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POOR PEOPLE AND THE ENVIRONMENT: ISSUES AND LINKAGES

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(Livelihoods and Institutions Group)

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The Natural Resources Institute (NRI) of the University of Greenwich is an internationally recognized centre of expertise in research and consultancy in the environment and natural resources sector. The Institute carries out research and development and training to promote efficient management and use of renewable natural resources in support of sustainable livelihoods.

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PREFACE

This series is principally concerned with current policy issues of importance to developing countries but also covers those relevant to countries in transition. The focus is upon policies which affect the management of natural resources in support of sustainable livelihoods. Much of the series will be devoted to concerns affecting the livelihoods of poor people in rural areas, recognizing the linkages with non-natural resource-based livelihoods. It will also include the interests of the urban poor, where these are linked to the use of natural resources as part of livelihood strategies.

The series will take a holistic view and cover both the economic and social components affecting livelihoods and associated factors, notably with respect to health and education. The aim is to provide topical analyses which are based upon field research where appropriate, and which will inform development practitioners concerned with issues of poverty in development.

The series is timely, given the increasing focus upon poverty and poverty elimination in the agenda of the development community. It is also timely with respect to the growing body of recent work which seeks to replace earlier, simplistic structural adjustment programmes, with more flexible approaches to livelihoods, institutions and partnerships.

Policy analysis is often assumed to be the remit of social scientists alone. Whilst it is recognized that social science may play a pivotal role, interactions with other disciplines may also be critical in understanding and analysing policy issues of importance to the poor. The series therefore draws upon a wide range of social and natural scientific disciplines reflecting the resource base at the Natural Resources Institute.

EXECUTIVE SUMMARY

This publication examines the nature of the linkages between rural poverty and the environment in developing countries, with particular respect to the causes of degradation and approaches to its mitigation. It also considers gaps in knowledge, research needs and policy implications for environmental management and poverty reduction. In so doing, a conceptual framework is developed for more generally guiding understanding of the environment–poverty nexus in rural situations.

It has long been known that poverty and the environment are closely linked. Many millions of poor rural people are closely dependent on natural resources for their livelihoods and the abundance and condition of these resources has a major bearing on livelihood quality. Until recently, the dominant thesis has been that rural poverty and population growth together comprise the major cause of degradation: in some circumstances poor people have no alternative but to over-exploit the natural resources and environment on which they depend. Where landscapes are fragile, over-exploitation affects the land's carrying capacity and reduces the number of people it can support – hence a downward spiral. In recent years, this theory has been criticized by some as over-simplistic and alternatives have been put forward which emphasize the importance of local institutions and power relations.

The paper briefly reviews the geographic distribution of the rural poor, the various forms poverty takes and the factors governing population density in any situation, including the carrying capacity of the land. It then develops a conceptual framework consisting of a series of linked boxes for understanding the relationship between rural poverty and environmental change in different situations. Rather than suggesting a given causal relationship, it indicates a set of factors that guide the different ways that

poverty impacts on the environment and, in turn, how environmental change can impact differentially on poverty.

The relative importance of each of these factors is shown to vary from case to case. Factors include:

- the local nature of poverty and access to resources;
- the fragility of the natural environment;
- the institutions and processes governing security and risk;
- the development of local markets and incentive structures.

These bear on a central box depicting the decision-making milieu of the poor. The framework also contains a box representing exogenous influences such as demographic change, economic growth, globalization, natural calamities such as drought or flood, political stability and the threat of conflict or war.

The final chapter discusses in broad terms key findings, policy lessons, gaps in knowledge and research needs. It concludes that while poverty and the environment in developing countries are closely related, the relationship is complex and multifaceted, and lines of causation are variable. Numerous examples of poor people acting in an environmentally sustainable manner indicate that poverty does not inevitably or even usually lead to degradation; nor, indeed, does poverty reduction necessarily lead to environmental improvement. There is little evidence to suggest that poor people *necessarily* discount the future more highly than others and, indeed, it is the wealthy who consume greater quantities of resources and create more waste than the poor.

In conclusion the paper suggests:

- environments vary a great deal in their natural attributes not least their susceptibility to degradation;
- markets for environmental goods and services are generally poorly developed which can give rise to externalities and non-sustainable natural resource management;
- changes in infrastructure and technology can greatly influence environmental management, both positively and adversely, by the poor and rich alike;
- policies and legislation sometimes create production incentives with adverse environmental impacts, and lessons should be sought from recent developments in conservation policy in Europe;

- poor rural people are more vulnerable than the wealthy to shocks and stresses over which they have no control;
- long-term security of the poor is influenced by factors such as property rights, the rule of law and the threat of future conflict; where there is little security and the future is uncertain, poverty can increase the likelihood of non-sustainable behaviour;
- low life expectancy may potentially influence environmental behaviour and it is not certain whether old people have a shorter or longer-term outlook on time.

In sum the publication concludes that while poverty does not *itself* give rise to degradation, it can increase the vulnerability of poor people to externally driven threats and thus play a part in the process. How poverty impacts on the environment in any situation depends on a host of economic and institutional factors that vary tremendously from place to place, and the aim of research and policy taken together must be to improve understanding of local driving forces. There is a need for systems-based and people-centred research that specifically examines such issues in locations with environmental and poverty problems. Research is required to explore issues such as the discount rate of poor people of different ages and in different circumstances and geographical situations.

The study also suggests that the issue of environmental degradation is less well-understood than is presently thought and is itself a critical research area. Environmental change is an inevitable accompaniment of economic activity and population growth and will grow in the decades ahead. However, environmental change is not the same thing as degradation and certain changes may be necessary to absorb increasing populations and growing material needs. Deforestation and other aspects of environmental change need to be analysed in depth and in context, not least in terms of the cost-benefit distributions of change, and simplistic assumptions about degradation should be avoided. There is need for in-depth, time-related, locally specific and systems-based research in these areas.

1

INTRODUCTION

BACKGROUND AND OBJECTIVES

This publication seeks to improve understanding of the relationship between poverty and the environment. More specifically, the objectives are:

- to improve understanding of the two-way linkages between poverty and the environment, particularly with respect to the causes of environmental degradation;
- to identify gaps in knowledge, research needs and lessons for policy;
- to provide an outline framework of factors influencing degradation and thereby help to develop an understanding of the nature of the environment–poverty nexus in any situation. Such understanding is considered especially important where government or donor intervention is considered.

ISSUES ADDRESSED

That poverty and the environment are linked in some way has long been realized (e.g. United Nations Conference on the Human Environment in 1972), although until recently little research has specifically addressed the problem. Many millions of poor rural people are closely dependent on natural resources for their livelihoods, and the abundance and condition of these resources undoubtedly have a major bearing on their livelihoods. Although in the last two decades there has been a decline in the proportion of people directly dependent on natural resources, in many countries absolute numbers are still increasing (UNDP, 2000, 2001).

Until recently the dominant thesis has been that rural poverty, allied with population growth, is a major cause of degradation of the natural

environment, including soils, forests, vegetation, water and natural habitats. It supposes that there are limits to the numbers of people that the natural environment can support and beyond these limits exhaustion and degradation take place. In these circumstances poor people have no alternative but to over-exploit and degrade the natural resources and environment on which they depend. This may become a downward spiral (or vicious circle) in which the rural poor, dictated by population pressure and the needs of survival, are forced to over-exploit natural resources and move to ever-more fragile lands, leading to further environmental degradation and a reduction in the land's carrying capacity. Thus rural poverty and environmental degradation are inextricably linked through a two-way and self-enforcing chain of causation. The only way to break into this chain and avoid environmental degradation is through policies and programmes that alleviate rural poverty (see Cleiver *et al*., 1994).

This thesis has recently been questioned by a number of observers, most notably by Forsyth *et al.* (1998), Leach and Mearns (1997), and contributors to a recent joint United Nations Development Programme (UNDP) and European Commission (EC) Initiative on Poverty and Environment. One paper describes the downward spiral model as "simplistic" and suggests that it sometimes leads to policies that reduce poverty at the expense of the environment, or reduce degradation at the expense of poor people (Scherr, 1999). These authors have challenged the orthodox view that poverty and environmental degradation are inextricably linked and self-enforcing, and that poverty alleviation necessarily leads to improved environmental management. Forsyth *et al*. (1998) put forward an 'entitlements approach' that argues that local institutional arrangements, underpinned by power relations, are crucial in determining who has access to, and control over, resources in any situation, and hence how environmental resources are managed. They suggest that the purpose of policy in developing countries should be "to increase the ability of poor people to achieve greater access to resources" (Forsyth *et al*., 1998, page 34; see also DFID/EC/UNDP/World Bank, 2002).

There is an urgent need to examine the arguments that give rise to these differing views of the relationship between poor rural people and the environment. In this publication we suggest that, except at a very abstract level, no simple model is appropriate for all circumstances and the nature of the relationship between rural poverty and environmental quality is specific to context. Although poverty and degradation are often closely related, the

nature of the relationship is complex and there is no single chain of causation. Degradation is dependent upon many factors – political, geographical, institutional and cultural – the importance of which varies from place to place. Parameters such as prevailing incentive structures, the security or vulnerability of local decision-makers to institutional and political change (and their perceptions of this), and the susceptibility of soils and water to pollution and over-exploitation may in different circumstances be of equal or greater importance than the level of poverty *per se*. If this is the case, over-simplification of the poverty–environment nexus is misleading and there is no substitute for careful location-specific analysis and study.

SCOPE AND FOCUS

This publication examines the arguments in the context of developing countries and considers the implications for policy development in the areas of poverty reduction and sustainable natural resource management. It focuses on rural rather than urban poverty and on the management of the natural environment such as land, water, forests and biodiversity, areas usually, but not always, classed as renewable. It examines the hypotheses that it is poor people who are primarily responsible for natural resource degradation because they have no alternative but to do so, hence policies that address poverty issues and aim at improving poor people's livelihoods will necessarily improve environmental quality.

The paper also considers how policies aimed at addressing poverty are likely to impact on the environment and how environmental policies deal in turn with questions of poverty. It provides a framework of factors governing degradation that can be used for guiding study and for understanding the nature of such problems in any situation where intervention is considered. A model for analysing the relationship between the poor and environment is put forward. It also briefly discusses research and policy needs, identifying gaps in present knowledge, ways of identifying win-win situations, and how to deal with situations where trade-offs between poverty and the environment can be anticipated.

2

DEFINITIONS AND DYNAMICS

Sustainable management and the need to pass to future generations a resource base as ample and productive as that we ourselves inherited has been a cornerstone of the development agenda for well over a decade. The notion of sustainable management is linked with the knowledge that natural resources are being rapidly depleted and degraded in many parts of the developing world, a fact associated with an increasing level and intensity of exploitation of fragile landscapes brought about by population growth and commercial activity. Concern over the deteriorating environment has at times pitted conservationists against the poor people held responsible, and has led to numerous conservation projects that remove local people from the area concerned or seek to constrain their actions (Grimble and Laidlaw, 2002a). Whatever the rights and wrongs and causal relationships of the matter, degradation undoubtedly has serious consequences for the many millions of poor people closely dependent upon the natural environment for their livelihoods and well-being.

While there are undoubted links between human activity and environmental quality, the nature of relationships is not clear-cut. Conventional wisdom views the link between poverty and the environment as a downward and self-perpetuating spiral. In the words of the Brundtland Report:

> "Poverty is a major cause and effect of global environmental problems. It is, therefore, futile to attempt to deal with environmental problems without a broader perspective that encompasses the factors underlying world poverty and international inequality. Many parts of the world are caught in a vicious downward spiral: poor people are forced to use environmental resources to survive from day to day, and their impoverishment of their environment further impoverishes them, making their survival ever more difficult and uncertain" (World Commission on Environment and Development, 1987).

The key arguments in this thesis are:

- The tendency, as seen by outsiders, for poor people to unavoidably weight long-term and sustainability needs against expediency and the needs of the immediate future. In economic terms this indicates an unacceptably high discount rate by the poor. While generally viewed as short-term behaviour, it may also be seen as a rational response to a situation where sustainable options are severely limited.
- Again as seen by outsiders, poor people have a limited scientific or technological knowledge of how to manage natural resources in a sustainable manner (i.e. for the long term) and lack suitable systems and methods for doing so. This may imply the need for new and appropriate technologies and widespread education and training.
- Rapid population growth leads to increasing intensification in resource use and thereby an ever-increasing strain on the environment. This is particularly serious where ecologically fragile areas are exploited by growing populations at (what are seen to be) limits to their carrying capacity. Where people have no livelihood alternatives to fall back on, further degradation is seen to be both inevitable and self-perpetuating.

In other words population growth, poverty and resource limitations in this thesis are seen to be responsible for over-exploiting given environments or for forcing the poor to move to increasingly fragile areas, whether for livelihood sustenance or commerce. Such areas are then further impoverished by environmental degradation and declining productivity of the remaining resources. Policies associated with this view stress the importance of off-farm income generation and other initiatives designed to increase livelihood options and reduce pressures on the environment. They may also stress the need for technology development and the exclusion of people from marginal areas. In recent years particular interest has been shown in improving the management of common pool resources (CPR) such as natural pastures, forests, fishing grounds and groundwater aquifers, as these are seen as being particularly liable to degradation and often associated with poverty.[1]

[1] Degradation often takes place where traditional public or common property regimes are insufficiently developed or robust to withstand pressures.

However, growing knowledge of natural resource usage and management in different circumstances casts doubt on a number of assumptions about the relationship between the poor and the environment. Improvements in sustainable farming alongside a growth in population densities and without an increase in poverty have been well documented in the last decade (see Machakos case study, page 29). At the same time there is evidence from around the world of serious (and unnecessary) degradation taking place in situations where population densities are low and people are relatively wealthy. Thus it is doubtful that addressing environmental concerns *necessarily* benefits the poor, or indeed, that poverty alleviation *necessarily* leads to improved environmental management.

To develop our understanding of people–environment linkages, it is helpful to first disaggregate the concepts of poverty and the environment.

POVERTY

The notion of poverty can be understood in various ways and in absolute or relative terms but is commonly assessed by level of income or wealth. One measure of poverty is those living on less than US$2 per day, a level which includes nearly 3 billion people or half the world's population (or 2 billion living on less than US$1 per day, one quarter of the world's population). However, such measures take no account of what that income can buy and should be used with great care, especially for inter-country comparison.

While income-based measures may be useful for assessing poverty levels in situations where people receive wages or salaries, they are less useful in rural locations or for the *very* poor in any location. Poor rural people seldom purchase their essential livelihood requirements from markets and make widespread use of subsistence crops and products, unpriced assets and commodities collected from the wild.

Another weakness of income-based poverty assessment is that it does nothing to show other factors often associated with poverty such as the prevalence of disease, low life expectancy, inferior housing and poor education and diet. In consequence, broader definitions have been developed that include indicators such as the standard of health, education and wealth (e.g. the UN Human Development Index).[2] Other definitions

[2] For example, limited human capital in the form of formal education, literacy skills or written qualifications.

include subjective assessments of empowerment, dignity or autonomy, including matters as wide as political influence, freedom of action, and exposure to risks, stresses and shocks.

Box 1 Geographic distribution of the poor, in millions

Region	Total population	Total rural population	Rural population on favourable lands	Rural population on marginal lands	Rural poor on marginal lands
Sub-Saharan Africa	530	375	101	274	176
Asia	2840	2044	755	1289	375
Central and South America	430	117	40	77	48
West Asia and North Africa	345	156	37	119	35

Source: Scherr (1999).

While lacking wealth, material goods and formal education and qualifications, poor people on the other hand may be exceptionally rich in skills and expertise derived from social interaction and personal experience, of indigenous technical knowledge. This is usefully taken to include skills for managing quite complex sets of assets and resources, including labour and natural resources, and balancing a range of livelihood aspirations and risks.

Important as these matters are, wider and all-encompassing definitions tend to be imprecise and create difficulty in understanding relationships. This publication uses a more restricted interpretation of poverty that focuses on the paucity of economic assets that poor people control or can utilize for livelihood sustaining or enhancing purposes. These assets may be held privately, in common, or by the state, but level and freedom of access to them is critical. Thus, following the sustainable livelihoods (SL) literature, poor rural people have:

- few economic assets, whether owned by themselves or rights of access and usage to CPR or public resources; of particular relevance to rural-based livelihoods are natural assets such as land, water, forests, and

that part of biodiversity that forms an essential part of many poor rural people's livelihood systems and strategies (Grimble and Laidlaw, 2002);

- few physical or financial assets in the form of monetary stocks or flows, or natural products that can be home consumed, exchanged or sold; this includes income from the sale of farm produce or harvested natural capital, received wages or salaries, inherited wealth, or credit, subsidies or payments from government or elsewhere.[3]

Box 2 Some concepts and terms associated with poverty and its measurement

Terms	Definitions and measures
Absolute poverty	The degree of poverty below which the minimal requirements for consumption (or survival) are not met. Can be measured in monetary terms (e.g. the US$1 per day 'poverty line') or in terms of minimum calorific requirement plus essential non-food items.
Relative poverty	This reflects the distribution of poverty and levels of income inequality in a society. It may be defined as a ratio or proportion of absolute poverty to the average or total income.
Human Poverty Index (HPI) for developing countries	The HPI has been developed by UNDP as a composite measure of poverty assessment. It covers factors such as the number of people expected to die under 40 years, adult illiteracy, people without access to safe water or health services, and underweight children.

[3] Many rural poor derive their food and other basic needs from the production or collection of natural produce such as non-timber forest products while others are dependent on employment on or off-farm.

Box 3 Who are the rural poor?

According to the World Bank (2000[4]), 24% of the population of developing countries live on less than US$1 a day and total nearly 2 billion people. In absolute terms, most of these live in South Asia (where there are 522 million people classified as poor). Proportionately, the problem is greater in sub-Saharan Africa where 290 million poor people constitute 46% of the population – over 34% of these are not expected to live beyond the age of 40). 278 million poor people live in East Asia and the Pacific (213 million in China) and 78 million in Latin America (about 16% of the population).

Three-quarters of the world's poor live in rural areas, often areas of low productivity and ecological fragility such as the Loess Plateau of China, the highlands of Bolivia and Nepal, the Sahel and other deserts, and the humid tropics of Africa, Asia and South America (World Bank, 2000).

The International Fund for Agricultural Development (IFAD) has classified the rural poor into six groups.

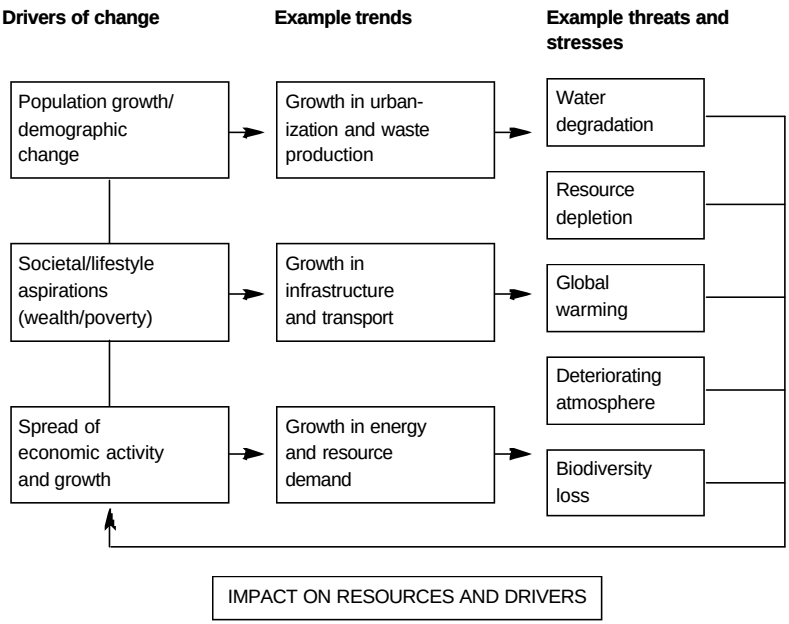
- Smallholder families accounted (in 1998) for 52% of the total rural population and 73% of the rural population in sub-Saharan Africa. IFAD considers that smallholder farmers who have less than 3 ha of land are poor whereas other studies use the figure of 0.6 ha. (There is no single correct figure as the productivity of land and access to inputs and markets varies greatly between locations.)
- Landless people without individual rights (*de jure* or *de facto*) to land of their own are concentrated in Latin America and the Caribbean, where they form approximately 30% of the rural population, and in Asia where the proportion is 26%.
- Displaced people away from their normal place of residence overall represent 6% of the rural population but this percentage varies greatly between locations and countries. Displaced people can be split into two groups: refugees escaping persecution, war or conflict and those who are temporarily displaced for economic reasons.
- Nomadic pastoralists are found mainly in sub-Saharan Africa where they account for 13% of the rural population. Nomadic pastoralism takes various forms (e.g. whether or not the livestock holder is a migrant or has a permanent base) but in all cases they are vulnerable to natural disasters such as droughts. Traditionally they have collectively managed large tracks of arid land as common property.
- Artisanal fishermen are found in large numbers in many countries or regions with lengthy coastal, lacustrine or riverine margins, including small islands such as Antigua, Cape Verde and the Comoros. IFAD suggest that as high a proportion as 11–21% of people living in rural areas are primarily artisanal fishermen or work in related processing industries.
- Indigenous populations or tribal people may belong to any of the above groups. Generally they tend to be relatively poorer than non-ethnic groups in the same population. In India, for example, an estimated 62% of the scheduled tribal population live below the poverty line compared with 42% of the total rural population.

4 World Bank (2000) *Poverty Trends and Voices of the Poor.* www.worldbank.org/poverty/data/trends/income.htm

THE NATURAL ENVIRONMENT

Strictly speaking the term 'environment' relates to all that surrounds us and with which we interact. Economists say it has three essential roles: a supplier of material resources and energy; a sink and assimilator of waste products; and a supplier of amenities that contribute to the quality of life. In this sense the word reflects a vast array of largely global or northern challenges such as industrial emissions and air and atmospheric pollution, climatic change and global warming, huge quantities of waste production and disposal, deteriorating water resources and supplies on a global scale, irredeemable biodiversity loss, and the depletion of non-renewable energy and mineral sources. One way of considering these environmental threats and stresses and the drivers that give rise to them is shown in Box 4.

Box 4 Drivers, trends, threats and stresses of environmental change



Source: developed from Foresight (2000).

This definition is too wide for this publication which is restricted to developing countries and rural areas within them. Here priorities are very different, largely concerned with the challenge of declining land and water productivity related to factors such as soil erosion, deforestation, vegetation loss, local over-exploitation or pollution of water resources, and increasing aridity. In this context the word 'environment' is taken to refer to the renewable natural resources of land, water and biological resources and the ecological functions they perform (e.g. hydrological and climatic regulation and nutrient cycling). In this sense the concept of environmental degradation concerns the long-term decline in the stock and productivity of renewable natural resources, while the concept of environmental sustainability (following Bruntland) concerns the need to leave for future generations a collection of resources and services at least as rich and healthy as we ourselves inherited.[5]

The term sustainable development takes a longer-term view and attempts to marry environmental, social and economic concerns, although it is argued elsewhere that trade-offs between them sometimes have to be made (Grimble *et al.*, 2000). The social and economic effects of environmental change are seldom neutral but are usually differentially distributed in society. Thus the frequent cutting and burning of forests to provide land for agriculture can be a perfectly legitimate livelihood strategy to some groups of local people but a worrying contribution to global warming as seen by Northern observers and scientists (see Box 5). Similarly, the banning of livestock from a natural park may substantially benefit wildlife habitats and game populations but threatens the livelihoods of local farmers and pastoralists.

Environmental resources vary greatly in their physical capacity to assimilate the effects of human exploitation and other activities. Poor people often live in marginal or fragile landscapes that are easily degraded, such as thin sandy soils on steeply sloping land and where rainfall is infrequent but heavy, and utilize water resources liable to depletion and contamination (e.g. aquifers with low safe yields and inadequate geological protection). Marginal lands in the developing world are often not privately owned and operate under open access or common property regimes. Traditional pastoral (often nomadic) and agricultural systems (including shifting agriculture) in these areas have come under increasing stress as population densities have grown,

[5] A major sustainability debate not discussed here concerns the inter-changeability of natural and man-made resources (or capital).

exploitation increased, and traditional cultural and institution systems broken down. In such circumstances, problems of environmental degradation are particularly acute (UNDP/UNEP/World Bank/WRI, 2000; see also Hazell and Garrett; Pinstrup-Anderson and Pandya-Lorch, 2001).

Box 5 Contrasting perceptions of land degradation and improvement in Cameroon

A form of shifting agriculture incorporating forest fallows has long been practised in the tropical forest of the Cameroon and local authorities are concerned about its effect on deforestation. In the late 1980s a project was instigated with overseas aid to establish timber plantations on land that had been cut and burnt, briefly cultivated, and left to return to forest.

Project authorities held that shifting agricultural practices were degrading and depleting the forest, and that it was highly desirable to establish plantations on what was described as abandoned land. This was especially so as the plantations were composed of introduced timber species of international value. Local people, on the other hand, held that their agricultural system was perfectly sustainable and it was the project that was degrading the environment, replacing forest fallow that regenerates naturally with introduced species of no use or value to them. Moreover the planted habitat was much less biodiverse than the secondary forest it replaced and did not provide the multiple products and game habitats they had long used. This secondary forest was more valuable than the dense forest it replaced because less labour was required to convert it to agriculture. Indeed, they often deliberately selected shorter fallows, trading off fertility losses against the higher economic returns to labour (labour was the major limiting factor).

The local shifting agricultural system worked on the basis that the forests were resilient and disturbance would correct itself over time, returning to something approaching its original state. In this case the carrying capacity of the forest ecosystem had not been reached, the shifting farming system was an integral part of the natural system, and ecological breakdown had not occurred. More generally, it demonstrates the need to relate environmental management to specific objectives. Local people wished to maintain and improve their livelihoods while foresters aimed to maximize the area and productivity of commercial forest.

A rider should be added. In this locality forests were not under great pressure and, at least for the time being, the shifting agricultural system was perfectly sustainable. In other circumstances increasing populations may lead to forest conversion and degradation. Whether or not it is acceptable to convert forests to agricultural land can only be judged from the local context.

CARRYING CAPACITY

The ability of land resources to support growing populations on a sustainable basis has been of concern ever since Thomas Malthus argued over 200 years ago that population growth would outstrip food supplies over time because of its inherently faster pattern of growth. The debate has re-emerged in recent years with the realization that in the coming 100 years the

earth will need to support at least twice its present population. Most of this expansion is likely to take place in developing countries and the majority of extra people will be poor. Fears are particularly acute in developing countries where populations are fast growing, natural limits appear to have been reached, and the potential for expansion to new areas has ended.

Box 6 Naturally determined population densities

Although there may be argument over the extent to which the carrying capacity of an area or landscape is fixed or can be raised by good management, there is no doubt that natural systems vary widely in their productivity and population-absorptive capacities (contrast, for example, temperate latitudes with the tundra). Natural resources such as land and soil conditions, rainfall patterns and transpiration vary greatly between countries, regions and zones and at an early stage in development largely determine the nature of livelihood systems and economic activities. Even today different countries support vastly different population densities. The average world population density of 40 per km^2 includes a range of densities as different as 4464 in Singapore, 293 in Rwanda, 29 in Canada and 14 in Mongolia.

Land's carrying capacity may vary enormously even within a single country. Kenya's population density (according to 1986 figures) varies by a factor of 140 between agro-ecological zones: the national average of 42 persons per km^2 comprises large areas of arid landscape with densities as low as 2 persons per km^2, while the central highlands support as many as 280 persons per km^2. Perhaps the principal determinant of carrying capacity is that of rainfall, both absolute amount and seasonal distribution, though soil fertility and other factors can also be critical. At the early stages of development, carrying capacity is increasingly affected by man-made constructs such as road and railway development and proximity to urban centres. With modern developments in communication and information technology, the overriding influence of natural carrying capacity remains to be seen.

The notion of carrying capacity centres on the ecological principle that an ecosystem or area (local or global) can support only a certain number or density of people associated with constraints imposed by soil, water and climatic conditions and the efficacy of management (see Box 6). Where these limits are exceeded through over-population, over-exploitation or poor management, famine and human disaster occurs. This can lead to environmental degradation and a further reduction in the area's carrying capacity (Grimble, 1996).[6]

[6] An increase in human population or economic activity in an ecosystem may lead to a change in that ecosystem or 'flip' to another ecosystem. Whether the change *is* for the better or worse can be assessed only in relation to the local context and the costs, benefits and distribution of change. This includes factors such as the ecological value of the ecosystem, the livelihood alternatives of local people, and the productivity of the new system. It is difficult to be entirely objective in viewing such situations.

The nature of the relationship between human activity and the natural environment, however, is exceedingly complex and imperfectly understood. Protagonists maintain that natural resources set limits to population growth and economic activity, and these imperil the future of the earth and ecosystems within it. Others disagree and emphasize the resourcefulness of mankind, including the poor, in adapting and transforming their environments; in economic terms, they argue, natural resources are no different from, and interchangeable with, resources built or made by man. Indeed, massive deforestation and industrial pollution have taken place in Europe and other parts of the world over the centuries without ecological disaster, and only the creation of wealth allows adverse effects to be mitigated. Others would say that the conversion and transformation of natural environments is as essential for continued wealth creation as is the development of new technologies.

These arguments were applied to developing countries most prominently by Esther Boserup (1966). Instead of gloomy predictions of famine and degradation, she saw in population growth an incentive for agricultural adaptation and intensification induced by the economic rationality of human behaviour, not least by the poorest. Growth in the labour force was the triggering mechanism for higher levels of land productivity made possible through increased labour input, more intensive agricultural systems and technological development. The Boserup argument thus reverses the causal link between food supply and population and shows how, at least in some circumstances, poor people adapt to new resource endowment situations and develop farming systems and technologies that improve on those they replaced.

The global environment has always changed and will continue to do so, given population growth, economic activity and human value systems – people in all situations wish to maintain or preferably improve their lot. However, it is important to distinguish between environmental change and environmental degradation, as the two are not necessarily the same. There is nothing inherently wrong with environmental change as long as it does not lead to a long-term decline in the productivity of the essential goods and services that nature provides, and that the management systems which replace the old are themselves environmentally sustainable.

However, the effects of environmental change are complex and unlikely to be socially neutral. Different stakeholder groups will be differentially affected by

change and value change differently. As we know well from numerous planning disputes in the UK, the costs to some (e.g. the loss of valued natural landscapes such as woodlands or grasslands) are the benefits to others (e.g. the increase in agricultural land or improved motorway systems) and there is no doubt that the same applies in developing countries (Grimble and Wellard, 1997).[7]

[7] See Wunder (2001) for a challenging discussion of the benefits and costs of deforestation in developing countries.

3

THE CONCEPTUAL FRAMEWORK

While we have shown that rural poverty and environmental quality are closely linked, it is clear that this is a complex and multi-faceted relationship. Land degradation, conservation and improvement are dependent upon a multitude of political, geographical, institutional and cultural factors that vary a great deal from place to place and over time. For this reason neither the downward spiral model nor any other model with a single chain of causation is an explanatory tool appropriate to all circumstances.

Having said this, the relationship between the poor and the environment is not without structure or form, and drawing on the SL literature, it is possible to develop a framework or model at a higher level of abstraction able to assist understanding and analysis (DFID, 1999; see also Ness, 1994).

THE CONCEPTUAL MODEL

This section puts forward a broad framework for understanding the multi-faceted relationship between rural poverty and the natural environment. The framework consists of a series of linked boxes governing a range of physical, economic and institutional factors, and can be applied at any level and to any locality. Each box can be considered a black box in systems terminology because its content is variable and, without study, unknown. The poverty–environment relationship is two-way, indicating the set of factors that guide the way poverty can impact in different ways on the environment and, in turn, how environmental change impacts differentially on poverty (see Figure 1).

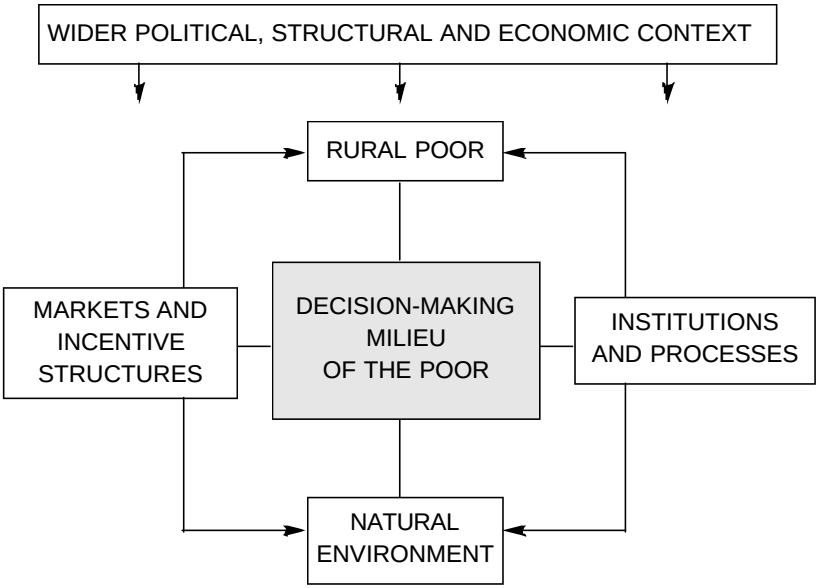


Figure 1 A framework for understanding the links between poor people and the environment

In any situation the nature of the poverty–environment relationship is dependent upon the particular content of each box and is, therefore, context-specific. The four boxes impacting on the central decision-making environment of the poor are:

- rural poor – the degree and nature of poverty in the locality in question as governed largely by both private and public assets;
- natural environment – the physical and biological characteristics of the local environment, particularly those governing its susceptibility to degradation;
- institutions and processes – the range of local institutional and political processes, particularly those governing levels of security and risk faced (or perceived) by the poor;
- markets and incentive structures – the development of local markets and prices (such as those for land and labour) governing the prevailing range of economic incentives and disincentives.

Each of these boxes bears on and influences the central box depicting the decision-making environment of the poor: this comprises an amalgam of factors including the physical and economic risks and uncertainties that poor people face, the various economic and livelihood maintaining and enhancing opportunities they may have, and the livelihood strategies and coping mechanisms they employ. Clearly this box is closely bound up with the four surrounding boxes and in practice is difficult to disassociate from these except in conceptual terms.

The conceptual framework also contains a box representing the wider (exogenous) contextual and dynamic influences on the central system. Relevant parameters in this box include national or regional population growth and demographic change (influencing migration to and from the area in question), economic growth and employment opportunities, globalization and increasing contact with the wider world, natural calamities such as regional drought, flooding, earthquake and epidemic, and a whole host of political and military factors governing stability, security, conflict and war. These factors are exogenous to the situation in question and outside the control or influence of local decision-makers; acting through local institutions and processes, they nevertheless have a bearing on the economic and livelihood behaviour of poor local people.

Given time and information constraints we will not discuss these exogenous parameters further here but rather will give attention to the boxes that immediately impinge on the decision-making environments of the poor. Understanding these boxes and the linkages between them is incomplete but, based on present knowledge and our own field experience, we introduce some of the key factors critical to designing policies and programmes in the area of the environment and poverty.

4

UNDERSTANDING THE LINKAGES

In Chapter 2 we discussed the meaning of rural poverty and noted the limited assets and resources (public and private) available to poor people. We also discussed natural environments in different localities and noted their variable capacity to assimilate intensive exploitation. We use the term over-exploitation to indicate the state of affairs where resource exploitation is non-sustainable and environmental degradation results.

Environmental fragility is of course not a consequence of poverty: fragile environments are susceptible to degradation irrespective of poverty or wealth. Unfortunately there does appear to be a tendency for the poor to live in marginal and environmentally vulnerable landscapes especially liable to soil, water and biodiversity degradation. Being less favourable for habitation and production, these lands are frequently colonized relatively late in the course of history, in which case settlers may be unfamiliar with hazards of local land management. For example, migrants to the Amazonian rainforest in the 1980s were unaware of the fragility of tropical forest soils, and the farming methods they employed were inappropriate to the conditions, so contributing to local land degradation.

In this chapter we move on from this discussion of poverty and environment to consider the central box, the decision-making setting of poor people and the livelihood strategies they devise. We begin by briefly discussing people's 'attitude' to time and the range of institutional and economic factors that can impinge on this.

THE DECISION-MAKING MILIEU OF THE POOR

There is little doubt that poor people make environmental decisions in the context of a range of factors, which include access to resources, the specific

opportunities available to them, and the incentives and disincentives associated with these. Decisions are also greatly influenced by their perceptions of risk and security associated with each opportunity, and more generally an understanding of, and confidence in, what the future holds.

The argument is often put forward that poor people are so concerned with satisfying their immediate livelihood needs that they seldom invest for the future or manage resources with the long term in mind. In economic terms this suggests they have high implicit discount rates, valuing the present much more highly than the future – indeed if they do not do this, they may have no future at all. Others disagree, pointing out that if the argument is correct then, *ipso facto*, the poor would long ago have depleted resources and set in motion the downward spiral of environmental degradation (Dasgupta, 1998). Pearce (1994) disputes the correlation between poverty and high discount rates on the grounds that, if this was actually the case, then development policies and programmes that raise living standards would always be environmentally beneficial (which demonstrably is not so).

Empirical evidence is inadequate but what there is suggests that the time preferences and time horizons of poor rural people vary a great deal between place and time and appear to be governed more by the local context or circumstance than by the level of poverty *per se*. Questioning of peasant farmers practising shifting agriculture in the tropical forests of Cameroon suggests that, where they are able to do so, the poor take the long term at least as seriously as do the rest of us (see Box 5). It would appear that household-level discount rates are primarily dependent not so much on the level of poverty itself but upon the decision-makers perception of what the future holds and how this will impact on them and their family (their vulnerability). Of course this perception of security/vulnerability cannot be entirely disassociated from poverty itself but it does suggest a somewhat different focus of concern.

To a degree the future is always uncertain; no one knows, for example, how much rain will fall next season or what the market prices for livestock and crops will be. Confidence in what the future holds is also specific to local circumstances. Land tenure and property rights in an area may be crucial: for example, villagers' perception of whether an area of common land (perhaps long used for gathering wild products, grazing livestock or cultivating cassava) will be available for their use in the seasons ahead is critical to the decisions they take. Such risk and uncertainty are also affected by the

likelihood of natural calamities such as earthquakes, floods and droughts and the threat of political turmoil, civil strife or war. Evidence derived from conflict situations suggests that the fastest rate of degradation occurs where there is no assurance of tomorrow and there are no alternatives to cutting down the last remaining tree.

Whereas the risks and uncertainties poor people face are usually given, their response to risk can be influenced by the degree and nature of poverty. The critical consideration is less a matter of being poor in the sense of having an income of under a particular threshold (say US$1 or US$2 a day) and more a question of their vulnerability to adverse events, in particular, whether they have a safety net in the form of food reserves, livestock to sell, or social insurance to fall back on if disaster strikes.

As a form of insurance, nomadic sub-Saharan pastoralists build up herd numbers beyond what many say is permitted by the land's carrying capacity to allow the sale or consumption of stock when the rains fail. Similarly arable farmers often grow a higher proportion of reliable crops including native bean varieties at the expense of more profitable but volatile crops such as cotton (Lamboll and Morris, 2002). Guaranteed access to wild lands yielding edible fruit and medicinal products amongst other things can also mitigate the effect of drought and famine. Retaining extended family or clan connections may also help. For example, subsistence rice farmers in the Central Highlands of Thailand moved away from their traditional homes in the floodplain to colonize new land in upland areas and, in the space of a few years, transformed their farming systems from rice production largely for home consumption (selling only the surplus) to maize production almost entirely for the market (Grimble, 1976). Farmers in the upland areas retained their family and religious connections with those in the floodplain and this acted as a form of social insurance (reducing the adverse consequences of hard times). Without such networks and measures, poor people may have no option when disaster threatens but to take a short-term and exploitative view of natural resources and the environment.

LOCAL INSTITUTIONS AND PROCESSES

That poor people's economic behaviour takes place within a complex network of social institutions and processes is now well established (Ostrom, 1986; Bromley, 1991; North, 1990). These may be formal or informal, enshrined in law or unrecorded, and comprise a combination of central

legislation and informal customary rights, practices and obligations. Without such institutions behaviour would be anarchic and transaction costs massive. Although in the final analysis individuals and households make their own choices and elements change or break down, the institutional framework provides the general set of rules governing livelihood maintenance and the use and management of natural resources.

Property rights concern the relationship between poor people and physical resources such as land and water, defining whom they belong to, who can use them and how. Property can be privately or state owned, or held locally by communities – as has traditionally been the case in much of Africa. Common land is especially important to the poor, providing basic needs and helping share risks in difficult times. Where the rights to property are well defined by law or custom, people can be reasonably sure they will be able to use the resources indefinitely into the future.[8] Increasingly, however, communal systems are breaking down and little or no management rules, restrictions and obligations apply. In such situations there may be no incentives to manage resources in the communal interest and open (free-for-all) competition may lead to over-exploitation and degradation (Hardin's (1968) tragedy of the commons scenario).

Thus whether poor people act in a sustainable manner or contribute to environmental deterioration must to an extent depend on both the management culture in which they live and their confidence in reaping the rewards. In Latin America, many landless people cultivate land belonging to large landowners knowing full well that sooner or later they will be evicted. Peasants such as these are unlikely to invest in soil conservation terraces, plant or conserve trees, not because they lack any interest in the future but because of the uncertainty that they or their children will benefit, as land conservation and improvement is seldom costless in labour or financial terms.[9] Indeed, it seems likely that the greater the uncertainty the less the likelihood that local people will invest in the natural environment or attempt to manage resources sustainably.

[8] Usufruct rights, for example, can determine who has the seasonal right of access to specified land areas for cultivation, livestock grazing, or the collection of wild products.

[9] Many invest in the movement, *Movimento dos Sem Terra*, that campaigns for their right to secure land access.

In the 1980s, many small migrant farmers in the Brazilian Amazonia with ownership rights to plots they had cleared from the forest were enticed to sell these to large landowners and cattle ranchers. In this case a lack of effective government jurisdiction and legal documentation appears to have contributed to this process and hence encouraged environmental destruction. However, we do not imply that formal land adjudication is always necessary for sustainable land management; informal rights may be just as effective where these are recognized and locally protected.

Not infrequently government policy fails to take account of locally established traditional systems or respect social justice. In the post second world war period, many Maasai families in Kenya and Tanzania were expelled from their traditional grazing and hunting grounds when national parks and reserves were created. Cut off from these lands and migration routes, local people turned to poaching valuable game (which preyed on their herds and harmed their crops) and grazing their livestock (illicitly) within park boundaries, thus setting up conflict situations. The exclusion of local people from such sites still happens today. For example, in the Ngorongoro national park wildlife preservation is seen by the local poor as benefiting not themselves but the authorities who evict them and the tourist industry with which they have little contact but which, it is felt, exploits them.

Such situations are relevant not only to the environmental impact of poor people but also to the way that environmental change may impact on poor people. Local communities commonly develop informal systems and practices for dealing with difficult times such as drought and famine, for example, through extended family arrangements, seasonal and longer-term migration, off-farm employment, and dietary changes involving the collection of wild products. At least in the short run such mitigation practices may reduce the need to 'live off' the environment and limit the impact of degradation on the economic welfare of local people. More formal policies and systems for dealing with emergencies may similarly help to avoid the vicious cycle of environmental decline, poverty and degradation.

LOCAL MARKETS AND INCENTIVE STRUCTURES

Such discussion naturally leads into the matter of markets and incentive structures as both institutions and economic incentives are likely to affect people's economic potential and livelihood activities. It is now well accepted that, as a whole, poor rural people are as economically rational as other

groups in society and, subject to the structures and rules set by institutions, their livelihood behaviour is determined by prevailing economic incentives/disincentives and the risks attached to these.

Economists often explain degradation as a consequence of market failure and the problem of externalities; negative externalities occur where individual decision-makers do not bear the full cost of their actions and consequently give inadequate weight to the future flow of benefits or off-site costs (Grimble and Wellard, 1997, page 178).[10] While negative externalities theoretically can affect both rich and poor people, in practice they bear principally on the poor who are unlikely to have the power or financial means for negotiating avoidance, obtaining compensation or mitigating effects. The inherent problem of negative environmental externalities is one in which one group of stakeholders (the decision-makers) impose costs on wider society or on other groups within it – typically the poor and least powerful – without appropriate compensation. For example, populations may be adversely affected by the pollution upstream of rivers and streams[11], by large-scale conversion of forests to pastures, by careless road construction, and by 'fortress conservation' policies discussed later in this section.[12]

Incentive structures favourable both to local people and the environment are governed by factors such as the availability of sound information and clearly defined property rights; where markets do not exist or function imperfectly, environmental degradation may result. Unfortunately many resources on which the poor rely (including most non-timber forest products and much biodiversity) have no market value, and there are few "markets for resources that can translate global demand into secure income streams for poor

[10] Incentive structures favourable both to local people and the environment are governed by factors such as the availability of sound information and clearly defined property rights. Where markets are absent or function imperfectly, market failure and environmental degradation are likely to result.

[11] For example, water courses are contaminated by upstream use of pesticides and other chemicals in the absence of property rights or markets for determining how much the polluter is willing to pay for using the river as a disposal unit. In such cases, downstream residents, who use the water for domestic consumption, livestock watering or crop irrigation, bear the burden.

[12] We should not give the impression that the development of well-functioning markets would by itself end degradation and benefit both the environment and the poor together. While there are numerous examples of win-win situations of benefit to all, problems occur even where markets are perfect. Trade-offs inevitably take place in a world where pressures on natural resources are growing and choices between ideals have to be made. These may involve ranking the needs of poor people against the need for environmental conservation (Grimble *et al*., 2000).

farmers" (Reardon and Vosti, 1995; Vosti and Reardon, 1997). Such situations can give rise to non-sustainable extractive activities such as over-exploitation of groundwater aquifers, natural pastures, and valuable tree and plant species. While this may sometimes result from the uninformed actions of the poor and under-educated, it can also result from commercial activities conducted by large firms or, on occasion, even the state. Rich farmers more than the poor are likely to over-irrigate and deplete groundwater through the use of deep boreholes and powerful pumps; the poor could not afford the cost. Similarly, pastoralists with large herds are more likely to cause serious overgrazing of common land than those with only a few head of stock (Ambler, 1999).

Thus the presence and operation of markets and access to them can be a key factor in explaining people's behaviour towards natural resources. In parts of western and central Africa, game from tropical forests has traditionally been a part of the diet of the local inhabitants including pygmies, but until recently hunting was largely confined for 'the pot' and hence generally sustainable. Growth in timber markets and the expansion of commercial logging, however, opened up vast areas and game exploitation rapidly increased. Today, rare and threatened species are offered for sale (live or as meat) on busy roads, in southern Cameroon and elsewhere. A similar situation is found in Amazonia where a decline in the market price of rubber and the development of new markets has led in some situations to the felling of valuable trees by the rubber tappers themselves.

Poverty is often put forward as the reason explaining bush-meat trading and small-scale illicit logging, and it is true that where people are extremely poor, the prospect of even a tiny financial reward may drive such behaviour. Yet the overriding reasons may not be poverty *per se* but rather the absence of viable alternatives for sustaining or enhancing livelihoods. Indeed, if these people were not so poor one can only suppose that similar exploitation would take place on a wider scale, perhaps using automatic weapons and chain saws rather than machetes and hand traps. In such circumstances poverty is not the driving force behind exploitation and indeed the wealthy might be expected to engage in degrading activities on a larger scale.

5

CASE STUDIES

MACHAKOS, KENYA

The most comprehensive and deliberate attempt to study the relationship between population growth, land use and economic change was carried out in Machakos, a semi-arid district in Kenya, south-east of Nairobi, in the early 1990s. The study adopted an historical approach and compared land use, population change and other measures between the 1930s and 1990. It had been predicted in the 1930s that a combination of rapid population growth and mismanagement of land resources would lead to serious environmental degradation and loss of productivity on a Malthusian scale. How the district avoided such economic distress has been recorded in a widely cited study (Tiffin *et al.*, 1994a,b).

In the period researched, the population grew from just over 250,000 to almost 1.4 million and the area cultivated expanded enormously at the expense of forest, bush and rangelands. A continuous process of agricultural innovation took place including the introduction of new crops, mixed farming, animal traction and terracing systems. Cash cropping raised the value of land encouraging the adoption of conservation measures, while staple food crops stabilized around the levels required for basic subsistence. Despite deforestation, fuelwood and timber supplies were sustained through increased on-farm tree production. Although grazing areas were reduced, increased cattle numbers were supported through stall feeding of fodder and cut and carry production systems.

The extent of change in land resource management in Machakos is illustrated by the comparison of 1930 and 1990 photographs of the same scene. The 1930 photographs show bare, gully eroded and practically treeless hills. The livestock herding practices of the Akamba people were

seen as a primary cause of degradation, and constituted a real worry to the colonial administration (perhaps one of the earliest expressions of governmental environmental awareness). Over the subsequent 60 years the problems of erosion have been met with increasing success, and over 200,000 ha have now been terraced and little cultivated land remains unterraced.

The researchers argue that population growth led to an increase in scarcity of land, which stimulated intensification of agricultural management and production. Much of the success must also be put down to favourable institutional and economic circumstances, including governmental support for research, education, extension, and perhaps more importantly, road construction. Land tenure presented no problem; land registration has not been a prior condition for investment since customary Akamba law has always taken an individualistic view of land and provided sufficient security. The proximity to Nairobi has also greatly facilitated the process, providing a market for agricultural surpluses, giving employment opportunities for local people, and providing funds for investment.

There is no doubt that Machakos provides exemplary evidence of how, when other circumstances permit, severe population pressure in a poor area can lead to the development of intensive and sustainable land management practices and push back critical thresholds. Present production levels far exceed anything that might have been contemplated in the 1930s, and attempts to hold populations to predetermined levels would have been disastrous. However, the study did not include any assessment of changes in biodiversity, natural habitats or other ecosystem products and services, and it is certain that there have been considerable modifications to these, and perhaps biodiversity loss.

A rider can be added to this generally optimistic account. The population of Machakos is still growing rapidly and the extent to which land use intensification can proceed further is uncertain; almost 100% of the land is now terraced and close to 90% of farmers use improved seeds. It is not proven that living standards can continue to rise as land/labour ratios continue to decline. The future may rest outside the area and be dependent on further employment and income earning opportunities in and around Nairobi.

ETHIOPIAN HIGHLANDS

Machakos is unusual in that it is a success story in a country which displays many of the problems associated with population pressure, including erosion, deforestation, and soil and water salinization. Thus the case is not proven that good management outweighs the natural restrictions set by carrying capacity, or whether it represents a reprieve or exception in the long term outstripping of resources by population growth. On balance, however, there is reason for optimism: the Machakos case demonstrates that the carrying capacity is, in an anthropocentric if not ecocentric sense, a movable boundary. At least in favourable circumstances, natural resource limits can be raised very considerably by the spontaneous actions of local people. Clearly the doomsday predictions inherent in a strict interpretation of the carrying capacity concept do not apply.

A less comfortable situation is found in the highlands of Ethiopia, 4% of which official statistics indicate is already degraded beyond recovery for agricultural purposes and 25% is moderately eroded (Stahl, 1990). Owing to population increase, stagnation in technology and civil war, the pace of degradation has not diminished in recent years, and severely threatens the natural resource base of the northern highlands.

In this case there is no evidence to show that local people have adapted their agricultural management systems and technologies as demands on natural resources have grown. Land which was once fallowed and rotated is now cultivated continuously, and cultivation has spread into areas formerly reserved for grazing. The expansion of cultivation diminishes the area available for grazing, and the falling cattle/grazing ratio has reduced productivity. It is reported that “some time after the 1940s, population and livestock growth reached a point at which the resilience of the local ecology started to break down. When the rains failed in 1973 and again in 1984, the stage was set for disaster” (Stahl, 1990).

Ethiopia has been subject to civil strife and social change on a massive scale and for many years. Insecurity has bred a short-term outlook, and centralized and paternalistic interventions by government have encouraged a dependency syndrome. State-supported activities have focused on ideology and organization while neglecting economic incentives and encouragement of local and individual initiatives.

In these circumstances the only available response to population pressure has been the spread of agriculture to ever more marginal lands and the more intensive use of existing cultivated areas, with little improved technology. This suggests that inappropriate policy measures and interventions by government can negate the natural inclination of local people to adapt sustainably to population pressure. The problem of land degradation in Ethiopia is thus not tied solely, and perhaps not principally, to population growth and the natural limits of carrying capacity but also to inappropriate political and institutional structures. A study in the Sudan similarly shows that 'bad government' can frustrate the natural tendencies towards intensification and commercialization as population density increases. The evidence suggests then, that while it is possible to raise the carrying capacity of an area, it cannot be counted on when institutional and policy measures are unfavourable.

The empirical evidence is at first sight confusing. On the one hand there is evidence to suggest that poor people in developing countries contribute to environmental degradation through forest depletion, water resource pollution and soil erosion. The example of Ethiopia above shows that much of the land has been highly degraded through over-stocking and poor management to the point where it is arguably beyond ecological recovery. In Lesotho, the unsuitable cultivation of fragile soils by poor farmers has similarly given rise to serious erosion which reduces land productivity and threatens the livelihoods of the burgeoning population. Elsewhere, however, the poor are seen to adapt to changing needs and circumstances through the application of new and sustainable systems and practices. Consider, for example, the development of intensive terraced farming in Java over the centuries and the farming systems of Kano region in northern Nigeria that bear population densities of over 200 per km^2.

6

KEY FINDINGS, POLICY LESSONS, GAPS IN KNOWLEDGE AND RESEARCH NEEDS

KEY FINDINGS

While poverty and the environment in developing countries are closely related, the relationship is complex and multifaceted, and lines of causation are variable and complex. Numerous examples of poor people acting in an environmentally sustainable manner indicate that poverty does not necessarily or even usually lead to degradation nor, indeed, does poverty alleviation always lead to environmental improvement. There is little evidence to suggest that poor people discount the future more highly than others in society and in favourable circumstances poor people as much as the non-poor take a long-term view of the environment. Indeed, it can be argued that the wealthy by definition consume more resources and create more waste than do the poor, and in the long run it may be these factors that have the greater global significance.

This publication does not take the poor–wealthy comparison further and instead focuses on natural resources management and the factors giving rise to degradation, factors sometimes associated with poverty. Although further research is required, with some confidence we can make some assertions which bear on this.

- Environments vary a great deal in their natural attributes not least their fragility or susceptibility to degradation. For example, sloping lands with thin sandy soils and occasional but heavy rainfall are particularly liable to degradation. In developing countries, more often than not, it is the poor rather than the rich who live in such marginal landscapes. Although the carrying capacity of most landscapes can be raised through

intensification and technological improvement, this is a complex and difficult process that cannot be done overnight.

- Markets for environmental goods and services are often poorly developed and their absence or malfunction gives rise to externalities and drives non-sustainable management. In rural areas it is generally the poor who are most immediately affected, for example, by the lack of markets for certain goods (such as non-timber forest products and ecological services such as nutrient cycling). Liberalizing markets may benefit the environment but, because of the nature of public goods, it is unlikely that social values can be reflected in full by any such market.
- The development of infrastructure and technology can greatly influence the treatment of the environment by the poor and rich alike. For example, the construction of roads into the equatorial forest facilitates access and helps open up new areas for timber exploitation, cattle ranching and agriculture; it also can give value to native forest products. Such effects can be both positive and negative and difficult to disentangle. The impact on poverty and the environment can only be established through local study and analysis.
- Policies and legislation can create artificial incentives for increased production or alternatively environmental conservation. In developing countries, the need to increase production often takes precedence but this can have unforeseen and unwanted environmental consequences. Even in Europe, the production-orientated Common Agricultural Policy has given financial encouragement to over-use of agricultural chemicals, draining of valuable wetlands, and the removal of hedgerows. In recent years, such adverse impacts are being countered at considerable expense by coexistent schemes (such as Countryside Stewardship) that encourage more extensive land use.
- Poor people are often highly exposed to exogenous shocks and stresses, both natural and anthropocentric in origin, over which they have little or no control. Though they develop institutions and coping mechanisms that act against or mitigate the effect of natural and man-made disasters, the fact that they are poor and have fewer reserves makes them vulnerable to such events. In this indirect sense then poverty can increase the likelihood of non-sustainable behaviour.
- The long-term security and future confidence of local people depend on a range of institutional factors such as local property rights, the rule of law, and the threat of war or conflict. While poor communities develop systems that reduce the incidence and consequence of adverse events, these are not always sufficient and over-exploitation may take place.

- The prospect of financial rewards negligible by developed world standards may drive non-sustainable exploitation by the poor but also environmentally friendly farming practice.
- It is possible but unproven that poor health and low life-expectancy prevalent amongst the poor can influence environmental behaviour. Research is required to determine whether older people coming to an end of their lifespan take a shorter-term view of the future or, on the other hand, feel responsible for the welfare of their offspring and the wider environment long after they themselves are gone.

Box 7 Common myths about the poverty–environment connection

A study by UNDP/EC has challenged a number of entrenched myths about poverty–environmental interactions (Ambler, 1999), which bear out the conclusions discussed here.

- **Poverty necessarily leads to environmental degradation.** Studies have failed to show a common pattern in the relationship; in certain situations the poor are immediately responsible for degradation while in others they are seen to take great care in maintaining or improving the environment.
- **It is necessary first to tackle poverty concerns before dealing with environmental improvement**. Some of the most extreme degradation takes place in boom periods rather than slumps; neither rural poverty nor environmental programmes should be conducted in isolation but rather as part of an integrated and well-analysed approach.
- **Poor people are too poor to invest in the environment**. Where incentives are favourable, poor people mobilize resources, particularly labour, and invest in environmental improvement. This is not to suggest that external help cannot also be a valuable aid.
- **Population growth necessarily leads to degradation**. Most agricultural landscapes can support higher populations in a sustainable way by adopting more intensive technologies and farming methods; in some situations population growth may provide economies of scale helpful to the economy.
- **The poor lack the technical know-how for good resource management**. Although lacking in formal education, poor people have an enormous store of indigenous technical knowledge and develop sophisticated resource management systems. Supposedly primitive water and agricultural systems can be equitable, efficient and sustainable, especially under low population densities.
- **Markets always lead to efficient allocation of resources**. While markets can be conducive to good management, they may also encourage over-exploitation of natural resources (e.g. timber and non-timber forest products). This is especially so where factor prices do not reflect wider social and environmental costs.

POLICY LESSONS

We concluded above that poverty itself does not induce poor land management or give rise to environmental degradation. There is nothing about poverty *per se* or the behaviour of the poor that automatically gives rise to unsustainable management of the environment. In an increasingly turbulent world, however, there may be conditions associated with the poor that increase their vulnerability to external threats outside their control or influence. How this impacts on the environment in any one place depends on a host of market and institutional factors that vary tremendously, and the aim of policy must be to understand local constraints and address them in a proper manner.

The strategic and policy lessons that could be drawn from this analysis merit further analysis. However, at a strategic level, a significant finding with implications for policy development is the multi-dimensional causality of poverty–environment interactions, implying the need for holistic understanding and analysis prior to intervention. We have already emphasized the considerable variation that can be expected between different situations and the need for in-depth local understanding for the design of appropriate interventions.

The conceptual model we have developed provides a general framework for enquiry but this needs to be taken forward, and if possible a typology of environment–people situations and required interventions developed. Such a typology would be based on parameters such as population density, carrying capacity, resource endowments, access to markets, available technologies, and local institutional arrangements (see Box 8 below).

There is also a need to work toward win-win situations that provide livelihood and off-farm employment opportunities for poor people that *at the same time* are beneficial to the environment. Local fishermen and farmers in the Ramsar Convention-designated coastal wetlands of Ghana, for example, were deliberately selected and trained for employment as guides, administrators and field staff, rather than skilled people being brought in from outside the area; this was to ensure that local people and the authorities both have a similar economic interest in wildlife conservation, something missing at present. It is similarly possible to work with, and train local people, especially women and the poor, in identifying development options that maintain or enhance environmental quality.

Box 8 Pathways for sustainable development

Scherr and others have suggested a number of possible pathways for supporting sustainable development by the poor (Scherr, 1999; Ambler, 1999).

- **Co-invest in the natural resource assets of the poor**. Joint investment in the improvement of the productive resources of the poor appears promising in situations where it is possible to relieve constraints related to farmer awareness, technology access, farmer capacity to invest, and local institutional capacity.
- **Employ the poor in efforts to improve the resource base**. Many environmental improvements are public goods whose benefits accrue only partially to local people. Eco-friendly activities are often labour intensive and offer opportunities for paid employment.
- **Develop and promote agricultural technologies with environmental benefits**. Develop technologies and resource management systems tailored to local conditions designed to raise overall productivity, increase household incomes, lower unit costs, and protect or improve the natural resource base.
- **Promote low-risk perennial production in poor and marginal areas**. Develop tree and agroforestry systems that provide year-round vegetative cover and multi-purpose products of local value, especially those that are not excessively labour demanding or have inflexible input or harvesting patterns.
- **Compensate the poor for conserving or managing resources**. Develop approaches for compensating land users for the cost of foregoing unsustainable methods where these impose external costs on others (i.e. internalize the costs of environmental degradation).
- **Facilitate access to natural assets useful to the poor**. Facilitate access by the poor to land and water held in common or on land controlled/owned by others. This includes renewed attention on the massive subjects of land tenure and water rights reform, and developing insurance systems for poor farmers.

KNOWLEDGE GAPS AND RESEARCH NEEDS

While reasonably confident in the conclusions reached in this publication, we recognize that the evidence is somewhat anecdotal rather than scientifically based. Debates about poverty–environment interactions have in the past been difficult to resolve, in part owing to the complexity of the challenge but also because of data limitations. The temptation has been to generalize research and field findings from single case studies with little regard for the number and variety of variables in any one situation. For example, it is wrong to generalize (as has been done) from the Machakos example and suggest that population growth is (always) beneficial to both development and the environment.

Efforts are needed to collect inter-temporal data sets that integrate poverty and the environment issues at community and regional levels, and investigate key relationships under a range of agro-ecological and

demographic conditions. In-depth investigation of a range of individual households of variable wealth levels is required to examine people's time-preference and discount rates, especially but not exclusively those of the poor. More generally there is a need for systems-based and people-centred research in areas with environmental and poverty problems, which specifically examines the issues raised here. A particular need is for in-depth local research and analysis that explores the issues of discount rate and views of the future by poor people in different circumstances and situations.

In conclusion we add a final caveat about environmental degradation itself, which we believe is a less well-understood concept than presently thought and itself a critical research area. We have suggested that environmental change is inevitable, and under the continued influence of economic activity and population growth, is likely to increase in the decades ahead. Environmental change is not the same thing as degradation, and some change may be desirable or inevitable if we are to absorb increasing populations and satisfy growing material needs. It is increasingly argued that forest conversion is not wholly harmful and on balance often may benefit society, especially the rural poor (Wunder, 2001; see also Lomborg, 2001). Clearly deforestation and other aspects of environmental change need to be analysed in depth and in context, not least in terms of cost-benefit distributions, as sets of interests may vary and simplistic assumptions about environmental degradation must be avoided. There is ample opportunity for well-focused, in-depth, location-specific and systems-based research in this area.

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ABBREVIATIONS

CPR	common pool resources
EC	European Commission
HPI	Human Poverty Index
IFAD	International Fund for Agricultural Development
SL	Sustainable Livelihoods
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

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