. In this regard, a combination of incentive mechanisms would be needed to encourage farmers to invest in slow-maturing fruit trees. For example, initial investment costs (see Table 16) could be covered as part of public investment in exclosures. Moreover, diversifying investment by intercropping early maturing fruits with slow maturing fruits could help to ease investment costs and cascade the flow of benefits.

Conclusion and Recommendations

Restoring degraded ecosystems through the establishment of exclosures is an increasingly common practice in the Ethiopian Highlands, and regional states are also following this practice. The areas covered by exclosures reached about 4.5 Mha by the end of 2016, with expected annual increases of 2% per year, possibly reaching a total of around 5-7 Mha in the early 2030s. The expansion of exclosures is due to their many benefits outlined in this report. However, exclosures usually reduce the ability of households and communities to continue existing uses and the benefits generated from the land.

This report proposes the use of an adapted business model framework that outlines high potential economic opportunities to enhance the short-term benefits of exclosures, the institutional and community approach needed to implement and sustain the effectiveness of business models in the natural resources management context, and the interventions likely to maximize the ecological benefits over the longer term.

A potential business model is presented based on three revenue streams for application within an exclosure: beekeeping, livestock fattening and the cultivation of high-value plant species. The framework presented in this report uses a business model that is adapted to the context of communal natural resources management and economic development. The adapted model includes revenue streams that can be integrated within an exclosure, key resources needed for proper functioning of the business, key activities, key stakeholders, financial analysis, and markets and channels through which products and services are delivered. Our adapted business model also includes an analysis of the enabling laws and policies for community participation in revenue-generating activities, the incentives for sustainable management of exclosures by different actors at multiple levels, and the opportunities to support value addition through identified revenue streams within exclosures.

The development of components of the business model consists of suitability mapping; environmental sustainability; institutional, policy and regulatory context; governance of exclosures; and value chains, finance and economic viability. The *suitability mapping* focuses on identifying potential areas where exclosures could be established, and assesses whether existing biophysical conditions favor the proposed revenue streams for application within exclosures. The *environmental sustainability* component of the business model mainly focuses on the contribution of the three proposed revenue streams to improve and sustain the ecological benefits of exclosures while enhancing livelihoods over time. The *institutional, policy and regulatory context* component of the business model looks at the processes of establishing and managing exclosures. This component describes the key policies, strategies and proclamations related to environmental management and analyzes how these might support or hinder the success of the proposed exclosure-based revenue streams. The governance section of the business model details the roles and responsibilities of stakeholders at village, district, regional and national levels, and proposes stakeholder engagement strategies. Finally, the value chains and financial analyses section examines value chains for the proposed revenue-generating activities and considers potential sources of finance and financing mechanisms. This component of the framework analyzes the financial viability of the three revenue streams for application within exclosures.

The cost-benefit analysis conducted within the business model framework revealed that investment in beekeeping and honey production would be profitable, though only after 7 years using the minimum number of hives or as early as 1 year by increasing the number of beehives in an enterprise. Similarly, the analysis revealed that investment in livestock fattening is profitable, but only after a number of years with an optimal number of livestock. Livestock fattening also represents a high opportunity cost for smallholder farmers, and more so for landless women and youth. Investment in the cultivation of fruit trees would also be profitable given that sufficient time is taken into consideration to achieve production. Incentive mechanisms, such as intercropping early maturing fruits with slow maturing fruits, would likely be needed to encourage farmers to invest in this activity.

The aim is to encourage investment in an optimal mix of profitable, private sector enterprises and public sector-supported interventions, which combined would enable short- and long-term returns, thereby generating incentives for investment in exclosures. The adapted framework can be used by the public and private sectors, and NGOs. To facilitate the use of the framework by different sectors, we outlined a number of recommendations for public investment in exclosures. We also suggest a set of actions to be taken prior to the integration of revenue streams within exclosures. The recommendations and set of actions are summarized in Table 19, as a guide for future investment in exclosures.

Table 19. Actions to be considered prior to integrating suggested revenue streams within exclosures.

Revenue streams	Beekeeping	Livestock fattening	Cultivation of high-value plant species
Appropriate time to start setting up the business activity	Two to three years after the establishment of the exclosure	Four years after the establishment of the exclosure	One year after the establishment of the exclosure
Actions to ensure the flow of revenue to farmers managing exclosures	■ Identify districts/*kebeles*/villages that favor implementing beekeeping. ■ Consult local communities about their preference on getting modern beehives in groups or individually. ■ Mobilize financial resources for purchasing modern beehives from government and nongovernmental organizations.	■ Identify districts/*kebeles*/villages that favor implementing livestock fattening. ■ Identify women and men to engage in livestock fattening. ■ Consult women and men about their preference to engage in livestock fattening in groups or individually. ■ Mobilize financial resources for purchasing improved livestock breeds from government and nongovernmental organizations.	■ The choice of tree species should be guided by experimenting on the environmental adaptability of selected plant species; moreover, involving local communities and addressing their diverse needs, and maximizing the short-term economic benefits of the exclosures. ■ The CWT should work closely with experts at district agricultural offices to get technical advice for managing and harvesting products. ■ The CWT should consult the beneficiaries to decide on benefit-sharing mechanisms; the interest of the majority of the beneficiaries should be respected. ■ The experts at district agricultural offices could provide technical support to manage the trees planted and for estimating total yield.
Actions to ensure the sustainability of the business	Providing training and continuous follow-up is key to sustaining this revenue stream. Also, it will be crucial to establish formal agreements between the government and the individuals or groups of people engaged in beekeeping, and the other beneficiaries or members of an exclosure. Facilitate market opportunities in the value chain for local communities and enterprises (e.g., create market linkages; establish innovation platform to engage with market actors; and identify specialty market and export market opportunities).	Providing training and technical support could help sustain this revenue stream. If the business is undertaken by a cooperative, a clear description of the responsibilities of each member will be needed. Also, there should be a signed agreement on benefit-sharing mechanisms. Facilitate market opportunities in the value chain for local communities and enterprises (e.g., create market linkages; establish innovation platform to engage with market actors; and integrate livestock and animal-based protein product processors).	The sustainability of this revenue stream can be ensured with regular follow-up and technical support from the regional agricultural bureaus, district agricultural offices, and local and international NGOs. Facilitate market opportunities in the value chain for local communities and enterprises (e.g., create market linkages; and establish innovation platform to engage with market actors).

Notes: The list and activities covered in Table 19 may not be exhaustive.

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Further Reading

Additional resources on exclosures from the International Water Management Institute (IWMI) and the CGIAR Research Program on Water, Land and Ecosystems (WLE).

Catalogue on exclosures

Mekuria, W.; Barron, J.; Dessalegn, M.; Adimassu, Z.; Amare, T.; Wondie, M. 2017. *Exclosures for ecosystem restoration and economic benefits in Ethiopia: A catalogue of management options*. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE). 28p. (WLE Research for Development (R4D) Learning Series 4). Available at http://www.iwmi.cgiar.org/Publications/wle/r4d/wle_research_for_development-learning_series-4.pdf (accessed on October 21, 2019).

Case study on exclosures

CGIAR Research Program on Water, Land and Ecosystems (WLE) (2015-2017). *Sustaining land management interventions through integrating income generating activities, addressing local concerns and increasing women's participation*. Available at https://wle.cgiar.org/project/sustaining-land-management-interventions-ethiopia (accessed on October 21, 2019).

Annex 1. Glossary of Terms.

Woreda (also spelled *wereda*) - the third-level administrative divisions of Ethiopia. They are further subdivided into a number of wards (*kebeles*) or neighborhood associations, which are the smallest unit of local government in Ethiopia.

***Kebele* -** A *kebele* is the smallest administrative unit of Ethiopia, similar to a ward, a neighborhood or a localized and delimited group of people.

Exclosure - Exclosures are common land areas, which are traditionally 'open access', where wood cutting, grazing and other agricultural activities are forbidden or strictly limited as a means to promote the restoration and natural regeneration of degraded lands.

Business Model Canvas - Business Model Canvas is a strategic management and lean startup template for developing new or documenting existing business models. It is a visual chart with elements describing a firm's or product's value proposition, infrastructure, customers and finances. It assists firms in aligning their activities by illustrating potential trade-offs.

Business model - A business model is a company's plan for generating revenues and making profits. It explains the products or services that the business plans to manufacture and market, and the methods used to achieve this, including the expenses incurred.

SWOT – an acronym for strengths, weaknesses, opportunities, and threats – is an approach to analyzing the characteristics of any business or venture. The user collects information from an environmental analysis and divides it into two categories: (i) internal: comprising strengths and weaknesses, and (ii) external: comprising opportunities and threats. Once these factors are assigned, the SWOT analysis determines the factors and components that are necessary to fulfil the objectives of the program, and the obstacles that have to be overcome, neutralized or minimized.

Annex 2. SWOT Analysis.

We conducted a SWOT analysis (see Table A2.1) to understand the internal and external factors that could affect the viability of the proposed exclosure-based activities, and consider how to minimize the weaknesses and threats to the revenue streams. A conducive environment, policy support, new government initiatives and the willingness of local communities to engage were among the key strengths identified from this analysis. The weaknesses mainly related to poor institutional setup, lack of facilities and limited technical knowledge, limited access to financial services and shortage of resources. A high demand for the proposed products in domestic, regional and international markets, and well-established infrastructure (e.g., nursery sites) present opportunities for successfully implementing livelihood activities in exclosures. Growing market competition, regional politics, climate variability, and disease and pest outbreak were seen as the main threats (Table A2.1).

Table A2.1. Strengths, weaknesses, opportunities, and threats to the three revenue streams.

Strengths	**Weaknesses**
▪ Diverse climatic and agroecological conditions ▪ Policy support ▪ Cost of production ▪ Geographical location (i.e., proximity to European and Middle Eastern markets) ▪ Private sector service provision ▪ New initiatives (e.g., Agricultural Growth Project, Growth and Transformation Plan) ▪ Potential for irrigation ▪ Transport (i.e., ground and air transport) ▪ Code of practice in watershed management, income-generating activities, etc. ▪ Diversity of livestock breeds ▪ Willingness of local communities	▪ Poor institutional setup for assuring quality ▪ Packaging ▪ Storage/logistics ▪ Technical know-how ▪ Research and extension ▪ Input supply ▪ Land tenure ▪ Market information ▪ Initial capital ▪ Labor ▪ Access to financial services ▪ Livestock feed ▪ Health services
Opportunities	**Threats**
▪ Demand in domestic, regional and international markets ▪ Demand for processed fruits and biomass energy ▪ Availability of established nursery sites	▪ Increased competition in the European and Middle Eastern markets ▪ Regional politics ▪ Climate variability (e.g., erratic rainfall, recurrent drought) ▪ Pest and disease outbreaks

Annex 3. Annual Cash Flows.

Table A3.1. Annual cash flow of beekeeping (honey production) integrated within an exclosure (in ETB).

Year (time)	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual net cash flow
0	68,880	0	68,880	0	-68,880
1	0	36,800	36,800	151,800	115,000
2	0	36,800	36,800	151,800	115,000
3	0	36,800	36,800	151,800	115,000
4	0	36,800	36,800	151,800	115,000
5	0	36,800	36,800	151,800	115,000
6	0	36,800	36,800	151,800	115,000
7	0	36,800	36,800	151,800	115,000
8	0	36,800	36,800	151,800	115,000
9	0	36,800	36,800	151,800	115,000
10	0	36,800	36,800	151,800	115,000
NPV @18% discount rate					447,939.92
IRR					167%

Note: ETB – Ethiopian Birr

Table A3.2. Annual cash flow of livestock fattening integrated within an exclosure (in ETB).

Year (time)	Ox fattening					Sheep/Goat fattening				
	Initial investment cost	Average annual production cost	Total cost	Annual gross income	Annual net income	Initial investment cost	Average annual production cost	Total cost	Annual gross income	Annual net income
0	41,400	0	41,400	0	-41,400	81,500	0	81,500	0	-81,500
1	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
2	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
3	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
4	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
5	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
6	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
7	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
8	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
9	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
10	0	323,550	323,550	397,500	73,950		419,370	419,370	577,500	158,130
NPV @18% discount rate					290,937.68				629,149.87	
NPV @24% discount rate					230,873.27				500,711.94	
IRR					179%				194%	

Table A3.3. Annual cash flow of fruit (avocado and apple) production integrated within an exclosure (in ETB).

Year (time)	Avocado					Apple				
	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow
0	38,270	0	38,270	0	-38,270	62,300	0	62,300	0	-62,300
1		15,550	15,550	0	-15,550		15,550	15,550	0	-15,550
2		15,550	15,550	0	-15,550		15,550	15,550	0	-15,550
3		15,550	15,550	0	-15,550		15,550	15,550	0	-15,550
4		15,550	15,550	0	-15,550		15,550	15,550	0	-15,550
5		15,550	15,550	0	-15,550		15,550	15,550	300,000	284,450
6		15,550	15,550	0	-15,550		15,550	15,550	300,000	284,450
7		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
8		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
9		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
10		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
11		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
12		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
13		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
14		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
15		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
16		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
17		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
18		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
19		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
20		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
21		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
22		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
23		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
24		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
25		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
26		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
27		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
28		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
29		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450
30		15,550	15,550	147,200	131,650		15,550	15,550	300,000	284,450

(Continued)

Table A3.3. Annual cash flow of fruit (avocado and apple) production integrated within an exclosure (in ETB). (Continued)

Year (time)	Avocado					Apple				
	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow
31		15,550	15,550	147,200	131,650	NPV @ 18% in 5 years			20,205.26	
32		15,550	15,550	147,200	131,650	NPV @ 18% in 6 years			75,590.06	
33		15,550	15,550	147,200	131,650	IRR		56%		
34		15,550	15,550	147,200	131,650					
35		15,550	15,550	147,200	131,650					
36		15,550	15,550	147,200	131,650					
37		15,550	15,550	147,200	131,650					
38		15,550	15,550	147,200	131,650					
39		15,550	15,550	147,200	131,650					
40		15,550	15,550	147,200	131,650					
NPV @ 18% in 7 years					51,329.09					
NPV @ 18% in 9 years					13,376.12					
NPV @ 24% in 9 years					-13,485					
NPV @ 24% in 10 years					1,833.40					
IRR					32%					

Table A3.4. Annual cash flow of fruit (mango and papaya) production integrated within an exclosure (in ETB).

Year (time)	Mango					Papaya				
	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow
0	37,822	0	37,822	0	-37,822	38,180	0	38,180	0	-38,180
1		15,550	15,550	0	-15,550		15,550	15,550	0	-15,550
2		15,550	15,550	0	-15,550		15,550	15,550	288,280	272,730
3		15,550	15,550	0	-15,550		15,550	15,550	288,280	272,730
4		15,550	15,550	0	-15,550		15,550	15,550	288,280	272,730
5		15,550	15,550	0	-15,550		15,550	15,550	288,280	272,730
6		15,550	15,550	118,500	102,950	NPV @18% 2 years				144,512
7		15,550	15,550	118,500	102,950	NPV @24% 2 years				126,654
8		15,550	15,550	118,500	102,950	IRR				205%
9		15,550	15,550	118,500	102,950					
10		15,550	15,550	118,500	102,950					
11		15,550	15,550	118,500	102,950					
12		15,550	15,550	118,500	102,950					
13		15,550	15,550	118,500	102,950					
14		15,550	15,550	118,500	102,950					
15		15,550	15,550	118,500	102,950					
16		15,550	15,550	118,500	102,950					
17		15,550	15,550	118,500	102,950					
18		15,550	15,550	118,500	102,950					
19		15,550	15,550	118,500	102,950					
20		15,550	15,550	118,500	102,950					
21		15,550	15,550	118,500	102,950					
22		15,550	15,550	118,500	102,950					
23		15,550	15,550	118,500	102,950					
24		15,550	15,550	118,500	102,950					
25		15,550	15,550	118,500	102,950					
26		15,550	15,550	118,500	102,950					
27		15,550	15,550	118,500	102,950					
28		15,550	15,550	118,500	102,950					

(Continued)

Table A3.4. Annual cash flow of fruit (mango and papaya) production integrated within an exclosure (in ETB). (Continued)

Year (time)	Mango					Papaya				
	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow
29		15,550	15,550	118,500	102,950					
30		15,550	15,550	118,500	102,950					
31		15,550	15,550	118,500	102,950					
32		15,550	15,550	118,500	102,950					
33		15,550	15,550	118,500	102,950					
34		15,550	15,550	118,500	102,950					
35		15,550	15,550	118,500	102,950					
36		15,550	15,550	118,500	102,950					
37		15,550	15,550	118,500	102,950					
38		15,550	15,550	118,500	102,950					
39		15,550	15,550	118,500	102,950					
40		15,550	15,550	118,500	102,950					
NPV @18% 8 years				11,394						
NPV @24% 9 years				3,919						
IRR				33%						

Table A3.5. Annual cash flow of fruit production (banana and orange) integrated within an exclosure (in ETB).

Year (time)	Banana					Orange				
	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow
0	53,208	0	53,208	0	-53,208	38,208	0	38,208	0	-38,208
1		15,550	15,550	0	-15,550		15,550	15,550	0	-15,550
2		15,550	15,550	126,000	110,450		15,550	15,550	0	-15,550
3		15,550	15,550	126,000	110,450		15,550	15,550	0	-15,550
4		15,550	15,550	126,000	110,450		15,550	15,550	0	-15,550
5		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
6		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
7		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
8		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
9		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
10		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
11		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
12		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
13		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
14		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
15		15,550	15,550	126,000	110,450		15,550	15,550	238,000	222,450
16	NPV @18% 2 years				12,938		15,550	15,550	238,000	222,450
17	NPV @24% 2 years				6,084		15,550	15,550	238,000	222,450
18	IRR				93%		15,550	15,550	238,000	222,450
19							15,550	15,550	238,000	222,450
20							15,550	15,550	238,000	222,450
21							15,550	15,550	238,000	222,450
22							15,550	15,550	238,000	222,450
23							15,550	15,550	238,000	222,450
24							15,550	15,550	238,000	222,450
25							15,550	15,550	238,000	222,450
26							15,550	15,550	238,000	222,450
27							15,550	15,550	238,000	222,450
28							15,550	15,550	238,000	222,450

(Continued)

Table A3.5. Annual cash flow of fruit production (banana and orange) integrated within an exclosure (in ETB). (Continued)

Year (time)	Banana					Orange				
	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow	Initial investment	Average annual production cost	Total cost	Annual gross income	Annual cash flow
29							15,550	15,550	238,000	222,450
30							15,550	15,550	238,000	222,450
31							15,550	15,550	238,000	222,450
32							15,550	15,550	238,000	222,450
33							15,550	15,550	238,000	222,450
34							15,550	15,550	238,000	222,450
35							15,550	15,550	238,000	222,450
36							15,550	15,550	238,000	222,450
37							15,550	15,550	238,000	222,450
38							15,550	15,550	238,000	222,450
39							15,550	15,550	238,000	222,450
40							15,550	15,550	238,000	222,450
						NPV @18% 5 years				17,196
						NPV @24% 5 years				285
						IRR				58%

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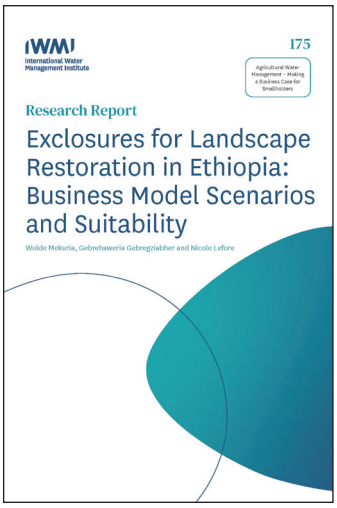

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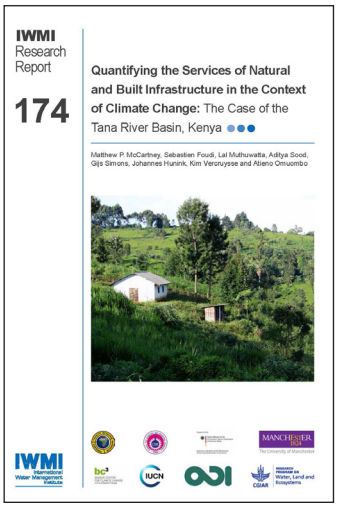

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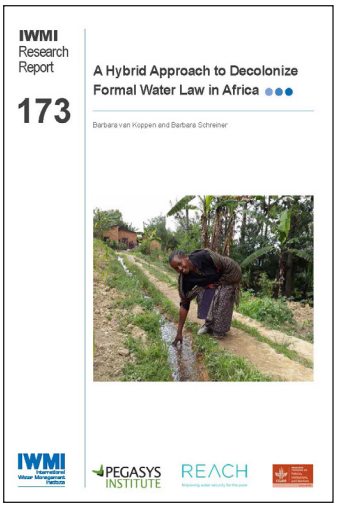

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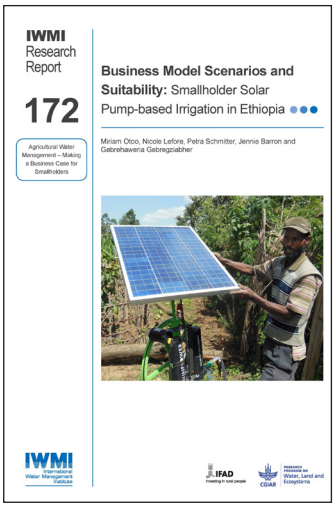

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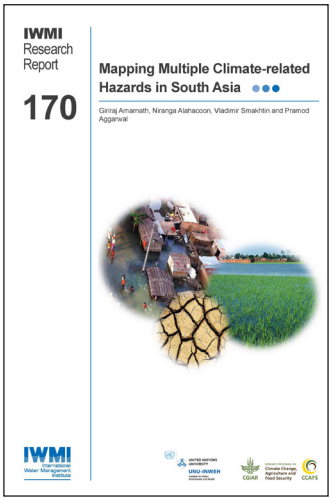

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