GLOBAL
LAND
OUTLOOK WORKING PAPER

THE ECONOMICS OF LAND POLICY, PLANNING AND PRACTICE

Nicola Favretto (University of Leeds), Martin Dallimer (University of Leeds), Ian Johnson (GLO Coordinator), Ida Kubiszweski (The Australian National University), Hannes Etter (ELD Secretariat), Richard Thomas (CRP-Dryland Systems ICARDA)*

** Corresponding author. E-mail: n.favretto@leeds.ac.uk, School of Earth and Environment, University of Leeds, Leeds LS2 9JT, UK*

September 2017

United Nations
Convention to Combat
Desertification

CONTENTS

1. INTRODUCTION

Land is front and center of the sustainable development and climate change debates. A goal dedicated to Land Degradation Neutrality (LDN) (see Box 1) was endorsed in 2015 by the United Nations (UN) General Assembly as part of the Sustainable Development Goals (SDGs) 2015–2030 framework, following on from the UN's Millennium Development Goals of 2000 (UN General Assembly, 2015). SDG 15 aims to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss", with the specific target 15.3 to "combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world" by 2030 (UN General Assembly, 2015: 24).

Box 1: Land Degradation Neutrality:

LDN was born out of the United Nations Conference on Sustainable Development (Rio+20) and can be understood as a state where the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remain stable or increase over time (UNCCD, 2015). This can happen within different scales and ecosystems, with a view to combining avoided or reduced rates of land degradation with increased rates of recovery. It can occur naturally or through the implementation of better land management. LDN is based on the idea that economic benefits from taking action to prevent and/or reverse land degradation and obtained from investing in and applying sustainable land management practices are commonly higher than the costs of action (ELD Initiative, 2015a).

Far from being a stand-alone target, LDN underpins the full range of post-2015 development policy, particularly in light of the global consensus on the need to promote Sustainable Land Management (SLM) which has been reflected by 193 countries through ratification of the United Nations Convention to Combat Desertification (UNCCD) (Stringer et al., 2007). Productive land is a prerequisite of at least eight of the SDGs (i.e., SDG #1 on poverty reduction, #2 on food security and sustainable agriculture, #5 on gender equality, #6 on water, #7 on sustainable energy, 10# on reduced inequality, #14 on reduced marine pollution from land-based activities, and #16 on peaceful and inclusive societies requiring adequate land rights), and is generally an underperforming asset in the global economy (ELD Initiative, 2015a).

Land degradation threatens the growing need for, and availability of, fertile lands. It also impacts the range of provisioning, supporting, regulating and cultural ecosystem services that land provides (see Section 2.1), by reducing the benefits humanity derives from them (Costanza et al., 1997; Costanza et al., 2014; Haberl et al., 2007; Bateman et al., 2013; TruCost, 2013; Mirzabaev et al. 2015). Competition for access to increasingly scarce resources, such as healthy and productive soils and water, is accelerating, further intensified by population pressures, climate change, and resource demands (Quillérou and Thomas, 2012).

Agricultural commodity markets fail to internalize the environmental costs associated with land use and management decisions, while global prices of land are observed to be far below their real value to society (The Economist, 2011; Oakland Institute, 2011a). High quality land is available worldwide at a fraction of its "real", full economic price. Africa has been reported to be the continent where the largest share of foreign agribusiness investment in land occurs, accounting for ten million hectares of land, and representing 42% of the 1,004 agricultural deals concluded between 2000 and 2016 (Kerstin et al., 2016). While direct ecosystem service values provide up to 90% of the livelihoods of rural populations in Africa (see Section 2.1 for an outline of the types of ecosystem values), low prices are paid by large investors to customary users to compensate for their loss of the use of land (Cotula et al., 2009). As observed by the Global Mechanism of the UNCCD, market prices have been historically distorted either by government policies (i.e. including price controls) or market failures, which make investments to address land degradation unattractive (CATIE and GM, 2012). Examples of low payments for farmland include Ethiopia, where in 2008 a large foreign investor acquired 300,000 hectares for a ninety-nine-year lease, with rents of US$1.00-1.25 per hectare (Oakland Institute, 2011a). It was also reported that in Sub-Saharan Africa the price agri-investors pay for good agricultural land "is 1/7th of the price of similar land in Argentina, Brazil and America" (Oakland Institute, 2011b: 24). This is partly the result of a lack of tangible market prices needed to measure ecosystem services through common monetary metrics, which limits the capacity to compare alternative land use options and their impacts on society as a whole.

A failure to consider key use- and non-use values of ecosystem services (including cultural, spiritual and landscape beauty) in land policy decisions and market transactions may be associated with increasing levels of degradation (Mirzabaev et al 2015; Bryan, 2013). Increasing degradation, combined with often weak land tenure and property rights in developing countries, do constrain the ability of a country or community to manage land sustainably (Cotula et al., 2009).

A range of economic tools is used to quantify the value of land, the costs of degradation and the benefits of SLM, in order to allow for better informed decision-making through increased transparency, as well as to improve the capacity to provide fairer levels of compensation and a more equitable distribution of resources to society (ELD Initiative, 2015a; Laurans et al., 2013). Economic valuation informs the design of market-based and financial environmental policy instruments that are promoted with the aim to correct market failures and incentivize SLM (Farley and Costanza, 2010; Bryan, 2013). These tools occupy a central place in the political and academic development agendas, and their potential is recognized by the Parties to the UNCCD, the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) (CATIE and GM, 2012).

In line with the aims of these international conventions, a number of global initiatives have been designed to promote the integration of economic arguments into land use decisions and policy making. The Economics of Land Degradation (ELD) Initiative aims to transform global understanding of the value of land and to create awareness of the economic case for SLM in preventing loss of natural capital, preserving ecosystem services, combatting climate change, and in addressing food, energy and water security (ELD Initiative, 2015a). The Economics of Ecosystems and Biodiversity (TEEB) focuses on “making nature’s values visible” by mainstreaming these values into decision-making at all levels, following a structured approach to economic valuation (TEEB, 2010). The World Bank’s Wealth Accounting and Valuation of Ecosystem Services (WAVES) programme establishes an environmental accounting system for ecosystems across the globe (WAVES, 2014). Common to these initiatives is the concept that economic tools help to address issues such as fairness and equity more directly in land decision-making, particularly with regard to key dimensions of gender, poverty and equal economic opportunities, as targeted in the SDGs. It is argued that, when carefully designed, policy and regulation, informed by economic arguments, can foster the achievement of increased fairness and equity. However, policy frameworks to fight land degradation often remain ineffective due to a range of contradictions, and the capacity of economic valuation to be instrumental in changing policy has been questioned (Laurans and Mermet 2014; Boezeman et al., 2010; Mirzabaev et al., 2015). Moreover, knowledge gaps remain when it comes to the impacts of economic incentives on policy efficiency and ecosystem services (Bryan and Crossman 2013; Zhang and Pagiola 2011).

This paper reviews existing information on the economic tools and frameworks used in the valuation of land and its ecosystems, and presents the range of economic policy mechanisms available to incentivize SLM. Several interlinkages are explored, between: economic valuation and instruments; policy implementation; implications for ecosystem services preservation; and SDGs achievement through changes in land use and management. The opportunities and challenges regarding improved mainstreaming of economic arguments into land policy are discussed. In light of the dearth of literature addressing this topic, this review does not aim to detail all the methods and instruments available, but provides a comprehensive overview through which the reader can access the relevant material. Challenges in the practical application of these decision-making tools are explored through case study examples, with a view to providing a foundation for an increased understanding of the role of economic policy towards the promotion of LDN in the context of the SDGs.

2. MATERIAL, METHODS AND FRAMEWORKS FOR VALUING LAND AND ECOSYSTEMS

A literature review was performed by gathering relevant material on ecosystem valuation and SLM from prestigious peer-reviewed articles published since the 1990s. Key search terms used in databases such as Science Direct, ISI Web of Knowledge, Google Scholar and Scopus included the following: land degradation, sustainable land management, ecosystem valuation, economic valuation, environmental valuation, total economic value and environmental economic policy. This information was expanded through the references found in the literature examined in the first step (which covers more than 5,000 publications on the topic of ecosystem valuation and economic policy for SLM – Table 1), and integrated with additional grey literature references from policy and project reports, working papers and government documents.

Table 1: **Major reviews of ecosystem valuation and economic policy for SLM identified**

Reference (in alphabetical order)	Number of studies identified / reviewed
Adamowicz 2004	1850
Adhikari and Nadella 2011	Not specified
Crossman et al 2013	122
Egoh et al. 2012	67
Laurans et al. 2013	5028
Liu et al 2010	850
Martinez-Harms and Balvanera 2012	70
Milcu et al. 2013	104
Mirzabaev et al. 2015	Not specified
Molnar and Kubiszewski 2012	3770
Nkonya et al. 2011	73
Quillérou and Thomas 2012	Not specified
Schägner et al. 2013	69
Turner et al. 2003	Not specified
Turner et al. 2016	Not specified

2.1. Ecosystem services and the Total Economic Value framework

The services provided by the world's ecosystems are commonly classified according to the Millennium Ecosystem Assessment's definition, which includes the four following categories: provisioning (e.g., food, freshwater and fuel), supporting (e.g., soil formation, nutrient cycling and species habitat), regulating (e.g., climate regulation, nutrient cycling and pollination), and cultural (e.g., spiritual experience, landscape beauty, recreation and tourism) services. These have been further conceptualized in various publications and are summarized in Table 2.

Table 2: **Categories of ecosystem services (adapted from MA, 2005; Costanza et al., 1997; De Groot et al., 2010; ELD Initiative, 2015a)**

Ecosystem Service category	Example
Provisioning	Food, freshwater, fiber, timber, fuel, fodder, minerals, building materials, genetic resources, medicinal resources
Supporting	Primary production, soil formation, nutrient cycling, species habitat, maintenance of genetic diversity
Regulating	Climate regulation, moderation of extreme events, pollution purification, nutrient cycling, erosion prevention, maintenance of soil fertility, pollination
Cultural	Spiritual experience, landscape beauty, opportunities for recreation, tourism and education, hunting

These methods are grounded on the principles of classical and neoclassical economics, where demand and supply curves for a good or service are derived and used for estimating the economic value of a given environmental service (Hanley et al., 1997). Assumptions are made on the price that would be charged in order to maximize profit under alternative scenarios. The hypothetical revenue associated with a transaction is given as a measure of the value of flow of ecosystem services. The demand curve for land and its environmental goods is considered highly elastic to changes in market prices, and can either be observed in "real" markets (i.e. through adjusted market prices), or derived according to the values of similar goods and services purchased in "surrogate" markets. Alternatively, estimates can be based on the willingness of a land user to pay according to marginal utility functions in "simulate" markets. The supply of land is considered "fixed" in physical terms, with an inelastic supply curve in which the overall supply of land is expected to change little as a result of a change in market prices. "Exhaustible resource" theories indicate that supply increases might occur due to the introduction of new technologies - i.e. in agriculture or industry - or discovery of substitutes that would render previous essential natural resources inessential (Dasgupta and Heavl, 1974). These are defined as "backstop technologies" not constrained by exhaustibility. Under these assumptions, the capacity to develop best policies depends on the probability of such an occurrence, and on the ability to encourage the support and utilization of profitable backstop technologies in land planning (e.g. hydroponic urban agriculture or improved water use technologies in rural agriculture).

When data availability is limited, benefit transfer is used to apply the results obtained in the valuation of ecosystem services in one context (i.e., 'study site') to another context (i.e., 'policy site') with similar environmental features (ELD Initiative, 2015b; Richardson, 2015). Figure 1 outlines the TEV approach and summarizes the techniques that can be used to value each of the TEV components. For more details on the application of these tools, we refer to literature outlined in Table 1, which integrates a wealth of relevant sources.

	USE-VALUE			**NON-USE VALUE**		
	Direct	**Indirect**	**Option**	**Existence**	**Bequest**	**Stewardship**
TEV	Food, fibres and timber production (provisioning); carbon storage (regulating); tourism, recreational, hunting (cultural)	Pollination (provisioning); watershed protection, flood attenuation, pollution assimilation (regulating and cultural); nutrient cycling, micro-climate (supporting)	Premium from use of biodiversity resources for pharmaceutical industry in the future (provisioning); area that becomes of recreational value (cultural); area used for water recycling (regulating)	Biodiversity hotspot, symbolic species – e.g. panda, tiger (cultural)	Land passed onto our children (cultural)	Land maintained in good working conditions for both humans and their surrounding ecosystems

	Non-demand based	**Revealed preference**		**Stated preference methods**	
Valuation methods	Market price, replacement cost, dose-response, damage cost avoided, mitigation costs, opportunity costs	Hedonic price	Travel cost	Contingent valuation	Choice experiment
	Benefit transfer				

Figure 1: **The Total Economic Value (TEV) of land and main valuation techniques (adapted from ELD, Initiative, 2015a; Pagiola et al., 2005; Nkonya et al., 2011)**

Direct, and to a minor extent indirect, (use-) values of provisioning and regulating services are the most commonly mapped values through the use of non-demand based monetary techniques (Crossman et al., 2013; Laurans et al., 2013; Egoh et al., 2012). Conversely, mapping of option (use-) values and non-use values through conventional monetary techniques proves to be more challenging. How different stakeholder groups attach value to an ecosystem service will vary; for example, a farmer focused on increasing agricultural yields might value the survival of a lion in a given territory differently than a conservationist (Hein et al., 2006). Hence, these different perspectives need to be taken into account.

It follows that when the value of a service is not commonly quantified or priced, monetary valuation might have a limited capacity to reflect the full societal value of land and to capture key cultural, spiritual or "shared" values which people hold for others and for the society in which they live (Kenter et al., 2015). Alternative mixed-method approaches, such as Multi-Criteria Decision Analysis (MCDA), are proposed to integrate monetary and non-monetary dimensions related to ecosystems services, with a view to assessing these values in a systematic way by incorporating major socio-economic, policy and environmental priorities into decision-making (Favretto et al., 2015; Fish et al., 2011; Kenter et al., 2015). Integrated approaches to bring land use and management priorities into the policy mainstream are further outlined and discussed in the following sections.

2.2. Towards an integrated assessment of the value of land to inform decision-making: the ELD 6+1 steps approach

The “6+1 steps” is a multi-level, holistic methodological approach conceptualized by Noel and Soussan (2010) and endorsed by the ELD Initiative. It provides a concrete application of the TEV framework and is grounded on the concept that SLM generates greater economic benefits than its associated costs. It integrates the range of methods outlined in Section 2.1 to undertake a full Cost-Benefit Analysis (CBA) of the impact of alternative land management options (i.e., increased productivity and production, establishment of alternative livelihoods, and other benefits) for ecosystem service and land conservation. The ELD 6+1 provides an understanding of how biophysical degradation of land translates into an economic cost, with a view to informing case-based study analyses towards the identification of the most economically desirable SLM option(s). The 6+1 steps are summarized in Table 3.

This approach is consistent with the concept of LDN promoted under SGD 15 and is supported by the Offering Sustainable Land Use Options (OSLO) consortium. It has been tested, to variable extents, to assess the value of land at multiple levels: nationally, across Africa and Asia, as well as globally (ELD, Initiative 2015a; Mirzabaev et al., 2015). The approach provides a guide on the use of CBA, combined with qualitative assessments for context-specific dimensions (i.e., biophysical, cultural, legal, political, social and technical), to assess the full societal value of land, including those values that normally remain underestimated. Through CBA, the total economic benefits of SLM (e.g., derived by increased crop production and productivity, or by the establishment of alternative livelihood activities and creation of new markets) are compared to the costs of action (e.g., investment and operation costs of land rehabilitation or restoration).

Table 3: **The ELD 6+1 steps methodological approach to assess the economics of land management (adapted from ELD Initiative, 2015b)**

Step	Description
1. Inception	Identification of the scope, location, spatial scale, and strategic focus of the ecosystem services valuation, based on stakeholder consultations and the preparation of background materials on the socio-economic and environmental context of the assessment.
2. Geographical characteristics	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 categorized into agro-ecological zones and analyzed through a Geographical Information System (GIS).
3. Types of ecosystem services	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).
4. Roles of ecosystem services and economic valuation	Establishment of the link between 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. Assessment of the distribution of benefits across social groups at multiple levels. Estimation of the Total Economic Value (TEV) for each ecosystem service.
5. Patterns and pressures	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. Revision of previous steps if needed, to ensure the assessment is as comprehensive as possible.
6. Cost-benefit analysis and decision making	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 changes lead to net benefits. (‘Action’ scenarios include land management changes that can reduce or remove degradation pressures). Mapping of net benefits for identification of the locations for which land management changes are suitable from an economic perspective. This will lead to the identification of “on-the-ground” actions that are economically desirable.
“+1”. Take action	Facilitating and implementing 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.

By comparing results between alternative scenarios, the costs of land degradation are measured as the opportunity costs of the loss of ecosystem services that occur in a business-as-usual scenario compared to an hypothetical scenario exemplified by a full restoration of land. Such opportunity costs indicate the benefits "foregone" when land is degraded (ELD Initiative, 2015a; Quillérou and Thomas, 2012). By looking beyond the short-term gains of land use and considering the future rewards of SLM, such analyses aim to inform the identification of financial and economic incentives to be promoted by policy and decision makers towards the fight against land degradation and the achievements of the SDGs.

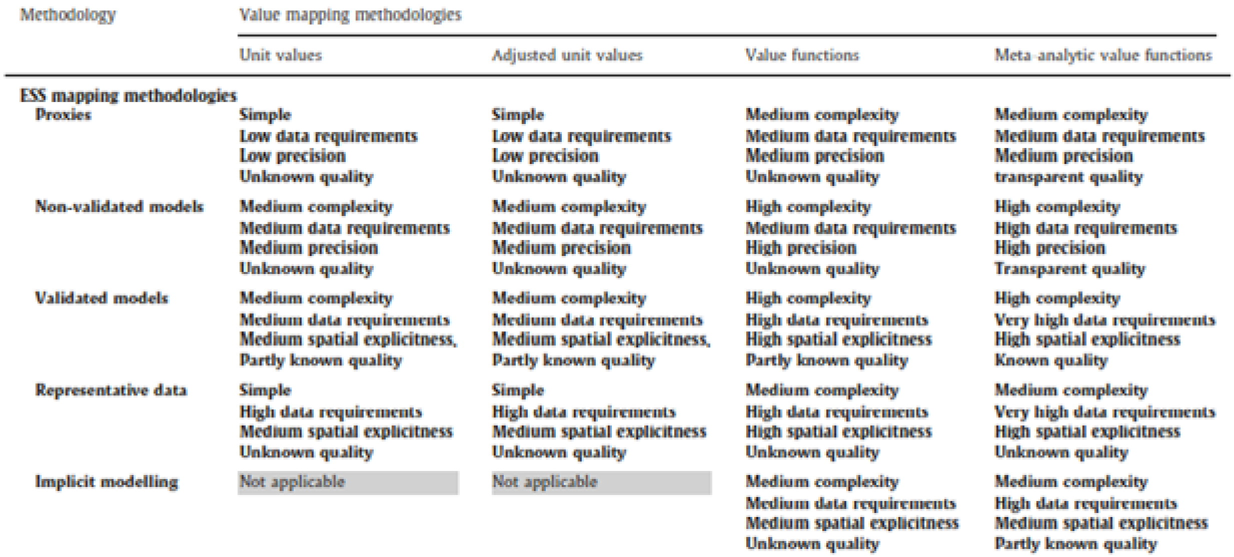
3. RESULTS

As outlined in Section 2, over 5,000 studies have assessed the monetary value of land and its ecosystems. This section summarizes key results at multiple levels, i.e., global and national, and outlines the range of monetary-based mechanisms applied by policy and decision makers towards the fight against land degradation. This paper does not aim to expand the systematic reviews listed in Table 1, but intends to extract significant results (i.e., selected according to their relevance and scale as classified by the original authors) that can guide discussions on the role of economic valuation in policy making (see Section 4). Case study examples are chosen to alternatively illustrate how economic valuation results can feed into policy, or to highlight key constraints in reaching this goal.
While major differences are observed in the valuation and incentive methods applied, the literature widely recognizes that the value of land is important. The costs of land degradation are high, and the costs of action to promote SLM are notably lower than the long term benefits generated, both in terms of monetary rewards and positive societal impacts (ELD Initiative, 2015a; Costanza et al., 2014; Nkonya et al., 2015; Bateman et al., 2013).

3.1 Global and national estimates of economic loss due to land degradation

Wide variations in the estimated global costs of land degradation are observed in the literature; this is due to a number of factors (Schägner et al., 2013). Firstly, the valuation methods applied vary extensively, ranging between the use of simplistic approaches – using land use and cover data as a proxy for ecosystem service supply - and sophisticated methods, integrating a range of spatial variables, validated against primary data in order to derive ecosystem service models and value functions. Secondly, variations depend on spatial heterogeneity in the biophysical and socioeconomic conditions being assessed. Alternative spatial scopes of analysis are often combined with varying structural premises and ecosystem service focus (i.e., different number of biomes valued in each study), posing considerable challenges in the capacity to compare, aggregate and scale up the values derived from different studies. Through in-depth analysis of 69 publications including 79 case studies, Schägner et al. (2013) identified five methodologies used for mapping ecosystem service supply - namely, (i) one-dimensional proxies, (ii) non-validated models, (iii) validated models, (iv) representative data of the study area, and (v) implicit modeling within a monetary value transfer function. They also identified four methodologies for distributing values across the study area – specifically, (i) unit values, (ii) adjusted unit values, (iii) value functions, and (iv) meta-analytic value function transfers. The advantages and disadvantages of the combined use of these methodologies are summarized in Table 4. We refer to Schägner et al. (2013) for a detailed outline and discussion of each methodology.

Table 4: Evaluation of methodologies for ecosystem service assessment (source: Schägner et al., 2013: 42)



Methodology	Value mapping methodologies			
	Unit values	Adjusted unit values	Value functions	Meta-analytic value functions
ESS mapping methodologies				
Proxies	**Simple** **Low data requirements** **Low precision** **Unknown quality**	**Simple** **Low data requirements** **Low precision** **Unknown quality**	**Medium complexity** **Medium data requirements** **Medium precision** **Unknown quality**	**Medium complexity** **Medium data requirements** **Medium precision** **transparent quality**
Non-validated models	**Medium complexity** **Medium data requirements** **Medium precision** **Unknown quality**	**Medium complexity** **Medium data requirements** **Medium precision** **Unknown quality**	**High complexity** **Medium data requirements** **High precision** **Unknown quality**	**High complexity** **High data requirements** **High precision** **Transparent quality**
Validated models	**Medium complexity** **Medium data requirements** **Medium spatial explicitness,** **Partly known quality**	**Medium complexity** **Medium data requirements** **Medium spatial explicitness,** **Partly known quality**	**High complexity** **High data requirements** **High spatial explicitness** **Partly known quality**	**High complexity** **Very high data requirements** **High spatial explicitness** **Known quality**
Representative data	**Simple** **High data requirements** **Medium spatial explicitness** **Unknown quality**	**Simple** **High data requirements** **Medium spatial explicitness** **Unknown quality**	**Medium complexity** **High data requirements** **High spatial explicitness** **Unknown quality**	**Medium complexity** **Very high data requirements** **High spatial explicitness** **Unknown quality**
Implicit modelling	Not applicable	Not applicable	**Medium complexity** **Medium data requirements** **Medium spatial explicitness** **Unknown quality**	**Medium complexity** **High data requirements** **Medium spatial explicitness** **Partly known quality**

This section provides examples of value variations based on studies focusing at the global and national levels. Globally, the estimated annual costs of degradation range between US$ 40 billion (LADA, 2009), and US$ 20 trillion (Costanza et al., 2014). LADA (2009) focused on multiple indicators grounded on satellite data and existing global databases, which include net primary productivity, rainfall use efficiency, aridity index, rainfall variability and erosion risk. Costanza et al. (2014) assessed the direct and indirect values of 17 ecosystem services for 16 marine and terrestrial biomes using the benefit transfer approach. According to the ELD Initiative, global losses of ecosystem services due to land degradation cost between 6.3 and 10.6 trillion US$ annually, representing 10–17 % of the world's GDP (ELD Initiative, 2015a). These costs are distributed unevenly throughout human populations, with negative impacts mostly affecting the vulnerable rural poor. According to Nkonya et al. (2015), the annual global cost of land degradation due to Land-Use Change and Land-Cover Change (LUC-LCC) and lower cropland and rangeland productivity accounts for roughly US$ 300 billion. With Sub-Saharan Africa accounting for the largest share of these costs (i.e., 22%), it is noted that 62% of the costs related to (LUC-LCC) (accounting for 78% of the US$ 300 billion loss) is borne by the final consumers benefitting from ecosystem services, i.e. the farmers.

Estimates of the future values of ecosystem services by the year 2050 were produced by the ELD Initiative for three existing sets of global scenarios (Costanza et al., 2015; Bateman et al., 2013; Raskin et al., 2002) under four alternative land-use scenarios based around the four following archetypes of the "Great Transition Initiative" (Hunt et al., 2012; ELD Initiative, 2015a): (i) Market Forces (MF), i.e., economic and population growth based on neoliberal free market assumptions; (ii) Fortress World (FW), i.e., nations and the world becoming fragmented, inequitable, and heading towards temporary or permanent social collapse; (iii) Policy Reform (PR), i.e., a continuing economic growth but with assumptions about the need for government intervention and effective land policy; and (iv) Great Transition (GT), i.e., a transformation that overcomes limits to conventional GDP growth and focuses on environmental and social well-being and sustainability.

As shown in Figure 2, in the period 2011-2050 the future total values under the MF and FW are estimated to decrease by USD 36.4 and USD 51.6 trillion a year, respectively. In PR a small increase (i.e., USD 3.2 trillion a year) is expected, while in GT thanks to the strong policy focus on SLM and social well-being, the value increased by USD39.2 trillion a year. These findings reaffirm the need to promote adequate policy measures in order to sustain the socio-economic value of our land in the future, otherwise the losses produced will grow at alarming rates.

Figure 2: Global total annual flow of ecosystem service 2050 values under four transition scenarios (source: ELD Initiative, 2015a: 72)

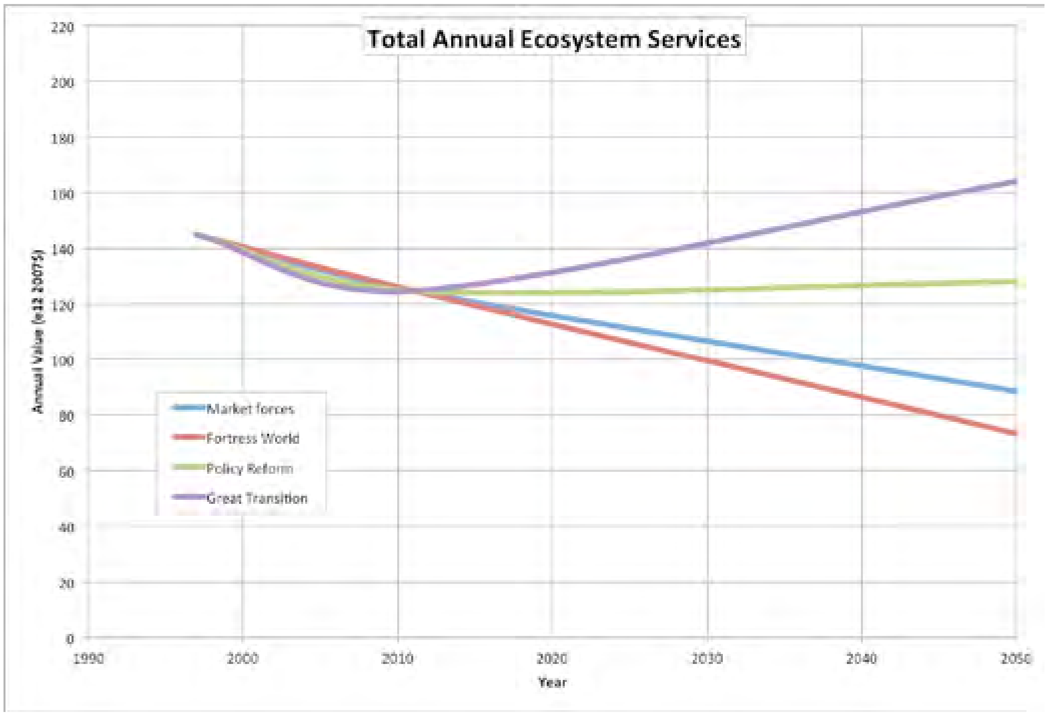
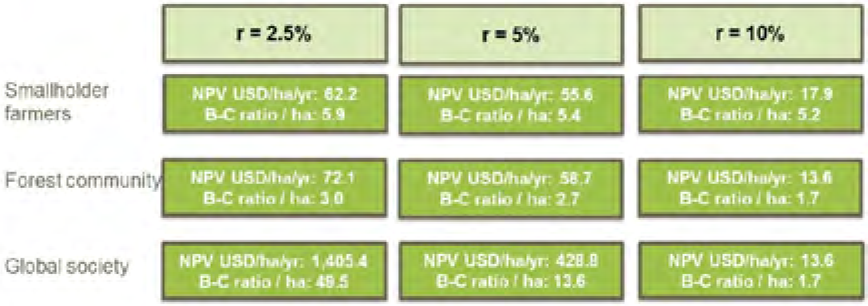


Figure 3: Net benefits of agroforestry and reforestation scenarios in the Kelka forest watershed, Mopti (source: Sidibé et al., 2014:14).



	r = 2.5%	r = 5%	r = 10%
Smallholder farmers	NPV USD/ha/yr: 62.2 B-C ratio / ha: 5.9	NPV USD/ha/yr: 55.6 B-C ratio / ha: 5.4	NPV USD/ha/yr: 17.9 B-C ratio / ha: 5.2
Forest community	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: 13.6 B-C ratio / ha: 1.7
Global society	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

When the hypothetical results are compared between the FW and GT scenarios, it is shown that adoption of SLM can provide an additional USD 75.6 trillion annually across the 2 billion hectares of land currently degraded worldwide (ELD Initiative, 2015a).

These costs, and the derived benefits of SLM, have also been estimated at national levels by multiple studies, with findings that mirror those of the global-level, reported above. An *ex-ante* CBA of the carbon sequestration potential of large-scale agroforestry and reforestation scenarios was performed in the Kelka forest in Mali. By integrating productivity change, avoided cost, replacement cost, and market-based valuation methods, the study suggests that the benefits of large-scale landscape restoration in the study area largely outweigh the costs, both at the local and global levels, when discounted at 2.5, 5, and 10% for a time horizon of twenty-five years (Sidibé et al., 2014). Agroforestry provides the highest per hectare return on investment to smallholders: between USD 5.2 to USD 5.9 of benefits for every dollar invested, accounting for a Net Present Value (NPV) ranging between USD 17.9 and USD 62.2 per hectare per year (see Figure 3). The societal value of the forest landscape restoration scenario is significantly larger when integrating the global benefits from enhanced carbon sequestration: these account for up to USD 13.6 of benefits for every dollar invested (at a discount rate of 5%), equivalent to a value of USD 428.8 / ha/year.

Myint and Westerberg (2015) carried out an *ex-ante* CBA of large-scale rangeland restoration within the Zarqa River Basin in Jordan through the Hima system (i.e., traditional pastoralist rangeland management based on communal sharing). The valuation methods used included a combination of stated preference, avoided costs, replacement cost and market prices approaches. The economic analysis (built on remote sensing, GIS, and biophysical soil and water assessment tools) allowed for the assessment of the impact of land use changes on forage availability, ground water infiltration, carbon sequestration, and sediment stabilization. The study found that, over a twenty-five-year horizon, the potential benefits of large-scale rangeland restoration outweigh the costs of such an action. The NPV benefit to pastoral communities accounts for USD17 million at a discount rate of 5%, while the benefit-cost ratio is 2.1, indicating that pastoral communities could enjoy two dollars of benefit for every dollar they invest in implementing rangeland restoration through the Hima system. When the benefits associated with groundwater infiltration and carbon sequestration are considered for the Jordan society as a whole, the NPV accounts for up to USD200 million. These findings aim to inform the development of a mix of regulatory and economic policy incentives to promote rangelands restoration in Jordan, which, as recommended by the study, include the following: to improve land tenure rights, cross-compliance schemes to finance the costs of action should be used; unconditional fodder subsidies should be rethought, while new integrated ones focused on SLM should be developed; extension services should be increased; voluntary contractual payments for ecosystem service (PES) agreements should also be considered as a valuable option. The extent to which these recommendations have been implemented is discussed in Section 4.

Kirui and Mirzabaev (2015) found that in Tanzania and Malawi the annual costs of degradation account for, respectively, USD2.5 and USD0.3 billion, and represent roughly 15% and 10% of their GDP. Over a thirty -year timeframe, the costs of action towards SLM are estimated to be lower than the costs of keeping a business-as-usual scenario (or inaction) by 3.8 times in Tanzanian and 4.3 times in Malawi. Similar findings are supported in Central Asia, where the annual cost of degradation across Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan are estimated at USD6 billion, with the costs of action outweighing those of inaction by a factor of five (Kirui and Mirzabaev, 2015).

3.2 Policy incentives and market-based mechanisms to promote SLM

A mix of policy instruments has been traditionally employed in land use public governance, including (i) command-and control instruments directly affecting land use, e.g., protected areas; (ii) policies influencing land-based activities, e.g., agriculture or forestry; and (iii) policies indirectly affecting land use, e.g., macroeconomic, trade and fiscal measures (Mather, 2006; Lambin et al., 2014). The latter are primarily informed by price signals and require a thorough understanding of the costs and benefits of action and inaction across scales (i.e., achieved through the methods outlined in the previous sections), so that a mix of financial and economic incentives can be designed and implemented to promote a fairer distribution of the value of environmental services generated for society as a whole. These instruments aim to reduce market failures in land use, with a view to managing the public supply of ecosystems more effectively and allow all land users to benefit from reduced land degradation rates and fewer externalities (Bryan, 2013; Farley and Costanza, 2010).

A range of Incentive and Market-Based Mechanisms (IMBMs) for SLM are promoted by the UNCCD and other international organizations and initiatives. These are summarized in Table 4 and include: (i) public payment schemes, i.e., contract farmland set-asides, payments for investments in conservation, permanent conservation easements, taxes and environmental fees, and subsidies; (ii) open trading under regulation, i.e., conservation banking, trading of emissions reductions, in-lieu fee mitigation, and tradable pollution rights; (iii) self-organized private deals, i.e., payments for ecosystem services, purchase of development rights, and voluntary carbon offsets; and (iv) eco-labelling and certification of products and services.

Table 4: Incentive and Market-Based Mechanisms (IMBMs) for SLM (source: adapted from CATIE and GM, 2012; ELD Initiative, 2015a and ADB, 2015)

1. PUBLIC PAYMENTS

Mechanism	Description
Contract farmland set-asides	Land owners receive a payment to give away the right to use part or all of their farmland in order to deliver environmental benefits.
Payments for investments in conservation	Governments provide payments, based on the investments made per unit of area, to promote SLM.
Permanent conservation easements	Legal agreements promoted by government agencies which permanently limit the use of a given area of land with a view to protecting its ecological values. Examples include national and regional parks and reserves.
Taxes and environmental fees	Fiscal policy tools aimed at addressing market failures by increasing the price of activities which have harmful environmental impacts. Negative externalities (or "harms" to society) are internalized into market prices so that consumers and producers consider these impacts in their decisions and minimize their environmental footprint.
Subsidies	Direct subsidies provided by government to particular firms and sectors encourage environmental protection and the use of SLM technologies.

2. OPEN TRADING UNDER REGULATION

Mechanism	Description
Conservation banking	Compensating for environmental damage caused by land development through a banking system that manages parcels of land and sells credits to projects that foster conservation.
Trading of emissions reductions	Tradable pollution permits are set according to a total pollution goal/allowance and distributed. Examples include carbon-trading mechanisms such as the Clean Development Mechanism, EU Emission Trading System.
In-lieu fee mitigation	A permittee pays a fee to a third party (i.e., public agency or non-proft organization) instead of conducting project-specific mitigation or buying credits from a conservation bank. The fees collected are used to finance compensation projects.
Tradable pollution rights	A cap is set for pollution emissions or ambient pollutant concentrations in a region. Those who reduce their pollutants below thresholds can sell credits to others who cannot meet restrictions.

3. SELF-ORGANISED PRIVATE DEALS

Mechanism	Description
Payments for ecosystem services	Incentives (i.e., conditional payments to voluntary providers) offered to landowners or farmers in exchange for managing their land so that it provides certain ecosystem services. These include deals between ecosystem service providers (e.g., upstream farmers or forest landholders) and private companies or governments (e.g., a bottler of natural mineral water or provider of hydroelectric utilities) to promote upstream land management practices that ensure a certain quantity or quality of water to be delivered downstream.
Purchase of development rights	Development rights purchased by an interested party (e.g., local community) to provide financial compensation to landowners for not developing their land. These are obtained through a legal easement that restricts development on the land.
Voluntary carbon offsets	Carbon offsets voluntarily purchased by individuals, governments or companies to balance out their own carbon footprints.

4. ECO-LABELLING AND CERTIFICATION

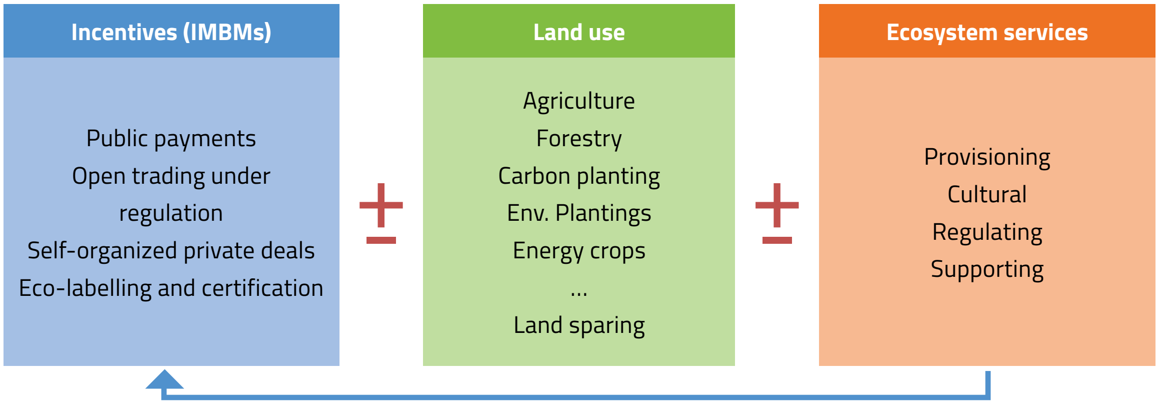
Mechanism	Description
Eco-labels and certification of products and services	Eco-labels are certified through standard processes (e.g., though the International Organization for Standardization, FairTrade Foundation, or Forest Stewardship Council) and are used to measure the sustainability of certain food and consumer products. Payments for ecosystem services are embedded in these products with the aim to incentivize the purchasing of eco-sensitive commodities.

3.3 Impacts of IMBMs and financial policy interventions as drivers of land use change

The use of IMBMs and financial policy interventions informed by economic valuation tools is not straightforward, and their impacts on land and ecosystems might vary between being positive (i.e., co-benefits), negative (i.e., trade-offs), or even perverse (i.e., opposite of what was intended) (Bryan and Crossman, 2013). Figure 4 outlines the key linkages between IMBMs, land use and ecosystem services. It is shown that financial incentives and IMBMs can have synergies (+) or tensions (-) in changing land use and management. As a result, various co-benefits (+) and trade-offs (-) may be generated across multiple ecosystems. These relationships are non-linear and vary across space and time, therefore they are difficult to predict. The bottom arrow shows that when changes in the supply of ecosystem services occur, this impacts on IMBMs (e.g., prices) (Bryan, 2013).

As stressed in Section 1, global prices of land are notably lower than their real value to society. A detailed understanding of the linkages, as outlined above, is needed to design more effective policy instruments that can help enhance equity in land ownership. Ziqubu et al. (2010) examined the impacts of land reforms on farmland values and agricultural commodity prices in South Africa. While the promotion by the South African government of a "willing seller willing buyer regime" (i.e., where beneficiaries are provided with grants for the purchase of land) has positively influenced the demand for farmland, results were noted to be slow. Monetary sector variables (i.e., monetary supply and exchange rate) were found to impact on commodity prices and input costs. It is reported that the market value of farmland under maize, sugar cane and deciduous fruit production differs significantly from its productive value.

Figure 4: Linkages between IMBMs, land use and ecosystem services (source: adapted from Bryan, 2013)



Overall, the land values analyzed were significantly impacted by fluctuations in agricultural commodity prices, with impacts also varying depending on the variable interest rates being charged. Weersink et al. (2011) assessed the changes in the price of farmland in Ontario, Canada, and linked them to changes in the price of land rents and farmers' income earning potential. The study stressed the important role played by interest rates and rental rates in determining the price of rural farmland and noted that, historically, high land rents and low interest rates have placed an upward pressure on land prices.

Osano et al. (2011) estimated land prices and opportunity costs of conservation across 174 land purchases in the Western Cape Province in South Africa, and stressed that reliable information on the costs and benefits of SLM interventions is key to the success of policy measures. Biodiversity conservation is strictly dependent on the variability in economic factors as well as on ecological criteria. Two approaches were used to estimate the opportunity costs of biodiversity conservation, including: (i) the use of net present income values, such as potential returns from the most profitable alternative land use; and (ii) the estimation of the land acquisition (i.e., purchase) costs, or the difference in the price of land under uses that are more or less favorable to conservation. These monetary values are proposed to inform the development of policy measures that include conservation easements and payments for biodiversity services, with a view to ensuring that the opportunity costs of conservation are covered in the application of these IMBMs. The study noted that opportunity costs are highest in critically endangered areas of high biological value, where higher payments for biodiversity services could, for example, be generated.

4. DISCUSSION

Since the 1990s the discourse on ecosystem service valuation has been increasingly promoted to influence environmental policy, with a view to fostering sustained economic growth and ecosystem conservation towards the achievement of international development goals (i.e., the Millennium Development Goals and the SDGs) (Section 1). As a result, economic valuation is now widely perceived by scientists and policy makers as a powerful approach to inform land management decisions (Bateman et al., 2013; Costanza et al., 1997; ELD Initiative, 2015a; Favretto et al., 2016). Under a TEV perspective, focus is directed at the range of trade-offs among competing land use sectors, such as agriculture, tourism and industry; investments in land resources have strong implications for the health of the world's ecosystems and their multiple values (i.e., direct and indirect) affecting society as a whole (Section 2.1). A number of complex and interrelated factors are identified as drivers of land degradation. While "proximate" drivers such as topography, climate, and soil characteristics are relatively well understood, the "underlying" drivers of degradation are less so. These include: a growing population, increasing urbanization rates, poverty distribution and land tenure security. This review shows that economic factors are among the major drivers of land use and land use change, in combination with the other drivers outlined above. The failure to internalize the environmental costs of commodity markets (i.e., across primary, manufacturing and tertiary sectors) in land use decisions results in increasing levels of degradation and socio-economic inequality (The Economist, 2011; Oakland Institute, 2011a). Long-term sustainability is often traded by the world's most profitable industries, as they tend to favor short-term gains for the benefit of shareholders. Results show that if these industries had to pay for the environmental damage produced by their activities, they would face costs that would vastly outweigh their revenues. As estimated by the TEEB, the costs to cover the environmental impacts of the cattle ranching and farming sector would account for 710% of its revenues globally, followed by wheat farming (400%), cement manufacturing (120%), coal power generation (110%) and iron and steel mills (60%) (TruCost, 2013). When these costs are not internalized by the producers, a considerable financial burden is placed on the public sector, which might face serious difficulties in implementing land policies that can effectively fight degradation and conserve ecosystems, particularly when public funds are tight.

With land becoming a new kind of asset class, a growing number of investors are looking to place their liquidity into it, with the expectation of exponentially rising long-term returns (The Economist, 2011). Trends in global markets and the global economy are likely to affect land prices, ownership and distribution, raising concerns about the impacts that large-scale land consolidation will generate when poor small-holders move away (Oakland Institute, 2011a; Cotula et al., 2009). The valuation literature analyzed calls for the adoption of sustainable practices to reverse and halt degradation by investing in SLM, providing evidence of tangible economic benefits, as well as broader societal benefits (Section 3).

Economic approaches assist in recognizing the interlinkages between the proximate and underlying drivers of degradation, with a view to identifying optimal solutions within diverse geographical and socio-economic realities. A range of examples in the application of innovative IMBMs is found in the US, where governments promote the development and institutionalization of policies that integrate ecosystem service economic assessments into planning, investment and regulatory contexts to help maintain community resilience (US Government, 2015). Through the US voluntary Wetlands Reserve Federal Program (WRP) initiated in the 1990s, guidance and incentives similar to the PES schemes are provided to private landowners, across a total area of 930,000 hectares, with a view to restoring wetlands in agricultural lands (US Government, 2011). Evaluation in the Mississippi River Valley under the WRP indicates that public expenditure was surpassed by social value within one year of implementation (Jenkins et al., 2010). Through programmes implemented by the US Department of Agriculture (USDA), in 2007, a total of 4% of US farmland enjoyed conservation status.

Under the Conservation Reserve Federal Programme (CRP) initiated in the 1980s, payments mechanisms are established to incentivize farmers to maintain plant cover and ecosystem health. As estimated by the USDA, the CRP resulted in reduced phosphorus and nitrogen pollution, soil erosion and improved carbon sequestration (Molnar and Kubiszewski, 2012). Similarly, under the Florida Ranchlands Environmental Services Project (FRESP), cattle ranchers are paid by state agencies to increase water storage and reduce nutrient loading in their land management. Such incentives aim to discourage the development of more intensive agriculture via the disbursement of an amount of public funds estimated to be lower than that needed to achieve the same goals through infrastructural investments (*ibid*).

It must however be noted that the capacity to put in place effective IMBMs is often complicated by land tenure issues, particularly in developing countries with weak governance and insecure land tenure (Egoh et al, 2012). Insecure tenure results in lower adoption of SLM, as well as limited opportunities to set up well-functioning IMBMs and markets for land and corresponding ecosystems (Cotula et al., 2009; Egoh et al, 2012). Through a review of sixty land deals concluded by foreign investors between 2000 and 2009 across developing countries, the International Institute for Sustainable Development (IISD) produced a policy tool to support contract negotiation with a sustainable development lens. The need to recognize and respect land rights was stressed as a key component of operation, e.g., through the establishment of set-aside contracts that allow farmers to maintain ownership of their land while achieving conservation goals (Smaller, 2014). The IISD found that crucial aspects to be considered in land deals include the rights of the investor to use and access the project site, and the total area of land under concession (as well as options to expand or reduce the area). The latter is considered to be of critical importance, given the growing trend of communal rights being transferred to private investors. IMBMs can inform policy-makers on the alternative farming and investment models that can support economically profitable and socially acceptable large foreign-owned investments in land, through the establishment of "hybrid" rights models. For example, the IISD identified annual rental payments on land as a tool commonly used in the contracts analyzed, which can allow governments to establish a market value on the lands being leased and provide incentives for productive use. Alternatively to paying a fixed rent, revenue-sharing agreements between investors and local communities are indicated as effective tools to promote inclusive business models, where a percentage of monthly turnovers is transferred from the investor to the community (Mirza et al., 2014). Other mechanisms, such as the outgrower schemes (or contract farming), allow private large-scale land ownership to be enforced while retaining public and communal rights of access and use. Based on the analysis of thirty-nine deals covering 150,000 outgrowers, the World Bank found that outgrower schemes create a higher amount of jobs per hectare (on a ratio of 1:3) in comparison to private plantations (ratio 1:19), and also enhance transfer of technology and know-how (e.g., on farming and irrigation techniques and yield improvement) (Mirza et al., 2014). These findings are of particular relevance in the context of the increasing global levels of conflict and migration driven by major climatic, socio-economic and demographic challenges. The promotion of SLM informed by the use of economic mechanisms can help address some of these unprecedented challenges, e.g. by securing land productivity and maximizing job creation as a step towards providing better local opportunities for communities dependent on land.

In terms of broader limitations, most of the past economic studies on land degradation have failed to consider the complexity of degradation impacts by focusing on simpler relationships (e.g., soil erosion and implications for yields) (Laurans et al., 2013). Moreover, gaps occur in how knowledge can be explicated or contextualized. As observed by Laurans et al. (2013), out of 313 studies reviewed on ecosystem service valuation, only eight (2%) took utilization as a central subject. Such "supply-side" logic of providing economic evidence, combined with the high variability of the estimates provided across studies, as well as the difficulties in planning the future impacts of IMBMs (Section 3), pose clear challenges in the integration of economic valuation into policy. According to the integrated, quantitative analysis carried out by Bryan and Crossman (2013) on the interaction of multiple IMBMs, and their impacts across multiple ecosystem services, it was revealed that while some integrated incentives provide positive outcomes, some others may generate negative tensions (Section 3.3). For example, biodiversity payments in South Australia were found to augment a carbon price to enhance biodiversity conservation, but also to generate negative influence on agricultural production and fresh water. Tensions were also observed in the CRP programme presented above, which paid users to set land aside some agricultural use, whilst other Federal subsidies were provided to support agricultural production.

After three decades of research, gaps in our understanding of the economics of land still need to be addressed, particularly on the following questions: (i) how do we define the "true" economic value of land and measure it accurately and reliably (Quillérou and Thomas 2012; Pagiola et al. 2005), and (ii) how do we promote policies that integrate multiple types of values and dimensions of human well-being with the complex and interrelated drivers of land degradation, whilst also considering the distributional biases of markets and the equity and fairness implications across space and time (Wegner and Pascual, 2011)?

Policy is not always grounded on rational monetary thinking, and political decisions might be influenced by political agendas and pressures exerted by multiple interest groups (Laurans and Mermet, 2014). Under such a paradigm, an improved understanding of ecosystems values and trade-offs in land use can help rationalize decisions and reveal hidden values that would otherwise remain unseen. Economic mechanisms can serve as powerful "influence-making" tools to raise awareness and aid in the defense of certain decisions towards enhanced land and ecosystem service conservation.

For instance, political science literature on framing, agenda-setting and knowledge utilization analyzed the impact of ecological economics on the formulation of problems and measures in the Dutch environmental policy agenda (Boezeman et al., 2010). Alternating policy frames between 1972 and 2007 in the Netherlands resulted in varying levels of temporary integration of specific ecological economics concepts into the policy agenda. In line with these findings, the chances of adoption of land economics concepts into policy depend on three key interrelated variables: (i) good-quality rhetoric about the concept; (ii) coalition building and advocacy towards the concept's popularization across the scientific and policy arenas; and (iii) contextual factors, such a "match" between the concept proposed and the dominant policy frame (ibid). Additionally, policy mainstreaming must be accompanied by delivery mechanisms that enable knowledge to be transformed into action (Molnar and Kubiszewski, 2012). Stakeholder engagement and capacity building are key components towards the delivery of concrete outcomes. For example, as a result of the economic valuation of the Hima system conducted by the International Union for Conservation of Nature (IUCN) in Jordan with support of the ELD Initiative (Section 3.1), the government has revisited its rangeland policy, and launched an official Jordanian Rangeland Strategy, in 2015. Based on this progress, IUCN, in partnership with the Jordanian government, replicated the model in a sylvo-pastoral area in the Southern governorates in the country, and initiated a PES scheme funded by the International Fund for Agricultural Development of the United Nations. Operations are grounded in the economic evidence provided by the study, which indicates that rangelands biodiversity conservation can provide important benefits to society. Modalities have been implemented to ensure that the costs of direct local on-site investments are shared among the upstream rangeland users and the downstream users who will enjoy future off-site benefits, such as better ground water recharge and availability, reduced reservoir siltation, and the avoided cost of land restoration. In line with these measures, support has been provided towards the preparation of the National Action Plan to Combat Desertification 2015-2020. A "Sustainably Investing in the Jordan Rangeland" plan has also been promoted in the form of reports and policy briefs in order to upscale the knowledge implemented at the local level towards the promotion of large-scale, sustainable investments across vast rangeland areas in the Jordan Badia and mountains.

Finally, economic incentives must ensure that land management is undertaken with a long term perspective driven by societal needs. Careful attention is needed on the distribution of the costs and benefits of SLM interventions across individual stakeholder groups, i.e., the poor and/or indigenous communities. In addition to valuing the amount of absolute benefit a group might receive, it is key to understand the wider implications of that benefit for the livelihood strategies pursued by each group (Pagiola et al 2005). More broadly, this review has shown that success factors go beyond considerations on the demand- and supply-side of land economics, and include a range of national-level (e.g., institutional capacity, governance and macroeconomics), and local-level (e.g., land tenure and environmental know-how) aspects (CATIE and GM, 2012). In terms of global development perspectives, while LDN is a global target, concrete progress will have to be built through the aggregate impacts of local and national-level actions (ELD Initiative, 2015a). Increased empirical evidence of the economic value of land can help in defining clearer directions, as well as increase policy mainstreaming of SLM and implementation on the ground, towards the achievement of the voluntary targets set by individual countries. Further research, stakeholder engagement and capacity building facilitated by multi-scale initiatives such as the ELD, TEEB or WAVES (Section 1) could be instrumental in ensuring a stronger representation of SLM in the SDGs, with a crucial impetus for LDN (Mirzabaev et al 2015; UNCCD, 2016).

5. CONCLUSIONS

The capacity to protect fertile soils and restore degraded land across the globe underpins the achievement of a range of post-2015 development policy objectives, as reflected in SDG 15, and particularly in target 15.3 on LDN. Ensuring a sustained delivery of land-related ecosystems across degraded and currently degrading areas is vital in order to allow for the delivery of broader societal benefits, including poverty eradication, water and energy security, gender equality and enhanced economic opportunities. Economic valuation of land and its derived ecosystems, as promoted by scientists and policy makers, offers an effective tool to inform and foster more sustainable land use and management decisions. It provides an increased understanding of the costs and benefits of competing land use options, with a view to helping the identification and promotion of SLM practices. This paper reviews existing information on the economic tools and frameworks used to value land and foster SLM, and presents evidence on the multiple mechanisms available in economic policy to implement optimal decisions from an economic lens. A number of environmental valuation methods, incentives and market-based mechanisms have been used with some levels of success, e.g., allowing for improvements of yields, establishing alternative livelihood activities, enhancing levels of conservation in protected areas, and mainstreaming land economics into national policies and strategies. However challenges remain when it comes to bridging the gaps between the opportunities these tools offer, policy implementation and practice, and in scaling up successful SLM interventions. With most of the past economic studies on land degradation focusing on simpler relationships such as soil erosion and yields, the capacity to explicate or contextualize economic knowledge, or, further, to transform it into concrete actions is often hampered by the complexity of the proximate and underlying factors of degradation, particularly the weak governance in developing countries and inadequate legal and institutional frameworks. There is a need to promote policies that integrate multiple types of values and dimensions of human well-being with the complex and interrelated drivers of land degradation, whilst also considering the distributional biases of markets, as well as equity and fairness implications across space and time.

The efforts to harmonize the existing knowledge on land economics, and to promote further research, stakeholder engagement and capacity building is facilitated by a number of multi-scale initiatives such as the ELD, TEEB and WAVES. These can prove instrumental in encouraging a stronger representation of SLM within the SDGs, with a view to fostering the achievement of LDN across the developed and developing world.

6. ACKNOWLEDGEMENTS

We thank the staff of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), United Nations Convention to Combat Desertification (UNCCD) and United Nations University Institute for Water Environment and Health (UNU-INWEH) for their support. R. Thomas acknowledges support from the CGIAR Research Program on Dryland Systems.

7. REFERENCES

Adamowicz WL. 2004. What's it worth? An examination of historical trends and future directions in environmental valuation. The Australian Journal of Agricultural and Resource Economics 48(3), 419-443.

ADB, 2015. Investing in Natural Capital for a Sustainable Future in the Greater Mekong Subregion. Bangkok: GMS Environment Operations Center.

Adhikari B, Nadella K. 2011. Ecological economics of soil erosion: a review of the current state of knowledge. Annals of the New York Academy of Sciences 1219(1), 134–152.

Bateman IJ, Harwood AR, Mace GM, Watson RT, Abson DJ, Andrews B, Binner A, Crowe A, Day BH, Dugdale S, Fezzi C, Foden J, Hadley D, Haines-Young R, Hulme M, Kontoleon A, Lovett AA, Munday P, Pascual U, Paterson J, Perino G, Sen A, Siriwardena G, van Soest D, Termansen M. 2013. Bringing ecosystem services into economic decision-making: Land use in the United Kingdom. Science 341(6141), 45–50.

Boezeman D, Leroy P, Maas R, Kruitwagen S. 2010. The (limited) political influence of ecological economics: a case study on Dutch environmental policies. Ecol. Econ. 69, 1756–1764.

Bryan BA. 2013. Incentives, land use, and ecosystem services: Synthesizing complex linkage. Env. Sci. Pol. 27, 124-134.

Bryan BA, Crossman ND. 2013. Impact of multiple interacting financial incentives on land use change and the supply of ecosystem services 4, 60-72.

CATIE and GM. 2012. Incentive and market-based mechanisms to promote sustainable land management: Framework and tool to assess applicability. Cartago/ Rome: CATIE / the Global Mechanism.

Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'neill RV, Paruelo J, Raskin RG, Sutton P, van den Belt M. 1997. The value of the world's ecosystem services and natural capital. Nature 387(6630), 253–260.

Costanza R, de Groot R, Sutton P, van der Ploeg S, Anderson S, Kubiszewski I, Farber S, Turner RK. 2014. Changes in the global value of ecosystem services. Global Environmental Change 26, 152–158.

Costanza R, Kubiszewski I, Cork S, Atkins PWN, Bean A, Diamond A, Grigg N, Korb E, Logg Scarvell J, Navis R, Patrick K. 2015. Scenarios for Australia in 2050: A synthesis and proposed survey. Journal of Future Studies 19(3), 49–76.

Costanza R, Kubiszewski I, Ervin D, Bluffstone R, Boyd J, Brown D, Chang H, Dujon V, Granek E, Polasky S, Shandas V, Yeakley A. 2011. Valuing ecological systems and services. F1000 Biology Reports 3, 14.

Cotula L, Vermeulen S, Leonard R, Keeley J. 2009. Land grab or development opportunity? Agricultural investment and international land deals in Africa. London/Rome: IIED/FAO/IFAD.

Crossman D, Burkhard B, Nedkov S, Willemen L, Petz K, Palomo I, Drakou E, Martin-Lopez B, McPhearson T, Boyanova K, Alkemade R, Egoh B, Dunbar MB, Maes J. 2013. A blueprint for mapping and modelling ecosystem services. Ecosystem Services 4, 4–14.

Dasgupta P., Heal G. 1974. The Optimal Depletion of Exhaustible Resources. The Review of Economic Studies 41, 3-28.

de Groot RS, Fisher B, Christie M, Aronson J, Braat L, Haines-Young R, Gowdy J, Maltby E, Neuville A, Polasky S, Portela R, Ring I. 2010. Integrating the ecological and economic dimensions in biodiversity and ecosystem service valuation. In: TEEB. ed. The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations. London/Washington: Earthscan.

Egoh B, Drakou EG, Dunbar MB, Maes J, Willemen L. 2012. Indicators for mapping ecosystem services: a review. Luxembourg: Publications Office of the European Union.

ELD Initiative. 2015a. The value of land: Prosperous lands and positive rewards through sustainable land management. Bonn: GIZ.

ELD Initiative. 2015b. ELD Initiative User Guide: A 6+1 step approach to assess the economics of land management. Bonn: GIZ.

Farley J, Costanza R. 2010. Payments for ecosystem services: from local to global. Ecological Economics 69, 2060–2068.

Favretto N, Luedeling E, Stringer LC, Dougill AJ. 2016. Valuing ecosystem services in semi-arid rangelands through stochastic simulation. Land Degradation & Development 28, 65-73.

Favretto N, Stringer LC, Dougill AJ, Dallimer M, Perkins JS, Reed MS, Atlhopheng JR, Mulale K. 2016. Multi-Criteria Decision Analysis to identify dryland ecosystem service trade-offs under different rangeland land uses. Ecosystem Services 17, 142-151.

Fish R, Burgess J, Chilvers J, Footitt A, Haines-Young R, Russel D, Turner K, Winter DM. 2011. Participatory and deliberative techniques to embed an ecosystems approach into decision-making. London: Defra.

Haberl H, Erb KH, Krausmann F, Gaube V, Bondeau A, Plutzar C, Gingrich S, Lucht W, Fischer-Kowalski M. 2007. Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems. PNAS 104(31), 12942–12947.

Hanley N, Shogren JF, White B. 1997. Environmental economics in theory and practice (2nd ed.). New York: Oxford University Press.

Hein L, van Koppen K, de Groot RS, van Ierland EC. 2006. Spatial scales, stakeholders and the valuation of ecosystem services. Ecological Economics 57, 209–228.

Hunt DVL, Lombardi DR, Atkinson S, Barber ARG, Barnes M, Bokyo CT, Brown J, Bryson J, Butler D, Caputo S, Caserio M, Coles R, Cooper RFD, Farmani R, Gaterell M, Hale J, Hales C, Hewitt CN, Jankovic L, Jefferson I, Leach J, MacKenzie AR, Memon FA, Sadler JP, Weingaertner C, Whyatt JD, Rogers CDF. 2012. Scenario Archetypes: Converging Rather than Diverging Themes. Sustainability 4(4), 740–772.

Jenkins WA, Murray BC, Kramer RA, Faulkner SP. 2010. Valuing ecosystem services from wetlands restoration in the Mississippi Alluvial Valley. Ecological Economics 69, 1051–1061.

Kenter JO, Brady E, Bryce R, Christie M, Church A, Irvine KN, Cooper N, Davies A, Evely A, Everard M, Fazey I, Hockley N, Jobstvogt N, Molloy C, O'Brien L, Orchard-Webb J, Ravenscroft N, Ranger S, Reed MS, Ryan M, Watson V. 2015. What are shared and social values of ecosystems? Ecological Economics 111, 86-89.

Kerstin N, Wytske C, Markus G. 2016. International Land Deals for Agriculture. Fresh insights from the Land Matrix: Analytical Report II. Bern, Montpellier, Hamburg, Pretoria: Centre for Development and Environment, University of Bern; Centre de coopération internationale en recherche agronomique pour le développement; German Institute of Global and Area Studies; University of Pretoria; Bern Open Publishing.

Kirui O, Mirzabaev A. 2015. Economics of land degradation and improvement in Tanzania and Malawi. In The Economics of Land Degradation and Improvement. Edited by Nkonya E, Mirzabaev A, von Braun J: Springer.

LADA. 2009. Assessing the status, causes and impact of land degradation. Land Degradation Assessment in Drylands (LADA) Fact Sheet. Italy: Food and Agriculture Organization of the United Nations.

Lambin EF, Meyfroidt P, Rueda X, Blackman A, Borner J, Cerutti PO, Dietsch T, Jungmann L, Lamarque P, Lister J, Walker NF, Wunder S. 2014. Effectiveness and synergies of policy instruments for land use governance in tropical regions. Global Environmental Change 28, 129–140.

Laurans Y, Mermet L. 2014. Ecosystem services economic valuation, decision-support system or advocacy? Ecosystem Services 7, 98–105.

Laurans Y, Rankovic A, Billé R, Pirard R, Mermet L. 2013. Review Use of ecosystem services economic valuation for decision making: Questioning a literature blindspot. Journal of Environmental Management 119, 208–219.

Liu S, Costanza R, Farber S, Troy A. 2010. Valuing ecosystem services: Theory, practice, and the need for a transdisciplinary synthesis. Annals of the New York Academy of Sciences 1185, 54-78.

MA. 2005. Ecosystems and Human Well-being: Current State and Trends. Millennium Ecosystem Assessment Vol. 1. Washington D.C: Island Press.

Martinez-Harms MJ, Balvanera P. 2012. Methods for mapping ecosystem service supply: a review. International Journal of Biodiversity Science, Ecosystem Services & Management 8, 17–25.

Mather AS. 2006. Land-use policies. In: Geist, H.J. (Ed.), Our Earth's Changing Land: An Encyclopedia of Land-use and Land-cover Change, Vol. 2. London: Greenwood Press.

Milcu A, Ioana J, Hanspach D, Abson D, Fischer J. 2013. Cultural ecosystem services: a literature review and prospects for future research. Ecology and Society 18(3), 44.

Mirza H, Speller W, Dixie G, Goodman Z. 2014. The practice of responsible investment principles in larger-scale agricultural investments: Implications for corporate performance and impact on local communities. Washington, D.C/New York: World Bank Group / United Nations.

Mirzabaev A, Nkonya E, von Braun J. 2015. Economics of sustainable land management Current Opinion in Environmental Sustainability 15, 9–19.

Molnar J, Kubiszewski I. 2012. Managing natural wealth: Research and implementation of ecosystem services in the United States and Canada. Ecosystem Services 2, 45–55.

Myint MM, Westerberg V. 2015. An economic valuation of a large-scale rangeland restoration project through the Hima system in Jordan. Nairobi/Bonn: International Union for Conservation of Nature / ELD Initiative.

Nkonya E, Anderson W, Kato E, Koo J, Mirzabaev A, von Braun J, Meyer S. 2015. The global costs of land degradation. In The Economics of Land Degradation and Improvement. Edited by Nkonya, E., Mirzabaev. A., von Braun J: Springer.

Nkonya E, Gerber N, Baumgartner P, von Braun J, De Pinto A, Graw V, Kato E, Kloos J, Walter T. 2011. The Economics of Desertification, Land Degradation, and Drought. Toward an integrated global assessment. Washington, DC: International Food Policy Research Institute.

Noel S, Soussan J. 2010. Economics of land degradation: Supporting evidence-base decision making. Methodology for assessing costs of degradation and benefits of sustainable land management. Bonn: The Global Mechanism of the UNCCD.

Oakland Institute. 2011a. Understanding land investment deals in Africa: Country report Ethiopia. Oakland: The Oakland Institute.

Oakland Institute. 2011b. Understanding land investment deals in Africa: Country report Mozambique. Oakland: The Oakland Institute.

Osano PM, Rouget M, Turpie J, Thuiller W, Balmford A. 2011. Estimating land prices and opportunity costs of conservation in a megadiversity country. Kenya: African Technology Policy Studies Network.

Pagiola S, von Ritter K, Bishop J. 2005. How much is an ecosystem worth?: Assessing the economic value of conservation. Washington, DC: World Bank.

Quillérou E, Thomas RJ. 2012. Costs of land degradation and benefits of land restoration: A review of valuation methods and suggested frameworks for inclusion into policy-making. CAB Reviews 7, 060.

Raskin P, Banuri T, Gallopin G, Gutman P, Hammond A, Kates R, Swart R. 2002. Great transition: The promise of lure of the times ahead. Somervi l le, Massachuset ts. USA: Stockholm Environment Institute.

Richardson L. 2015.The role of benefit transfer in ecosystem service valuation. Ecological Economics. Ecological Economics 115, 51–58.

Schägner JP, Brander L, Maes J, Hartje V. 2013. Mapping ecosystem services' values: Current practice and future prospects. Ecosystem Services 4, 33–46.

Sidibé Y, Myint M, Westerberg V. 2014. An economic valuation of agroforestry and land restoration in the Kelka Forest, Mali. Assessing the socio-economic and environmental dimensions of land degradation. Report for the Economics of Land Degradation Initiative, by International Union for Conservation of Nature, Nairobi, Kenya. Available at: www.eld-initiative.org.

Smaller C, Mann H, Bernasconi-Osterwalder N, Pinter L, McCandless M, Parry JE. 2014. The IISD guide to negotiating investment contracts for farmland and water. Canada: The International Institute for Sustainable Development.

Stringer LC, Thomas DSG, Twyman C. 2007. From global politics to local land users: applying the United Nations Convention to Combat Desertification in Swaziland. The Geographical Journal 173(2), 129-142.

TEEB. 2010. The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations. Edited by Kumar. P., London/Washington: Earthscan.

The Economist. 2011. The surge in land deals: When others are grabbing their land. The Economist 5 May 2011.

TruCost. 2013. Natural capital at risk: The top 100 externalities of business. London: TEEB for Business Coalition.

Turner KG, Anderson S, Gonzales-Chang M, Costanza R, Courville S, Dalgaard T, Dominati E, Kubiszewski I, Ogilvy S, Porfirio L, Ratna N, Sandhu H, Sutton PC, Svenning JC, Turner GM, Varennes YD, Voinov A, Wratten S. 2016. A review of methods, data, and models to assess changes in the value of ecosystem services from land degradation and restoration. Ecological Modelling 319, 190–207.

Turner RK, Paavola J, Cooper P, Farber S, Jessamy V, Georgiou S. 2003. Valuing nature: lessons learned and future research directions. Ecological Economics 46, 493/510.

UN General Assembly. 2015. Transforming our world: The 2030 agenda for sustainable development. Resolution adopted by the General Assembly on 25 September 2015. A/RES/70/1. New York: United Nations.

UNCCD. 2015. Reaping the rewards: Financing land degradation neutrality. Bonn: United Nations Convention to Combat Desertification.

UNCCD. 2016. Land in Balance The Scientific Conceptual Framework for Land Degradation Neutrality. Bonn: United Nations Convention to Combat Desertification Science-Policy Brief 02.

US Government. 2011. Restoring America's Wetlands: A Private Lands Conservation Success Story. Washington D.C.: Department of Agriculture Natural Resources Conservation Service.

US Government. 2015. Incorporating ecosystem services into federal decision making. Washington D.C.: Executive Office President of the US.

WAVES. 2014. Botswana - Natural Capital as a Diversification [Online]. Available from: http://www.wavespartnership.org.

Weersink A, Deaton BJ, Bryan J, Meilke K. 2011. Farmland Prices. Canadian Agricultural Trade Policy and Competitiveness Research Network Trade Policy Brief. Guelph: University of Guelph.

Wegner G, Pascual U. 2011. Cost-benefit analysis in the context of ecosystem services for human well-being: A multidisciplinary critique. Global Environmental Change 21, 492–504.

Zhang W, Pagiola S. 2011. Assessing the potential for synergies in the implementation of payments for environmental services programmes: an empirical analysis of Costa Rica. Environmental Conservation 38, 406–416.

Ziqubu M, Tennassie N, Mainardi S. 2010. An examination of the relationships between farmland values, agricultural commodity prices, and land reform issues in South Africa. Journal of Interdisciplinary Economics 22(3), 203-218.

GLOBAL
LAND
OUTLOOK WORKING PAPER

United Nations
Convention to Combat
Desertification