21 Sustainable Land Management and Global Development: Factors Affecting Land Users' Efforts to Adopt and Sustain the Productive Use of Natural Resources

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Abstract

With growing global awareness of the dangers of land degradation, the value of sustainable land management (SLM) has become increasingly obvious, particularly in developing and transition countries. A brief overview of the state of the world's land resources – especially soils, water, flora, and fauna – draws attention to the need for improved land management. This article outlines the preconditions for adoption and on-the-ground implementation of sustainable land management, based on a review of research conducted within the framework of a major international programme. Adoption of sustainable land management practices by land users can only be positively influenced if land users' agency is fully taken into account; this requires attention to five interrelated aspects: knowledge, aptitude, commitment, means of production, and legitimation. In addition, the article concludes, an urgent need remains for better data and information on the extent, dynamics, and impact of land degradation worldwide, and the effectiveness of technologies and approaches to address these problems. Moreover the article calls for research on the valuation of global environmental benefits achieved by sustainable land management measures.

Keywords: Natural resources; land degradation; sustainable land management (SLM); technology effectiveness; agency.

21.1 Evolution of the concept of sustainable land management

Sustainable land management (SLM) has regained prominence in current global debates. One major cause of this re-emergence is the increasing news coverage of land-related themes such as food security, climate change, and desertification. Other key causes include a growing awareness of progressing land degradation and of the importance of land-related resources, which constitute the basis for agricultural production and provision of ecosystem services as defined by the Millennium Ecosystem Assessment (MA 2005). It is increasingly accepted that sustainable land management is crucial to achieving the various goals of the three United Nations conventions on desertification, climate change, and biodiversity – UNCCD, UNFCC, and UNCBD. Indeed, SLM contributes substantially to limiting land degradation, rehabilitating degraded areas, and maintaining productivity and other functions of land for present and future generations (Thomas 2008; Hurni et al 2010).

The concept of sustainable land management grew out of a 1991 workshop in Chiang Rai, Thailand, organised by the International Board for Soil Research and Development (Dumanski 1997). In various post-workshop follow-up activities, the initial focus on soil conservation was extended into an integrated concept that accounts for the multiple dimensions of sustainability and includes other land resources in addition to soil (Hurni et al 1996). According to Herweg and colleagues (1999), sustainable land management may be defined as the use of land resources such as soils, water, animals, and plants for the production of goods – to meet changing human needs – in a way that assures the long-term productive potential of these resources and the maintenance of their environmental functions. Similarly, albeit displaying a stronger orientation towards the concept of sustainable development and a clearer focus on operational implications, Hurni and colleagues (1996, p 27) see sustainable land management "as a system of technologies and/or planning that aims at integrating ecological with socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and intergenerational equity". Ideally, sustainable land management and its technologies should be oriented towards the five pillars of sustainability, striving to be: "(1) ecologically protective, (2) socially acceptable, (3) economically protective, (4) economically viable, and (5) risk reducing" (Hurni 1997, p 212). The opposite of sustainable land management – unsustainable land management – produces what is commonly referred to as land degradation. Land degradation includes all processes that diminish or eliminate the capacity of land resources to provide ecosystem services (MA 2005; Bai et al 2008; Hurni et al 2010).

Despite numerous research reports on land degradation and various new interdisciplinary approaches to addressing it, achievements on the ground have been rather limited. Although land degradation is widely recognised as a global problem, it remains a contested topic in terms of its determinants, degree, distribution, and effects (Gisladottir and Stocking 2005). Even very recently there has been a tendency to address land degradation itself, rather than examine what causes and drives it. Moreover, the questionable reliability of certain figures on land degradation, coupled with hyperbolic projections of its seriousness on a global scale, have contributed little to the development of sound approaches. Nonetheless, many different local approaches and new models have recently been proposed, replacing earlier, somewhat simplistic technical solutions (e.g. Gisladottir and Stocking 2005); these new approaches and models view sustainable land management not merely as a technical concern, but as a means of contributing to poverty reduction and, eventually, sustainable development (Chamay et al 2007).

21.2 Global state of land resources

The agricultural price spikes that occurred in 2007 and 2008 were a stark reminder of the importance of food production and food security. Due to the corresponding food crisis, the number of the world's hungry rose to over one billion, or roughly 15% of the global population. By 2050, agricultural output will have to be increased by 70% in order to feed the projected global population of nine billion (FAO 2009). Today, almost half of the earth's land surface is used for agriculture, and estimates suggest that 40% of this is moderately degraded, while another 9% is strongly degraded, contributing to a global reduction in crop yield of 13% (Oldeman 1994; Wood et al 2000). These degradation trends are expected to be further aggravated by intensified land use and unadapted land management based on population growth, dietary changes – such as increasing consumption of livestock products – and the negative overall effects of climate change on agricultural lands. Meanwhile, agriculture, land cover change, and land degradation are major contributors of the greenhouse gases that are fuelling global climate change. It is estimated that agriculture accounts for 13.5% of the world's greenhouse gas emissions, with three quarters of this share originating from developing countries. Another 18.2% of all greenhouse gas emissions stem from land cover changes, including deforestation and general land degradation processes (Baumert et al 2005).

This article offers an overview of the current state of various land resources – in particular soils, water, plants, and animals – and provides some insights towards overcoming the challenges inherent in sustainable land management. Based on a global land surface – excluding Antarctica – of 13,430 million hectares, 31% of that land surface consists of forest ecosystems (just over 4 billion hectares); about 26% (3,400 million hectares) is pastureland, of which about half was converted from natural grassland and the rest from forestland or woodland; and about 11.5% is cropland (1,500 million hectares), of which most was converted from forestland. Deserts, shrubland, and tundra make up approximately 25% of the global land surface; inland waters and wetlands account for about 4%; and built-up land, such as buildings or roads, comprises about 5% (FAO Statistics 2006; FAO 2010). Roughly 40% of the world's land surface is used for agricultural activities such as crop cultivation, livestock grazing, plantation forestry, and aquaculture. Today's land use patterns attest to the importance of agriculture as a major land management system transforming and making use of natural ecosystems (IAASTD 2009).

21.2.1 Soil

As a natural resource, soils are vitally important – whether for agricultural production, carbon sequestration, or biodiversity preservation (Hurni et al 2006). Estimates indicate that 10–15 million hectares of land are irreversibly lost each year due to erosion, salinisation, and a general lack of productivity (Pimentel et al 1993; Faeth and Crosson 1994; Pimentel 1997); this represents about 1% of global cropland. Without sustainable land management measures, there is a danger that the world's soils will be depleted in about 200 years (Hurni et al 2008). Soil erosion caused by wind and water is the largest driver of land degradation, accounting for about 84% of global soil losses (Oldeman et al 1991).

In and of itself a natural process, erosion becomes a problem when it is accelerated by inappropriate land management or other human activities, such as mining or infrastructure and urban development, that omit well-designed, well-maintained conservation measures (UNEP 2007). Estimates of the global extent of soil degradation and its impact on productivity are scarce and debated; nevertheless, the costs of soil degradation are undoubtedly high (World Bank 2008), and about one third of all agriculturally used land (cropland, pastureland, forestland) is affected (Oldeman et al 1991). A recent study by Cohen and colleagues (2006) suggests that the financial magnitude of soil erosion in Kenya equals that of its national electricity production or agricultural exports, or roughly 3.8% of the national GDP. Fortunately, there are examples of successful land management technologies that have been implemented on a large scale around the world and are well documented (Liniger and Critchley 2007).

21.2.2 Water

Soil and water degradation are intimately linked, as soil degradation reduces the productivity of water-related ecosystem services and affects water availability, quality, and storage (Bossio et al 2010). As the product of hydrological cycles on land, fresh water resources constitute only 2.5% of the earth's water. Fresh water is finite, and its global distribution was long dominated by natural cycles of freezing and thawing, precipitation, evapotranspiration, and runoff. Pressure on the global water system has grown due to increased human activities, such as land use, as well as changing climatic patterns (WWAP 2009). These developments may negatively impact surface water balance, evapotranspiration, runoff, and groundwater flow. Surface runoff and river discharge, in particular, increase when natural vegetation, such as a forest, is cleared (Foley et al 2005), or when more land is cultivated.

Access to adequate supplies of safe, reliable water is crucial to food production and poverty reduction (CA 2007). More than 2.8 billion people live in river basins where water is scarce, and about 1.6 billion people suffer from inadequate access to water. Agriculture is the biggest user of fresh water – accounting for 70% of freshwater withdrawals, most often for irrigation – while industry uses 20% and municipalities use 10% (CA 2007). Excessive use of agrochemicals and intensive livestock production are likely the most significant sources of water pollution (Steinfeld et al 2006; CA 2007) aside from industrial pollution and lack of environmental sanitation. Water conservation and water harvesting thus have important implications for agriculture (Liniger and Critchley 2007).

21.2.3 Forests and biodiversity

While deforestation has decreased globally over the past ten years, it continues at alarming rates in certain regions, in particular in South America and Africa. Forests store vast amounts of carbon and are therefore particularly important for climate change mitigation. They are also crucial to the preservation of cultural heritage, the conservation of biological diversity, and the protection of soil and water resources. Approximately 3.3 billion hectares of forest – or 8% of global forests – have the primary function of conserving soil and water, for example by stabilising sand dunes or by controlling avalanches. This percentage has increased in the last 20 years mainly because of large-scale plantations in China that are specifically aimed at desertification control and soil and water conservation (FAO 2010). While the efficacy of measures introduced is generally high, widespread adoption by land users has been impeded by the associated high initial costs, which usually have to be borne by society.

Biodiversity, including agrobiodiversity, is rapidly declining due to climate change, the destruction and fragmentation of natural ecosystems, invasive species, pollution, expansion of agricultural frontiers, overexploitation, and changes in agricultural practices and land use (MA 2005; IAASTD 2009). Between 1970 and 2000, the global number of wildlife species declined by about 30%, and recent studies show a continuation of this trend (MA 2005; WWF International et al 2008; Butchart et al 2010). Moreover, more than half of all species exist primarily in agricultural landscapes (World Bank 2008), and although agriculture began with the domestication of wild animals and plants, the decline in genetic diversity is particularly pronounced among cultivated species: 75% of the genetic diversity of agricultural crops has been lost over the last century (FAO 1998).

21.3 Factors affecting land users' efforts towards sustainable land management

21.3.1 Individual and group agency

Today, discussions about how to implement sustainable land management focus on people's actions both as individuals and as social groups, institutions, countries, and groups of countries within the United Nations. In this context, the concept of agency – defined for example by McLaughlin and Dietz (2008, p 105) as "the capacity of individual and corporate actors, with the diverse cultural meanings that they espouse, to play an independent causal role in history" – is increasingly being used. Individual and group agency can be viewed as determined by the five dimensions of *knowledge*, *aptitude*, *commitment*, *means* of production, and *legitimation* (Hurni et al

1993). This concept can be visualised by means of a pentagram inscribed in a pentagon and linking these five components (Figure 1); it is designed to analyse a given situation and identify appropriate support activities (Hurni 2007).

Land users' motivation and willingness – that is, their *commitment* – to invest in sustainable land management depends on a wide array of factors rooted in the economic, sociopolitical, and ecological environments in which they live and work. People's *knowledge* and individual perceptions of the state of land resources, as well as their understanding of the basic processes involved in changing features of land resources are key to any effort towards sustainable land management. Generally, for most land users the existence of land degradation per se is unlikely to be a concern unless it adversely affects their productivity (Stocking and Murnaghan 2001; Hurni et al 2010). Closely related to knowledge-driven aspects of sustainable land management, *aptitude* – or skills and learning ability with regard to technical improvements – also plays an important role. Training and extension are effective means of translating knowledge into concrete approaches in order to adapt technical measures to changing contexts and enable people to implement them accordingly.

Land users' economic intentions and the frame conditions within which they can act accordingly are decisive when it comes to introducing sustainable land management practices. The following *means* are positively associated with adoption of sustainable land management practices among land users: anticipation of secured livelihoods, alternative income opportunities, pro-

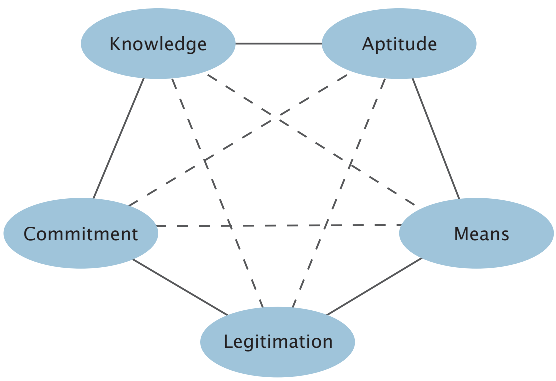

Fig. 1
The five dimensions determining agency, which constitute prerequisites for adoption of sustainable land management by land users. (Adapted from Hurni et al 1993)

ductivity gains, financial incentives, subsidies (including compensation for off-site benefits of sustainable land management measures), access to low-rate credit, and labour availability. A final key to adoption of sustainable land management is its *legitimation* through an enabling sociopolitical environment. On the one hand, an enabling environment encompasses governance issues such as legislative and regulatory provisions, land tenure, land access, compensation mechanisms, and mechanisms of resource conflict mediation. On the other hand, it includes the social and cultural acceptability of particular land management practices, in addition to aspects of people's participation, power, social status, and decision-making.

21.3.2 Knowledge and aptitude

Knowledge is generally considered a key factor for sustainable development and thus also for sustainable land management. According to the World Bank (2011, no page numbers), "a country's ability to build and mobilise knowledge capital is just as important for sustainable management as the availability of physical and financial capital. The basic component of any country's knowledge system is its indigenous knowledge. It encompasses the skills, experiences, and insights" that people apply to maintain or improve their livelihoods, thus improving their *aptitude* for sustainable land management. Experience shows that efforts to create better knowledge of sustainable land management cannot rely solely on scientific knowledge; the knowledge of local actors and other stakeholders must also be incorporated. The call for incorporating local knowledge is based, on the one hand, on the fact that actions and strategies relevant to land resources are influenced by numerous factors, including (local) perceptions, attitudes, and overall societal conditions such as economics, politics, and power structures (Chambers 1983; Hurni 1997). On the other hand, it is widely acknowledged nowadays that local populations possess complex and highly relevant information on land resources and their management. This information is more closely related to the concrete realities on the ground than scientific knowledge, which is more analytical and reflects rather abstract representations of the world (Agrawal 1995; Rist et al 2011).

Clearly, local and external knowledge are both important. Co-production of knowledge based on collaboration between academic and non-academic communities thus constitutes a very valuable asset in achieving sustainable management of land resources. According to the experience of the Swiss National Centre of Competence in Research (NCCR) North-South programme, researchers face three challenges in the co-production of knowledge for sustainable development: (a) addressing power relations; (b) interrelating different perspectives on the issues at stake; and (c) promoting a previously negotiated orientation (Pohl et al 2010). The above observations underscore that science has no monopoly on knowledge. They also cast doubt on certain one-sided strategies of knowledge and know-how transfer that are frequently applied in development projects.

An in-depth study including more than 100 interviews with key informants – from local to international levels – showed that average knowledge of land management issues hardly differs between the various levels, that is, between land users, district and provincial-level officials, civil society organisations engaged in rural development, scientists from local academia, and members of international donor agencies. However, within each stakeholder category, substantial differences were observed in terms of people's knowledge, innovative ideas, and main expectations of land management, the latter ranging from conservation of land resources to optimisation or intensification of agricultural production. Against this background, conventional knowledge transfer activities – namely, from state agencies or development cooperation agencies to land users – are unlikely to have a significant impact. The results of the study suggest that communication between and, even more so, *within* stakeholder levels has been disrupted. Thus, initiating learning processes and knowledge generation within the respective stakeholder levels appears to bear the greatest potential for promotion of sustainable land management, at least in the short to medium term (Breu 2006).

Knowledge alone, however, will not lead to sustainable land management; it is only one prerequisite. Another crucial factor is the translation of knowledge into practical skills and techniques – that is, *aptitude* – particularly when adapting or introducing new forms of land resource use. Establishing a new land management technology, such as the use of fodder shrubs, requires multiple skills, in this case including the ability to raise seedlings in a nursery, prune trees, and feed the leaves. An absence of such skills constrains the rapid spread of the corresponding technology (Liniger and Critchley 2007). This highlights the importance of training and extension. Conventional transfer-of-technology approaches have sought to make clear distinctions between the categories of researchers, extension agents, and land users, relating them to one another in a rigid hierarchy in the process of technology development and dissemination. In these contexts, extension services and adoption of promising approaches to land management were fragmented, leading to separate specialisation processes, each focusing only on a narrow aspect of the given situation and neglecting underlying causes of unsustainable practices as well as farmers' needs and constraints. As a result, even adapted and technically sound sustainable land management technologies proved unacceptable to farmers (Mitiku Haile et al 2006). Based on these experiences, however, the need for greater participation and devolution of power, as well as for sharing and incorporating indigenous technical knowledge is now well recognised.

The combination of indigenous technical knowledge – adapted to the local environment and accepted by local people (Stocking and Murnaghan 2001) – with sustainable land management technologies applied in other geographical contexts bears vast potential for innovative technology and skills development. This is particularly true when it comes to adapting technologies and approaches to specific local sociopolitical and environmental contexts, and ensuring their cost-effectiveness. Research shows that adaptations of local innovations often perform better and are more readily integrated into a land use system when compared to 'standard' soil and water conservation technologies introduced from the outside (Liniger and Critchley 2007).

Another key to continuously enhancing knowledge of and aptitude for sustainable land management is the development and application of impact assessment and monitoring systems. These can serve as learning instruments and go beyond traditional management tools (Herweg and Steiner 2002). This requires support for joint efforts between scientists and various stakeholder groups, working together to adapt and develop more cost-effective monitoring systems, including indicators, measures, and procedures adjusted to farmers' needs and means (Wolfgramm et al 2010). Aside from the practical value that such impact assessment and monitoring systems have as a means of knowledge generation and skill-oriented learning, they also yield data regarding the efficacy, effectiveness, and sustainability of adopted measures that are key to securing external support for sustainable land management activities.

21.3.3 Means and commitment

While farmers' decisions regarding sustainable land management are undoubtedly influenced by economic considerations and *means* – such as costs or financial returns based on productivity losses or gains influenced by the physical characteristics of available land resources – other types of considerations are at least equally important. Among the further determinants also shaping land users' willingness and *commitment* to adopt sustainable land management practices are: associated risks, effectiveness, the time and effort it takes to implement sustainable land management measures, labour availability, prestige and social acceptability, availability of investment opportunities, and incentives. These additional *means* all need to be taken into account in research on sustainable land management. It is commonly assumed that land management practices which simultaneously meet economic, social, and ecological requirements will be assessed most favourably (Stocking and Murnaghan 2001; Mitiku Haile et al 2006; Woldeselassie Ogbazghi et al 2011). Various studies have shown that when it comes to analysing adoption of sustainable land management practices, farmers' attitudes cannot be reduced to an imaginary *homo oeconomicus* ideal: they do not decide for or against certain land use practices based solely on rational choices oriented towards economic optimisation of their farm. Internal processes of 'sense-making' and actor-specific perceptions have been shown to be just as important as favourable structural conditions for sustainable land management (Schneider et al 2010).

Poverty, or the absence of financial means, is often seen as a major obstacle to farmers' adoption of sustainable land management practices. Above all farmers involved in small-scale subsistence farming are often primarily concerned with the daily struggle for survival and securing a livelihood. Thus, they often do not perceive sustainable land management practices – such as soil and water conservation – as a high priority, concluding that they cannot afford to make the initial investment in sustainable land management and wait for conservation measures to pay off (Hurni et al 1996). As a result, lack of investment in sustainable land management leads to further land degradation and, eventually, to more poverty. The consequences of this downward spiral include low crop yields, lack of food security, and little surplus to sell on the open market, all of which combine to reinforce land users' poverty and decrease their social stability (Stocking and Murnaghan 2001; Mitiku Haile et al 2006). On the other hand, availability of opportunities for investment in sustainable land management technologies can make a change, with long-term positive effects on water, land, and agriculture (Hurni 2011).

In order to implement sustainable land management practices, be it land conservation measures (e.g. structural measures such as terracing) or rehabilitation measures, the availability of a labour force represents a crucial precondition – indeed, one that comes before even financial means, knowledge, materials (e.g. machinery, seeds, fertilisers), and infrastructure for accessing markets. Labour availability is a major determinant of sustainable land management, and this has special relevance in areas affected by outmigration. Research in Central Asia by Shigaeva (2007) and Breu and co-authors (2005) highlights the importance of the labour situation in poor rural households, which are often headed by women or consist mainly of elderly persons. Among land users affected by labour shortages, sustainable land management practices requiring less labour and inputs – such as conservation agriculture – stand a better chance of being adopted (Liniger et al 2010).

Most observers agree that land users' primary interest lies in increasing their productivity and reducing their costs. Thus, the same type of outlook drives their motivation and willingness to adopt sustainable land management practices and sustainable agriculture. Many assume that soil and water conservation measures require high investments and relatively long waiting periods before initial investments pay off. Yet there are numerous examples of profitable, cost- and time-saving sustainable land management technologies that become effective within a short span of time. Liniger and Critchley (2007) and colleagues revealed that out of 70 sustainable land management technologies and approaches introduced, 62% produced short-term benefits that were noted by land users, even in light of the initial investment required. Such demonstrations of swift returns increase land users' motivation to continue implementing sustainable land management approaches.

In addition to the time it takes to experience returns on investments, land users' willingness to adopt sustainable land management measures is greatly influenced by incentives, subsidies, prices, and market structures. In order to increase the attractiveness of sustainable land management measures – particularly to small-scale farmers – soil and water conservation was and is regularly combined with subsidies (food for work, cash for work) and incentives (Mitiku Haile et al 2006; Liniger and Critchley 2007). Incentives for sustainable land management should not be interpreted exclusively as financial or material support, but should also be seen as including the intangible stimulus (or 'internal incentive') that land users experience through higher production, or by saving time and money (Liniger et al 2010). Although incentive and subsidy schemes are often criticised, implementation of many sustainable land management practices and adaptation of numerous technical innovations would never have been possible without them. However, use of such economic instruments often fails to produce lasting effects on the ground. Liniger and co-authors (2010) suggest that the lower the degree of outside financial or material support, the greater the level of genuine initiative and participation on the part of land users and, consequently, the greater the likelihood that the corresponding interventions are sustainable. It is therefore crucial to increase land users' access to financial services and (micro) credit schemes with low interest rates, as this will support their own initiative. No less important are the ways in which markets and their price structures affect land users' decisions for or against farming practices that conserve or degrade land. Stocking and Murnaghan (2001) underline that price distortions often favour urban consumers, making it difficult or impossible for land users to recover the costs of sustainable production methods. Similarly, market volatility often impedes investment in sustainable natural resource management because it renders financial returns uncertain.

21.3.4 Legitimation

Unlike the factors described above – knowledge, aptitude, means, and commitment – that directly pertain to land users themselves, *legitimation* refers to the overall environment shaped by wider society. Legitimation determines the degree to which an environment enables something like sustainable land management to occur, essentially establishing the overall boundaries for land users' application of such practices. On the one hand, enabling environments for sustainable land management encompass decision-making at different levels that are beyond land users' direct sphere of influence, concerning policies, institutions, legal and regulatory provisions, and mechanisms for resolving conflicts over resources, among other things. Important issues that are dealt with at these levels and have a direct influence on land users' actions include land tenure, access to land, as well as compensation mechanisms for off-site effects of land management practices. On the other hand, land users' activities are determined by and subject to the social and cultural acceptability of land management practices, as well as aspects of social resilience (Obrist et al 2010), participation, power relations, social status, and decision-making.

National and international policies are crucial for creating an enabling environment in support of sustainable land management. Policy development should reflect the complexity of sustainable land use systems, while addressing the root causes and secondary effects of land degradation. Policies should also provide the bases and incentives necessary for investment in sustainable land management, beginning at the household level and extending on up to national or even regional levels (Liniger et al 2010). Key to successful implementation of natural resource policies and related legal provisions are negotiated, socially accepted mechanisms, and regulatory provisions to encourage or enforce them. In this respect, greater community involvement in formulating policies and identifying implementation mechanisms increases the likelihood of success. Research in Laos has shown that increases in the influence of external actors and public policy on rural transformation – at the expense of local decision-making – have aggravated poverty and resource degradation (Messerli 2010). Although many countries, including those in the developing world, possess bodies of national-level legislation relevant to sustainable land management (e.g. laws for nature protection, water, soil, and forest management), at the regional (transboundary) and local levels, existing land management regulations are often inadequate, poorly enforced, and increase the suffering of marginalised people in particular (Upreti et al 2009). Further, national policies and legislation often fail to adequately address individual countries' regional and international obligations as signatories, for example, of the three global United Nations conventions.

Appropriate institutions are vital when it comes to translating policies and legislation into rules and regulations as well as managing natural resources in a manner that is economically viable. In contrast to neoclassical and neo-Marxist economic theorists, new institutional economists suggest that institutions are equally as important as – or possibly more important than – availability of classical production factors (land, labour, and capital) in terms of their effect on economic growth (Steimann 2011). There is evidence that sound institutional arrangements coupled with good general economics can lower pressure particularly on common-pool resources (Haller 2010). Institutions bear great importance for sustainable land management, as they often play pivotal roles in resource conflicts as well as decision-making regarding compensation for positive off-site effects (e.g. increased water availability) or penalties for negative off-site effects (e.g. sedimentation) of land management practices. In general, the costs incurred downstream of land users' plots are unlikely to be incorporated into the land use decisions of those same users (Stocking and Murnaghan 2001); these types of dynamics often result in growing competition and conflicts between various groups of land users from upstream and downstream areas (Kiteme et al 2008), gradually harming investment in sustainable resource management overall.

Land tenure and access to land are crucial determinants of land users' willingness to invest in improving or conserving land resources. Considering that land is a very strategic socio-economic asset in agrarian economies where wealth and survival are measured by control of, and access to, land (Shrestha 2009), secure land ownership and land rights constitute a necessary prerequisite for sustainable land management (UNEP 2004). Uncertainties over land tenure – in particular concerning individual land use rights and the status of rural communities in relation to land ownership – mean that farmers, herders, and forest users feel legally insecure as to their long-term rights to use resources; this, in turn, gives them little personal incentive to assume responsibilities of stewardship and protect and conserve local natural resources, for example, those of mountain ecosystems (Hannam 2005). Yet even if formal, state-sanctioned property rights for common and private property are granted, property rights may remain locally contested and disputed. On the one hand, this is because such rights are not only constituted by state regulation, but are often – primarily – embedded in local social norms and power relations (Steimann and Geiser 2011); on the other, land is often subject to overlapping rights held by communities, individuals, and the state (Deininger et al 2010). Nevertheless, evidence from studies in Central Asia suggests that clearly assigned property rights alter people's relationships to natural resources in terms of who takes responsibility for protecting these resources (Bichsel et al 2010).

Also ranking with institutional feasibility, ecological suitability, and economic viability is social acceptability, in terms of its decisive influence on adoption of sustainable land management practices and technologies (Hurni et al 2006). Considered in relation to land management technologies and approaches, social acceptability refers to issues such as traditional norms and values, religious or social customs and taboos, local power structures, and aspects of social status. If it appears impossible to obtain social acceptance for a given sustainable land management practice, even one with proven effectiveness – for example, a measure to control soil erosion – it is probably better to forgo attempts to implement it in favour of more locally acceptable sustainable land management practices. Such locally adapted practices can be developed jointly with land users, by incorporating their knowledge and actively involving them in planning processes. In this respect, special emphasis must be given to broadly based negotiation, involving land users from all strata, and going beyond technological aspects to arrive at overall sustainable land management objectives and mechanisms that reflect local norms and values (Rist et al 2007). In the implementation phase, the likelihood of successful adoption of sustainable land management practices is greatly increased if new measures are integrated into pre-existing farming systems (Mitiku Haile et al 2006).

21.4 Conclusions and outlook

In general, despite a wealth of scientific knowledge on sustainable land management, including on the costs of land degradation and benefits of land management technologies, the magnitude of the issue and the high number of affected populations calls for enhanced dissemination of this knowledge among policymakers, experts in the socio-economic spheres, and land users themselves. Thus, the challenge at hand is not only – or primarily – one of generating more knowledge about sustainable land management, but also one of better channelling existing knowledge into the 50-plus advisory and policy processes related to the environment (Mackensen and Chevalier 2002). Nevertheless, from a global perspective, there remains an urgent need for better data and information on the extent, dynamics, and impact of land degradation worldwide, as well as on the effectiveness of technologies and approaches to address these problems.

The planned creation of sustainable land management observatories – as promoted by the UNCCD through its Policy and Investment Programme – appears to be a far-sighted and instrumental means of providing the required data and information. Besides the need to generate knowledge and channel it into policy processes at the national and international levels, there is a continued need to complement and further expand knowledge, approaches, and technologies that improve land management practices at the local level, and tap into local opportunities for alternative land use. One of the main tasks for scientists and non-scientists alike looking to support sustainable land management is to find evidence of its impacts on natural resources and to assess the societal, economic, and policy implications of these impacts (Hurni et al 2006). Along this line, the adoption of sustainable land management technologies and approaches must be further stimulated by emphasising their advantages in terms of increased production and reduced costs to land users. To enable evidence-based decision-making by land users, accurate assessments of costs and benefits (see Kappel 1996) through participatory processes will be of paramount importance (Liniger and Critchley 2007).

From a global perspective, the valuation of global environmental benefits from improved and sustained ecosystem services achieved by means of sustainable land management will be a major challenge (Gisladottir and Stocking 2005; Schwilch et al 2010). The design and implementation of quantification and compensation schemes for ecosystem services supported by sustainable land management – such as, for example, carbon sequestration in soils and biodiversity conservation – will require joint efforts by both the research community and policymakers at the international level in the years to come.

Endnotes

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