CIAT Working Document No. 226

Bringing the economics of land degradation back to the farm level:

A conceptual framework for addressing the costs and benefits of sustainable land management

CIAT
International Center for Tropical Agriculture
Since 1967 / Science to cultivate change

Centro Internacional de Agricultura Tropical

International Center for Tropical Agriculture

Apartado Aéreo 6713

Cali, Colombia

Phone: +57 2 4450000

Fax: +57 2 4450073

E-mail: lucy@environment-group.org

Website: www.ciat.cgiar.org

CIAT Working Document No. 226

August 2014

Bringing the economics of land degradation back to the farm level: A conceptual framework for addressing the costs and benefits of sustainable land management / Lucy Emerton -- Cali, CO : Centro Internacional de Agricultura Tropical (CIAT), 2014.
13 p. – (Working Document No. 226)

Correct citation

Emerton L. 2014. Bringing the economics of land degradation back to the farm level: A conceptual framework for addressing the costs and benefits of sustainable land management. CIAT Working Document No. 226. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. 13 p.

Bringing the economics of land degradation back to the farm level: A conceptual framework for addressing the costs and benefits of sustainable land management

Lucy Emerton*

This paper was commissioned by the International Center for Tropical Agriculture (CIAT) in order to contribute to the knowledge base on the economics of land degradation, and feed into the development of a conceptual framework for incorporating economic approaches into sustainable land management projects. It synthesises and reviews information on the costs and benefits of sustainable land management, and discusses how recent developments in the economics of land degradation offer a set of tools and insights that can assist in the planning of more equitable, effective, and sustainable land management interventions. To these ends, a stepwise approach is proposed for assessing farm-level actions to tackle the social and economic drivers of land degradation, capture and redistribute the costs and benefits associated with sustainable land management, and enhance the monetary and non-monetary payoffs to farmers from the application of such techniques, technologies, and practices.

Posing the challenge: Towards more joined-up economic thinking

The recognition that land degradation is not solely a technical or technological problem, but is fundamentally economic in its causes, effects, and potential solutions, is hardly a novel insight (Barbier, 1997). An extensive (and often rather bewildering) body of literature now exists on the economics of land degradation. This encompasses many different models, methodologies, and case studies. For the most part, these different approaches, however, remain somewhat fragmented and disconnected from each other. While each addresses a key part of the land degradation equation, it is sometimes difficult to discern exactly how the various pieces fit together into a coherent whole.

As a result, conservation and development decision makers are often left struggling to understand how economics can be best used to assist in tackling the problems associated with land degradation, or what it adds in terms of improving the effectiveness of the actions that are undertaken in support of sustainable land management. It is perhaps hardly surprising that economic concerns have tended to be only weakly reflected in the planning of sustainable land management projects – or that the resulting interventions have often failed to adequately address the wider economic factors underlying land degradation (Bojö, 1991) or result in solutions that are economically viable, equitable, and sustainable for land managers (Giordano, 2003; Pretty and Shah, 1997). A key challenge remains: to foster more practical, policy-relevant, and "joined-up" economic thinking that brings together these different – and often rather disparate – approaches into an integrated framework that can be used to inform sustainable land management planning and implementation.

This paper addresses these issues. It unpacks the core elements in the economic analysis of sustainable land management interventions, and proposes a stepwise approach for integrating economic approaches into project planning. Reflecting CIAT's focus on developing technologies, methods, and knowledge that "better enable farmers, mainly smallholders, to enhance eco-efficiency in agriculture," the paper is concerned primarily with farm-level sustainable land management interventions in agricultural landscapes.

* Environmental Economist. Director Economics & Finance. Environment Management Group, Sri Lanka.
E-mail: lucy@environment-group.org

Understanding the monetary payoffs to the farmer

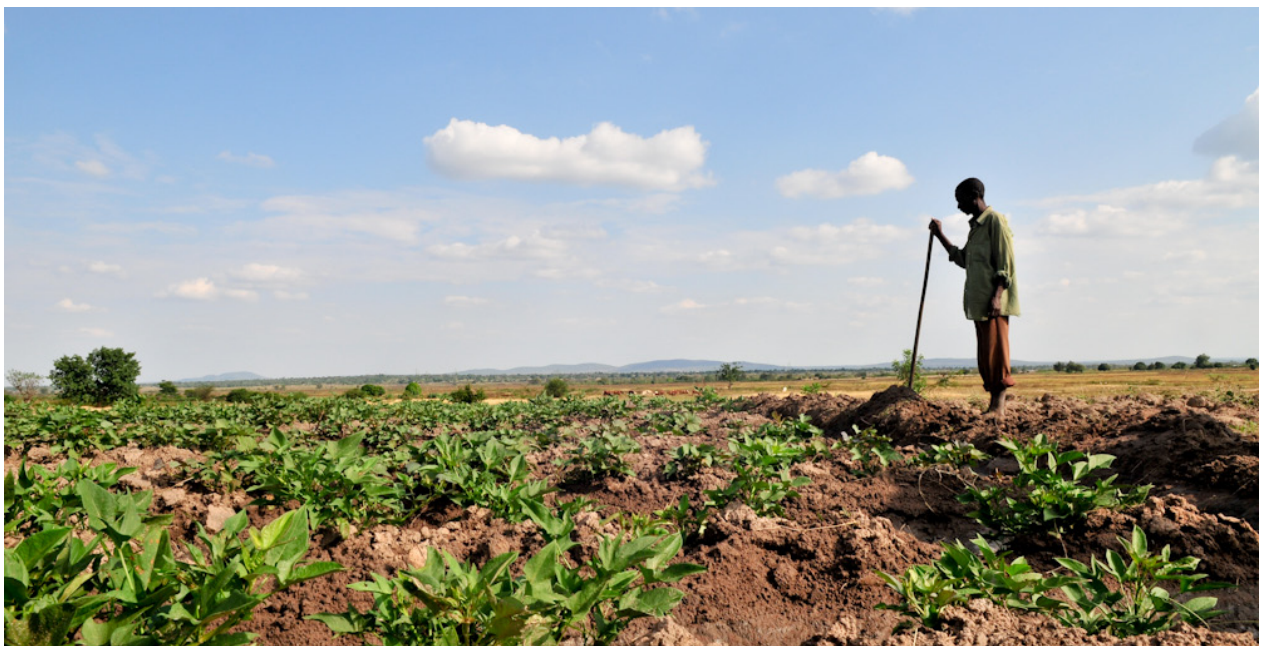
It is perhaps self-evident that sustainable land management interventions should be profitable for the farmer who is expected to adopt them: as a standalone activity and relative to alternative (unsustainable) land uses, technologies, and management practices (Mazvimavi, 2011). A first step in the economic analysis of sustainable land management interventions is, therefore, usually to identify, quantify, and compare these farm-level costs and benefits.

While this might seem so obvious and basic a step as to be unnecessary to mention, it is, nonetheless, a critical one. The issue of ensuring that interventions are feasible and attractive in financial terms from the perspective of their intended beneficiaries is one that has all too often been underplayed, or omitted altogether, in sustainable land management planning (Tisdell, 1996). There is ample evidence of a long history of unsuccessful interventions designed to encourage (or even demand) the adoption of sustainable land management practices by farm households, mainly based on coercive regulatory approaches (Jones, 2009). Many of these actions failed either to improve farmers' livelihoods or to reverse land degradation problems because their design and selection did not take account of the need to be financially viable at the farm level (Barungi and Maonga, 2011; Lovo, 2013; Mangisoni, 2009; Nakhumwa and Hassan, 2012), or consider that the costs to farmers of undertaking sustainable land management might outweigh the benefits generated (Iiyama et al., 2010).

Although both the different components of farmers' earnings and expenditures and the key determinants of financial viability will, of course, vary in different contexts, some common factors emerge. The idea of the economic viability of sustainable land management practices and technologies as being shaped by higher yields and/or improved income possibilities is mentioned repeatedly in the literature (see, for example, Orr and Ritchie, 2004; Sauer and Tchale, 2006). Effective cost is also singled out as being a decisive factor, with market access and input prices exerting a powerful influence on whether a particular technology or technique is taken up (Chinangwa, 2006; Tchale and Wobst, 2004). Careful analysis of the various elements that enter into the cost and benefit equations that affect farmers' land management decisions is essential.

Going beyond cash income and expenditures

Analysis of economic viability (and, by implication, likelihood of adoption) does not stop at comparing the cash income and expenditures associated with different land management options. While a positive monetary return is almost always a necessary



condition for a farmer to be willing – and able – to take up a particular practice or technology, by itself it is rarely sufficient. Economic viability depends upon a wide variety of factors which include, but are not limited to, cash returns (Tisdell, 1996); for example, the stability and certainty of earnings, the input requirements of the farming system, the alternative earnings and opportunities that are diminished or foregone by a shift in land management regime, the type of product or output that is generated, and the farmers' own tastes, aspirations, and preferences. It is not just the quantity of costs and benefits that are important, but their quality, nature, and form.

Identifying and understanding non-monetary elements of the profit-loss equation is an important step in the economic analysis of sustainable land management interventions. Although, as is the case with cash costs and benefits, these obviously vary greatly in different places, and under different circumstances, there are certain recurrent themes. Opportunity costs, for example, are frequently cited as being a particularly important determinant of uptake. This particularly concerns the ability of resource-poor farmers to reallocate inputs and assets away from other productive uses and towards sustainable land management (FAO, 2001; liyama et al., 2010). Additional labour requirements are often identified as being an especially critical factor in the choice to adopt or reject a particular sustainable land management technology or practice (Barungi and Maonga, 2011; Chinangwa, 2006). Cashflow and liquidity constraints are other important concerns (Chirwa, 2008; Marenya et al., 2012). In other words, it is not just the overall increase in output or income that is of interest, but the balance and timing of production that can be readily transformed into earnings to offset household expenditure needs; there is often a premium attached to cash earnings as compared to non-marketed output.

Linked to this, time preference is highlighted as a key factor by many authors, both with respect to the immediate costs of shifting to sustainable land management practices and the rate at which its benefits accrue, as well as in relation to how far into the future the costs associated with land degradation are perceived to lie. Thus, smallholder farmers may in some cases be overexploiting soil quality stock or failing to invest in soil conservation technologies because they have a high time preference; that is, they value current consumption more than their future consumption and wellbeing (Nakhumwa and Hassan, 2012; Yirga and Hassan, 2010). Particularly for poorer households, land conservation strategies with low initial costs and short payoff periods are more likely to be adopted (Giordano, 2003). Farmers' perceptions of risk are also mentioned as a major factor influencing the uptake of sustainable land management practices. Smallholder farmers are typically characterised as risk averse in terms of their preferences for sustainable land management technologies (Marenya et al., 2012; Ngwira et al., 2013) and as regards their response to the expected returns from the adoption of new technologies and land management practices (Kassie et al., 2008; Simtowe, 2006; Zeller et al., 1997).

Tracing the economic drivers of land management decisions

The preceding paragraphs have underlined the importance of factoring farm-level costs and benefits into the planning of sustainable land management interventions. However, there has often been scant attention paid to understanding the broader physical, human, policy, and institutional landscape within which farming takes place, or to addressing the underlying structural conditions and factors that determine land management decisions in the first place (Gebremedhin, 2004; Giordano, 2003). Farmers do not produce, consume, and invest in a vacuum: they respond (usually very logically) to the economic opportunities and constraints that they face as they go about their day-to-day business. A wide range of economic (and other) stimuli variously enable, encourage, or even force people to produce, consume, and invest in particular ways or at particular levels (Barbier, 1997). Understanding the signals that markets, prices, policies, institutions and social norms send to farmers about the most "profitable," "desirable," or "feasible" land management options is a key step in the economic analysis of sustainable land management actions (The World Bank, 1996). Of primary concern is to understand the underlying economic causes or drivers of land degradation, and identify the broader economic conditions that can help to foster and encourage sustainable land management.

Various examples can be found in the literature, which serve to illustrate the kinds of economic drivers that influence farmers' land management decisions. Local institutions and property rights typically have a major effect because they regulate land use and land management decisions, facilitate or inhibit collective action, and affect households' incentive and ability to invest in land management practices (Pender et al., 2006). Lack of secure land tenure and well-defined property rights among smallholder farmers, and particularly the unequal distribution of land, is often identified as a binding constraint to farmers investing in land improvements (Alamirew, 2011; Barungi and Maonga, 2011; Chirwa, 2008; Morey, 1986; Southgate, 1988; Stocking and Murnaghan, 2001; Yirga and Hassan, 2010).

Widespread poverty is also frequently cited as one of the most pervasive underlying economic causes of land degradation, incorporating a host of factors in addition to cash income, such as asset endowment, livelihood breadth and resilience, food security, social capital, and "voice" in decision making. It is argued that any effort to persuade farmers to engage in sustainable land management, without finding concrete solutions to the problems they face in terms of poverty, is futile (Mangisoni, 2009). In particular, there is repeated reference in the literature to the "vicious economic cycle" of low agricultural productivity, poverty, and land degradation. A host of underlying economic conditions have been identified, which bring about and sustain these vicious cycles (or, conversely, enable farmers to break out of them or to enter into so-called "virtuous cycles" or "upward spirals" [Pender et al., 2006]).

One factor that is commonly mentioned is the weak, exploitative, and unfavourable agricultural input, output, credit, and labour markets that are argued to perpetuate the low farm returns and chronic shortages of food and cash that force farmers into unsustainable land management practices (Munthali and Murayama, 2013; Sauer and Tchale, 2006). A great deal of attention has been devoted to understanding the ways in which poorly performing markets and distorted prices serve to both undermine farmers' livelihoods and make sustainable land management options unprofitable (Nakhumwa and Hassan, 2012; Tchale and Wobst, 2004). Ironically, these distortions are often the result of public policies, which – although originally geared towards improving agricultural production and income, or stimulating growth in other sectors of the economy – serve as "perverse incentives" by encouraging farming practices that lead directly to land degradation (Barbier, 1996; Boardman et al., 2003; Giordano, 2003). Erratic pricing policies, agricultural subsidies, and an overvalued exchange rate have, for example, all been argued to have distorted the incentives of poor smallholders away from adopting sustainable farming systems (Barbier, 2000). There is also evidence that the effects of price reforms and trade liberalisation have served to exacerbate land degradation by undermining farm profits and crowding farmers out of the agricultural input market (Chinsinga, 2008; Smale and Jayne, 2003; Sauer and Tchale, 2006).

Articulating economic impacts for other sites, sectors, and groups

A major critique of these essentially micro-economic models is that they stop at the farm level. Focusing only on the direct, biophysical, or on-site effects of land degradation fails to acknowledge that a large part of the costs of land degradation (and the benefits of sustainable land management) typically accrues outside the farm (Boardman et al., 2003; Nkonya et al., 2011a). In fact, it is the presence of such externalities that provides the basic economic rationale for intervening in land management in the first place; one of the most fundamental reasons for externally led or outside-funded actions to address land degradation is the wish to secure broader social benefits or, conversely, to mitigate or avoid costs and losses to other sites, groups, and sectors (Baumol and Oates, 1988; Kirby and Blyth, 1987; Pagiola, 1999a,b).

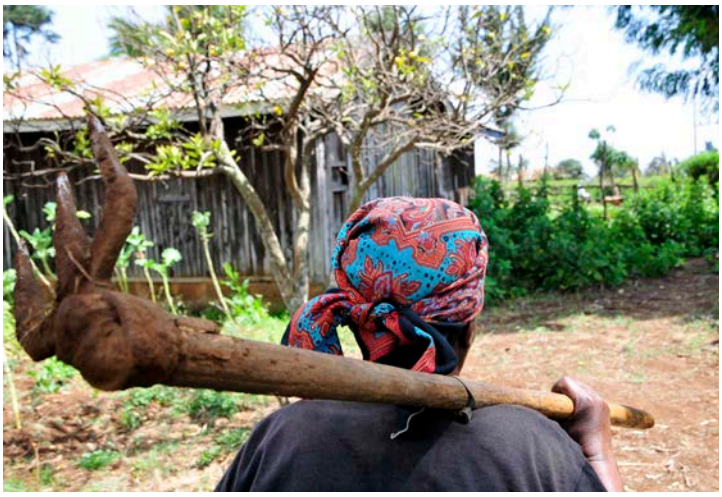
Until relatively recently, these wider economic values were largely taken as given, and were rarely included in the cost-benefit calculations used to inform sustainable land management projects. Over the last two decades there has, however, been a steady broadening in perspective. Considerable efforts have been made to quantify off-site costs and benefits, and especially to expand the scope of valuation beyond the direct physical products and marketed commodities to which economists have conventionally limited their analysis. During the 1980s and 1990s, parallel to the entry of

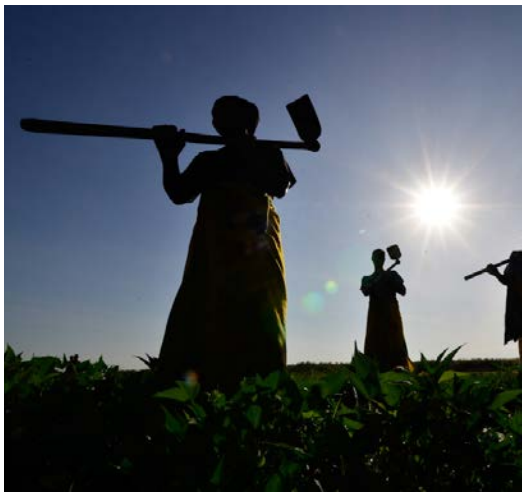
environmental economics into mainstream conservation and development thinking, a suite of methods were developed and came into common usage for valuing the off-site impacts of land degradation (see, for example, Barbier 1996, 1997; Clark, 1996; Dixon et al., 1990; Dreschel and Gyiele, 1999; Magrath, 1990; Morey, 1986; Mullen, 2001; Seckler, 1987).

A substantial evidence base has now accumulated, which provides monetary estimates of its local, national, and even global economic costs (see, for example, Barbier and Bishop, 1995; Coxhead, 1996; Pagiola, 1999a; Pimentel et al., 1995; Scherr and Yadav, 1996; Upstill and Yapp, 1987; The World Bank, 1996). This includes a large number of studies carried out in sub-Saharan African countries (see, for example, Abegunde et al., 2006; Bishop, 1995; Bojö, 1991; Bojö and Cassells, 1995; Chabala et al., 2012; Convery and Tutu, 1990; Eaton, 1996; Hein et al., 2008; Holmberg, 1990; Iiyama et al., 2010; Kaggwa et al., 2009. Majule et al., 2012; Mangisoni, 2009; Mazvimavi, 2011; Nakhumwa and Hassan, 2012; Norse and Saigal, 1992; Sauer and Tchale, 2006; Selassie and Belay, 2013; Sutcliffe, 1993; Xinshen Diao and Sarpong, 2007; Yaron et al., 2011).

The past few years have seen something of a resurgence of interest in environmental valuation, especially as concepts such as "green economy," "natural capital," and "economics of ecosystems and biodiversity" have taken hold and gained influence among the international research and development community (see, for example, TEEB, 2008, 2010; Turner and Daily, 2008; UNEP, 2011). Major advances have been made in incorporating these approaches into the discourse surrounding land degradation (see, for example, Chabala et al., 2012; ELD Initiative, 2013; Hein, 2006; Jones, 2009; Low, 2013; Majule, et al., 2012; Nkonya et al., 2011a,b, 2013; Poulsen, 2013; SCBD et al., 2013; von Braun et al., 2012). Whereas earlier valuation studies tended to consider only a relatively limited range of costs and losses (mainly those incurred by the agricultural and water sectors from soil erosion and nutrient loss), the "new" economics of land degradation is based on a far more comprehensive framework that articulates the value of ecosystem services for human wellbeing (Millennium Ecosystem Assessment, 2005a). This allows for a much broader range of land management benefits and impacts to be incorporated into economic analysis (and, typically, results in much higher economic value estimates); for example, pollination and pest control, water flow and quality regulation, mitigation of natural hazards and disasters, climate adaptation, carbon sequestration, recreational values, nutrient cycling, protection of wild species and habitats, aesthetic and landscape values, and so on (Low, 2013; Millennium Ecosystem Assessment, 2005b).

Renewed efforts are also being made to use the economic valuation of off-site or economy-side impacts to "make the case" for actions to address land degradation. This responds to a series of very practical concerns, namely the critical shortage of funding, continuing policy inaction, and apparently low political will to address land degradation. The assumption is that this state of affairs results from limited knowledge of the costs related to land degradation and weak appreciation of the potential benefits to be gained from more sustainable land





management on the part of decision makers (Low, 2013; Poulsen, 2013; Nkonya et al., 2011a, 2013). Valuing the economic costs and losses associated with land degradation is seen as a way of providing a powerful (and often much-needed) argument in support of increasing the level of public and private investment in sustainable land management (Jones, 2009). The logic is that, far from being a problem that only affects crop yields and farm profits, land degradation should be seen as something that gives rise to economic impacts that stretch across local, national, regional, and even global boundaries (Low, 2013; Nkonya et al., 2011a). Furthermore, it is argued that the investments required to prevent or reverse land degradation will, in most cases, be far lower than the benefits that can be obtained (von Braun et al., 2012) – or, indeed, the costs that society and the economy will ultimately incur if land degradation is permitted to continue unchecked. The key message is that neither the onus for financing sustainable land management actions nor the gains arising from these investments lie only with the farmers on whose lands degradation occurs. It is demonstrably to the advantage of governments and other agencies that are concerned with public or global interests, as well as off-site actors that feel the impacts of land degradation, to ensure that such measures are implemented (Ibrahim et al., 2012).

Weighing up the gainers and losers, gaps and imbalances

It is clear that there has been a progressive widening of focus in economic approaches to land degradation – from more conventional farm-level models of production, consumption, and resource allocation, through analysis of the underlying economic forces and conditions that drive farmers' land management decisions, to the current preoccupation with valuing changes in the supply of ecosystem services to other sites, sectors, and groups. These various levels of analysis, however, usually remain quite separate from each other. There is a tendency for economic studies to focus either on the micro-level of the farm or the macro-level of the wider economy. Yet some of the most useful insights come only when these different perspectives and interests are compared and considered together.

This is because the primary economic challenge associated with reaching sustainable land management outcomes is one of overcoming the uneven spatial, temporal, and socio-economic distribution of land management costs and benefits, and reaching effective trade-offs that balance the gaps between private and social interests, short- and long-term goals, and on- and off-site impacts (Morey, 1986; Mullen, 2001; Tanui et al., 2013). While the costs of controlling land degradation tend to be immediate and are incurred almost exclusively on-site, the benefits of sustainable land management typically build up more slowly and accrue to a wide range of other groups in addition to farmers (Giordano, 2003). Not only is this asymmetry of benefits and costs inequitable, but it is rarely economically efficient or sustainable (Hein et al., 2008). There is no reason why farmers (who are often among the poorest and most marginal groups) should subsidise the provision of economically valuable ecosystem services to others (especially when the beneficiaries are relatively affluent, or are gaining considerable value-added and costs avoided from their consumption or use of these services). In most cases farmers will be unwilling – and often also economically unable – to do so (Pagiola, 1999b; Shiferaw and Holden, 2000).

Being able to shed light on where, for whom, and in what form such imbalances are manifested provides important information for planning sustainable land management actions. It indicates where there are needs, niches, and opportunities to use economic and financial instruments to fill these gaps, align private and social costs and benefits and, ultimately, provide incentives and financing for sustainable land management (TEEB, 2008, 2010). On the one hand, this type of analysis shows where farmers face a net loss from shifting to sustainable land management practices, even when the economic impact of these actions is positive in terms of the overall effects on society (or, of course, the opposite: where farmers' actions, even though privately profitable, are leading to broader social costs and losses). In such instances, efforts to fill the economic gap that results from these unrewarded actions, uncompensated costs, or unpenalised damages is both warranted and required. Even where sustainable land management actions are clearly and unambiguously in the private interest of the farmer, the fact that off-site benefits

are simultaneously being generated may also be grounds to argue that some form of redistributive mechanism is justified in order to remunerate or otherwise reward these actions. By the same token, if valuable services are being gained at low or zero cost by off-site beneficiaries or are generating large economic surpluses for them, this may indicate that there is a niche or opportunity to tap into this uncaptured value so as to provide some kind of cash or in-kind payment, transfer, or funding back to the farmer, in support of sustainable land management.

Leveraging incentives and finance for sustainable land management

It cannot be emphasised too strongly that the ultimate aim of economic analysis is to contribute towards more informed decision making, which will in turn result in more equitable, effective, and sustainable land management interventions. The intention is to help to change the economic conditions and circumstances that cause farmers to degrade land, and instead set in place the opportunities and rewards that will make sustainable land management a more economically viable, desirable, and profitable option. Experiences from a large number of projects suggest that the main problem to be overcome in sustainable land management projects is not the lack of technologies *per se*, but the absence of economic incentives to adopt (Jones, 2009; Kaggwa et al., 2009; Pandey, 2006) and the critical shortage of investment and funding for actions to address land degradation (Nkonya, 2011a,b; von Braun et al., 2012).

Bringing together on-site, off-site, and distributional aspects of economic analysis points to the kinds of concrete instruments that can generate finance and incentives for sustainable land management. It also allows for their feasibility, appropriateness, and "fit" to a particular set of economic conditions, constraints, and opportunities to be assessed. Unfortunately, most economic analyses stop short of doing this. As a result, policies aimed at promoting sustainable land management have generally not been based on a diagnosis of the causes of divergence between private incentives and social returns (Jones, 2009), nor have they explicitly attempted to better realign them (Pagiola, 1999a). Yet, however great the economic costs of land degradation or benefits of sustainable land management actions are demonstrated to be in

theory, this has little meaning unless it translates into real changes in the economic conditions and opportunities that farmers face as they go about their day-to-day business. Along similar lines, however convinced decision makers are that it is in the public interest to take action against land degradation, this will have only a minor impact unless the groups that are directly involved in managing land have adequate incentive and perceive there to be sufficient gains from doing so.

Traditionally, interventions to address land degradation were heavily biased towards command-and-control approaches, often backed up by some kind of subsidy or public payment scheme funded by donor projects and transfers from central government (Jones, 2009). These arrangements frequently proved to be ineffective or unsustainable over the long term due to weak enforcement capacity, uncertain availability of public funds, and their failure to provide positive incentives for farmers to effect long-term changes in land management practices (Gebremedhin, 2004; Kirby and Blyth, 1987; Shiferaw and Holden, 2000). Today, price and market-based instruments have gained in popularity, particularly those that encourage private investment and application of the user-pays principle and that are based on developing the markets and economic opportunities, allowing farmers to add value to or achieve price premiums from sustainable land management practices and products (Ibrahim et al.,2012). Examples include payments for ecosystem services, such as carbon sequestration or watershed protection, eco-labelling and certification of sustainable products and services, conservation and development easements and offsets, the provision of targeted or preferential credit and investment capital, and fiscal incentives, such as tax breaks and exemptions or relief on export and import duties. Although it is beyond the scope of the current paper to provide a detailed description of these instruments, a large number of documents are available, which offer further guidance and examples of how economic and financial instruments can be applied to support land management interventions (see, for example, ELD Initiative, 2013; Ibrahim et al., 2012; Jones, 2009; TEEB, 2008, 2010).

A framework for incorporating economic approaches into sustainable land management projects

This paper has outlined the various economic approaches that are used to describe, explain, and analyse land degradation. Integrating these perspectives and insights provides the kind of "joined-up" economic thinking that can assist in planning for more equitable, effective, and sustainable projects. Incrementally and in combination, they allow for a picture to be built

1 Monetary and non-monetary payoffs to the land manager	Understanding the financial, economic, and social costs and benefits to the farmer of shifting to sustainable land management (SLM) from existing land management practices
2 Economic drivers of land management decisions	Describing the economic conditions that constrain, discourage, or disempower farmers from investing in or benefiting from SLM and those that encourage, enable or empower it
3 Economic impacts for other sectors, sites, and groups	Tracing through how land management improves or undermines economically valuable services for other sectors, sites, and groups
4 Gainers and losers, gaps and imbalances	Weighing up who gains and loses from shifting to SLM, determining how, why, and for whom actions remain unrewarded, costs, uncompensated, damages unpenalised, and/or values uncaptured
5 Instruments to capture and redistribute values for SLM	Identifying viable policy, market, price, investment, and other mechanisms that can provide finance and incentives for SLM, and overcome the root economic causes of land degradation

up of the complex array of economic factors that drive land management decisions, and for decision-support information to be generated on the types of economic and financial instruments that are required to enable, encourage, and empower sustainable land management at the farm level.

An initial step is to **assess the monetary and non-monetary returns to the farmer from different land management options.** It is clearly necessary to establish whether or not sustainable land management is likely to be an economically viable and attractive choice, as a standalone activity and in comparison to alternative, environmentally degrading practices.

Following on from this, it is necessary to understand the **economic conditions that drive land management decisions** and shape how farmers produce, consume, and invest. This provides essential information to assist in tackling the factors that encourage or force land degradation, or act as barriers and constraints to more sustainable land management.

Building on micro-level farm analysis, valuation of **the costs of land degradation and benefits of sustainable land management for other sectors, sites, and groups** helps to identify where there is an economic rationale for intervening in land management. It can provide a convincing, and much-needed, argument to public and private decision makers as to why it is in their interests to invest in sustainable land management.

Analysis of the distribution of costs and benefits over space and time, and between different groups, allows for the **economic imbalances that arise from a shift to sustainable land management to be weighed up, and for gainers and losers to be identified.** This shows where there are needs, niches, and opportunities to use economic and financial instruments to address the asymmetries and fill the gaps left by the unrewarded actions, uncompensated costs, unpenalised damages, or uncaptured values associated with sustainable land management.

Last but not least is to use the findings of the economic analysis to **identify concrete instruments and mechanisms that can be used to provide incentives and financing for sustainable land management,** and to assess their feasibility, appropriateness, and "fit" to a particular set of economic conditions, constraints, and opportunities. The ultimate intention is to set in place the conditions under which sustainable land management becomes a more economically viable, desirable, and profitable option for farmers.

References

Abegunde A; Adeyinka S; Olawuni P; Oluodo O. 2006. An assessment of the socio-economic impacts of soil erosion in South-Eastern Nigeria. Paper presented at XXIII International Federation of Surveyors Congress, Munich, Germany. 15 p.

Alamirew B. 2011. The impact of poverty, tenure security and risk on sustainable land management strategies in northern central Ethiopia: Analysis across three agro-ecological zones. Journal of Sustainable Development in Africa 13(1): 227–240.

Barbier E. 1996. The economics of soil erosion: Theory, methodology and examples. Paper based on a presentation to the Fifth Biannual Workshop on Economy and Environment in Southeast Asia. Special Papers, Singapore. 29 p.

Barbier E. 1997. The economic determinants of land degradation in developing countries. Philosophical Transactions of the Royal Society 352:891–899.

Barbier E. 2000. The economic linkages between rural poverty and land degradation: Some evidence from Africa. Agriculture, Ecosystems and Environment 82(1–3):355–370.

Barbier E; Bishop J. 1995. Economic values and incentives affecting soil and water conservation in developing countries. Journal of Soil and Water Conservation 50(2):133–137.

Barungi M; Maonga B. 2011. Adoption of soil management technologies by smallholder farmers in central and southern Malawi. Journal of Sustainable Development in Africa 13(3):28–38.

Baumol W; Oates W. 1988. The theory of environmental policy. Cambridge University Press, Cambridge and New York. 299 p.

Bishop J. 1995. The economics of soil degradation: An illustration of the change in productivity approach to valuation in Mali and Malawi. LEEC Discussion Paper 95–02. International Institute for Environment and Development (IIED), London, England.

Boardman J; Poesen J; Evans R. 2003. Socio-economic factors in soil erosion and conservation. Environmental Science & Policy 6:1–6.

Bojö J. 1991. The economics of land degradation: Theory and applications to Lesotho. Dissertation for the doctor's degree in Economics, Economic Research Institute, Stockholm School of Economics, Stockholm. 352 p.

Bojö J; Cassells D. 1995. Land degradation and rehabilitation in Ethiopia: A reassessment. AFTES Working Paper No. 17. The World Bank, Washington DC, USA.

Chabala L; Kuntashula E; Hamukwala P; Chishala B; Phiri E. 2012. Assessing the value of land and costs of land degradation in Zambia. The Global Mechanism; Stockholm Environment Institute, University of Zambia. 93 p.

Chinangwa L. 2006. Adoption of soil fertility improvement technologies among smallholder farmers in southern Malawi. MSc Thesis. Department of International Environment and Development Studies (Noragric), Norwegian University of Life Sciences, Norway. 78 p.

Chinsinga B. 2008. The Malawi Fertiliser Subsidy Programme: Politics and pragmatism. Policy Brief 022, Future Agricultures Consortium. University of Sussex, Brighton. 8 p.

Chirwa EW. 2008. Land tenure, farm investments and food production in Malawi. Discussion Paper Series No. 18. Department for International Development; Institutions and Pro-Poor Growth (IPPG); University of Manchester, UK. 19 p.

Clark R. 1996. Methodologies for the economic analysis of soil erosion and conservation. CSERGE Working Paper GEC 96-13. Centre for Social and Economic Research on the Global Environment, University of East Anglia, Norwich, UK. 71 p.

Convery F; Tutu K. 1990. Evaluating the costs of environmental degradation: Ghana – Applications of economics in the environmental action planning process in Africa. Environmental Institute, University College Dublin, Ireland.

Coxhead I. 1996. Economic modeling of land degradation in developing countries. Agricultural and Applied Economics Staff Paper Series No. 385, University of Wisconsin-Madison, USA. 33 p.

Dixon J; James D; Sherman P, eds. 1990. Dryland management: Economic case studies. Earthscan, Abingdon, UK. 292 p.

Dreschel P; Gyiele L. 1999. The economic assessment of soil nutrient depletion: Analytical issues for framework development. Issues in Sustainable Land Management No. 7. International Board for Soil Research and Management, Bangkok, Thailand.

Eaton D. 1996. The economics of soil erosion: A model of farm decision making. Discussion paper 96-01. International Institute for Environment and Development (IIED), London, UK. 48 p.

ELD (Economics of Land Degradation) Initiative. 2013. The rewards of investing in sustainable land management. Interim Report for the Economics of Land Degradation Initiative: A global strategy for sustainable land management. 122 p. http://www.eld-initiative.org/fileadmin/pdf/ELD-Interim_Report_web.pdf

FAO (Food and Agriculture Organization of the United Nations). 2001. The economics of soil productivity in sub-Saharan Africa. FAO, Rome, Italy. 68 p.

Gebremedhin B. 2004. Economic incentives for soil conservation in the East African countries. Paper presented at the 13th International Soil Conservation Organisation Conference: Conserving Soil and Water for Society: Sharing Solutions. Brisbane, Australia. 4 p.

Giordano M. 2003. Economics and soil conservation on sloping lands: Nine hypotheses for MSEC project implementation and research. In Maglinao A; Valentin C; Penning de Vries F, eds. From soil research to land and water management: Harmonizing people and nature. Proceedings of the IWMI-ADB Project Annual Meeting and 7th MSEC Assembly, Bangkok, Thailand.

Hein L. 2006. Environmental economics tool kit: Analyzing the economic costs of land degradation and the benefits of sustainable land management. LDC and SIDS Targeted Portfolio Approach for Capacity Development & Mainstreaming of Sustainable Land Management Project, Global Environment Facility (GEF); United Nations Development Programme (UNDP); Global Support Unit (GSU), Pretoria, South Africa. 76 p.

Hein L; de Groot R; Soma K. 2008. Analyzing the economic impacts of land use change: A framework and a case study for the Miombo woodlands. Journal of Land Use Science 3(4):231–249.

Holmberg G. 1990. An economic evaluation of soil conservation in Kitui District, Kenya. In Dixon J; James D; Sherman P, eds. Dryland management: Economic case studies. Earthscan, Abingdon, UK. p 56–71.

Ibrahim M; Echavarría J; Sepúlveda C; Villanueva C. 2012. Incentive and market-based mechanisms to promote sustainable land management: Framework and tool to assess applicability. Tropical Agricultural Research and Higher Education Center (CATIE); The Global Mechanism of the United Nations Convention to Combat Desertification. Rome, Italy. 77 p.

Iiyama M; Athanase M; Badege P; Musana B; Rurangwa R; Tukahirwa J; Masuki K; Mowo J. 2010. Economic assessment of sustainable land management in Rwanda (poster). World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Jones S. 2009. Policy and financing for sustainable land management in Africa: Lessons and guidance for action. TerrAfrica Program; The Global Mechanism; Food and Agriculture Organization of the United Nations (FAO). 35 p.

Kaggwa R; Hogan R; Gowa E. 2009. Land use change, land degradation and human welfare: Lessons learned from the Lake Kyoga Catchment Area. Policy Brief. UNDP-UNEP Poverty-Environment Initiative, Nairobi, Kenya. 4 p.

Kassie M; Yesuf M; Köhlin G. 2008. The role of production risk in sustainable land-management technology adoption in the Ethiopian highlands. Environment for Development Discussion Paper Series. Resources for the Future, Washington DC; Environmental Economics Unit, University of Gothenburg, Sweden. 25 p.

Kirby M; Blyth M. 1987. An economic perspective on government intervention in land degradation. In: Chisolm A; Dumsday R (eds) Land degradation: Problems and policies. Cambridge University Press, Cambridge, UK.

Lovo S. 2013. Tenure insecurity and investment in soil conservation. Evidence from Malawi. Working Paper No. 11. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science, London, UK. 27 p.

Low P, ed. 2013. Economic and social impacts of desertification, land degradation and drought. White Paper I, UNCCD 2nd Scientific Conference, UNCCD Secretariat, Bonn, Germany.

Magrath W. 1990. Economic analysis of soil conservation technologies. In: Doolette J; Magrath W, eds. Watershed development in Asia: Strategies and technologies. The World Bank, Washington DC, USA. 240 p.

Majule A; Yanda P; Kangalawe R; Lokina R. 2012. Economic valuation assessment of land resources, ecosystems services and resource degradation in Tanzania. The Global Mechanism; University of Dar es Salaam. 46 p.

Mangisoni J. 2009. Farm-level economics of soil-conservation practices in the Zomba rural development project of Malawi. Organisation for Social Science Research in Eastern and Southern Africa, Addis Ababa, Ethiopia. 121 p.

Marenya P; Smith V; Nkonya E. 2012. Subsistence farmer preferences for alternative incentive policies to encourage the adoption of conservation agriculture in Malawi: A choice elicitation approach. Selected Paper prepared for presentation at the Agricultural and Applied Economics Association (AAEA) Annual Meeting in Seattle, USA. 59 p.

Mazvimavi K. 2011. Socio-economic analysis of conservation agriculture in southern Africa. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. 60 p.

Millennium Ecosystem Assessment. 2005a. Ecosystems and human well-being: Desertification synthesis. World Resources Institute, Washington DC, USA. 26 p.

Millennium Ecosystem Assessment. 2005b. Ecosystems and human well-being: Synthesis. World Resources Institute, Washington DC, USA.

Morey E. 1986. Desertification from an economic perspective. The Science of the Total Environment 55:101–110.

Mullen J. 2001. An economic perspective on land degradation issues. Economic Research Report No. 9. New South Wales Agriculture, Orange, USA. 99 p.

Munthali K; Murayama Y. 2013. Interdependences between smallholder farming and environmental management in rural Malawi: A case of agriculture-induced environmental degradation in Malingunde extension planning area (EPA). Land 2:158–175.

Nakhumwa T; Hassan R. 2012. Optimal management of soil quality stocks and long-term consequences of land degradation for smallholder farmers in Malawi. Environmental and Resource Economics 52(3):415–33.

Ngwira A; Thierfelder C; Eash N; Lambert D. 2013. Risk and maize-based cropping systems for smallholder Malawi farmers using conservation agriculture technologies. Experimental Agriculture 49(4):483–503.

Nkonya E; Gerber N; von Braun J; De Pinto A. 2011a. Economics of land degradation: The costs of action versus inaction. IFPRI Issues Brief 68. Center for Development Research (ZEF); International Food Policy Research Institute, Washington DC, USA. 8 p.

Nkonya E; Gerber N; Baumgartner P; von Braun J; De Pinto A; Graw V; Kato E; Kloos J; Walter T. 2011b. The economics of desertification, land degradation, and drought: Toward an integrated global assessment. Center for Development Research (ZEF); International Food Policy Research Institute, Washington DC, USA. 188 p.

Nkonya E; von Braun J; Mirzabaev A; Quang Bao Le; Ho Young Kwon; Kato E; Kirui O; Gerber N. 2013. Economics of Land Degradation Initiative: Methods and Approach for Global and National Assessments (Basic standards for comparable assessments). Center for Development Research (ZEF); University of Bonn and International Food Policy Research Institute (IFPRI), Washington DC, USA. 34 p.

Norse D; Saigal R. 1992. National economic cost of soil erosion: The case of Zimbabwe. Paper presented at Workshop on Environmental Management and Natural Resource Management in Developing Countries. The World Bank, Washington DC, USA.

Orr A; Ritchie M. 2004. Learning from failure: Smallholder farming systems and IPM in Malawi. Agricultural Systems 79:31–54.

Pagiola S. 1999a. The global environmental benefits of land degradation control on agricultural land: Global Overlays Program. The World Bank Environment Department Working Paper No. 16. The World Bank, Washington DC, USA. 62 p.

Pagiola S. 1999b. Economic analysis of incentives for soil conservation. In: Sanders D; Huszar P; Sombatpanit S; Enters T, eds. Using Incentives for Soil Conservation. Science Publishers, Enfield, New Hampshire.

Pandey S. 2006. Land degradation in sloping uplands: Economic drivers and strategies for promoting sustainable land use. Paper presented at Sustainable Sloping Lands and Watershed Management Conference, Luang Prabang, Lao PDR. 26 p.

Pender J; Place F; Ehui S. 2006. Conceptual framework and hypotheses. In: Pender J; Place F; Ehui S (eds). Strategies for sustainable land management in the East African highlands. International Food Policy Research Institute, Washington DC, USA. p 31–50.

Pimentel D; Harvey C; Resosudarmo P; Sinclair K; Kurz D; McNair M; Crist S; Shpritz L; Fitton L; Saffouri R; Blair R. 1995. Environmental and economic costs of soil erosion and conservation benefits. Science 267(520):1117–1123.

Poulsen L. 2013. Costs and benefits of policies and practices addressing land degradation and drought in the drylands. White Paper II, United Nations Convention to Combat Desertification (UNCCD) 2nd Scientific Conference held in Bonn, Germany, 9–12 April 2013. Global Risk Forum GRF Davos; UNCCD. 137 p.

Pretty J; Shah P. 1997. Making soil and water conservation sustainable: From coercion and control to partnerships and participation. Land Degradation and Development 8(1):39–58.

Sauer J; Tchale H. 2006. Alternative soil fertility management options in Malawi – An economic analysis. Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, 12–18 August 2006. 33 p.

Scherr S; Yadav S. 1996. Land degradation in the developing world: Implications for food, agriculture, and the environment to 2020. International Food Policy Research Institute, Washington DC, USA. 46 p.

Seckler D. 1987. Economic costs and benefits of degradation and its repair – Issues in the economic valuation of soil and water conservation programmes. In: Blaikie P; Brookfield H (eds). Land degradation and society. Methuen, London, UK. p 84–96.

Secretariat of the Convention on Biological Diversity; The Global Mechanism of the United Nations Convention to Combat Desertification; OSLO Consortium. 2013. Valuing the biodiversity of dry and sub-humid lands. Technical Series No. 71. SCBD, Montreal. Canada. 94 p.

Selassie Y; Belay Y. 2013. Costs of nutrient losses in priceless soils eroded from the highlands of northwestern Ethiopia. Journal of Agricultural Science 5(7):227–235.

Shiferaw B; Holden S. 2000. Policy instruments for sustainable land management: The case of highland smallholders in Ethiopia. Agricultural Economics 22:217–232.

Simtowe F. 2006. Can risk-aversion towards fertilizer explain part of the non-adoption puzzle for hybrid maize? Empirical evidence from Malawi. MPRA Paper No. 1241. Munich Personal RePEc Archive, University of München, Germany. 18 p.

Smale M; Jayne T. 2003. Maize in eastern and southern Africa: Seeds of success in retrospect. International Food Policy Research Institute, Washington DC, USA. 90 p.

Southgate D. 1988. The economics of land degradation in the third world. The World Bank Environment Department Working Paper 2. The World Bank, Washington DC, USA.

Stocking M; Murnaghan N. 2001. Handbook for the field assessment of land degradation. Earthscan Publications, London, UK. 169 p.

Sutcliffe J. 1993. Economic assessment of land degradation in the Ethiopian highlands: A case study. National Conservation Strategy, Ministry of Planning and Economic Development, Addis Ababa, Ethiopia.

Tanui J; Groenveld R; Klomp J; Mowo J; van Ierland E. 2013. Explaining investments in sustainable land management: The role of various income sources in the smallholder farming systems of western Kenya. Paper presented at the 4th International Conference of the African Association of Agricultural Economists, Hammamet, Tunisia, 22–25 September 2013. 29 p.

Tchale H; Wobst P. 2004. Soil fertility management choice in the maize-based smallholder farming system in Malawi. Proceedings of the Inaugural Symposium, held in Grand Regency Hotel, Nairobi, Kenya, 6–8 December 2004. Center for Development Research (ZEF); Department of Economics and Technical Change, University of Bonn. 23 p.

TEEB (The Economics of Ecosystems and Biodiversity). 2008. The Economics of Ecosystems and Biodiversity: An interim report. European Communities. Germany. 66 p.

TEEB (The Economics of Ecosystems and Biodiversity). 2010. Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB. 39 p.

The World Bank. 1996. A cost-benefit approach to soil conservation. Environment Department Dissemination Notes, No. 35, The World Bank, Washington DC, USA. 2 p.

Tisdell C. 1996. Economic indicators to assess the sustainability of conservation farming projects: An evaluation. Agriculture, Ecosystems and Environment 57:117–131.

Turner R; Daily G. 2008. The ecosystem services framework and natural capital conservation. Environmental and Resource Economics 39(1):25–35.

UNEP (United Nations Environment Programme). 2011. Towards a green economy: Pathways to sustainable development and poverty eradication. UNEP, Nairobi, Kenya. 631 p.

Upstill G; Yapp T. 1987 Offsite costs of land degradation. In: Chisolm A; Dumsday R, eds. Land degradation: Problems and policies. Cambridge University Press, Cambridge, UK. p. 99–107.

von Braun J; Gerber N; Mirzabaev A; Nkonya E. 2012. The Economics of Land Degradation. An Issue Paper for Global Soil Week, Berlin, 18–22 November 2012. Center for Development Research (ZEF); University of Bonn and International Food Policy Research Institute, Washington DC, USA. 30 p.

Xinshen D; Sarpong D. 2007. Cost implications of agricultural land degradation in Ghana: An economywide, multimarket model assessment. International Food Policy Research Institute (IFPRI), Washington DC, USA. 42 p.

Yaron G; Mangani R; Mlava J; Kamweba P; Makungwa S; Mtethiwa A; Munthali S; Mgoola W; Kazembe J. 2011. Economic analysis of sustainable natural resource use in Malawi: Economic study. United Nations Development Programme (UNDP); United Nations Environment Programme (UNEP), Lilongwe, Malawi. 150 p.

Yirga C; Hassan R. 2010. Social costs and incentives for optimal control of soil nutrient depletion in the central highlands of Ethiopia. Agricultural Systems 103(3):153–60.

Zeller M; Diagne A; Mataya C. 1997. Market access by smallholder farmers in Malawi: Implications for technology adoption, agricultural productivity, and crop income. International Food Policy Research Institute (IFPRI), Washington DC, USA. 25 p.

CIAT Working Document No. 226

Soils Research Area

Graphic design:	Julio César Martínez
Layout:	Luz Elena Sánchez
Production editing:	Victoria Eugenia Rengifo and Claudia Marcela Calderón
Photo credits:	Neil Palmer