CHAPTER 1

ECONOMICS OF POVERTY, ENVIRONMENT AND NATURAL-RESOURCE USE

Introduction

ARJAN RUIJS[#], ROB B. DELLINK[#, ##]
AND DANIEL W. BROMLEY[###]

[#] *Environmental Economics and Natural Resources Group, Wageningen University and Research Centre, P.O. Box 8130, 6700 EW Wageningen, The Netherlands*
[##] *Institute for Environmental Studies, VU University of Amsterdam, De Boelelaan 1087, 1081 HV Amsterdam, The Netherlands*
[###] *Department of Agricultural and Applied Economics, University of Wisconsin-Madison, 427 Lorch Street, Madison, Wisconsin 53706-1513, USA*
E-mail: arjan.ruijs@wur.nl

Keywords. environmental economics; payments for environmental services; land use

INTRODUCTION

Reduction of poverty is a tremendous and persistent challenge for the global community. Although everyone agrees on the goal of poverty abolishment, policies often remain controversial or ineffective. Indeed, there is continual debate about which policies will be effective in different settings. Given that livelihoods of millions are at stake, there is an urgent need to reconsider the causes of and the remedies for poverty.

Poverty and its reduction are often linked to the natural-resources base (Adams et al. 2004; Sunderlin et al. 2005; Millennium Ecosystem Assessment 2005). Grazing lands may be overused, private plots suffer from a lack of fertilizer and accelerated loss of topsoil, artisanal fisheries are under pressure from local population growth and the incursion of near-shore commercial vessels, landlessness in many countries pushes the poor into indigenous forests – leading to increased rates of land clearing. Shortages in local fuelwood supplies place increased

Rob B. Dellink and Arjan Ruijs (eds.), Economics of Poverty, Environment and Natural-Resource Use, 3-15.

importance on the need for better management arrangements for non-traditional forest products. The quality and bounty of the local environment certainly affect living conditions of the poor, and their poverty is often seen as a contributing factor to the degraded condition of the local environment. Teasing apart the direction of causality in this resource–poverty nexus is a serious empirical challenge. What is not in doubt is that livelihoods cannot be improved if the local settings and circumstances remain degraded. It is equally likely that local environmental conditions cannot be improved if most people are living at the very margin of survival. Moreover, it is clear that many poverty reduction efforts will fail if the environmental effects are neglected (Adams et al. 2004).

This book contributes to an improved understanding of the economic dimensions of environmental and natural-resource management and poverty alleviation. In this introductory chapter we offer a brief overview of current knowledge concerning the relation between poverty, environment and natural-resource use. We discuss a number of the causes of the poverty–resource degradation relation that are most often cited in the literature. In addition, we consider some of the comments on these causes and present alternative viewpoints and policy advices. Finally, we offer a brief summary of the papers included in this volume and discuss how those chapters contribute to the discussion on the resource–poverty relation.

THE RELATION BETWEEN POVERTY, ENVIRONMENT AND NATURAL-RESOURCE USE

The nexus of environment and poverty is especially strong in developing countries. The economic well-being of many (especially rural) households directly depends on the quality of the environment and on the availability of natural resources. Especially for low-income countries, a substantial percentage of national income and an even larger share of the active population directly depend on agricultural, forestry and fisheries resources. Moreover, the use of natural resources often carries a high opportunity cost in terms of time required to obtain access to water and firewood – time that could otherwise be devoted to agricultural production. Moreover, poor water quality can lead to frequent illnesses. Where political pressure is strong to protect biodiversity, agricultural production may suffer.

In the literature, a multitude of reasons are advanced for the importance of the resource–poverty nexus. Some common arguments include erosion due to deforestation, contamination of drinking water by agricultural chemicals, depletion of groundwater aquifers, and excessive harvesting of near-shore fish stocks. These circumstances then directly affect income levels of the poor. Second, when national governments and international donors put pressure on the rural poor to alter their use of the natural environment, the income effects can be severe. Third, and often mentioned as one of the most important reasons for resource degradation, communal ownership and management may be identified as contributing to what is often – incorrectly – referred to as ‘tragedy of the commons’ (Bromley 1991). As a result,

uncontrolled resource use is said to have important adverse environmental effects. The incomes of the rural poor are often inordinately dependent on land, water, forests and fisheries in settings of increasing population pressure on these resources. When social conventions (institutions) make it difficult to exclude additional claims on fragile natural resources, it is inevitable that resource degradation will set in. In some cases, use rights may be strengthened if the land is properly managed, thereby giving farmers an incentive to invest in erosion prevention or soil fertility management. In other cases, however, fallowing is discouraged as population pressure increases the demand for arable land (see below for a more elaborate discussion on these issues). Coordinated management and robust compliance protocols are required if degradation is to be stopped.

There are, however, many examples of well-managed communal resources (Ostrom et al. 2002; Ostrom et al. 1999; Bromley 1992). But when natural resources are available to all who wish to use them, problems are sure to arise. In this context, it is important to be clear as to which policy failure is the essential reason for resource degradation. It is common to focus on 'missing property rights' but it is equally true that efforts to alter degradation or stimulate development are often frustrated by missing or flawed credit markets, input and product markets that function badly, corruption, well-meaning but ineffective governments, and poor enforcement of existing laws and regulations. The increased pressures from a globalizing economy also figure in here[1]. The point here is that it is often too easy to blame property-rights problems when in fact a number of institutional failures serve to hamper the economic prospects of the poor.

Due to the complex, two-sided character of the resource–poverty nexus, the most promising strategies for poverty alleviation and environmental conservation are those that seek to integrate both dimensions. We will discuss the issue from two sides. One approach concerns to what extent payments for environmental services can be an effective tool for stimulating sustainable resource use and poverty alleviation. The other side of the debate concerns alternative strategies to break the land degradation–poverty cycle. Because of the site-specific nature of agricultural conditions, demographic circumstances, climatic variation, cultural and political specifics, and specific market settings, it is not possible to prescribe one, all-encompassing recipe to stimulate soil quality maintenance (Foley et al. 2005; Pascual and Barbier 2006). The same complexities impede universal guidelines for land use, forestry, and water quality concerns. As we cannot discuss all elements in this volume, we only concentrate on the two themes mentioned above.

ARE PAYMENTS FOR ENVIRONMENTAL SERVICES EFFECTIVE FOR REDUCING POVERTY?

In the last decade, based on the idea that new conservation policies should be developed, the concept of Payments for Environmental Services (PES) emerged as a more direct conservation approach. The core idea is that beneficiaries of environmental services pay others for adopting resource uses that secure ecosystem conservation. Beneficiaries' willingness to pay stems from private preferences (e.g.,

eco-tourism or reduction of pollution), national or international public preferences (e.g., protection of species) or international policies (e.g., carbon sequestration in forests) (Wunder 2007).

Payments for environmental services are often characterized as a cost-effective means to internalize both the negative externalities of resource extraction and the positive externalities provided by ecosystems (Kosoy et al. 2007). Usually, PES schemes compensate those providing positive externalities or those agreeing not to generate a negative externality. This is in contrast to the 'polluter pays' principle, in which those causing negative externalities should pay for the damage caused (Pagiola et al. 2005). The theoretical foundations of PES schemes stem from acceptance of an insight from the Coase theorem (Coase 1960), that when transactions costs – information costs, contracting costs and enforcement costs – are zero, there could be no Pareto-relevant externalities since they would all be costlessly bargained away. When bargaining is costless, either outcome is deemed efficient since the direction of payment will not matter. But of course, transaction costs are never zero, and the market for bargaining cannot possibly be considered costless. With this dose of reality, the Coase Theorem is of great novelty in theory, but of limited use in practice (Dahlman 1979). An additional practical problem is that the 'polluter pays' principle is difficult to apply to non-point pollution because often the very poorest individuals are dependent on land that may be suitable for producing environmental services. To be efficient, PES schemes should fulfil two conditions. First, compensation to resource users should at least equal the opportunity costs of the resource use. Secondly, payments should not be higher than the economic value of the environmental externality (Pagiola et al. 2005). This assures that both providers and receivers of payments will be better off and that both will in principle voluntarily participate in the program, at least when compliance is assured. A large strand of literature exists on valuing environmental services, which is necessary in order to determine the correct level of payments (see e.g. Carson et al. 1996; Garrod and Willis 1999; Montgomery et al. 1999). A practical issue concerns the reference level that shall anchor in which direction payments should flow (see Bromley 2000). By reference level we mean what is the 'correct' level of some environmental service so that we will know if the individual is adding environmental services over-and-above that level – in which case a payment might be warranted, or if the individual is responsible for a degradation in that reference level – in which case the 'polluter pays' principle would be appropriate. Moreover, these reference levels may shift over time and it is too easy to become paralysed by 'policy lock-in' (Bromley 2007).

While there is growing interest in PES schemes, experience is still scanty. Some Latin American countries are trying such programs, with Costa Rica being a prominent example. So far, the literature evaluated only a few such programs (see e.g. Sierra and Russman 2006; Pagiola et al. 2005; Zbinden and Lee 2005; Grieg-Gran et al. 2005). Detailed discussions of possible PES schemes are rare (see Landell-Mills and Porras 2002; Mayrand and Paquin 2004), but from the scattered evidence it seems that environmental and poverty effects are rather mixed. The most common PES schemes can be classified into four types (Wunder 2005; 2007):

- Carbon sequestration and storage, which includes long-term storage of carbon in woody biomass and soil organic matter;
- Watershed protection, concerned directly with the provision of sufficient and good-quality water;
- Biodiversity conservation, concerned with all processes that determine and maintain biodiversity at all levels; and
- Preservation of landscape beauty.

Water services are common in PES programs – particularly those oriented to the relation between upstream agricultural and forestry activities and downstream water quality. A number of PES programs seek to increase downstream water availability by increasing upstream forest cover – though scientific evidence on this relation is weak (Kosoy et al. 2007). For water quality management, other payment mechanisms, like water pricing, may be a more appropriate tool to get the incentives right.

Since many of those who might receive PES are poor, it would seem that PES schemes can reduce poverty and improve environmental conditions (Landell-Mills 2002). Those PES programs aimed at watershed protection and biodiversity conservation are usually expected to be beneficial for the poor. This is because poorer households are often relegated to steep upland sites that are ecologically sensitive (Sunderlin et al. 2005). If the poor are prevented from gathering fuelwood, or if their standard swidden agriculture is prohibited, it would seem that some compensation is called for. In addition, if their colonisation of new lands is prohibited in order to protect watersheds or biodiversity, some economic retribution seems particularly justified. Pagiola et al. (2005, p. 248) warn, however, that "PES programs are not a magic bullet, but there can be important synergies when program design is well thought out". But, as with all such schemes, the specifics are essential. If PES programs are oriented towards well-specified environmental services, it might mean that those living in a particular area – even if not necessarily the poorest – will benefit. Moreover, if PES programs limit access to communal land or reduce land-tilling activities, the landless may be affected most and may not be compensated for their losses. That is, landowners may reap significant benefits from PES schemes, at the expense of the landless. In the best of circumstances, say with carbon sequestration, it might be possible to enhance sustainable forestry, contribute to carbon sequestration, and to help alleviate poverty. The evidence seems to suggest, however, that PES programs under the Clean Development Mechanism (CDM) of the Kyoto protocol will be more cost-effective in large-scale industrial plantations due to the high transaction costs and institutional problems in community-based CDM projects in poor communities (Minang et al. 2007; Smith and Scherr 2003). This problem with small-scale projects may also extend to other PES schemes, although clear evidence is still scarce.

Successful implementation of PES programs is hindered by a number of problems, including uncertain or inequitable land tenure, problems with contract monitoring and enforcement, missing information, and the lack of non-agricultural investment and employment opportunities (Ferraro and Kiss 2002). In addition to PES schemes, other creative approaches are needed that will enhance sustainability

and also reduce poverty. Ecotourism is a common approach (Neto 2003; Uddhammar 2006). Such developments may encourage environmental conservation and also generate additional jobs and income (Wunder 2000). However, Kiss (2004) argues that in many community-based ecotourism projects, the areas conserved are small, few people are involved, earnings are limited and linkages between biodiversity gains and commercial success are weak. Moreover, the level and distribution of benefits depend on many factors, and for most participants, agricultural and forestry activities remain an important source of income (Wunder 2000). Ferraro and Kiss (2002) and Ferraro and Simpson (2002) argue that, especially when conservation is the main objective, directly paying for ecosystem conservation (i.e. PES programs) is more cost-effective than encouraging commercial activities such as eco-tourism. However, they ignore transaction costs and other policy failures. Moreover, they argue that the community development and spill-over benefits of indirect approaches such as eco-tourism will be rather limited, even though that may be a more important objective for eco-tourism projects than biodiversity conservation.

DO SHIFTS IN LAND USE AGGRAVATE OR AMELIORATE POVERTY?

"Land use presents us with a dilemma. On the one hand, many land-use practices are absolutely essential for humanity, because they provide critical natural resources and ecosystem services such as food, fibre, shelter, and fresh water. On the other hand, some forms of land use are degrading the ecosystems and services upon which we depend" (Foley et al. 2005, p. 570). The relation between land use, land degradation and poverty has been extensively analysed. Two main perspectives have emerged for explaining the causes and consequences of land degradation (Pascual and Barbier 2006). On the one hand, the Malthusian explanation argues that due to increasing population pressure, fallow periods are shortened and this results in a vicious cycle between land degradation and poverty. This trades short-term increases in food production for long-term losses in ecosystem services, many of which are important to agriculture (Foley et al. 2005). On the other hand, the Boserupian argument is that population pressure and declining yields will induce farmers to intensify land use. More fertilizers, pesticides, high-yielding varieties and land management techniques will be used to maintain soil fertility and to replace fallowing periods, which will lift farmers out of their chronic poverty situation. An additional argument put forward in the literature reminds us that the land use–poverty relation is affected strongly by the institutional set-up of rural economies (Panayotou 2000; Pascual and Barbier 2006) and opportunities and constraints created by markets and global factors (Lambin et al. 2001). Institutional factors, such as land tenure, land and labour constraints, and uncertainty in factor, product, and capital markets will affect farmers' land conservation strategies and incentives and affect their willingness to adopt improved production techniques (Panayotou 2000; Lambin et al. 2001; Ruijs et al. 2004; Barbier 1997; Maatman et al. 2002). The risk of low crop yields may seriously hamper the ability of farmers to borrow

funds to improve land quality. In many African communities effective interest rates for small-scale farmers may be extremely high. Other factors that affect land management decisions include cultural, demographic and urban labour demand.

Barbier (1997) and Pascual and Barbier (2006) conclude that both the Malthusian and the Boserupian hypotheses are valid, but that the specific relation depends on the institutional set-up. Both conclude that differences in opportunity costs of labour or political and market power will induce the poor to extensify agriculture as a response to increasing population pressure. The better-off farmers will choose intensification and they use their superior position to ensure access to better resources. Improving off-farm labour conditions may help breaking the vicious degradation–poverty cycle. Lambin et al. (2001) conclude that population pressure may result in a 'stressed' system with declining yields and under-investments in terraces, irrigation and land degradation. Another response, however, may be intensification and increasing commercial output as well as diversification strategies by households including migration and off-farm employment. Views on reasons for and effects of migration differ somewhat between the approaches adopted. Roughly, two perspectives are popular: the Todaro-type models focusing on the individual's decision to migrate, and the 'new economics of migration' explanation focusing on the family as decision unit (De Haan 1999; Taylor et al. 2003). An extensive literature review by De Haan (1999) shows that reasons for migration as well as the effects on rural areas and poverty are very much context-dependent, depending on, among other things, aspects such as seasonal movements, educational levels of migrants, length of time spent away, assets and social structures and institutions.

SOME GENERAL OBSERVATIONS ON THE LINK BETWEEN POVERTY AND NATURAL-RESOURCE USE

A few general observations on the linkages between poverty, the environment and natural-resource use can be made. First, institutions matter! Irrespective of the instruments adopted or objectives of intervention programs, if institutions are malfunctioning, objectives will not or only partly be obtained. Well-functioning credit, product and labour markets, effective monitoring of rules and regulations, proper enforcement of policies and secure land tenure are of utmost importance. A complexity is that improvements of institutions in a second-best world may work counter-productive. For instance, allocation of individual land rights to farmers in a situation with imperfect capital markets may induce subsistence farmers to sell their land to large, wealthy land owners. Communal PES schemes for forestry management may fail due to free-rider behaviour by a few participants if proper monitoring of contracts is absent. Correct institutions are necessary to give farmers and landowners the correct opportunities and let incentives work the way they are intended. There still is a large gap in the economic literature on which institutions exactly are important, how they should be organized and whether they will lead the poor out of the poverty trap.

Secondly, large differences can be observed between continents, countries and even within regions. Due to a large array of environmental, climatological, cultural, economic and other reasons, it is difficult to derive general relations between poverty and environmental conditions and to formulate general guidelines on how to break the environmental-degradation–poverty vicious cycle. Moreover, even though much is known on how ecosystems function and how environmental conditions affect economic developments, still a lot of scientific evidence on ecosystem functioning and environmental interlinkages is missing. This makes developing effective policies a complex task, as successful interventions in one location may be counterproductive in other locations. It can be questioned, however, whether it will ever be possible to formulate generic policies that can be applied with disregard for the specific circumstances. For that reason, more knowledge is needed on robust decision making under limited information and under uncertainty.

Thirdly, the above exposition shows that it is often difficult to exploit synergies and reach a win-win situation. Simultaneously reaching multiple objectives may be hard as objectives may be (partly) conflicting, especially in case of missing institutions. Although in theory it may be possible to create synergies, in practice it is often hard to reach multiple objectives with a single policy instrument. It is important that an integrated approach is adopted in which problems are analysed from different angles and by different disciplines and that, as much as possible, indirect effects of envisaged programs are considered.

OVERVIEW OF THE BOOK

Each of the chapters of this book reviews an element of the resource–poverty nexus from a different viewpoint. The book has been divided into three parts.

Part I contains, next to this introductory Chapter 1, two chapters that provide a more theoretical exposition on the relation between resource use and poverty. In Chapter 2, *Barrett* provides an overview of one of the essential issues under discussion here – linking economic decision making with ecosystems analysis (i.e. welfare dynamics with resource dynamics) – to explain poverty traps. Poverty traps are situations where people cannot get out of an equilibrium (or steady state) that has a low level of well-being. This can be explained by (i) the original Ramsey-Cass-Koopmans growth model for an entire population; (ii) by distinguishing groups of individuals with similar characteristics, where some groups may get stuck in a poor equilibrium (club convergence); (iii) thresholds and multiple equilibria for each individual (possibly in combination with (ii)). The third case is the most interesting. As pointed out above, possible causes for multiple equilibria are (i) market imperfections in combination with credit constraints; (ii) imperfect learning and bounded rationality; and (iii) co-ordination and institutional failure. The dynamics of welfare and resources are not only linked through the assets of the household, where poor households are heavily linked to natural resources, but the causes of poverty traps also extend to the natural-resource base. Barrett illustrates these links with detailed examples for various regions and resources. He concludes that intervention

is essential to get away from the poverty trap and most likely also to avoid ecosystem collapse. Appropriate interventions are however difficult to design, due to the multiple causal mechanisms of poverty traps.

In Chapter 3, *Hellegers, Schoengold* and *Zilberman* investigate reforms of policies and incentives to improve water resource management. They place special emphasis on distributional issues, i.e. the link between water policies and poverty. They identify four main types of reforms that are required: (i) rules to improve design of and decision-making process about water project development and maintenance; (ii) principles to improve water allocation and pricing, which includes full marginal cost pricing, block-rate pricing and cap and trade systems; (iii) incentives for water conservation; and (iv) incentives to improve water quality. Furthermore, changes will be necessary in conveyance management, groundwater management and tradable water rights in order for these reforms to be efficient. The authors go on to stress the link between water use and energy use, and argue that increased scarcity of energy will impact water not only through higher production costs, but also through increased water demand from alternative fuels. They conclude that while the distributional effects can be problematic in the short run due to higher water prices, there are substantial positive effects in the long run, including better access to water and more sustainable use of water resources.

Part II of the book deals with payments for and values of environmental and forestry resources. The part opens with a contribution by *Meijerink* on Payments for Environmental Services (Chapter 4). Meijerink argues that both goals of PES systems, i.e. providing additional income to the poor and maintaining environmental services, are difficult, if not impossible, to measure and often payments are not made dependant on the quality of the service provided. Thus, good indicators to measure and monitor contributions to these goals are essential. Through extensive literature review and systematic analysis she derives that different institutional arrangements for monitoring are required for successful implementation of different types of PES schemes, taking transaction costs, including monitoring costs, explicitly into account. Several moral-hazard problems may arise that have to be dealt with in the design of the scheme; these depend on (i) the type of environmental service provided (and the underlying production process); (ii) the extent to which the environmental service can be freely observed or measured; (iii) the extent to which activities of the resource managers, who provide the environmental service, can be freely observed; and (iv) the extent to which the outcomes are determined by the production process or by natural processes (such as climate).

Chapter 5, by *Sarr, Boncoeur, Cormier-Salem* and *Travers*, looks at another financial instrument for environmental policy. They investigate whether non-extractive use of a resource, in this case ecotourism, can provide the economic incentives to overcome the 'tragedy of the commons' caused by the extractive use of the resource (in this case artisanal fishing). An empirical survey of the Saloum Delta in Senegal shows that demographic pressure and agricultural crises have led to substantial over-fishing. Furthermore, Sarr et al. use a bio-economic model to show how ecotourism and artisanal fishing are interlinked through the use of a common resource and as fishing entails a negative externality on ecotourism, interventions are needed to limit fishing and stimulate ecotourism.

The links between poverty and deforestation are explored by *Pfaff, Kerr, Cavatassi, Davis, Lipper, Sanchez* and *Timmins* in Chapter 6. They review various theories on how income changes affect forest clearing and, as the theoretical results are ambiguous, examine the net impact in a time-series case study on Costa Rica. Using data for four decades, they estimate that, on balance, poverty is not significantly related to deforestation. They show, however, that this result is the combined effect of two significant effects: (i) marginalized lands are cleared less rapidly; and (ii) poorer areas tend to be cleared more rapidly, if these location differences are controlled for, as the location differences imply that the poorer appear to have more marginalized land. The latter effect is less strong for the poorest areas, and in these areas deforestation responds less to changes in land productivity.

Chapter 7 also looks at the link between deforestation and poverty. In their contribution, *Chukwuone* and *Okorji* use contingent valuation to estimate the willingness of households in forest communities to pay for the protection of non-timber forest products through systematic management of the forest. Their case-study area is the rainforest region in Nigeria. Non-timber forest products, especially food, fibre and herbal medicines from flora and fauna species, provide a substantial source of income for many households. The authors use a two-step approach to show that females have a higher willingness to pay (WTP) for community forests than males. This is not surprising since collection of non-timber forest products is mostly carried out by women. Similarly, having more females (males) in the household also increases (decreases) the WTP. Furthermore, farmers and middle-income households have a higher WTP, increased education (years of schooling) has a positive impact and distance to the source a negative impact. The average willingness to pay equalled around $4.50, but the authors also observe a significant and positive starting-point bias, which limits the numerical interpretation of their results.

Part III of the book, on sustainable land use, commences with two investigations of sustainable land use in the upland Philippines. In Chapter 8, *Omura* examines whether traditional, or indigenous, informal institutions encourage or hinder sustainable management of agricultural land. She finds that traditional institutions, especially access to the exchange-labour system, and informal credit can be effective in maintaining the land resource. Construction activities and adoption of sustainable techniques are significantly and positively related to property-rights strength. As technique adoption is also significantly and positively related to restrictions of property rights, the author concludes that moderate restrictions on property rights encourage adoption of sustainable techniques, although her conclusions may hinge on the limited definition of property-rights strength used in the paper. Other informal institutions, such as the presence of a traditional authority, and several household characteristics are found to be of less significance.

In Chapter 9, *Romero* and *De Groot* use similar econometric techniques to examine incentives to invest in land quality. Rather than the destructive slash-and-burn technique that is often applied, farmers can invest in terracing, contour bunds, (sprinkler or channel) irrigation, agro-forestry and/or tree plantation. Regression analysis of their survey reveals that investments in land quality significantly increase with the age of the household head, indicating life-cycle effects. More knowledge of

sustainable techniques, availability of non-farming income and village-level characteristics are also significant. Contrary to the Boserupian hypothesis, Romero and De Groot do not find a significant impact of population density.

The last chapter (10) in the book, by *Mensah-Bonsu* and *Burger*, deals with the important issue of migration. They formulate a bargaining model of migration where individuals will migrate only if their remittance is larger than their contribution as resident household member: this ensures that both the migrating individual and the remaining household are better off. Using cross-sectional data from Ghana, they test their model using regression analysis. They find that per-capita farmland size and local employment conditions reduce the probability of migration and, apart from the migrant's sex, age and educational level, more livestock sales of the farm significantly influence remittances. Mensah-Bonsu and Burger cannot validate the core of their theoretical model, however, because they cannot find a significant effect of land quality on migration – or on remittances. It is clear though that migration is a response to overpopulation (which implies, among other things, smaller farmland sizes) and a lack of non-farm economic activities in the region.

ACKNOWLEDGEMENTS

We would like to thank the participants to the International Conference on the Economics of Poverty, Environment and Natural-Resource Use. The conference was organized by the Environmental Economics and Natural Resources Group of Wageningen University, chaired by Prof. E.C. van Ierland, H.P. Weikard and R.B. Dellink and held in Wageningen, The Netherlands, from 17 to 19 May 2006. Moreover, we thank all the authors for their contributions to the conference book and the anonymous referees for their constructive comments and suggestions. Finally, we thank the sponsors of the conference, the Netherlands Organization for Scientific Research (NWO), Royal Netherlands Academy of Arts and Sciences (KNAW), Frontis – Wageningen International Nucleus for Strategic Expertise, the Ministry of Foreign Affairs, the Wageningen Institute for Environment and Climate Research (WIMEK), Mansholt Graduate School of Social Sciences and the Social Sciences Department of Wageningen University and Research Centre for their contributions to organizing the conference.

NOTES

[1] These include, e.g., large, internationally operating fishing vessels pushing local fishermen to smaller and near-shore fishing grounds, growing cattle ranches and soybean and sugarcane plantations forcing subsistence farmers to clear more remote forest fields, and ever-increasing urbanization causing an increased demand for water and staple food forcing farmers to invest in more efficient irrigation and cultivation systems.

REFERENCES

Adams, W.M., Aveling, R., Brockington, D., et al., 2004. Biodiversity conservation and the eradication of poverty. *Science*, 306 (5699), 1146-1149.

Barbier, E.B., 1997. The economic determinants of land degradation in developing countries. *Philosophical Transactions of the Royal Society of London. Series B. Biological Sciences,* 352 (1356), 891-899.

Bromley, D.W., 1991. *Environment and economy: property rights and public policy*. Blackwell, Oxford.

Bromley, D.W. (ed.) 1992. *Making the commons work: theory, practice and policy*. ICS Press, San Francisco.

Bromley, D.W., 2000. Can agriculture become an environmental asset? *World Economics,* 1 (3), 127-139.

Bromley, D.W., 2007. Environmental regulations and the problem of sustainability: moving beyond "market failure". *Ecological Economics,* 63 (4), 676-683.

Carson, R.R., Flores, N.E., Martin, K.M., et al., 1996. Contingent valuation and revealed preference methodologies: comparing the estimates for quasi-public goods. *Land Economics,* 72 (1), 80-99.

Coase, R.H., 1960. The problem of social cost. *Journal of Law and Economics,* 3, 1-44.

Dahlman, C.J., 1979. Problem of externality. *Journal of Law and Economics,* 22 (1), 141-162.

De Haan, A., 1999. Livelihoods and poverty: the role of migration; critical review of the migration literature. *Journal of Development Studies,* 36 (2), 1-47.

Ferraro, P.J. and Kiss, A., 2002. Ecology: direct payments to conserve biodiversity. *Science,* 298 (5599), 1718-1719.

Ferraro, P.J. and Simpson, R.D., 2002. The cost-effectiveness of conservation payments. *Land Economics,* 78 (3), 339-353.

Foley, J.A., DeFries, R., Asner, G.P., et al., 2005. Global consequences of land use. *Science,* 309 (5734), 570-574.

Garrod, G. and Willis, K.G., 1999. *Economic valuation of the environment: methods and case studies.* Edward Elgar Publishing, Cheltenham.

Grieg-Gran, M., Porras, I. and Wunder, S., 2005. How can market mechanisms for forest environmental services help the poor? Preliminary lessons from Latin America. *World Development,* 33 (9), 1511-1527.

Kiss, A., 2004. Is community-based ecotourism a good use of biodiversity conservation funds? *Trends in Ecology and Evolution,* 19 (5), 232-237.

Kosoy, N., Martinez-Tuna, M., Muradian, R., et al., 2007. Payments for environmental services in watersheds: insights from a comparative study of three cases in Central America. *Ecological Economics,* 61 (2/3), 446-455.

Lambin, E.F., Turner, B.L., Geist, H.J., et al., 2001. The causes of land-use and land-cover change: moving beyond the myths. *Global Environmental Change-Human and Policy Dimensions,* 11 (4), 261-269.

Landell-Mills, N., 2002. Developing markets for forest environmental services: an opportunity for promoting equity while securing efficiency? *Philosophical Transactions of the Royal Society. Mathematical, Physical and Engineering Sciences,* 360 (1797), 1817-1825.

Landell-Mills, N. and Porras, I.T., 2002. *Silver bullet or fools' gold? A global review of markets for forest environmental services and their impact on the poor*. International Institute for Environment and Development (IIED), London. [http://www.poptel.org.uk/iied/docs/flu/psf_silvbullet.pdf]

Maatman, A., Schweigman, C., Ruijs, A., et al., 2002. Modeling farmers' response to uncertain rainfall in Burkina Faso: a stochastic programming approach. *Operations Research,* 50 (3), 399-414.

Mayrand, K. and Paquin, M., 2004. *Payments for environmental services: a survey and assessment of current schemes*. Unisféra International Centre, Montreal. [http://www.cec.org/files/PDF/ECONOMY/PES-Unisfera_en.pdf]

Millennium Ecosystem Assessment, 2005. *Ecosystems and human well-being: synthesis report*. Island Press, Washington.

Minang, P.A., McCall, M.K. and Bressers, H.T.A., 2007. Community capacity for implementing Clean Development Mechanism projects within community forests in Cameroon. *Environmental Management,* 39 (5), 615-630.

Montgomery, C.A., Pollak, R.A., Freemark, K., et al., 1999. Pricing biodiversity. *Journal of Environmental Economics and Management,* 38 (11), 1-19.

Neto, F., 2003. A new approach to sustainable tourism development: moving beyond environmental protection. *Natural Resources Forum,* 27 (3), 212-222.

Ostrom, E., Burger, J., Field, C.B., et al., 1999. Revisiting the commons: local lessons, global challenges. *Science,* 284, 278-282.

Ostrom, E., Dietz, T., Dolsak, N., et al. (eds.), 2002. *The drama of the commons*. National Acadamy Press, Washington.

Pagiola, S., Arcenas, A. and Platais, G., 2005. Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date from Latin America. *World Development*, 33 (2), 237-253.

Panayotou, T., 2000. *Population and environment*. Harvard University, Center for International Development, Cambridge. CID Working Paper no. 54. [http://www2.cid.harvard.edu/cidwp/054.pdf]

Pascual, U. and Barbier, E.B., 2006. Deprived land-use intensification in shifting cultivation: the population pressure hypothesis revisited. *Agricultural Economics*, 34 (2), 155-165.

Ruijs, A., Schweigman, C. and Lutz, C.H.M., 2004. The impact of transport- and transaction-cost reductions on food markets in developing countries: evidence for tempered expectations for Burkina Faso. *Agricultural Economics*, 31 (2/3), 219-228.

Sierra, R. and Russman, E., 2006. On the efficiency of environmental service payments: a forest conservation assessment in the Osa Peninsula, Costa Rica. *Ecological Economics*, 59 (1), 131-141.

Smith, J. and Scherr, S.J., 2003. Capturing the value of forest carbon for local livelihoods. *World Development*, 31 (12), 2143-2160.

Sunderlin, W.D., Angelsen, A., Belcher, B., et al., 2005. Livelihoods, forests, and conservation in developing countries: an overview. *World Development*, 33 (9), 1383-1402.

Taylor, J.E., Rozelle, S. and De Brauw, A., 2003. Migration and incomes in source communities: a new economics of migration perspective from China. *Economic Development and Cultural Change*, 52 (1), 75-101.

Uddhammar, E., 2006. Development, conservation and tourism: conflict or symbiosis? *Review of International Political Economy*, 13 (4), 656-678.

Wunder, S., 2000. Ecotourism and economic incentives: an empirical approach. *Ecological Economics*, 32 (3), 465-479.

Wunder, S., 2005. *Payments for environmental services: some nuts and bolts*. CIFOR, Bogor. CIFOR Occasional Paper no. 42. [http://www.cifor.cgiar.org/publications/pdf_files/OccPapers/OP-42.pdf]

Wunder, S., 2007. The efficiency of payments for environmental services in tropical conservation. *Conservation Biology*, 21 (1), 48-58.

Zbinden, S. and Lee, D.R., 2005. Paying for environmental services: an analysis of participation in Costa Rica's PSA program. *World Development*, 33 (2), 255-272.