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Local Perception of Land Degradation in Developing Countries: A Simplified Analytical Framework of Driving Forces, Processes, Indicators and Coping Strategies

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Abstract

Programs addressing land conservation are not succeeding where they are most needed. Understanding, preventing and mitigating land degradation (LD) at the local scale seem to require more than technical knowledge and perception by external agents such as agricultural advisors and government officials. The main purpose of this paper is to identify the factors determining farmers' decisions to adopt land conservation practices in the local context. We argue that peasant decision-making procedures are strongly based on their perceptions of the forces that drive degradation. First, we summarize and rank prominent driving forces in LD particularly at the local level. Next, we discuss how local perception and traditional knowledge, including local indicators, have been addressed in published studies. Finally, we inspect the attitudes and strategies to cope with degradation from the perspective of local communities as reported in the scientific literature. We conclude that local communities should not be expected to simply *adopt* suggested practices; they may rather be supported to develop their own projects on the basis of their indicators and perception of LD, and their own survival priorities.

Keywords: land conservation, traditional knowledge, local indicators, desertification, peasant communities

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1 Introduction

Land degradation (LD)[1] is a complex phenomenon triggered by the interplay of environmental, economic and social factors (Warren, 2002; Geist and Lambin, 2004; Reynolds *et al.*, 2007). It is reaching a significant dimension especially in rural areas of developing countries where its effects are more severe (Eswaran *et al.*, 2001; Safriel, 2007; Bai *et al.*, 2008). Research in developing regions has been substantial during recent decades (e.g., Thapa and Weber, 1991; Oldeman, 1998; Mertz *et al.*, 2009; Kondolf and Podolak, 2014; Vu *et al.*, 2014). LD patterns have been also studied at the local scale (Douglas, 2006; Waswa *et al.*, 2013; Dahal *et al.*, 2014), and causative (proximate and underlying) forces are receiving increased attention (Geist and Lambin, 2001; Schreiber *et al.*, 2012; Agyemang, 2012; Bisaro *et al.*, 2014). However, the contribution of the social perception of these forces at the local level has not been sufficiently emphasized (Kiage, 2013).

Underlying driving forces are decisive; in some instances, proximate causes may be merely symptoms of underlying causes. For instance, poverty does not have a linear relationship with degradation, but in marginal lands, and where natural resources are scarce, it may be an underlying force (Gisladottir and Stocking, 2005). Both the causes and the effects of degradation are time- and site-dependent (Santibañez and Santibañez, 2007; Mertz *et al.*, 2009). Thus, it is desirable to understand the driving forces that are decisive at the local level, particularly as perceived by local agricultural producers (Gisladottir and Stocking, 2005; Verstraete *et al.*, 2008; Maitima *et al.*, 2009; Kiage, 2013). Assessment of LD at the local level may help to mitigate its development in a given rural area. Blaikie and Brookfield (1987) suggested that public policy and socio-economic and cultural contexts decisively influenced degradation; only during the past decade has this been widely accepted. The Millennium Ecosystem Assessment (MEA, 2005, p. 9) concluded that policies leading to unsustainable resource use, and lack of supportive infrastructure, are major contributors to degradation, yet both the academic and the technical communities have been reluctant to accept this; the literature reveals an emphasis on rather technical aspects (e.g., Safriel, 2007), biophysical indicators (e.g., Sankhayan *et al.*, 2003) and measurements of degradation patterns through remotely sensed data (e.g., Bai *et al.*, 2008). Approaches have been more descriptive of processes than explanatory of causality; top-down projects dominated, and a gap developed between science and successful decision-making. Programs addressing land conservation are not succeeding where they are most needed. Understanding, preventing and mitigating land degradation at the local scale seem to require more than technical knowledge and perception by external agents such as agricultural advisors and government officials, an issue also raised by (Hammad and Børresen, 2006).

Hence, two questions may require research attention. Should local community perception feature strongly in technical assessments of land degradation? What factors influence farmers' attitudes to coping with it? In this paper we explore the relevance of peasant perceptions of causes and implications of land degradation processes in rural areas of developing countries. The main purpose is to identify the factors determining farmers' decisions to adopt land conservation practices in the local context. We argue that peasant decision-making procedures are strongly based on their perceptions of the forces that drive degradation. Moreover, if perception were taken in conjunction with technical evaluation to construct a hybrid vision, particularly in the field, simple solutions to these complex problems would be feasible. We believe that the absence of this conjunction contributes to the failure of top-down approaches to land conservation. First, we summarize and rank prominent driving forces in LD at the local level. Next, we discuss how local perception and traditional knowledge (TK),[2] including local indicators, have been addressed in published studies.

[1] In this paper, "land" is regarded as a specific portion of the geographic space or a territory, encompassing terrain, water, soil and land cover components. This definition is derived from Ciparisse (2003).

[2] Although local and traditional knowledge (TK) are not exactly the same concept, here we use TK because the differences between the two do not influence the main discussion in this paper.

Finally, we inspect the attitudes and strategies to cope with degradation from the perspective of local communities as reported in the scientific literature.

2 LD processes and driving forces

Of the encountered causative factors, both proximate causes and underlying forces (Geist and Lambin, 2001; Schreiber *et al.*, 2012; Bisaro *et al.*, 2014), and on the basis of our own field experience, we consider some to be particularly important at the local level (Table 1). Following von Braun *et al.* (2013), the proximate causes of land degradation are those that have a direct impact on terrestrial ecosystems, while the underlying causes are those that stimulate the proximate causes. Although we emphasize the local level, proximate and underlying forces operate at any level, and there is no clear demarcation between levels or between forces. Rather, a chain of connections adds complexity to the understanding of land degradation processes and factors.

It is well known that land degradation operates in a synergistic manner with other phenomena such as climate change, biodiversity loss and water scarcity, among others (Geist and Lambin, 2001; MEA, 2005; Maitima *et al.*, 2009; Agyemang, 2012; Vu *et al.*, 2014). One of the most recurrent synergies is, for example, population increase, leading to a pressure on the use of land, leading to deforestation and forest degradation, in turn leading to climatic variability and poverty. This is one vicious circle difficult to cope with and to reverse (Bremner *et al.*, 2010; Nkonya *et al.*, 2011). Local perception and knowledge of these links is important to understand the complexity involved in land degradation (Akinnagbe and Umukoro, 2011; Agyemang, 2012; Kassa *et al.*, 2013).

Table 1: Simplified analytical framework of driving forces and processes involved in land degradation

Type of Cause	**Causative Factor (Driving force)**
Processes	*Prominent:* Vegetative cover degradation; water and wind erosion *Others:* Acidification; aridization; biodiversity loss; bush encroachment; drylands expansion; fresh water reduction; physical soil degradation; pollution; salinization; sand drift; sandification; soil crusting; soil fertility decline.
Proximate Causes	*Prominent:* Agricultural mismanagement; deforestation; land use change *Others:* Slope steepness and poor soils; demand for food; fires; forest resources overexploitation; inadequate waste disposal; land cover change; overfertilization; overgrazing; overplowing; illegal logging; urban encroachment.
Underlying Causes	*Prominent:* Inadequate environmental policy; land mismanagement; unsuitable land use; insecure land tenure; tenure fragmentation. *Others:* Floods; droughts; lack of available environmental knowledge; lack of information about appropriate alternative technologies; unplanned land use change; unplanned urban growth; land use pressure; limited access to farm inputs and credit; livestock pressure; population pressure; poverty; breakdown of the indigenous (local) institutions; lack of local non-farm employments; demand of forest products.

Sources for Table 1	**Major Focus**
Contreras-Hermosilla (2000)	Underlying causes of tropical forest degradation
Geist and Lambin (2004)	Proximate and underlying causes in desertification-prone regions
Olson *et al.* (2004)	Proximate causes for undesirable land use change in tropical regions
Carr *et al.* (2005)	Proximate and underlying causes of soil erosion in developing countries
Zhang *et al.* (2006)	Proximate and underlying causes of LD in China
Rasul (2007)	Underlying causes of tropical forest degradations
Schreiber *et al.* (2012)	Proximate causes in desertification-prone regions
Bai *et al.* (2008)	Global studies on LD
Maitima *et al.* (2009)	Proximate and underlying causes for LD in African countries
Nellemann *et al.* (2009)	Underlying causes in developing countries
Saad *et al.* (2011)	Proximate and underlying causes in arid regions
Agyemang (2012)	Proximate causes in tropical regions
Kissinger *et al.* (2012)	Proximate and underlying causes of tropical forest degradation
von Braun *et al.* (2013)	Proximate and underlying causes in developing countries
Peprah *et al.* (2014)	Proximate causes of tropical forest degradation

3 From local perception to definition of LD indicators

How do local communities perceive and cope with degradation? At the local level, perception occurs in two dimensions: the internal, basically that of farmers, and the external, basically that of technical and government officials. The perception varies as a function of the way these two dimensions interact in the field. Hybrid approaches (peasant/scientific), which are becoming widely accepted, are feasible at the local, field level. Perception will partly control awareness, goals and methods to be applied in research or practical actions. Local perception refers to the causes and status of LD as farmers detect and express it as occurring on their lands. For example, in Kushinga Ward, Zimbabwe, the major causes of soil erosion identified by peasants were the cultivation of steep slopes and stream banks, population pressure and overgrazing (Manjoro, 2006). The farmers' perceptions coincided with the views of researchers and agricultural advisers in the district. Peasant perception is strongly based upon TK-derived indicators (Table 2). Long-term observations of LD patterns and qualitative assessments of LD processes are of paramount importance and can be scientifically accepted on the basis of quantitative evaluations (Pulido and Bocco, 2003; Di Falco *et al.*, 2006; Tsegaye and Bekele, 2010).

Other indicators are less referred to in the literature. They include slope gradient, fast sedimentation, turbidity in streams, sand deposition, crop diseases, termite mounds, low rainfall, decreased water level, anomalous vegetation cover, decline of wild, splash pedestals, build-up of soil against barriers, drying up of vegetation, poor seedling emergence, reduced human population and poverty.

Land quality indicators perceived by peasants

In natural resources management in general and in land degradation in particular, traditional knowledge refers to the concept of land rather than soil. During the late 1980s, traditional knowledge was gradually accepted by leading soil and water conservation institutions (Bocco, 1991). It is strongly based on peasant perception of land quality and land degradation (Pulido and Bocco, 2003). TK held by communities proved to be useful in evaluating and classifying lands according to types, levels and risks of degradation. Indicators derived from local perception and traditional knowledge are complex, i.e., they encompass an holistic suite of partial elements. (Millar and Dittoh, 2004). Peasant land quality indicators are a good example of this approximation, as documented by case studies. Peasants frequently assess suitability to land degradation in terms of soil fertility depletion and soil erosion; this is corroborated by a high correlation between crop yields and nutrient availability (Pulido and Bocco, 2003; Malley *et al.*, 2006). Other common peasant LD indicators include plant species (Oberthur *et al.*, 2004; Styger *et al.*, 2007), weed abundance, changes in soil texture and stoniness, crop yield and crop performance. In Kenya, farmers divided soils into productive and non-productive classes, according to yield and crop performance, soil colour and texture (Mairura *et al.*, 2007); categories used by farmers were highly correlated with key soil parameters. In some cases, indicators commonly used by external stakeholders do not detect degradation changes otherwise perceived by local producers. Conversely, Gray and Morant (2003) showed that land degradation features perceived by farmers in southwest Burkina Faso were not detected by conventional laboratory tests.

In brief, there are many locally derived site-specific indicators. Ranking of each indicator varies among farmers. Ranking may depend upon individual experience, age, gender and social position (Warren *et al.*, 2003). Indicators are based on sensory perception and are intrinsically practical; robust ones usually follow long-time observations at parcel level. Therefore they are recommended for inclusion in local assessments. Sometimes, they may contradict technical indicators (Gray and Morant, 2003), or at least be more sensitive to seasonal change. In other cases they are complementary and technical knowledge may validate TK (Pulido and Bocco, 2003). When coupled with technically based indicators they ground integrated, participatory approaches.

Table 2: Biological, physical and chemical indicators used by local communities to assess land degradation

Indicator	References	Comments
Declining crop yields	(1), (4), (5), (6), (7), (9), (10), (11), (18), (21), (23), (24), (25)	A tendency during short to medium time spans. It is an integrated consequence derived from many other degradation processes, particularly soil erosion, loss of soil organic matter and declining soil fertility.
Sheet, rill and gully erosion; sedimentation	(1), (4), (7), (9), (10), (11), (12), (18), (21), (22), (23), (25)	Frequently, gullying is a symptom of severe past erosion. In (4) and (21) sheet erosion is considered as more damaging than gullying. Controversy exists on the effects of different types of erosion.
Changes in rangeland condition for livestock production	(3), (6), (7), (13), (14), (16), (19), (24), (25)	Also referred to as (3) reduced herbaceous cover; (6) change in plant species composition; (7, 19) disappearance of grass cover; (13) decline of plant abundance; (14, 16) decline of key forage species; (17) disappearance of useful plant species; (14) a condition that varies according to spatial and temporal perspectives, and also for different livestock species.
Presence of particular weed species	(1), (7), (10), (17), (18), (19), (25)	Also referred to as (7, 10, 19) emergence of weeds and unpalatable species; (17) invaded by previously unknown grasses and weeds that are of no economic value; (18) weed infestation.
Surface soil color	(1), (10), (18), (21), (25)	Specifically (18), assessing change in color: pale or red colors indicate degradation; dark color suggests stability (organic matter).
Barren or infertile land	(2), (3), (9), (17), (19), (20), (22)	Also referred to as (3) reduced herbaceous cover; (9) badlands development; (17) increase of bare lands; (19, 20) decreased vegetation cover/increased bare land.
Stoniness	(1), (9), (11), (12)	Also referred to as (9, 12) rock exposure and limited soil depth; (11) soil becoming coarse and stony.
Fewer trees and increased distance and time to collect fuel wood	(2), (3), (9), (17)	Also as (2) use of non-appropriate wood for fuel, and a need to rely on vehicles for collection; (9) related to deforestation and selective cutting of good-quality woody vegetation close to human settlements; (17) loss of woody vegetation.
Exposure of roots; pedestals	(7), (9), (12), (22), (25)	Specifically (9, 12) as related to sheet erosion, steep slopes and poorly structured top soil horizons.
Changes in livestock parameters	(3), (14), (16)	Also referred to as (14, 16) decline in livestock productivity.
Decreased water absorption capacity	(7), (10), (22), (25)	Also referred to as (10) low moisture retention and increased runoff; (12) a need of investment in soil and water conservation structures
Soil structure degradation; soil crusting	(10), (12), (22), (24)	Also referred to as (12) “weak” soils
Change in color of crop leaves	(7), (11), (25)	Also referred to as (11) “yellowing” of the crop
Stunted crops	(7), (10), (25)	In (10) this is referred to as less vigorous crop/vegetation. In (11) it is referred to as poor crop performance
Bush encroachment	(2), (8)	In (8) it was also pointed out that perception of bush encroachment as LD indicator depends on the livestock species.
Bare land, wind erosion, and sand dune formation	(3), (14)	In (14) sand dunes formed by wind erosion are referred to as dead lands, an extreme LD stage.

(1) Lestrelin and Giordano (2006); (2) Khwarae (2006); (3) Dembélé (2006); (4) Chizana *et al.* (2007); (5) Clément (2006); (6) Dembele (2006); (7) Dejene *et al.* (1997); (8) Katjiua and Ward (2007); (9) Kessler and Stroosnijder (2006); (10) Malley *et al.* (2006); (11) Moges and Holden (2007); (12) Okoba and Sterk (2006); (13) Ward *et al.* (2000); (14) Roba and Oba (2009); (15) Paniagua *et al.* (1999); (16) Oba and Kaitira (2006); (17) Macharia (2004); (18) Gray and Morant (2003); (19) Reed *et al.* (2007); (20) Solomon *et al.* (2007); (21) Pulido and Bocco (2003); (22) Muia (2013); (23) Jones (2002); (24) Akinnagbe and Umukoro (2011); (25) Abdulrashid and Mashi (2014).

4 Farmers' attitudes and strategies to cope with LD

What factors and socioeconomic characteristics of local communities govern the adoption of management strategies to cope with land degradation? What strategies do local communities adopt? In this section we discuss guidelines, which may serve for research and policy formulation. Antle *et al.* (2006) analyzed the feasibility of adopting conservation practices using econometric models among farmers in Peru; they found that farmers choose to invest in soil conservation technology if the cropping system becomes more productive in the short term. Okoba and Sterk (2006), in the Kenyan highlands, identified three options that the farmers would follow when facing soil degradation, depending on the severity of the process: (1) to allow nutrient replenishment by either natural or improved fallow systems; (2) to change to crop types that would adapt to relatively degraded soils; and (3) to sell soil materials for construction purposes when they became nutrient depleted. Manjoro (2006) showed that, in Kushinga Ward, Zimbabwe, farmers' adoption of soil and water conservation practices was significantly influenced by farm size, perception of the causes and severity of soil erosion, off-farm employment, availability of animal power and access to extension services. A significant aspect was the lack of understanding of the conservation practices; a participatory learning process was then recommended. Shiferaw and Holden (1998), in a degraded area of the Ethiopian highlands, advocated policies and technologies providing short-term benefits while at the same time allowing resource conservation. Conservation alternatives can be adopted or not by farmers depending on the specific socioeconomic or natural conditions of each place or community. For example, Hammad and Børresen (2006) found in their research in Palestine that the adoption of stonewall terraces depended on factors such as farmers' perceptions of erosion, land tenure and geomorphology.

In addition to the above, awareness of and attitude towards land degradation can be positively related to both severity of and susceptibility to degradation; the attitudes of Haitian peasants towards the environment were influenced by their socioeconomic status (Bayard and Jolly, 2007). This suggested that a positive attitude toward conservation would develop if farmers perceived a potential economic benefit from such practice, and that further studies were needed to analyze the importance of psychological variables for farmers' decisions regarding land degradation. At the local level, people act according to household conditions and local economic opportunities, the priority being the satisfaction of family needs. As an adaptive strategy to meet family needs, small farmers from an upland village of northern Laos, an area under the context of soil erosion and increasing population pressure, among other restrictions, diversified their activities to generate cash, which included land use intensification and the shortening of the fallow period, and sometimes crop diversification (Lestrelin and Giordano, 2006). Diversification may depend on household characteristics such as education, age and number of family members (Lestrelin *et al.*, 2006; Leutlwetse, 2006) diversification also is a key strategy for survival, and reduces risks in rain-fed agriculture (Winslow *et al.*, 2004). In some cases the choice for reducing pressure on land is to reduce the birth rate (Sankhayan *et al.*, 2003), as shown in a catchment in Mardi, Nepal. In the case of cattle herders, some of them rely on such adaptive strategies as transhumance, forage stocking and sale of animals, as exemplified for Mali (Dembele, 2006). Dietz *et al.* (2005) carried out research on livestock marketing among Mongolian pastoralists and found that herders did not have enough animals to sustain themselves in the traditional way, and that they were forced to combine subsistence livestock-grazing with a variety of other sources of income.

Agro-ecological and conservation practices that have been used to cope with or to reverse degradation processes include the following: afforestation and mechanical practices to fix dunes (Dembele, 2006); stonewall terrace construction to reduce runoff and erosion, and to preserve soil moisture (crucial in low rainfall areas) (Hammad and Børresen, 2006); and agro-forestry practices, including fallow (Malley *et al.*, 2006). These techniques have proven efficient in restoration of degraded lands and they deserve attention in conservation plans (Neupane and Thapa, 2001;

Pattanayak and Mercer, 2002); caution is needed, because the adoption of conservation practices is largely site-specific (Lapar and Pandey, 1999; Eswaran *et al.*, 2001).

5 Discussion and conclusion

In summary, local communities use several strategies to cope with land degradation, but the adoption of such strategies depends on their agro-ecological conditions and decisively on their socioeconomic and cultural characteristics. In many situations, local land users have a fair knowledge of causative factors and strategies to reverse degradation; nevertheless, they prioritize food security (i.e., survival) and do not take much action concerning mitigation of degradation in itself (Ryder, 2003; Moges and Holden, 2007). In this regard, in order to succeed, projects to cope with land degradation should consider the investment of time and effort by local producers. This is a major issue in ensuring local participation in land conservation and restoration practices. In addition, research suggests that an exchange of information about successful experiences between local communities leads to improved knowledge regarding best alternative practices (Bossio *et al.*, 2004; Li *et al.*, 2007).

Land degradation is a global phenomenon that affects human societies at the local level where rural communities closely related to land resources are vulnerable. Success in projects aimed at preventing or mitigating damage at the local level depends on the approach adopted. Since advantages and drawbacks are site- and goal-specific, traditional knowledge and community participation in all assessment stages and decisions related to implementation and follow-up are crucial (Abule *et al.*, 2005; Moges and Holden, 2007; Reed *et al.*, 2007). Integrated approaches seem to be appropriate to analyze causality and to define local indicators; perceptions and priorities defined by local people enable knowledge integration and consensus about goals and assessment methods (Hurni, 2000; Zurayk *et al.*, 2001; Gray and Morant, 2003; Lestrelin *et al.*, 2006; Styger *et al.*, 2007). Conversely, inadequate top-down policies allowing land mismanagement and unsuitable land use are among the most important underlying causes of degradation.

Many mitigation projects of land degradation, whose focus is only on symptoms or proximate causes, have shown limited or no success. The alternative is to address underlying causes, basically related to socioeconomic, political and cultural factors. This would yield a full understanding of causality. In the attempt to prevent or to reverse the effects of land degradation, diverse groups worldwide have tried to promote conservation practices. However, although the information generated has been technically sound, much of it is only available to researchers and not to resource managers (Seely and Wöhl, 2004; Seely *et al.*, 2008).

Rural producers use diverse strategies and diversified activities to cope with degradation. Local communities use diverse strategies and diversified activities to cope with degradation. Local communities often perceive land degradation in a wider context (Clément, 2006; Dembele, 2006) and perceive (or use) "land" or "landscape class" instead of "soil" (Oberthur *et al.*, 2004; Cervantes-Gutiérrez *et al.*, 2005; Ortiz-Solorio *et al.*, 2005). In addition, they assess land quality or land suitability on the basis of perception and traditional knowledge. Farmers are more comfortable using their terminology and classification schemes for their own soil or land resources. Combination of the two types of knowledge has been widely recommended, enhancing a better communication between farmers and external actors. In this way, such knowledge could be the basis for the design of land degradation prevention and mitigation strategies.

Local communities can exacerbate or reverse land degradation; the final outcome would depend on their social organization to properly manage their land resources, to carry out conservation projects, and on the sensitivity of local and national governments to develop and fund programs where such projects would be placed. The early identification of driving forces is crucial in understanding, mitigating or preventing degradation. Many programmes for poverty reduction in rural areas fail because they do not encompass other actions to cope with convergent driving forces of land degradation. In many instances, this inadequacy in policy design triggers the failure of attempts at mitigation.

Data from local case studies in Southeast Asia and Latin America show that increased population pressure has increased land degradation, primarily through deforestation. However, a high population density need not preclude the conservation of land resources provided it is accompanied by good agricultural practices (Boyd and Slaymaker, 2000; Carr, 2003; Nyangena and Sterner, 2008). The relationship between population and resources must be analyzed with caution because it is neither uni-directional nor linear. However, population pressure still remains a controversial issue (Erickson, 2006; Börjeson, 2007).

Environmental and socioeconomic contexts are crucial. Under extreme poverty, survival is the priority. Strategies to cope with land degradation include diversifying off-farm employment, managing fallow period and intensification of land use. Several soil and water conservation practices, and agro-ecological and agroforestry technologies have proven useful in reversing land degradation. But conservation practices are adopted if local communities have satisfied basic needs. Besides population pressure, other factors also need to be evaluated, such as the support of public institutions and sufficient cohesion of local communities, especially a strong community organization. The combination of these factors will result in the decision and the capacity of land users to invest time and resources in land conservation (Shiferaw and Holden, 1998).

Decision-making about land management and land degradation encompasses, among others, factors that may be biophysical (agro-ecological conditions, location), economic (access to credit and markets, non-farm incomes, availability of technologies), social (organizational structure, labor availability, land tenure), historical (environmental history and that of land tenure) and cultural (traditional knowledge, environmental awareness, and gender). Socioeconomic and cultural factors can be crucial to policy decision-making. For example, the attitude of local communities may be more critical than the availability of technology; the latter, although an important issue, may only be a tool to achieve goals in a social context. In turn, farmers' goals are defined by the conditions of their households (Tiffen *et al.*, 1994; Swinton and Quiroz, 2003; Nyangena and Sterner, 2008).

Development on the basis of the intensification of agriculture is a controversial issue in both developed and developing countries. In the case of rural areas in developing countries intensification needs to be embedded in bottom-up land management programs. In this respect cultural differences can explain the existence of different perceptions about development and land management models. In Machakos, Kenya, drought, low literacy and low income have been addressed by agricultural strategies (Tiffen *et al.*, 1994), showing that under certain conditions, basically strong social organization, population pressure can promote the conservation of land resources and agricultural intensification. The population quintupled in the period of 1930 – 1990 and by 1990 "there was no more land to occupy" and the new generation had to resort to other income sources in addition to agricultural activities. The experience was successful, especially because of the strength of local institutions, which have been transformed to adapt to new conditions. However, those authors indicated that the experience might be hard to replicate elsewhere. Despite criticisms from several authors, the work of Tiffen *et al.* (1994) has led to a rethinking of approaches to deal with LD; it has identified the need to stop seeing farmers as victims of world forces (globalization), or as passive receptors of government actions, and instead to encourage them to use their potential and capital to develop sustainable agriculture.

The priorities of local communities regarding the uses of natural resources must be recognized in order to reach a consensus concerning feasible alternatives within their socioeconomic context. In order to move beyond the typical methods to assess and combat land degradation, it is important to include adequate tools to address the factors that determine the farmers' attitudes to land conservation projects. Likewise, conservation actions need to be designed with consideration of short-term priorities for local people, in order to insure short-term economic benefits. Hence, resource conservation must incorporate actions that guarantee sufficient income for land users. This is likely to stimulate local people to adopt land conservation/restoration practices. Local communities should not be expected to simply adopt suggested practices; they may rather be supported to develop their own projects on the basis of their indicators and perception of land degradation, and their own survival priorities.

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