



## Chapter 2 - Setting the stage for structured economic assessment: The 6+1 step ELD approach

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### ► To cite this version:

Nicola Favretto, Emmanuelle Quillérou, Hannes C. Etter. Chapter 2 - Setting the stage for structured economic assessment: The 6+1 step ELD approach. Hannes Etter; Nicola Favretto; Tobias Gerhart-sreiter; Mark Schauer; Richard Thomas. The value of land: Prosperous lands and positive rewards through sustainable land management, The Economics of Land Degradation (ELD), pp.104, 2015, 978-92-808-6061-0. hal-01954797

**HAL Id: hal-01954797**

**<https://hal.science/hal-01954797>**

Submitted on 29 Mar 2019

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## The Value of Land



**Prosperous lands and positive rewards  
through sustainable land management**

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This ELD report was published with the support of the partner organisations of the ELD Initiative and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

**Photography:**

Clemens Bergmann/GIZ (pg. 93); Hannes Etter (pg. 29, 37, 109); Jiang Gaoming (pg. 46);

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Naomi Stewart (pg. 14, 61, 76); Richard Thomas (pg. 32)

**Visual concept:** MediaCompany, Bonn Office

**Layout:** kipconcept GmbH, Bonn

**ISBN:** 978-92-808-6061-0

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**Suggested citation:**

ELD Initiative (2015). The value of land: Prosperous lands and positive rewards through sustainable land management. Available from [www.eld-initiative.org](http://www.eld-initiative.org).

# The Value of Land: **ELD Main Report**

**Prosperous lands and positive rewards  
through sustainable land management**

September 2015

[www.eld-initiative.org](http://www.eld-initiative.org)



## Setting the stage for structured economic assessment: The 6+1 step ELD approach

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### Introduction

In this report, land degradation corresponds to the reduction in the economic value of land and land-based ecosystem services as a result of anthropogenic activities or natural biophysical evolution. Land degradation can take several forms and is linked to a specific land use – for example, salt-induced land degradation can be a severe problem for agriculture<sup>1</sup>. However, the same land used to build a tourist lodge may not be affected by such degradation from an economic perspective. The drivers of land degradation have been described by Lambin *et al.* (2013)<sup>2</sup>, and further elaborated by Nkonya *et al.* (2011)<sup>3</sup> (Table 2.1). Although these drivers affect the level of economic benefits derived from land, the ELD Initiative approach allows for broader consideration of other factors and not just those linked to land degradation. Such an approach attempts to be inclusive of all forms of land use and management with the view to improve livelihoods and well-being through the adoption of more sustainable land management rather than focusing on reducing land degradation itself.

The ELD Initiative draws from existing frameworks, approaches and methods, and adapts and combines them to include features specific to land management. This establishes a structured and comprehensive economic assessment process referred to as the “6+1 step approach”, which aims to provide information relevant to policy-/decision-makers. Variation in land degradation, management, and socio-economic contexts across the globe necessitates a flexible application of the “6+1 step approach”. This chapter provides an overview of this that can be used at different scales and for different scopes.

TABLE 2.1

**Drivers related to land degradation and their causes***(from ELD Initiative, 2013<sup>4</sup>, adapted from von Braun et al., 2013, Table 1<sup>5</sup>)*

Driver	Proximate	Underlying	Natural	Anthropogenic
Topography	✓		✓	
Land Cover	✓		✓	✓
Climate	✓		✓	
Soil Erodibility	✓		✓	
Pest and Diseases	✓		✓	
Unsustainable Land Management	✓			✓
Infrastructure Development	✓			✓
Population Density		✓		
Market Access		✓		
Land Tenure		✓		
Poverty		✓		
Agricultural Extension Service Access		✓		
Decentralization		✓		
International Policies		✓		
Non-farm Employment		✓		

**Complementary frameworks to structure a comprehensive economic assessment**

The following frameworks are used to approach and understand different relationships between key concepts as a basic underlying structure for an economic assessment of land degradation and the benefits of sustainable land management. Their primary objective is to help structure the assessment process. These frameworks are theoretical and general to allow for flexible application at different scales and contexts. Each framework can be combined with a range of different methods for analysis, and choosing a method depends on available capacity and resources, as well as the objective of the assessment

itself. Four different frameworks are presented here: impact pathways to sustainable land management, capital asset, ecosystem services, and total economic value frameworks, together with details of how they are combined and how the costs of inaction (or the benefits from action) are valued and compared to the costs of action.

**Impact pathways to sustainable land management: a framework for investment into increased productivity and/or alternative livelihoods**

Sustainable land management is generally assumed to result in improved land management for current and future generations. Agricultural land that is managed unsustainably could

become sustainably managed if demands that increase pressure for high levels of production are reduced, degrading practices are changed to more sustainable ones, or if a land use is changed for an alternative one that reduces pressure (e.g., changing from agriculture to value-added non-agricultural activities such as manufacturing, tourism, etc.). Sustainable land management can be pursued via multiple pathways, employing a range of intervention options. More specifically, there are many ways of ensuring that land management is sustainable, which can be conceptualised as land use **options for action** to be taken by land users themselves (e.g., improved productivity through the use of sustainable technologies, and adoption of alternative livelihoods), and **pathways for action** which focus on the actions taken by ‘facilitators’

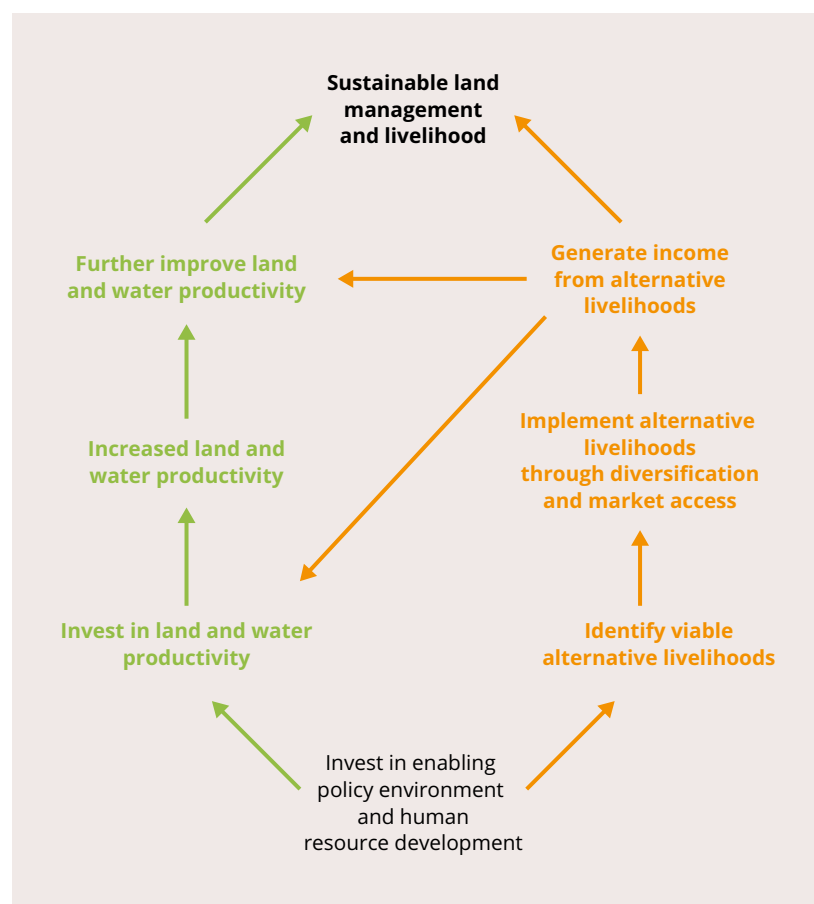
to promote or enhance the adoption of the land use options (e.g., institutional capacity building, regulatory policies, and demand management). Both options and pathways for action need to be combined for sustainable land management to be achieved successfully (Figure 2.1).

Pathways to sustainable land management and human well-being are depicted in Figure 2.1. The left side (green) represents a traditional agricultural/pastoral livelihood where investments are facilitated by enabling policies, regulations, access to agricultural markets and research/extension services, and includes inputs such as agrochemicals, water, and seeds. This pathway is often complemented by alternative livelihood options (e.g., eco-tourism, arts and crafts, and small-scale manufacturing, or through migration and remittances), and is depicted on the right side of Figure 2.1 (orange). The alternative livelihood options can partially or fully replace the current sources of income. Diversification of activities can help reduce pressures currently exerted on land, and economic assessments can help choose livelihood option(s) and pathway(s) that are most economically desirable. These assessments provide insights that can guide private and public sector investment decisions accordingly, in particular when economic analysis is integrated into policy implementation and design. Both pathways require investments from private and public sectors, training in skills, knowledge, and capacities, and integration of land degradation issues into mainstream government policies to ensure successful adoption of sustainable land management options. Pathways might be influenced by global factors (e.g., prices, actors and discourses) and need to be appropriate to an individual country’s national environmental, political, economic, and institutional frameworks and conditions, and typically vary between countries.

FIGURE 2.1

### Pathways to sustainable land management, considering agricultural (green) and alternative livelihoods (orange)

(from ELD Initiative, 2013<sup>4</sup>, originally adapted from Adeel & Safriel, 2008<sup>6</sup>, sourced from Thomas, 2008, pg. 599<sup>7</sup>)



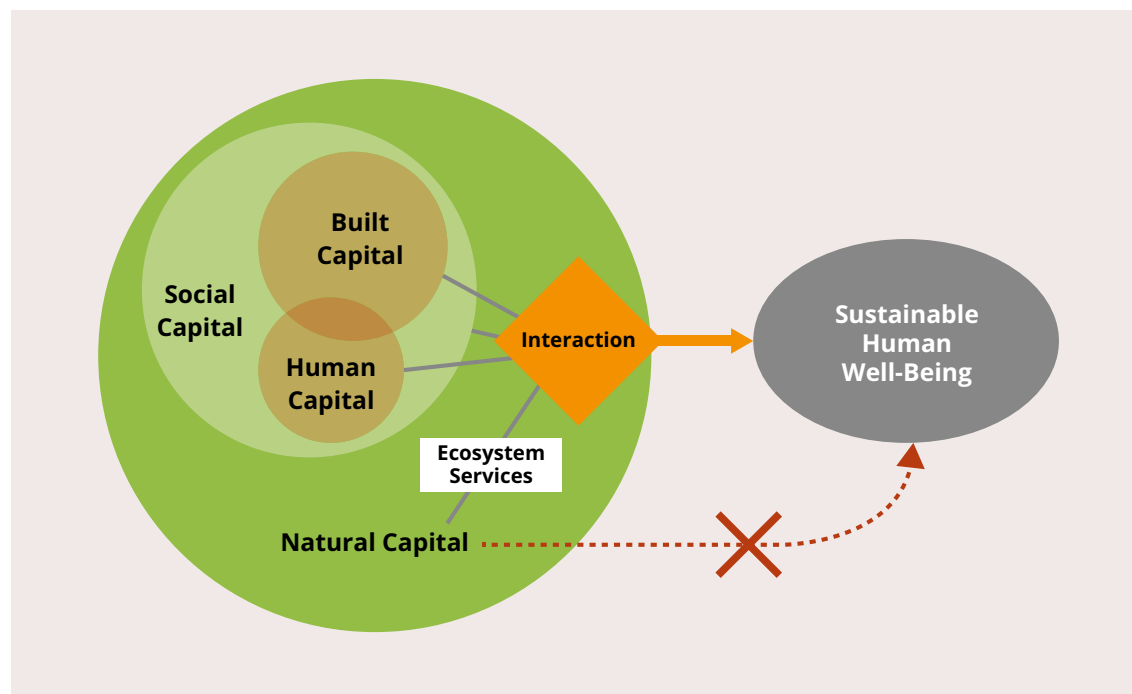
### Capital asset framework

The economic approach must be linked to human well-being, which encompasses economic, social, and ecological aspects of development and land management<sup>8</sup>. This is key in adopting a holistic approach, so that the sustainability of land management options is measured by taking into consideration the overall human-environmental

FIGURE 2.2

### Interaction between built, social, human and natural capital required to produce human well-being

(from Costanza et al., 2014<sup>14</sup>)



Built and human capital (the economy) are embedded in society (social capital), which is embedded in the rest of nature (natural capital). Ecosystem services are the relative contribution of natural capital to human well-being, they do not flow directly (red arrow)

connection, rather than just focusing on market-driven processes. The following four types of capital assets within the overall human-natural system are necessary in supporting sustainable human well-being (Figure 2.2<sup>9,10</sup>):

- **Human capital:** individual people, including their accumulated knowledge and information, physical health, and labour;
- **Built capital:** manufactured goods such as tools, equipment, and buildings;
- **Natural capital:** the natural world (e.g., animals, soils, air, plants, water and minerals) – the stock of natural resources that produce a flow of ecosystem service benefits to human beings and that does not require human agency to be produced or maintained<sup>11,12</sup>, and;
- **Social capital:** networks and norms that facilitate cooperative action, including cultures

and institutions (e.g., the market and financial system<sup>13</sup>).

Achieving sustainable land management and sustainable economic development requires action undertaken in consideration of all four types of capital. The ELD Initiative focuses on the natural capital element for assessment, but stresses that the other three types of capital are critical to facilitate and enhance the success of any action, and indeed, ecosystem services are the indirect contribution of natural capital to human well-being<sup>14</sup>.

#### Ecosystem service framework

Land provides many different multi-functional services that interact and contribute to human well-being. Each of these services has a (socio-)economic benefit that is of value to society as a whole and goes beyond market values. For example, terrestrial plants are a source of food, building materials, fuel

and fiber, while also providing other key services such as regulating the quality of soil, water, and air. Estimating the total economic benefit of land is not easy or straightforward. The ecosystem service framework can facilitate comprehensive ecosystem assessment by dis-aggregating land into broad independent categories (ecosystem services) that can be valued separately (i.e., provisioning, supporting, regulating and cultural services, see *Figure 2.3*). Land degradation from an economic perspective is the loss or reduction in services provided to society as a whole. The reduction in this natural capital threatens the sustainability of current pathways of exploitation (this is

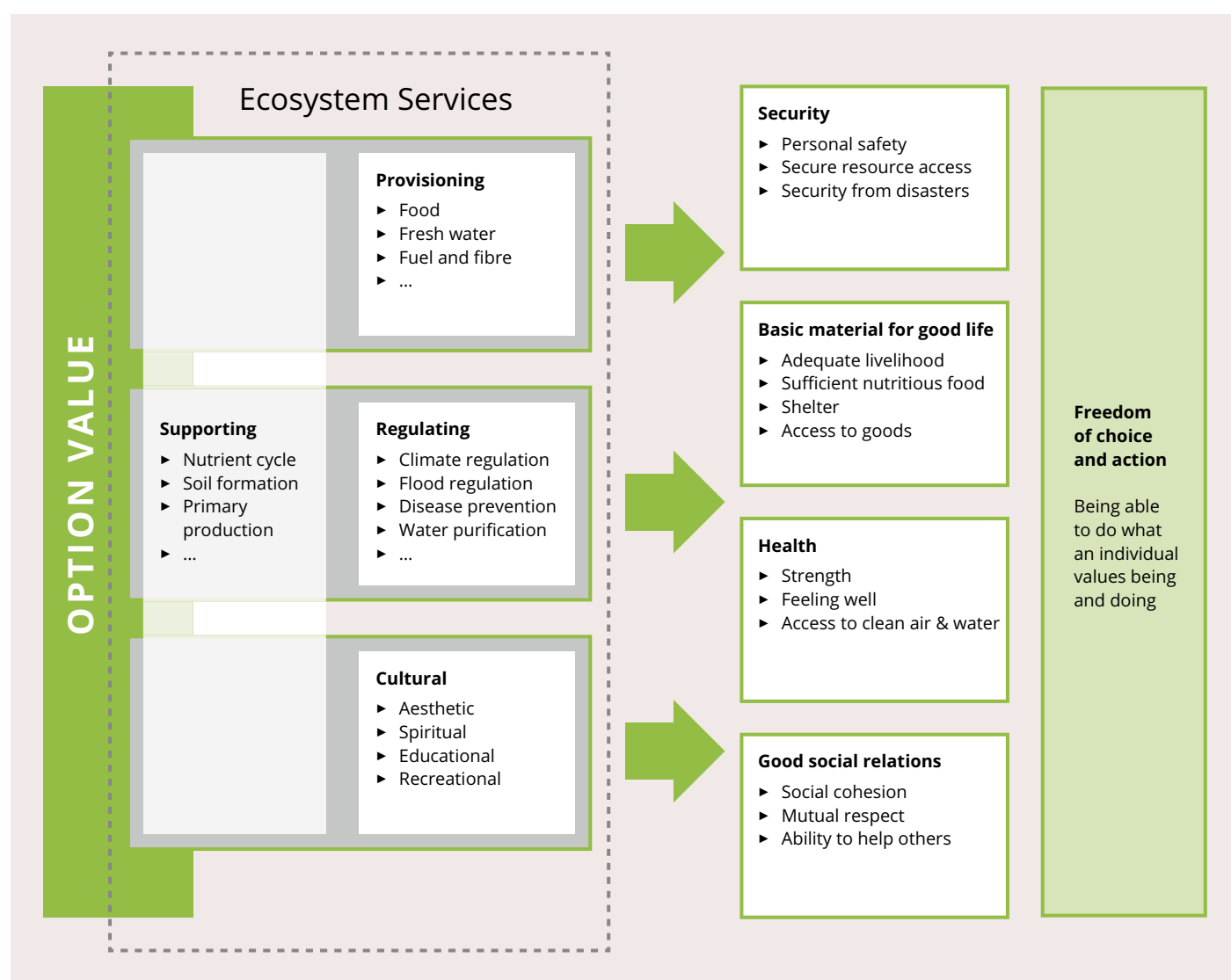
sometimes referred to by economists as the strong sustainability concept).

The ecosystem service framework has several classifications of ecosystem services for a range of purposes<sup>12,15,16,17,18,19,20</sup>. These classifications have been established as guides for comprehensive ecosystem assessments rather than 'blueprints'. The categorisation used by the Millennium Ecosystem Assessment<sup>17</sup> is one of the most popular, and is the basis for classification adopted by the ELD Initiative to identify a complete list of services provided by land that have an economic value to society as a whole. *Figure 2.3* shows the relationship between

FIGURE 2.3

### The provision of ecosystem services from natural capital: Linkages between ecosystem services and human well-being

(from ELD Initiative, 2013<sup>4</sup>, originally adapted from MEA, 2005, Figure A pg. vi<sup>17</sup>)



ecosystem services and well-being, and the flow from ecosystem services to human sustenance and well-being and ultimately to freedom of choice and action.

There are four general types of ecosystem services<sup>8</sup>:

- **Provisioning services** – natural capital combines with built, human, and social capital to produce food, timber, fibre, water, fuel, minerals, building materials and shelter, biodiversity and genetic resources, or other ‘provisioning’ benefits. For example, grains delivered to people as food requires tools (built capital), farmers (human capital), and farming communities (social capital) to produce;
- **Regulating services** – natural capital combines with built, human, and social capital to regulate processes such as climatic events with water flow regulation (e.g., for increased flood or drought control, storm protection), pollution control, decrease in soil erosion, nutrient cycling, human disease regulation, water purification, air quality maintenance, pollination, pest control, and climate control with carbon storage and sequestration. For example, storm protection by coastal wetlands requires built infrastructure, people, and communities to be protected. These services are generally not marketed but have clear value to society;
- **Cultural services** – natural capital combines with built, human, and social capital to produce more material benefits linked to recreation (tourism) and hunting as well as non-material benefits such as spiritual or aesthetic, education, cultural identity, sense of place, or other ‘cultural’ benefits. For example, production of a recreational benefit requires an attractive natural asset (a mountain), in combination with built infrastructure (road, trail, etc.), human capital (people able to appreciate the mountain experience), and social capital (family, friends, and institutions that make the mountain accessible and safe). Such cultural services would tend to be mostly experienced through tourism or religious practices, and;
- **Supporting services** – these maintain basic ecosystem processes and functions such



as soil formation, primary productivity, biogeochemistry, soil formation, and nutrient cycling. They affect human well-being indirectly by maintaining processes necessary for provisioning, regulating, and cultural services. For example, net primary production is an ecosystem function that supports climate control through carbon sequestration and removal from the atmosphere, which combines with built, human, and social capital to provide climate regulation benefits. Some argue that these supporting ‘services’ should be defined as ecosystem ‘functions’, since they have not yet clearly interacted with the other three forms of capital to create benefits in terms of increased human well-being, but rather support or underlie such benefits. Supporting ecosystem services can sometimes be used as proxies for benefits when such benefits cannot be easily measured directly.

The ecosystem service framework provides the ELD Initiative with a fairly complete basis for assessment, which can help improve the transparency of the economic estimations and of the mapping of services, increase comparability between scales and sites, and improve communication amongst stakeholders to help them determine the relative merits of different options.

### Total Economic Value framework

This framework is set as a guide to facilitate the estimation of the 'total' economic value (TEV) of land and its ecosystem services to society as a whole. Considering the total economic value of land beyond imperfect market values can provide an improved basis for assessment of land value and comparison of land management options for informed decision-making. This is especially important as there is increasing land scarcity due to increased competition for land and between land uses. Similar to the ecosystem service

framework, the idea is to deconstruct the total economic value into individual components that can then be summed up together again, while avoiding overlap between these components to prevent double counting.

Total economic value is conceptualised as the sum of use and non-use values (*Figure 2.4*). Use value is the economic value associated with using the land for economically profitable activities and encompasses direct use, indirect use and option values. In the case of land, direct use value stems from direct consumption of land products

FIGURE 2.4

### The Total Economic Value concept and existing valuation methods

(from ELD Initiative, 2013<sup>4</sup>, originally adapted from Bertram & Rehdanz, 2013, pg. 28<sup>21</sup>)

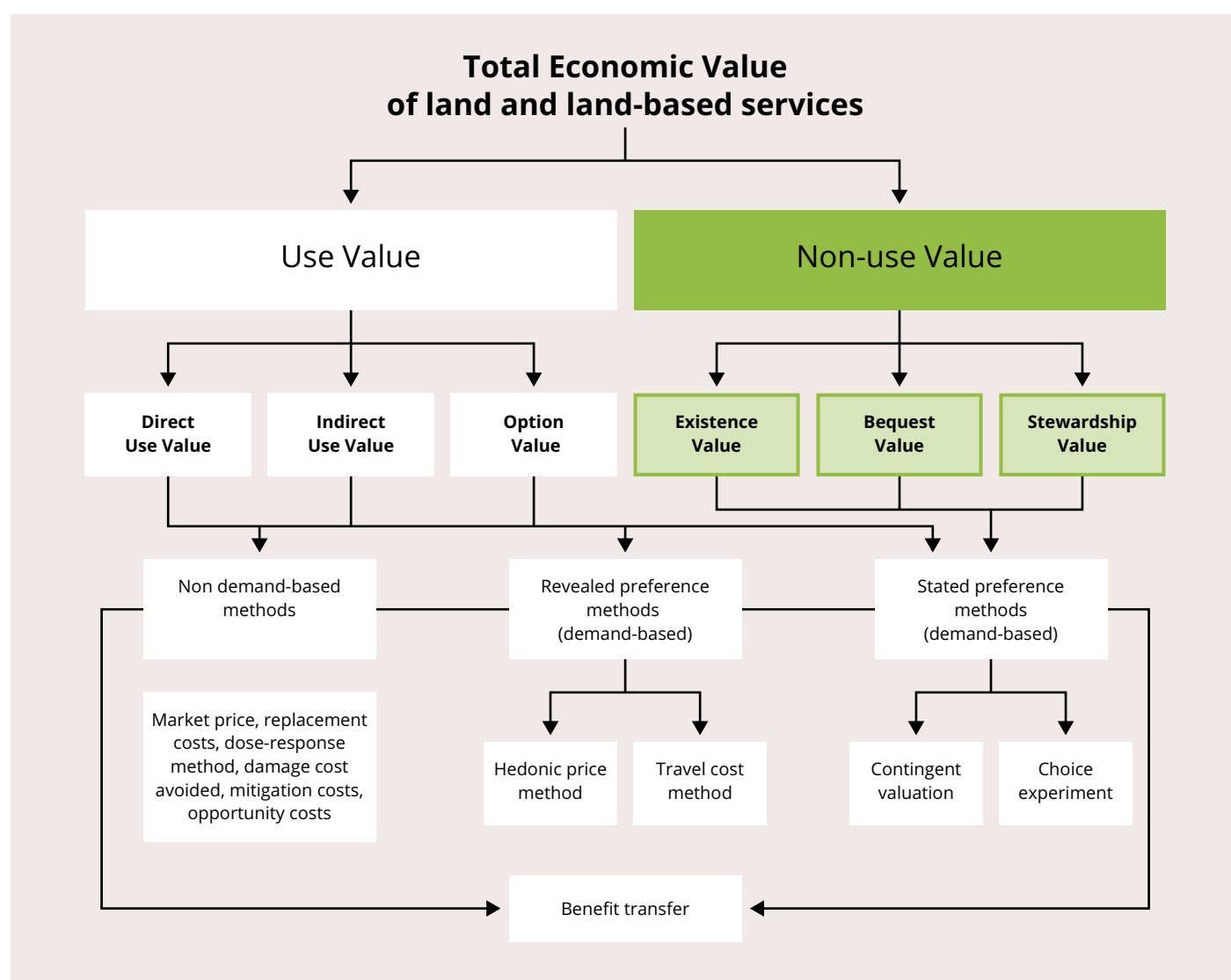




TABLE 2.2

**Economic value types typically estimated for ecosystem services***(from ELD Initiative, 2013<sup>4</sup>, originally adapted from Quillérou & Thomas, 2012<sup>23</sup>)*

		Provisioning services	Regulating services	Cultural services	Supporting services
Use value	Direct use	✓	✓	✓	
	Indirect use		✓	✓	✓
	Option	✓	✓	✓	
Non-use value	Existence			✓	
	Bequest				
	Stewardship				

(food, timber, etc.). Indirect value stems from indirect consumption (e.g., pollination leading to production of consumed food). Option value is associated with the option of keeping land use flexible for future direct and indirect uses (e.g., land kept under forest but possibly to agriculture in the future). This is essentially the economic value allocated to strategies that have been adopted to manage potential threats to profits or livelihoods. It is sometimes considered a use value, but is sometimes considered a non-use value, as it does not correspond to current use but rather to future consumption. Non-use value is the economic value of land that is not associated with consumption, and encompasses existence, bequest, and stewardship values. In the case of land, existence value is the economic value allocated to land simply because it exists. Bequest value is allocated to the possibility of bequeathing land to future generations. Stewardship value is allocated to land kept in good conditions for both direct economic production and the maintenance of surrounding ecosystems.

**Combining the ecosystem service and total economic value frameworks**

Direct use values encompass mostly provisioning services such as food or timber, and indirect use values are those entities not consumed directly

but which indirectly support directly consumed goods such as food and timber (e.g., the values of regulating services – nutrient cycling, water flow regulation, soil erosion prevention, etc.). The ecosystem service and TEV frameworks can be combined together for estimation of the TEV of land. This is the sum of individual cells represented in *Table 2.2* (note: it is possible to increase the level of detail in the table by listing individual ecosystem services rather than their categories). In light of the interconnectivity among the ecosystem service functions, which produce a range of intermediate and final values, caution must be paid in value aggregation so that double-counting is avoided<sup>22</sup>. By measuring marginal changes in values under specified alternatives or scenarios in the socio-ecological system (this can be pursued through cost-benefit analyses, see section on ‘economic benefits of sustainable land management’), rather than focusing on ecosystem units in a constant state, risks of double-counting in total economic valuation can be overcome<sup>22</sup>.

It is also noted that not all components of the TEV need to or can be, estimated for all types of ecosystem services. This is because such economic valuations can be costly to undertake, and there is generally an incentive to obtain the easiest information first. Relevance will depend on the cultural, social, and environmental contexts, as well as the objective(s) of the economic valuation





and assessment. In addition, some types of economic values such as bequest and stewardship values are difficult to estimate because economic numbers are often not seen by individuals as a suitable way to capture such values.

#### **Valuing the costs of inaction or the benefits from action for comparison to the costs of action**

The **costs of action** include those associated with investment into land rehabilitation, restoration or in sustainable land management as well as operation of land management activities. They can be associated with a transition that is limited in time (e.g., conversion or switching costs associated with restoration and rehabilitation of land, a change of land management practices or a change of land use). Others such as operation costs occur on an ongoing basis. Potential barriers to action stem from investment costs, operation costs, or both. Cost-benefit analysis of land management ideally includes both investment and operation costs for comparison to the economic benefits.

On the benefit side of the cost-benefit analysis, two different types of benefit estimates can be used: costs of inaction or the benefits from action. The **costs of inaction** correspond to the maximum level of benefits that could be obtained from land. This potential may or may not materialise when action is taken, with **actual benefits from action** somewhere between their current level and the costs of inaction<sup>24</sup>. Using costs of inaction may lead to an overestimation of the actual benefits from action, which can create disappointment and frustration when expected levels of benefits do not materialise (*Case study 2.1*). Using costs of inaction also does not allow for consideration of different levels of action. Based on the merits of discussions that have evolved amongst economists, the ELD Initiative tends to give more weight to

#### **CASE STUDY 2.1**

##### **Expected benefits prior to action not translating fully into economic benefits after action**

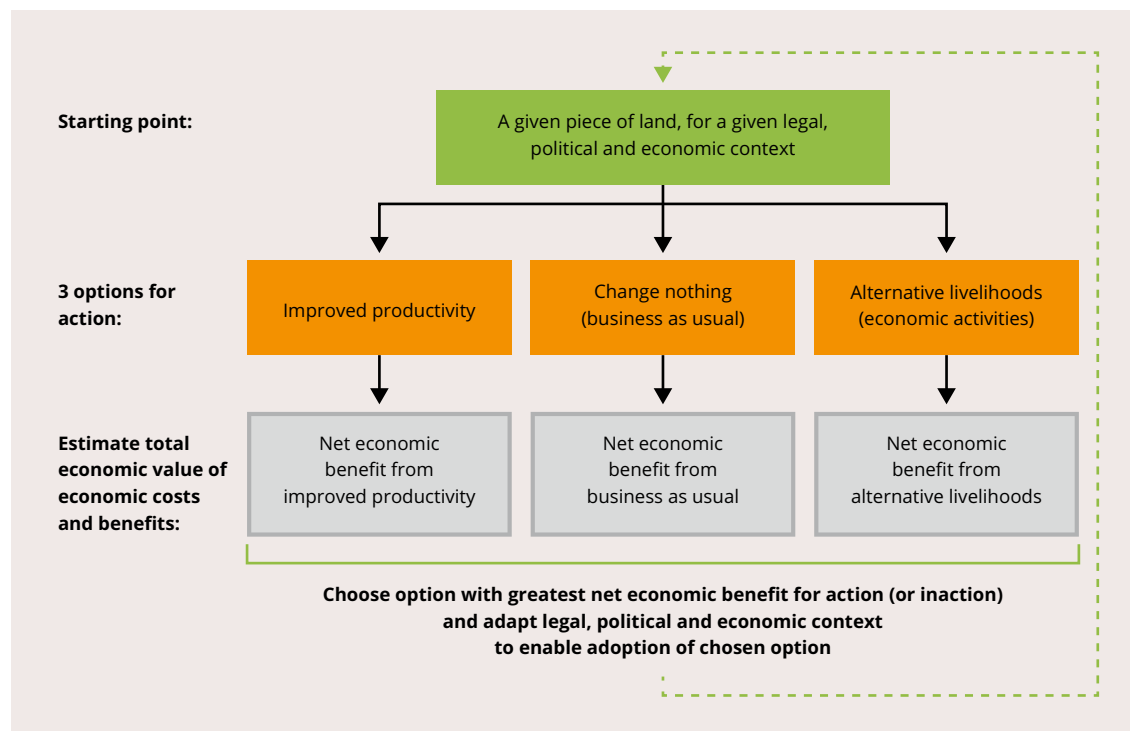
*(from ELD Initiative, 2013, pg. 35<sup>4</sup>, originally from Kosoy et al., 2007<sup>24</sup>)*

Three technical studies, including an economic valuation, were conducted in Honduras to inform the provision of a payment scheme for water-related environmental services. The study indicated that the fee charged to fund the payment scheme (aimed at promoting forest conservation) was lower than the opportunity cost (i.e., foregone economic benefits) for upstream landholders in pursuing alternative land uses. The fee accounted only for 3.6 per cent of the estimated willingness to pay of water users. Thus, the valuation study was used to inform policy, but also identified that the necessary budget to be leveraged for such services was not enough and would lead to under-provision of water-related environmental services, compared to what water users would prefer. Therefore, the expected economic benefits prior to action (estimated based on the valuation study results) could not fully translate into economic benefits after action. The fee charged to water users was instead decided through the voting of representatives from the different urban water sectors. The level of fee to be charged was in this case decided based on political considerations over economic ones.

FIGURE 2.5

### A decision-making framework with net economic benefit as a choice criterion (i.e., economic benefits minus costs)

(from ELD Initiative, 2013<sup>4</sup>)



the benefits from action rather than the cost of inaction, especially at the local level where more accurate information is needed. This approach is also supported by the Offering Sustainable Land Use Options (OSLO) consortium. However, the costs of inaction are often easier to estimate, especially at the global level, and the ELD Initiative uses both costs of inaction and benefits from action depending on the available data and context.

#### Multi-level, multi-scale simple decision-making framework

There are three major types of options available to a land manager for land use: change nothing, improve productivity of current land use, or adopt alternative livelihoods. The improved productivity option includes both investment into restoring degraded lands (state) and investment into decreasing the rate of land degradation or even reverse it (process) (Figure 2.5). It must be considered that the available options and preferences might vary across different types of land managers (e.g., state, smallholder,

private actor, community). When a given piece of land is owned or managed by multiple stakeholders, coordination amongst them is required for a given measure to be agreed upon and implemented.

Alternative livelihoods can be adopted alongside current land use activities to diversify sources of income or even replace current land-based activities. The net economic benefits (i.e., economic benefits minus costs) derived from each of the options should be compared over the same timescale and spatial scale to select the most economically beneficial in time. Once this option has been identified, economic, legal, motivational, political, technical, and social barriers to action may still exist. Such barriers can create perverse incentives fostering land degradation and would need to be removed to provide incentives for action and facilitate adoption of more sustainable land management. This often goes beyond the range of actions that can be taken by land users and calls upon inputs from institutional capacity, policy-making, law, scientific research, etc. (see Chapter 6).

**6+1 step approach: six steps drawing from a collection of methodologies (pluralistic) to establish a cost-benefit analysis of possible actions, plus one step to take action**

The approaches, frameworks, and methods detailed in previous sections have been integrated into a 6+1 step approach conceptualised by the Global Mechanism of the UNCCD and further

developed by Noel & Soussan (2010)<sup>25</sup> for the OSLO Consortium, with each step further disaggregated as required in order to meet the specific objectives of individual studies. The 6+1 steps – defined as the ELD Initiative methodology (ELD Initiative, 2013, pg. 42<sup>4</sup>) – are designed to ensure a thorough knowledge base is established for credible cost-benefit analysis to inform subsequent decision-making processes (Table 2.3).

**TABLE 2.3**

**The 6+1 step approach of the ELD Initiative**

*(adapted and expanded from Noel & Soussan, 2010<sup>25</sup> and ELD Initiative, 2013<sup>4</sup>)*

<b>1. Inception</b>	<p>Identification of the scope, location, spatial scale, and strategic focus of the study, based on stakeholder consultation.</p> <p>Preparation of background materials on the socio-economic and environmental context of the assessment.</p> <p><b>Methods for:</b>  <i>stakeholder participation (consultation, engagement); systematic review and synthesis of academic and grey literature; selection of relevant existing case studies; extrapolation of existing case studies for global comparison; collection of background socio-economic and environmental data; policy analysis.</i></p>
<b>2. Geographical characteristics</b>	<p>Establishment of the geographic and ecological boundaries of the study area identified in Step 1, following an assessment of quantity, spatial distribution, and ecological characteristics of land cover types that are categorised into agro-ecological zones and analysed through a Geographical Information System (GIS).</p> <p><b>Methods for:</b>  <i>stakeholder participation (consultation, engagement); definition and mapping of land covers and agro-ecological zones from the sciences (physical geography, ecology, soil sciences, landscape sciences, etc.).</i></p>
<b>3. Types of ecosystem services</b>	<p>For each land cover category identified in Step 2, identification and analysis of stocks and flows of ecosystem services for classification along the four categories of the ecosystem service framework (provisioning, regulating, cultural, and supporting services).</p> <p><b>Methods for:</b>  <i>stakeholder participation (consultation, engagement); identifying different ecosystem stocks and flows (from ecology); categorising ecosystem services into the four categories of the ecosystem service framework.</i></p>

<b>4. Roles of ecosystem services and economic valuation</b>	<p>Identification of the role of ecosystem services in the livelihoods of communities living in each land cover area and in overall economic development in the study zone.</p> <p>Estimation of the total economic value of each ecosystem service.</p> <p><b>Methods for:</b>  <i>stakeholder participation (consultation, engagement); identification of available economic data from relevant case studies; data collection and surveys; multi-criteria analysis to identify important ecosystem services; valuation methods for estimation of “missing” economic values (no market price); extrapolation of case studies for global comparison.</i></p>
<b>5. Patterns and pressures</b>	<p>Identification of land degradation patterns and drivers, pressures on sustainable management of land resources and drivers of adoption of sustainable land management (including determining the role of property rights and legal systems), and their spatial distribution to inform the establishment of global scenarios.</p> <p>Revision of previous steps if needed, to ensure the assessment is as comprehensive as possible.</p> <p><b>Methods for:</b>  <i>stakeholder participation (consultation, engagement); identification of types of land degradation, patterns, and pressures (from soil sciences, ecology, agricultural sciences, physical geography, etc.); mapping methods (GIS); establishment of global scenarios.</i></p>
<b>6. Cost-benefit analysis and decision making</b>	<p>Cost-benefit analysis comparing costs and benefits of an ‘action’ scenario to that of a ‘business-as-usual’ scenario to assess whether the proposed land management to net benefits. (‘Action’ scenarios include land management changes that can reduce or remove degradation pressures).</p> <p>Mapping of net benefits for identification of the locations for which land management changes are suitable from an economic perspective. This will can help identify ‘on-the-ground’ actions that are economically desirable.</p> <p><b>Methods for:</b>  <i>stakeholder participation (consultation, engagement); cost benefit analysis with participatory establishment of ‘action’ scenario and ‘business as usual’ scenario, choice of discount rate, computation of indicators of economic viability; mapping methods (GIS); estimation of shadow interest rates.</i></p> <p><b>Tools to facilitate the building of cost-benefit analyses (micro-economic level):</b>  <i>Toolkit for Ecosystem Service at Site-based Assessment (TESSA); Assessment and Research Infrastructure for Ecosystem Services (ARIES); Corporate Ecosystem Services Review (ESR); Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST); Multi-scale Integrated Models of Ecosystem Services (MIMES); Natura 2000, etc.</i></p>

**+1. Take action****■ Land users:**

implement the most economically desirable 'on the ground' option(s) by changing land management practices or land use, at multiple scales and levels.

**Methods for:**

*stakeholder participation (consultation, outreach, awareness raising, engagement).*

**■ Private sector:**

engage in discussions with stakeholders from all sectors directly impacted by changes in ecosystem services to reduce risks associated with a weaker link in the value chain and increasing opportunities for investment in sustainable land management. This requires relevant and suitable impact pathways to be identified, to promote and facilitate actions that can be scaled up and out.

**Methods for:**

*Stakeholder participation in relation to corporate social responsibility (consultation, outreach, awareness raising, engagement), land materiality screening toolkit, value chain analysis.*

**■ Policy-/decision-makers:**

facilitate adoption of most economically desirable option(s) on the ground by adapting the legal, policy, institutional and economic contexts at multiple scales and levels. This requires relevant and suitable impact pathways to be identified, to promote and facilitate actions that can be scaled up and out.

**Methods for:**

*stakeholder participation (consultation, engagement); identification and social construction of impact pathways (e.g., multi-criteria analysis that identify preferences over possible impact pathways).*

**Tools at the macroeconomic level:**

*Green accounting using UN System of Environmental-Economic Accounting (SEEA) or using the Wealth Accounting and the Valuation of Ecosystem Services (WAVES) global partnership.*

Details on how each step is performed, with further examples from a range of case studies illustrating the application of the frameworks and various methods, are provided in the ELD Initiative Scientific Interim Report (2013)<sup>4</sup>, ELD User Guide (2015)<sup>26</sup>, ELD e-learning courses/MOOCs ([www.mooc.eld-initiative.org](http://www.mooc.eld-initiative.org)), and ELD Initiative Practitioner's Guides (2014, 2015)<sup>27,28</sup>.

## Economic benefits of sustainable land management

The ELD 6+1 steps approach is grounded on the premise that sustainable land management generates more often than not greater economic benefits than its associated costs. It provides a tool that allows for the assessment of these costs and benefits, with a view to materialise the net benefits of improved land management practices through increased productivity and production, or through the establishment of alternative livelihoods. This section outlines a few examples of studies supported by the ELD Initiative across Africa, Asia, and Latin America.



## CASE STUDY 2.2

**Step 1 of the ELD approach:****Preparing background materials on socio-economic and environmental contexts:****Sundarban Eco-restoration Programme in Bangladesh and India**

(sourced from Alam Shain S., Sharma, D., Rajasthan, U., & Sharma, P (Team 'South East Asia-01'), contribution to the 2014 ELD MOOC, available at [www.mooc-eld-initiative.org](http://www.mooc-eld-initiative.org))

**Background**

The land area of the Sundarbans, including exposed sandbars, occupies 414,259 ha (70 per cent), with water bodies covering 187,413 ha (30 per cent). The Sundarbans are ecologically and economically important at local, national, and even global levels, and the mangrove forest provides both ecological service and goods. Bestowed with scenic beauty and natural resources, it is internationally recognised for its high biodiversity of mangrove flora and fauna both on land and in water. It is also of importance for globally endangered species including the Royal Bengal tiger, Ganges and Irawadi dolphins, estuarine crocodiles, and the critically endangered endemic river terrapin (*Batagur baska*). Further, it is the only mangrove habitat in the world for *Panthera tigris tigris* species. Preserving the health of the Sundarbans ecosystems is a key priority, as the delivery of their highly valued services is threatened by land degradation.

**Major causes of degradation and the main effects**

The causes of deforestation and forest degradation in the Sundarban mangrove forests are over-demand, poor forest management, natural disasters, salinity, and sedimentation, and lead to the following issues:

- Reduced flow of water into the mangrove system;
- Extension of non-forestry land use into mangrove forest;
- Straying of tigers into villages along the western boundary;
- Increased demand for timber and fuelwood for local consumption;
- Poaching of tiger, spotted deer, wild boar, marine turtles, horse shoe crab, etc.;
- Uncontrolled collection of prawn seedlings;
- Uncontrolled fishing in the waters of the reserve forests;
- Continuous trampling of river/creek banks by fishermen and prawn seed collectors;
- Chemical pollution through marine paints and hydrocarbons, and;
- Organisational and infrastructure deficiencies.

## CASE STUDY 2.3

### Step 2 of the ELD approach: Establishing geographic and ecological boundaries in Ethiopia

(adapted from Hurni et al., 2015<sup>29</sup>)

The ELD Initiative case study in Ethiopia covers an area of 614,000 km<sup>2</sup>, or 54 per cent of the country where rainfed agriculture is practiced. By using Landsat imagery and the Homogenous Image Classification Units approach, a high-resolution land cover map was produced using 50 different

land cover types, with types ranging from forest to grassland, cropland to settlement, and bare land to waterbodies (Figure 2.6). Multiple information sources were used in creating these classification units, including altitude, terrain, farming system, rainfall pattern and soil.

FIGURE 2.6

#### Land cover types of the study area in Ethiopia

(Hurni et al., 2015<sup>29</sup>)

##### Agroecological Zones

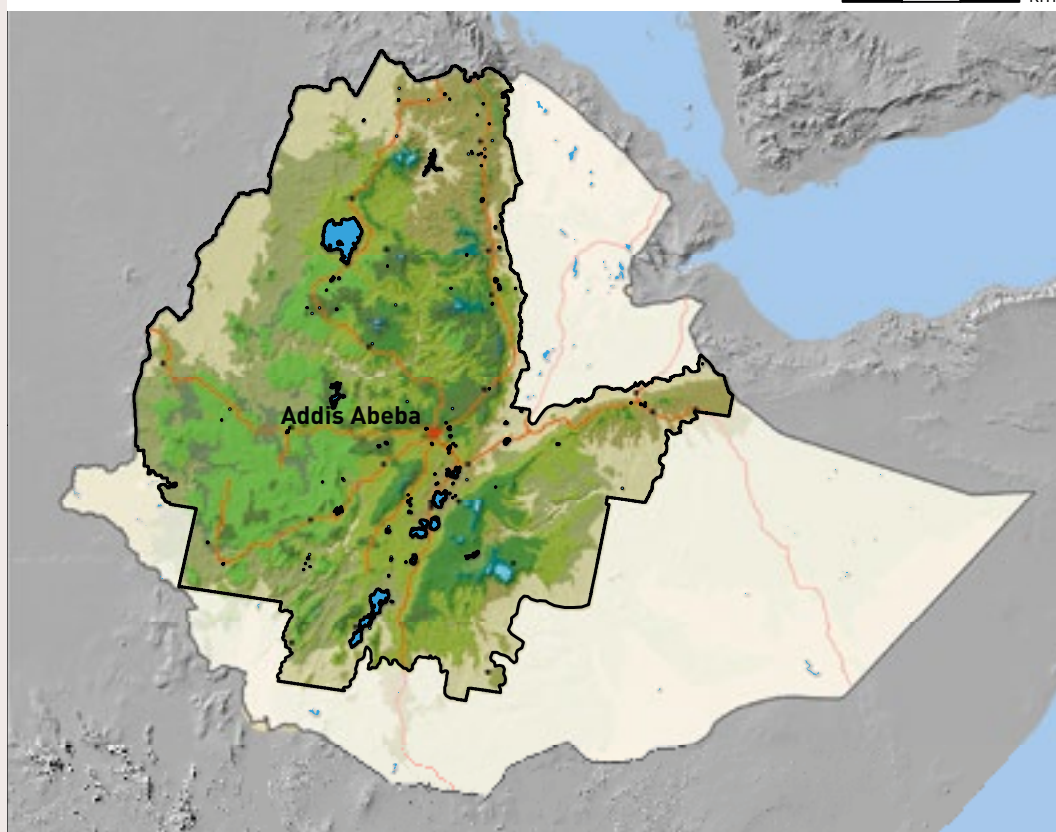
Dry Berha  
Moist Berha  
Dry Kolla  
Moist Kolla  
Wet Kolla

Dry Weyna Dega  
Moist Weyna Dega  
Wet Weyna Dega  
Dry Dega  
Moist Dega  
Wet Dega

Moist High Dega  
Wet High Dega  
Moist Wurch  
Wet Wurch  
Rivers/water bodies

Study area  
Main towns  
Major roads  
National boundary (not authoritative)

0 100 200 300 km



## CASE STUDY 2.3

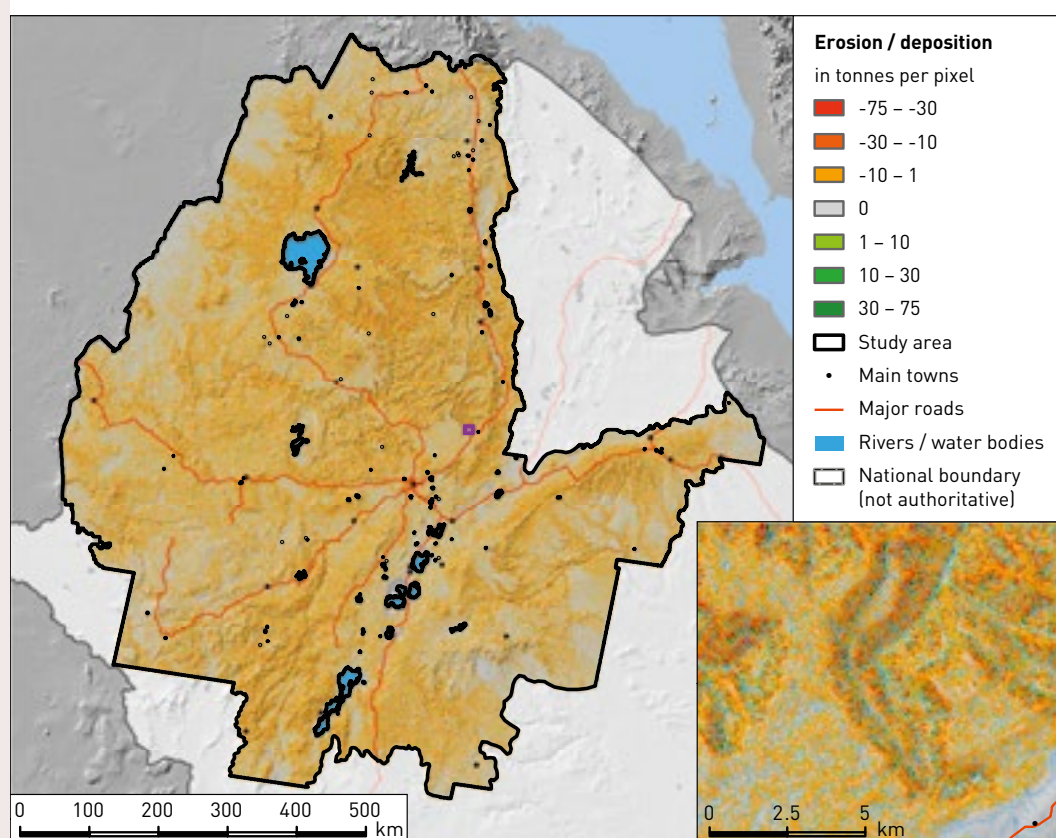
The occurrence of soil and water conservation structures and fertiliser application on cropland in the case study area was modelled, and a database including the information required to model soil erosion and deposition was created. Erosion and deposition estimates were then derived using a United-Stream-Power based Erosion Deposition (USPED) model (Figure 2.7), and applied to the landscape to develop visual maps.

The resulting information was also verified with expert opinion, to ensure that the land cover identification as well as estimates of land degradation (soil erosion) and its impacts (deposition) were correct. On this basis, the authors had a firm foundation from which they could develop alternative land management scenarios and compare them in a cost benefit analysis.

FIGURE 2.7

### Estimated net erosion / deposition for the study area in Ethiopia

(Hurni et al., 2015<sup>29</sup>)





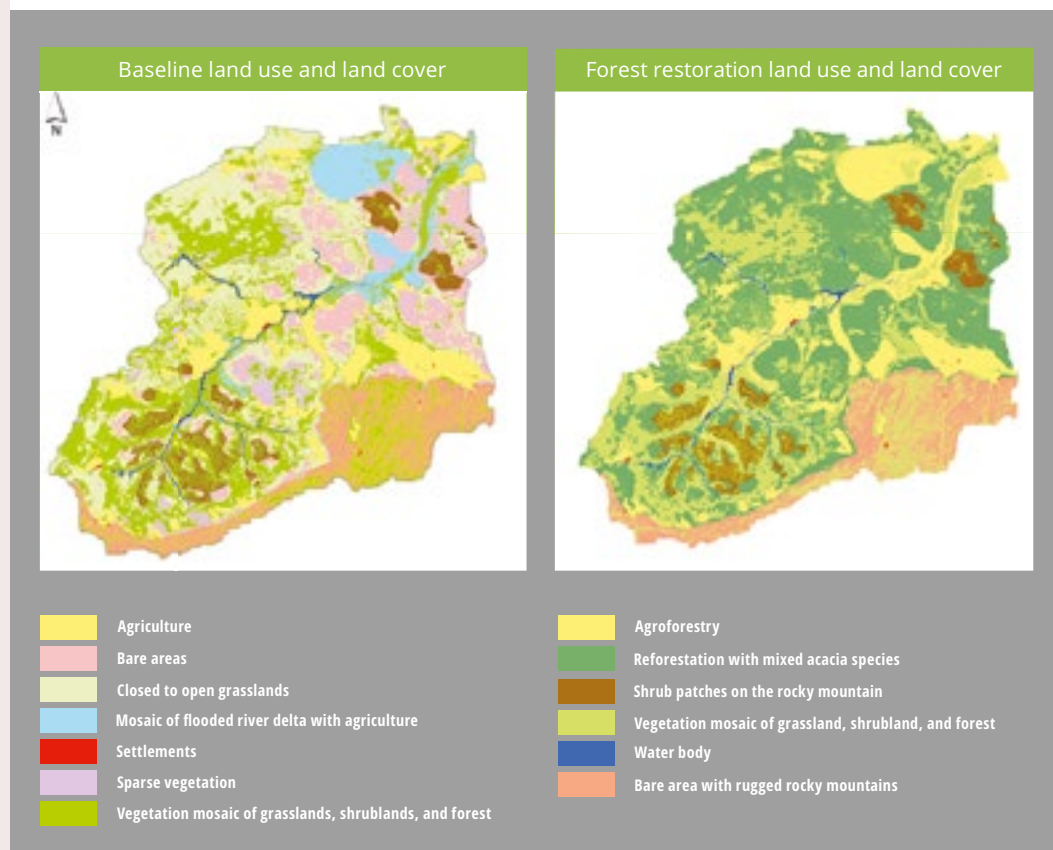
## CASE STUDY 2.4

**Step 6 of the ELD approach:****Cost-benefit analysis of large-scale agroforestry and reforestation in Mali***(adapted from Sidibé et al., 2014<sup>30</sup>)*

The ELD Initiative case study in Mali presented an *ex-ante* cost benefit analysis of large-scale agroforestry and reforestation in the Kelka forest. Productivity change, avoided cost, replacement cost, and market prices were used as valuation methods. High-resolution remote sensing techniques, an explicit spatially distributed

hydrological model, and a crop growth model were developed to assess the impact of land use change on various ecosystem services (i.e., firewood availability, soil moisture, carbon sequestration, and nitrogen fixation). Two alternative scenarios (i.e., baseline and agroforestry and reforestation) were developed (Figure 2.8).

FIGURE 2.8

**Land use and land cover map of baseline and reforestation scenarios in Mali***(Sidibé et al., 2014, pg. 14<sup>30</sup>)*

## CASE STUDY 2.4 (CONT)



The study showed that the benefits of large-scale landscape restoration in the study area are significantly higher than the costs of implementing the restoration options, both at the local and global levels, when discounted at 2.5, 5, and 10 per cent for a time horizon of 25 years. Agroforestry provides the highest per hectare return on investment to smallholders: between USD 5.2 to 5.9 of benefits for every USD invested (with a net present value (NPV) ranging between 17.8 and 62

USD/ha/yr). The societal value of the agroforestry and reforestation scenario is notably higher when the global benefits from enhanced carbon sequestration are integrated: up to USD 13.6 of benefits for every USD invested (at a discount rate of 5 per cent), equivalent to a value of 428.8 USD/ha/year (Figure 2.9). However, due to the instability of the market price for carbon, the latter estimates might be subject to variation.

FIGURE 2.9

### Net benefits of agroforestry and reforestation scenarios in the Kelka forest watershed, Mopti

(Sidibé et al., 2014, pg. 14<sup>30</sup>)

	r = 2.5%	r = 5%	r = 10%
<b>Smallholder farms</b>	NPV USD/ha/yr: 62.2 B-C ratio/ha: 5.8	NPV USD/ha/yr: 55.6 B-C ratio/ha: 5.4	NPV USD/ha/yr: 17.9 B-C ratio/ha: 5.2
<b>Forest community</b>	NPV USD/ha/yr: 72.1 B-C ratio/ha: 3.0	NPV USD/ha/yr: 58.7 B-C ratio/ha: 2.7	NPV USD/ha/yr: 13.8 B-C ratio/ha: 1.7
<b>Global society</b>	NPV USD/ha/yr: 1,405.4 B-C ratio/ha: 49.5	NPV USD/ha/yr: 428.8 B-C ratio/ha: 13.6	NPV USD/ha/yr: 13.6 B-C ratio/ha: 1.7

B = benefits; C = costs

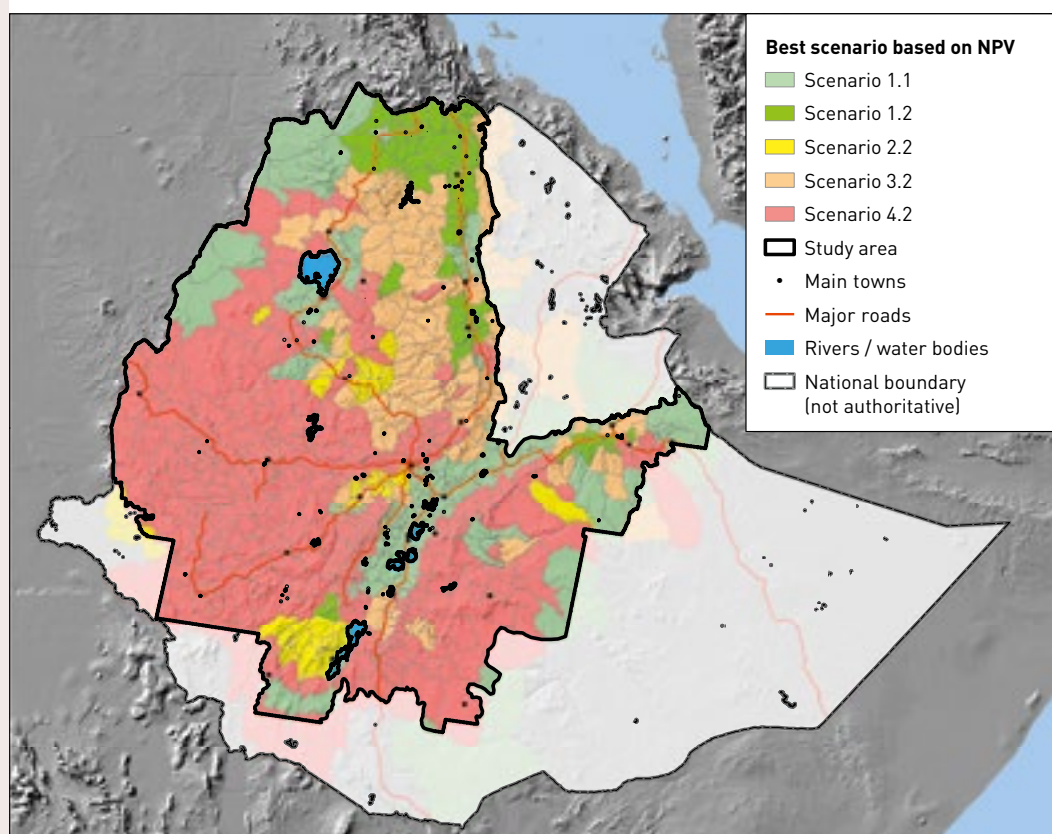
## CASE STUDY 2.5

**Step 6 of the ELD approach: Cost-benefit analysis: sustainable land management scenarios in the Ethiopian highlands***(adapted from Hurni et al., 2015<sup>29</sup>)*

In the ELD Initiative case study in Ethiopia outlined in *Case study 2.3*, soil and water conservation structures and fertiliser application on cropland was modelled, and a database created with the information required to model soil erosion and deposition. This allowed for the estimation of crop production and ultimately, the identification of eight scenarios for improved sustainable land management to be used for the cost-benefit analysis. Results show positive net present values under all the scenarios over a 30-year timeframe.

When comparing to business as usual, this indicates the profitability of a farmer to invest in soil and water conservation measures, with a view to increase future financial returns. If all the identified sustainable land management technologies were implemented, crop production was estimated to increase by 10 per cent over 30 years, at a discount rate of 12.5 per cent. A map was produced to help visualise which option would lead to the greatest net economic benefit in different locations (*Figure 2.10*).

FIGURE 2.10

**Optimal scenario locations based on net present value (NPV) for different regions in Ethiopia***(Hurni et al., 2015<sup>29</sup>)*

## CASE STUDY 2.6

**Benefit-to-cost ratios: Alternatives to current rice and mango production practices in the Piura region of Peru***(from ELD User Guide, 2015, pg. 27<sup>26</sup>, originally from Barrionuevo, 2015<sup>31</sup>)*

This study compares the costs of action to the benefits from action for rice and mango production in the Piura region, both dominating agricultural production in the region.

Rice production in the Piura region is affected by soil salinisation, which reduces crop yields. Two more sustainable land management alternatives are considered for economic assessment and derivation of benefit-to-cost ratios and replacing rice by quinoa production. The first option is costly and not economically attractive. The economic potential of quinoa production is very

attractive but depends on demand for quinoa and its market price (*Table 2.4*).

Mango production in the Piura region constitutes 75 per cent of mango exports of Peru. Organic production is seen as helping to reduce soil erosion and salinisation, and improve water retention capacity. Organic mango is in demand and thus the first alternative to current production practices. The second alternative is mango production as part of an agro-forestry system. Both are financially viable but agro-forestry has higher profitability.

TABLE 2.4

**Comparison of the net benefits of action and inaction under business-as-usual and improved sustainable land management scenarios***(adapted from Barrionuevo, 2015<sup>31</sup>)*

			Benefits		Costs		Net benefits	Net benefits of action
			Action	Inaction	Action	Inaction		
Business-as-usual	Rice		N/A	8,522	N/A	6,804	1,717	N/A
	Mango		N/A	10,513	N/A	4,563	5,959	N/A
Sustainable land management	Rice	Scenario 1a. horizontal desalination	11,589	N/A	11,304	N/A	285	-1,432
		Scenario 2a. replacing rice by quinoa production	30,000	N/A	10,000	N/A	20,000	18,282
	Mango	Scenario 1b. organic production	8,655	N/A	1,205	N/A	7,450	1,491
		Scenario 2b. production as part of an agro-forestry system	27,049	N/A	2,074	N/A	24,974	19,015

*All figures in Peruvian nuevo sol (PEN). Exchange rate PEN/USD = 0.31*



## Limitations

The various frameworks, approaches and methods outlined in this chapter provide useful tools to perform economic analyses of land management. However, as for any tools, they face a range of limitations.

### Limitations of frameworks

The impact pathways for sustainable land management framework outlines the varied pathways to be followed towards the achievement of improved land management and human well-being. While economic assessments can help the identification of the most economically desirable options, sustainable land management requires complementary impact pathways to be established in order to operationalise such options (see *Figure 6.1, Chapter 6*). The framework might provide too narrow a perspective, and a wider range of actions might be needed in order to drive change at a large enough scale. As detailed in *Chapters 5 and 6*, these actions include a range of cultural, economic, environmental, financial, legal, political, technical, and social enabling factors.

The ecosystem service framework emphasises the multiple benefits of ecosystems to humans, but there are ethical considerations raised over its anthropocentric focus<sup>32</sup>. There are a range of non-anthropocentric values – defined as biocentric values – that are not necessarily captured through the concept of ecosystem services which implicitly refer to ecosystem benefits to humans, whether direct or indirect.

Similarly, credibility concerns are raised on the TEV, as it provides a relatively simple framework that might be difficult to operationalise in real life. The value estimated under the TEV is not always translated into prices and real money flows, and it can be perceived as irrelevant, especially for smallholders. The TEV aims to reflect the preferences of society as a whole in the allocation of ecosystem goods and services, including those values that are not normally quantified in monetary terms. This is referred to by economists as the ‘economic’ value to society as a whole, which may or may not be reflected accurately in market prices or ‘financial values’. Economic valuation of ecosystems is carried out by humans

based on a utilitarian perspective, which assumes that alternative sources of ecosystem service values contribute interchangeably to human welfare<sup>33</sup>. Economic valuation is subject to the same anthropocentric criticism as the ecosystem service framework, added to a concern over the commodification of nature (Monbiot, 2012<sup>34</sup> with response by Costanza *et al.*, 2012<sup>35</sup>).

However, by aggregating individual preferences into a TEV value, this approach assumes that consumer preferences are in line with a shared concept of ecosystem sustainability. Sustainability is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”<sup>36</sup> Debates are raised on the varied conceptions of sustainability, which include a ‘weak’ conception, i.e., different types of capital such as natural versus manufactured which are substitutable towards the generation of human well-being, therefore the key focus must be on their aggregated value<sup>37</sup>. In contrast, a ‘strong’ conception, i.e., the capacity of natural capital to provide benefits to society, is derived by a complex interaction between a range of biotic and abiotic components. The stock of natural resources must be maintained and enhanced in order to preserve its capacity to deliver these benefits, which cannot be duplicated by manufactured capital<sup>38</sup>.

### Limitations of the economic assessment approach

Cost-benefit analysis should be used as a guiding tool to compare alternative land use options and scenarios, and identify the most desirable one(s) ‘only’ from an economic perspective. It should be considered that not everything can be nor should be valued in money, and that a range of non-monetary factors play a role in the identification and design of sustainable land management practices. When a full economic valuation is not an option due to a lack of data, capacity, or social acceptance, alternative valuation approaches can be used. For example, as a result of unpredicted time constraints, multi-criteria decision analysis (MCDA) was used as an alternative to cost-benefit analysis in Botswana’s Kalahari to identify key rangeland ecosystem service benefits (i.e., food, fuel, construction material, ground water, genetic diversity, climate regulation, recreation, and

spiritual inspiration)<sup>39</sup>. By integrating monetary and non-monetary valuation techniques, with ecological and socio-economic dimensions, the study revealed that while cattle production in the study area provides the largest financial returns to private cattle ranchers, its negative environmental externalities affect all users of communal rangelands, with costs and benefits not distributed fairly. The MCDA approach proved valuable in demonstrating that the policy-driven focus upon intensive commercial food production and ground water extraction in Botswana compromises the delivery of other provisioning ecosystem services (wild food, fuel, construction material and genetic diversity) and cultural services (recreation).

An alternative way of communicating results, instead of the usual indicators of economic desirability (i.e., net present value, internal rate of return, or benefit-to-cost ratio) and one which relates neatly to the concept of sustainability, is to calculate the rate of interest at which we are borrowing natural capital from future generations. A study by Quaas *et al.* (2012)<sup>40</sup> looked into overfishing and its related costs across 13

major European fish stocks, and stressed the need to compute return on investments when designing sustainable fishing practices. Through a shadow interest rate analysis (shadow prices differ to market prices as they aim to capture the social returns produced by a unit of privately owned capital over time), the study shows that the economic returns of catch reduction are higher than the ones produced by the current overfishing practices. Catch reduction should therefore be promoted as an investment in natural capital, with a view to increase the fishers income across time.

### Limitations of methods

Similarly to the concerns raised on the valuation approach, the choice of methods is not always easy to implement under limited capacity and/or with a limited data context. Also, the suitability of different methods is highly context-specific. An effective engagement of multiple stakeholders able to contribute to the use of multiple methods and implementation of their results is key in this process. The compilation of different types of





knowledge needs good facilitation of exchanges needs to be organised by public decision-makers within a political process in place. The wide variety of methods available can make the users feel lost, therefore a strong guidance is needed to support them in the choice of methods so that they can go beyond their comfort zone. Assessment to inform action need not necessarily be data- and capacity-intensive, as demonstrated in the outputs from the ELD MOOC 2014 ([www.mooc.eld-initiative.org](http://www.mooc.eld-initiative.org)). Simple assessment does not mean lower quality, as simple yet quality assessments were put together by participants, many of whom had not previously engaged in formal education or had professional experience in this field.

## Conclusion

This chapter outlined the range of frameworks, approaches and tools that can be used to address key land management issues and identify sustainable land management strategies. While it is recognised that there is no blueprint solution to land degradation and that each economic approach faces its own constraints, action must be taken to generate empirical knowledge that

can help prevent or reverse land degradation. The ELD 6+1 steps methodological approach for the economic valuation of alternative land use options through cost-benefit analysis was presented, and details on the limitations of such approach were discussed. This approach provides a tool to support policy-/decision-makers with transparent information to adopt economically-sound sustainable land management, through the estimation of the overall economic benefits of addressing land degradation and implementing ecosystem restoration. Such estimates will enable businesses and policy-/decision-makers to test the economic implication of land management decisions, based on a scenario-driven, net economic benefit decision-making framework. The ELD approach recognises that not everything can be valued in money, that a range of non-monetary factors play a role in the identification and design of sustainable land management practices, and that a comprehensive understanding of land degradation requires the combination of different disciplines, in particular integrating biophysical analysis of the root causes of degradation with socio-economic assessments. By focusing on the economic value of ecosystem services derived from land, and livelihood implications of alternative land use and management strategies, the ELD approach allows for broader consideration of other factors to promote land management and use bringing higher levels of economic benefits and not just those linked to land degradation. *Box 2.1* is an example of how an interlinked system can integrate these values into business models and approaches. By comparing the economic costs of action versus the benefits of action, impacts on human well-being and the long-term effects of decisions, better informed decisions can be made towards the identification and promotion of sustainable land management practices.

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This was published with the support of the partner organisations of the ELD Initiative and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

Design: kippconcept GmbH, Bonn  
Printed in the EU on FSC-certified paper  
Bonn, September 2015  
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[www.eld-initiative.org](http://www.eld-initiative.org)

ISBN 978-92-808-6061-0

