

While the friendly help and tolerance of all the above, and of others who have helped us in numerous smaller ways, have made the task both rapid and enjoyable, we cannot burden any of them with responsibility for the faults which remain. That responsibility belongs to us.

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## Introduction

If the problems of land degradation could have been solved by research and reports alone, they would have disappeared long ago. It has been forty years since some of the first seminal works on environmental degradation were written (for example, Jacks and Whyte 1939; Osborn 1948; Carson 1962; Sommerer 1972), and perhaps ten to fifteen since the high-water mark of environmental movements in the United States and Europe was reached. Even now, the volume of literature and proliferation of national and international institutions flows unabated. In spite of this, whole United Nations agencies and a worldwide environmentalist movement have been unable to make more than a marginal impact upon the prevailing effects of the exploitation of nature for short-term gain. It would be naive to assume that the root of this state of affairs lies in intellectual failure alone. However, it is argued in this book that much of the literature on land degradation is beset by a fundamental theoretical confusion. Discussants address each others' work but often appear not to discuss the same underlying issues at all. Implicit assumptions about the significance and importance of land degradation remain unexamined. 'Facts', ideologies and beliefs are not identified, and the relevance and accuracy of much of the data base remains in doubt. What people cannot start to agree about is hardly a basis for initiation of change, often of a fundamental, politically sensitive and pervasive nature.

This confusion can be traced to three major causes. First, the nature of the debate itself between scientists, commentators and decision-makers in government has hardly been critically examined. Since land degradation is *excellence* an interdisciplinary issue, a comprehensive theory requires the combination of analytical tools of both the natural and social sciences. Natural scientists have made great strides in understanding and explaining the process of accelerated land degradation, although their work is far from complete. However, there is a need to find ways to bring together natural and social scientists more effectively to address the central question of why 'land degraders', as we will call them (e.g. peasants, pastoralists, commercial farmers, state forest departments and so on) are so often unwilling or unable to prevent such accelerated degradation. It will be argued, in our first and second chapters, that the larger part of this task of explanation now lies with natural scientists.

Now social scientists have addressed this problem directly. There is a very rich literature on land tenure and agrarian structures as impediments to

productivity and causes of inequality, but in so far as the environment is considered at all in most of this literature, it is only as a passive background to human interaction. The degree to which this is so is quite remarkable. It runs through almost the whole of the vast literature on agrarian issues in Latin America, for example. Even in the series of reports prepared in the 1960s for the Inter-American Committee for Agricultural Development (CIDA), a major outcome of the Punta del Este conference convened in the aftermath of the Cuban revolution to find means of resolving agrarian discontent without revolution, environmental aspects are statically and briefly described as a basis for the real information on land use and land tenure. Very substantial work on environmental inventory has also been done in Latin America, but the points of connection between the agrarian literature and the environmental literature are so few as almost to be negligible. There has been somewhat closer linkage in Africa, but not to the point of leading toward the sort of integrated analysis which this book seeks. In South Asia, there has been a tremendous outpouring of academic work, as well as political debate at all levels, on the process of agrarian change following the initiation of the Green Revolution in the mid-sixties. Yet there has hardly been any serious work, or at least work taken seriously, on what is now regarded as one of the most serious problems faced by the countries of South Asia. It is only most recently that the Centre for Science and Environment (CSE) produced its report on the state of the environment in India (CSE 1982, 1985), and that there has been controversy over the 1985 Forest Bill and the whole issue of conservation, the state's demands upon the environment and the rights of other users. In consequence we have a substantial body of very insightful literature on agrarian problems of transition closely related to political and economic theory, and little until recently on the social, economic and political aspects of environmental transition. Perhaps one of the clearest symptoms of this theoretical and methodological failure to combine social and natural science is the constant bewailing of a 'lack of political will' in implementing conservation policies at the international or national level. Ignorance on the part of political leaders and land managers alike, lack of management skills, lack of data collection and monitoring skills are all invoked. Policies are sometimes initiated to put right these alleged causes of non-implementation. Still there is little in the way of successful theories which can explain the paralysis of the state to intervene effectively.

The second cause of confusion arises at a more fundamental and ideological level. There are profound differences of opinion on the overall significance of land degradation, which arise from opposing theories of social change. For example, there are such views as that of Simon (1981) who does not see that there is any problem of degradation at all. According to him and other 'technological optimists', the world has successfully managed to feed its rising population and supply its growing industries. Famines and disasters, while certainly unfortunate, can be attributed to bad luck or bad

management. Simon and those who think along similar lines (e.g. Kahn *et al.* 196 or Beckerman 1974) provide telling evidence which throws serious doubt upon the eco-doomsters, at least at the aggregated level of the whole world. More useful land is being added by man's ingenuity, they argue, than being lost. In any case, we are assured even by many geographers that man's mastery over nature' can cope with all problems. Thus, for example, Orley states that:

Man's relation to nature is increasingly one of dominance and control, however lovers of nature may deplore it. If the proponents of geography as scholarly discipline wish to continue to reflect on the relationships between society and nature they cannot afford to adopt models which ignore the glaring probability that this relationship is one which exists between an increasingly numerous, increasingly powerful and progressive, capricious, master and a large, increasingly vulnerable and spitefully conservative serf. (1973: 157)

In those who are more prepared to admit that natural forces have by no means been mastered by human technology include many who see the painful consequences of human interference as no more than 'externalities' of the development process, costs that have to be accepted where they can be added and otherwise ignored. It is more important, say some economists particularly from developing countries as well as some in other places) to secure economic growth and development first, and only after this has been achieved to meet the costs of repair.

On the other side of the same coin also applies to natural scientists. Their methods of measurement of land degradation, and the assumptions that are made about the social and political significance of these methods often remain unexamined. The attribution of land degradation to characteristics of soil, climate and to purely physical constraints tends to leave unexamined where the constraints lie and how far they are social. This task, it would argue, has to combine both physical and social theories. It therefore seems necessary to examine critically the political, social and economic aspects of seemingly physical and 'apolitical' measures such as the Universal Loss Equation, the 'T' factor and erodibility.

It would be wrong to blame natural scientists any more than social scientists for the failure to ask the right questions about the deeper causes of soil degradation. It would not be difficult to present many examples of soil scientists and agronomists writing about degradation in a manner which puts all blame on the folly, ignorance or ineptness of the people who are working the land; indeed, we could cite writings by social scientists who do much the same. This book shows that blame is not so easily placed, that remedies are not found simply in compelling or persuading the private land managers to mend their ways. However, there have been major changes in scientific perception in recent years. A few years ago, national and interdisciplinary groups undertook a major project on the

climatic change, potentially important for explanation of historical degradation, and we seek to evaluate the climatic factor along with possible causes of social origin. In chapter 8 the historical theme is developed in an unusual context; Bryant Allen and Robert Crittenden find the causes of land degradation, in an area only recently incorporated within the world economy, in the sort of political economy that developed over a previous period of 300 years following the introduction of a new crop.

In the remaining chapters the historical theme becomes secondary, and we discuss a selection of contemporary problems. Chapter 9 is concerned with the management and mismanagement of areas cleared from tropical rain forest, and converted into grassland or plantations. An introduction which focuses on Southeast Asia is followed by a detailed study of land-management problems in part of Borneo (Kalimantan) by Lesley Potter, and then by a search for understanding of destructive management of the land in Fiji, by William Clarke and John Morrison. Chapter 10 focuses on another specific problem, that of the management of common property resources. The first part examines the connections between degradation and the particular characteristics of common management of resources. The second part is a case study in northwestern India contributed by Narpat Jodha. Chapter 11, of which the major part is contributed by Vaclav Smil, sees continuity of the 'mastery over nature' ethos at the root of the huge degradation problems of China where serious weaknesses of central economic management are discussed. Chapter 12, by contrast, looks at the relations between the farmer, the state and the land in so-called market economies, and is balanced between a review of present management problems in the United States, and a study of the sociology and politics of conservation in Australia, contributed by Judy Messer. Chapter 13 presents our conclusions.

The treatment of land degradation in this book is inevitably selective. Not too much is written about irrigation problems, about either wetland or dryland salinization, about acidification, podsolization and laterization, or about wind erosion. Management and mismanagement of the forest lands themselves are mentioned only in passing, and the theme of desertification is only touched upon in these pages. We say nothing about the problems of the cold lands. In a book which is small relative to its subject matter, we felt it better to focus on certain specific problems in some depth rather than attempt an overview. Our main object is to demonstrate that there are social causes, and that they must be understood if there are to be social solutions; although our frame of reference is global, we have concentrated on themes and areas in which we and our contributors have some experience. There is a fairly strong focus on the southern and eastern fringes of Asia, with only brief excursions into other parts of the world. It would require another and much larger book to present a full coverage in both thematic and geographical terms.

The book arises out of a workshop held in the Australian National University in February 1984. Piers Blaikie led this workshop, which Harold

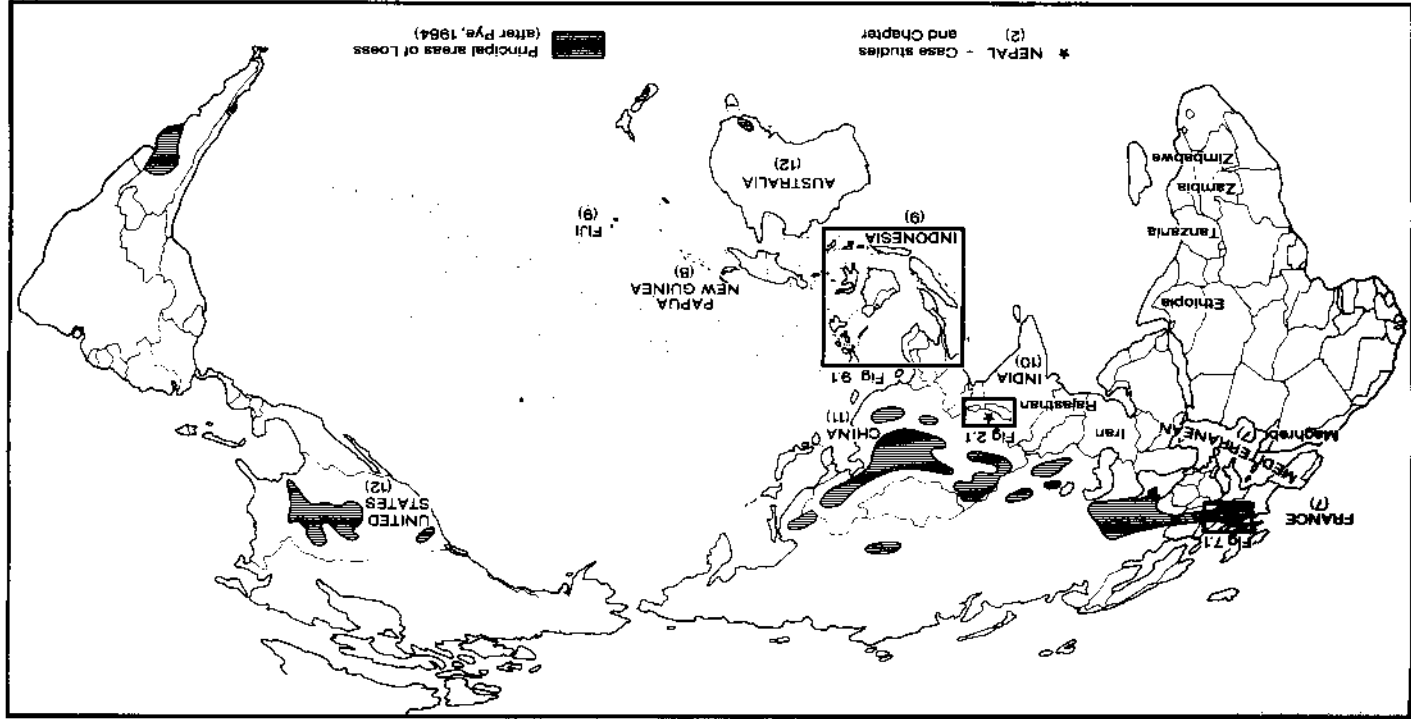


Figure 0.1 Location of case studies

Brookfield organized. Some of the contributors to that workshop are also contributors to this book, but we have also invited a number of others to contribute; these are Stocking, Seckler, Jodha and Smil. Each of us has been responsible for certain parts of the book, and there are some chapters and sections which are almost exclusively written by one or other of us with only minor co-author amendments. Other chapters, and introductory sections, are however truly joint and we have decided that all chapters other than parts by contributors should appear without separate attribution of authorship. Those familiar with our two very different writing styles and theoretical standpoint may be able to identify which parts are by whom, but we suspect that they might make mistakes. Nonetheless the two principal authors have rather different approaches to the subject. The lessons which the authors learnt at the book was written have a wider methodological relevance, and this is discussed in chapter 1, section 9.

Our contributors have had to endure some heavy editing, partly in the interests of length, partly because most of them initially wrote 'stand-alone' chapters which had to be blended into the flow of argument. There is quite a number of insertions by the authors, not separately distinguished. Also there are inevitably some differences in view between contributors, and between them and the authors. The insertions made by the authors in contributors' chapters have preserved these differences and have pointed out where they occur. For example, differences of view between chapters 3 and 5 are quite clear, and the authors think that they add to the strength of the book. There are also explicit differences in emphasis between other chapters and these are signposted clearly.

Specific mention of the various problems with which contributors had to contend would be invidious, but it must be made of Mike Stocking who had to write his chapter twice; a first version, completed in very good time, was lost when a case of research records fell off the back of a truck (literally) in Africa, and was stolen; one hopes that the chapter, and the results of three months' field research that were with it, were of interest to the new owners. We are grateful to all our contributors for their co-operation, even enthusiasm, and for their tolerance of our editorial heavy hands. Our other acknowledgements appear on page xiv.

# 1 Defining and debating the problem

*Piers Blaikie and Harold Brookfield*

## Land degradation and society: initial statements

### 1.1 Land degradation as a social problem

Land degradation should by definition be a social problem. Purely environmental processes such as leaching and erosion occur with or without human interference, but for these processes to be described as 'degradation' implies social criteria which relate land to its actual or possible uses. Other processes, such as acidification and salinization, are only rarely recognized under natural conditions, at least in an acute form, and have a more directly human origin. The word 'degradation', from its Latin derivation, implies a reduction to a lower rank'. The 'rank' is in relation to actual or possible uses, and reduction implies a problem for those who use the land. When land becomes degraded, its productivity declines unless steps are taken to restore its productivity and check further losses. In either case, the yield of labour and terms of production is adversely affected. Land degradation, therefore, directly consumes the product of labour, and also consumes capital inputs to production. Other things being equal, the product of work on degraded land is less than that on the same land without degradation.

It may be as well at the outset to face an objection to this statement, to which we return in chapter 5. It may be argued that, if there is abundant land and if losses in productivity can be made up by the provision of chemical fertilizers, degradation is neither an economic nor a social problem. However, this argument can be turned around: without degradation it would be necessary to move to new land with the attendant costs; without degradation, such large inputs of chemical fertilizers would not be necessary in order to sustain production at constant levels, and efficiency of their use by farmers would be greater. Either way, there are both economic and social costs. Also there are secondary costs, such as the nitrification of water courses, which are purely social in nature in that they affect people and social conditions away from the site.

The social significance of degradation has been the subject of a wide variety of views rather than of engaged debate for reasons which are outlined by Piers (1985a: 12). We argue that under defined conditions it is a problem of order. Decline in the productivity of the land and of labour can be regarded as the 'quiet crisis' which nevertheless erodes the basis of civilization

### Issues of significance

central to the issues discussed in this volume is the role of the 'land manager'. Land managers may find themselves responding to changes in social, political and economic circumstances quite independently of changes in the intrinsic properties of the land which they employ. They may be denied access to common resources, or be forced to grow crops by landlords, market or social demand, or by the state. They have to find a strategy with which to meet such pressures, and do this on land which itself changes in nature. The intersection of circumstances and strategies forms our subject matter.

Any interference by humans with the natural processes of soil formation, siltation and erosion has an effect upon these processes, often unforeseen. Ploughing, compaction and erosion of the soil, changes in plant cover and hydrological regime, changes in soil and water chemistry all take place naturally in the absence of any human intervention or even presence; some environments these processes take place quite rapidly under natural conditions. Violent atmospheric events can cause rapid changes in environments empty of people. In some islands of recent geological origin, it has been shown that the soil had been eroded and/or become able to support a limited biota long before the arrival of people. Yet human interference modified and usually accelerated all these processes and has created the conditions under which new sets of processes, previously absent or insignificant, come into play. With the exception of the work of bulldozers, tractors, trail-bikes and other tools of malice, all the processes of land degradation occur in nature, but human activity on the land changes the conditions of their operation. The task of land management is to recognize these changes and find some means of bringing them under control.

However, the effect of human interference is not the same at all times and in all places. Human management of the land without leading to degradation is only possible in a great majority of environments, but has been recently accomplished in human history. However, the same human skills are not useful and effective in all places; under similar systems of management the productivity of some land is well sustained, while that of other land deteriorates rapidly. The problem is further compounded by the fact that degradation has occurred at one period but not at another on the same land. Agro-technology has not only changed through time, but has also been applied with differing degrees of care and perception.

Man-induced degradation occurs when land is poorly managed, or when natural forces are so powerful that there is no means of management to check its progress. Some degradation is caused when land that has never been interfered with is brought into use, but most land subject to accelerated degradation is capable of more effective management than it receives. Our basic question is why these failures have occurred, and whether or not the problem has been perceived as such by those responsible at the place and time.

## 2 LAND DEGRADATION AND SOCIETY

- to adapt two phrases of Lester Brown (1981). This view claims that the problem is pervasive, often insidious but crucial to the future of humankind. There are elements of environmental fundamentalism in claims of this type - and we examine them in chapter 5 - but they underline the essentially social nature of the problem. Also, there is an important link between the chronic, slow-moving phases of the problem and the acute. When production conditions are adverse, as in a drought, the margin of productivity or of survival for a producer on degraded land is smaller than that of a producer on better managed land. When, as in large parts of Africa in recent years, climatic conditions remain adverse over a long period, farmers on badly degraded land suffer a particularly severe penalty. Land degradation, as well as drought, has been partly responsible for the severity of famine in agricultural areas of Ethiopia and Sudan (Eckholm 1976).

These simple considerations should alone be sufficient to establish land degradation as a problem of social significance. But it is also necessary to our argument to show that land degradation has social causes as well as consequences. While the physical reasons why land becomes degraded belong mainly in the realm of natural science, the reasons why adequate steps are not taken to counter the effects of degradation lie squarely within the realm of social science. Yet the problem of resource deterioration has been curiously neglected by the latter. There have been a few classic texts warning of the problems, such as Malcolm (1938), Jacks and Whyte (1939), Glover (1946), Rounce (1949) and Hyams (1952), but they are rarely cited in recent work. Also, neither classical nor Marxian economics have satisfactorily attacked the methodological problems of studying land degradation, thus depriving social scientists of a developed theoretical base. Seckler points out in chapter 5 that the problems of land degradation are as amenable to economic analysis as any other. But, for a variety of reasons, there has been remarkably little in the way of either empirical or methodological work on the economics of land and water conservation, by contrast with the economics of pollution which has a large literature. The *Journal of Soil and Water Conservation* and the output of some Departments of Agricultural Economics in the United States Midwest are perhaps honourable exceptions.

One of us (Blaikie 1985a) has recently sought to open the issue of degradation of land as a social problem. Essentially, that book built a number of theories to explain different aspects of degradation and conservation, drawn mostly from the standpoint of political economy. The present volume offers a greater diversity of approach, as well as a greater breadth of case-study material. A number of central social issues in land degradation which received only thematic treatment in the earlier book are discussed here in detail. These include the problems of measuring and economically appraising losses, and different institutional arrangements for land management, including common property and private property institutions and the state. More particularly, we also draw on a long and varied historical perspective in order to focus on the reasons why land management fails to be effective.

Since land degradation has occurred in such a wide variety of social and ecological circumstances, it is clearly futile to search for a uni-causal model of explanation. Equally, there is a number of hypotheses which have useful explanatory power, such as 'population pressure' or the exploitation by people of people, and these are examined in this volume. However, we shall see that while there are many causes where 'population pressure' has contributed to land degradation, in others a marked decrease in population densities has led to the same result. Likewise, an onerous burden of taxes, inequitable distribution of landholdings, corvée labour systems and the like, have probably led to declining management on the part of the exploited, but not invariably. On the other hand, there are many examples where very favourable prices for agricultural commodities or for timber have led to accumulation of profits, but also to land degradation. This complexity leads us away from any single theory of land degradation, since there are so many conjunctural factors operating at one place and time. Rather, case-study material and discussion of methodological issues together suggest a general approach to the problem of land degradation to provide an illustrated manual with which readers can approach their own empirical evidence.

## 2 Definitions of value, capability and degradation

### 2.1 Choices in defining degradation

As the opening paragraph of this chapter states, the dictionary meaning of degradation is 'reduction to a lower rank'. The term is therefore perceptual and implies at least a 'rank' scale of relative measurement. As a perceptual term, however, it is open to multiple interpretations. To a hunter or herder, the replacement of forest by savanna with a greater capacity to carry ruminants would not be perceived as degradation. Nor would forest replacement by agricultural land be seen as degradation by a colonizing farmer. Usually there are a number of perceptions of physical changes of the biome on the part of actual or potential land-users. Usually, too, there is conflict over the use of land - whether it be between farmers and conservationists, pastoralists and peasants, small farmers and the state, developers and concerned landholders. Since degradation is a perceptual term, it must be expected that there will be a number of definitions in any situation. It is, therefore, essential that the researcher recognizes any such conflict over the use of land and, therefore the definition of degradation. Sometimes the definition is given to the researcher as the 'ruling' one or the state-supported one, in the sense that land should be used in a certain way and degradation is, therefore, defined as reduction in capability to fulfil this demand. Sometimes the researcher will wish to supply other criteria derived from her/his own political and technical viewpoint.

It is of course more usual to employ the language of natural science to describe degradation, from the perspective of the soil scientist or agronomist.

However, the processes are varied and, from a social point of view, their impact may be felt in very different ways. Erosion, especially gully erosion and massive sheet or rill erosion, is very obvious, although the role of human agency may not be. Modification of horizon structure, partial removal of fine particles, pan formation, podsolization, compaction and similar changes are less obvious and have only a more gradual effect on the productivity of the land. Changes in hydrology affect the flow of streams and ground water, affecting storage and the supply of water to livestock and people as well as to the soil. Impoverishment of vegetation, the invasion of weeds and the selective elimination of soil fauna and the larger fauna which live on them affect the whole quality of environment as well as of the land; new environments, such as the Mediterranean *maquis*, may be created and come to be regarded as natural. Among more insidious processes, salinization becomes persistently severe in dry areas and periodically severe where drought is of irregular incidence, where it is seen as a problem mainly at such times. Acidification, on the other hand, affects the rooting depth of plants in a more lasting manner, but its build-up is very slow and it is not at once perceived as a problem.

These physical changes have to be evaluated also in social terms. The first step is to estimate reductions in yields of crops, livestock or useful vegetation resulting from these changes. A useful review can be found in Stocking and Wake (1985). This is a relationship which researchers are only beginning to be able to quantify, and there are many crucial gaps in both our basic understanding and in orders of magnitude under different conditions. The second step is the evaluation of degradation in economic terms. As chapter 5 indicates, there are on-site and external dis-benefits of degradation, now and the future; however, these are generalized income benefits expressed in money terms. Although these are of obvious and overriding importance in assessing the impact of degradation, they leave unanswered the problem of weighing and competing perceptions of degradation. For example, a reduction in income for agriculturalists may result in an increase for herders. Also there are issues of the distribution of losses from degradation between different groups, and access to alternative means of livelihood (e.g. new land) or to technologies to limit the effects of degradation or to reverse them - all of which affect the boundary conditions for accounting the social impact of land degradation.

### *The 'value' of land*

There is also another issue which should be discussed before proceeding to a definition of land degradation, and this concerns the 'value' of land, which in any way is reduced for the user by degradation. It raises a number of technical problems. In none of its forms does the theory of value take adequate account of the 'value' contained in the natural source of all energy in an ecosystem, the sun's energy and of the stored products of that energy,

which include the weathered material and nutrients which constitute the soil. Such 'value' cannot be said to be created by labour, does not have a cost of production, and is priced by the market according to a mixed set of utilities, including location, which often ranks higher than quality. Insightful comment on the failure of economics, specifically but not only Marxian economics, to take account of the physical processes underlying production is provided by Alier and Naredo (1982), Alier (1984) and Guzman (1985). While these authors, and the nineteenth-century socialist, Podolinsky, also fail to consider land degradation, they call attention to the failure of economics to consider energy flows or to come to terms with the notions of energy, except in a very imperfect manner.

Marx did, in fact, come somewhat closer to an appreciation of the role of land in production than did most other classical writers. He recognized that:

Man . . . can work only as nature does, that is by changing the form of matter. Nay more, in this work of changing the form he is constantly helped by natural forces . . . labour is not the only source of material wealth, of use-values produced by labour. (Marx 1887/1954: 50)

But while there is a recognition of land as the product of natural forces, land – and other natural resources – were considered 'free' inputs into production and did not produce value since it was only labour that was considered to perform this function. On the contrary, it is clear that land may need to be 'paid' a great deal in order to continue to 'exist' at the same quality, as this book seeks to demonstrate. Even modern resource-depletion models fail almost entirely to consider the environment itself as a degradable resource (Hufschmidt *et al.* 1983: 57). It is difficult, therefore, to use the term 'value' in relation to land, and even Robinson's (1963: 46) cop-out in regarding value as a metaphysical concept without empirical meaning does not help; we therefore avoid the term.

### 2.3 Capability of land

The term used instead is *capability*. When land is degraded, it suffers a loss of intrinsic qualities or a decline in capability. This term is not one within the economic literature. It is, however, in modern agronomic literature with something like the sense which is required. As a first step towards clarification, degradation is defined as a reduction in the capability of land to satisfy a particular use. If land is transferred from one system of production or use to another, say, from hunter-gathering to agriculture, or from agricultural to urban use, a different set of its intrinsic qualities become relevant and provide the physical basis for capability. Land may be more or less capable in the new context. This is important, because it must not be supposed that deforestation necessarily constitutes degradation in a social sense, even though it certainly leads to changes in micro-climate, hydrology and soil. Socially, degradation must relate to *capability*, and it is only if the

degradation process under one system of production has reduced the initial capability of land in a successor system, actual or potential, that degradation, as it were, carried across the allocation change. In actual practice, this is often the case, since more serious degradation reduces capability for most, if not all, future possible land uses.

### 4 A definition of degradation

We have noted that the effect of human interference need not always be deleterious. It is also possible to restore and improve land, and to create new productive ecosystems of which the outstanding example is the irrigated re-terrace. The land itself also has its own means of repair: new soil is formed, gullies grass over and become graded; nutrient status is restored under rest. Just as we need to take account both of the interaction between natural processes and human interference in degrading land, so also we must recognize both natural reproduction of capability and of human artifice in assisting this reproduction. Bidwell and Hole (1965) made a useful distinction between 'beneficial' and 'detrimental' effects of human works on the land. So also should we distinguish between the beneficial and detrimental processes in nature.

Degradation is, therefore, best viewed not as a one-way street, but as a result of forces, or the product of an equation, in which both human and natural forces find a place. We could say that:

degradation = (natural degrading processes + human interference) – natural reproduction + restorative management

As an example of the variation of natural reproduction and its impact upon degradation is provided by a comparative study of Hurni (1983) in which he compares the soil-loss tolerance in the mountains of Ethiopia and the hills of northern Thailand. In the former case, cultivation has been going on for 3 years with a fairly low rate of soil loss. However, the cumulative loss and rates of natural soil formation have both served to produce very serious degradation. In Northern Thailand, however, with higher rates of soil formation the local land-management system has 'compensated' for this and the ability of the land, in which soil formation is more rapid than in Ethiopia, is maintained.

### The role of land management

#### Ways of managing land

A definition of degradation as a reduction of capability, the role of land management becomes clear. Land management consists of applying known recovered skills to land use in such a way as to minimize or repair degradation, and ensures that the capability of the land is continued beyond

the formation of a capable solum in as little as ten years on some volcanic ashfalls under humid tropical climates. The impact of the cumulative loss of soil upon crop yields is also probably extremely variable. It has been estimated that a 15 mm loss from an Oxisol in an experiment in Indonesia (Suwardjo and Abyamia 1983, reported in Stocking and Peake 1985) caused a 40 per cent yield reduction, while a mere 2 mm loss from an Ultisol caused a 5 per cent yield reduction. Also, if these results are compared with data from the United States, it appears that the tropical Oxisol suffered a yield reduction ten times that of temperate soils and the tropical Ultisol twenty times that of temperate Ultisols, with similar soil loss. Even if these preliminary data are only approximately correct, they indicate great variation in the manager's task of maintaining land capability.

## 2 Landesque capital

is important to distinguish between land management in relation to the current crop, the object of which is the production of that crop and the consequences of which are incidental, and purposive land management designed to secure future production. In the nature of things, most of the water is in the physical area, though if a clearing for shifting cultivation is to last two or three crops, then a part of the labour put into initial clearing goes 'capital' for the second and third crops. The institutional costs of the organization of land tenure to make the installation of the three-field system possible in ancient Europe constituted 'capital' which endured for centuries. However, there is a class of works, including stone walls, terraces and such improvements as field drains, water meadows, irrigation systems and regional drainage and reclamation systems which is much more purposive in intent, a specific object of which is to create capital for the future maintenance of land capability. Investments of this nature have a long life and are sometimes described as *landesque capital*, which refers to any investment in land with an anticipated life well beyond that of the present crop, or crop cycle. The notion of landesque capital involves substantial 'saving' of labour and other costs for future production. There is very little literature on this subject, but what there is suggests that the private benefits to land managers of costly landesque investments are seldom enough over the term of typically 50-100 years to justify the high discounting rates. We therefore have to supplement these (rather negative) economic explanations with others to explain why landesque capital is so common. As we shall see later in this volume, sheer necessity is often a major factor. Landesque capital is created by a lack of other options (in order to ensure the survival of the land manager themselves) and particular coercive relations of production are two of the most common explanations, amongst other social and political reasons. There is a need to be aware that conservation decisions, including the investment in landesque capital, are not often made by individual decision-makers, who will bear all the costs and reap all the benefits. Therefore, one must be able to identify clearly the land manager(s) or hierarchy of land

the present crop or other activity, so as to be available for the next. There is no system of land use, anywhere in the world, that does not have agro-technical means with which to achieve or at least approach these ends, provided they are practised in natural environments suitable for their employment.

At the simplest level, rotational grazing and shifting cultivation are effective strategies if well managed, with sufficient land over which they can be applied. Both are 'avoidance' rather than 'control' strategies (Kellman 1974) in that they leave reproduction of capability to natural repair, and avoid the need for intensive inputs on site. Many control strategies are, however, incorporated into modifications of these simple and ancient methods of management; slope control and water control are both employed in association with shifting cultivation, and so also is the addition of fertilizer. Rotational grazing is more easily managed with the addition of fencing and tethering. The major step forward from these strategies in temperate lands was mixed farming, in which both cultivation and grazing were rotated in relation to one another. Thus, perhaps as early as from the eighth century onwards, the two-, three-, and four-field systems of Europe emerged from an essentially shifting-cultivation base. In the humid tropics, mixed rotational farming was less widely suitable and wholly arable technologies evolved, generally involving massive inputs of human labour aided by livestock and their manure to make possible the permanent cultivation of land. Modern technology has added a range of artificial fertilizers, leguminous crops employed in rotation, and the ability to undertake much larger site-management works. We encounter some of this range of practices in the following chapters.

Fundamentally, the land manager's job is to manage natural processes by limiting their degrading consequences, both 'on-site' and 'downstream'. By 'downstream' is meant external effects away from the site, whether actually downstream, downslope or downwind, or effects which undermine the efforts or exacerbate the problems of neighbours, wherever located. The natural processes involved fall into two main groups, the mainly biological/biochemical and the mainly physical. They have a different range of impact, and present different, though related, management problems. The main problems of biological/biochemical management are on-site, though they have important 'downstream' consequences through the movement of mobile ions which can lead to salinization. The basic problem is to cope with the fact that purposive plant growth and removal for use tends to extract mineral and organic elements from the soil faster than they can be reproduced. Natural replacement requires a rest period or the planting of crops and trees which often have a low value in use. Reproduction of the capability of the land itself is usually the secondary objective of farming systems, but it is a vital objective and one that can absorb a great deal of labour.

The natural rate of soil formation varies enormously over the world, from close to zero in a thousand years in parts of Africa and much of Australia, to

managers, whoever they may be – farmer, developer, landlord, agri-business, manager, government official or whoever. This issue of identification is discussed more fully in chapter 4 but it is enough to say here that managers may have different decision-making environments and different claims or demands upon the same tract of land.

#### 4 Conceptualizing the role of land management

While this larger question of defining the 'land manager' may be deferred until chapter 4, there remains a need to define briefly the task of land management in relation to the natural processes which require to be managed. These are two-fold and concern the role of land management respectively in checking the natural processes of degradation and in aiding the natural processes of repair. What we need to do is to define, simply and unambiguously, the characteristics of the land that is being managed in such a way that will specify the nature of the land-management task.

##### 4.1 Sensitivity and resilience of land

There are two qualitative terms which are useful in describing the quality of land systems (soil, water, vegetation) and these are *sensitivity* and *resilience*. A number of other terms have been used, including 'susceptibility' and 'fragility' (Winiger 1983; Glaser 1983), but some of these are loaded terms. The first term chosen here is sensitivity and it refers to the degree to which a given land system undergoes changes due to natural forces, following human interference. The term used here refers to sensitivity to erosion as well as to other forms of damage, such as the accumulation of mobile ions (which can give rise to salinization).

The second group of land characteristics of importance in land management concerns the ability of land to reproduce its capability after interference, and the measure of need for human artifice toward that end. This restoration of capital in the form of organic matter, nutrients and soil structure occurs naturally under forest or grassland fallow, as Nye and Greenland (1960) demonstrated in a manner that is still relevant. It occurs, however, at very different rates in different situations, while the depletion under cultivation which creates the need for restoration also takes place at very different rates. Certain ecosystems offer high initial productivity but this is rapidly depleted; in others, productivity is better sustained under repeated use. This property of standing up to, or absorbing the effects of interference, is only partly correlated with what is loosely termed 'fertility' of the soil.

Broadly following Holling, we propose to term this property *resilience*. Holling wrote of the resilience of a natural system where 'resilience is a property that allows a system to absorb and utilize (or even benefit from) change' (1978: 11). Where resilience is high, it requires a major disturbance

overcome the limits to qualitative change in a system and allow it to be transformed rapidly into another condition. Also, resilience is independent of quantitative primary productivity of the site, be it small or great.

It will be apparent that, where a site is highly resilient and also insensitive to the forces of damage, the task of land management is relatively easy. Many lands, even though they require some initial drainage and may be liable to occasional flood, have both these properties, as do alluvial plains in humid zones. It may be for this reason that, as recent research has established, at least early agriculture in southern Europe and the Middle East, and perhaps elsewhere also, was on moist land; it was fixed-plot cultivation on land easy to manage, from which there has been subsequent differentiation into various forms of wetland and dryland farming (Sherratt 1980, 1981). Even shifting cultivation, adapted to land of low resilience, is seen as a subsequent development in this argument.

Usually the resilience of land has limits, and the task of land management becomes one of supplementing natural resilience with devices such as land-crop-rotation, manuring and fertilization, the planting of legumes and a regime of tillage and land-preparation methods, many of which are also linked to the control of sensitivity to damage. It is a part of our argument to show that almost all land other than the most infertile or least capable, least fertile and most sensitive, can be managed at some level of production wherever there is water and a sufficient growing period. Recent research even in the Amazon basin has shown that only about 3 per cent of its soils are capable of management in some form, despite the acidity and low fertility (75 per cent of the remainder (Sanchez *et al.* 1982; Wade and Sanchez 1983). The cost of management may, however, be very high whether in terms of labour or material inputs.

To summarize the 2 × 2 table of characteristics of land and the implications of land use and management:

a land system of low sensitivity and high resilience only suffers degradation under conditions of very poor land management and persistent practices which remove soil, increase compaction, salinity, etc.;

a land system of high sensitivity and high resilience suffers degradation easily but responds well to land management designed to aid reproduction of capability;

a land system of low sensitivity and low resilience is initially resistant to degradation but, once thresholds are passed, it is very difficult for any system of land management to restore capability;

a land system of high sensitivity and low resilience easily degrades, does not respond to land management, and should not be interfered with in any major way by human agency, except (paradoxically) where major works create the landesque capital of a wholly new agro-ecosystem. The comparison between the impact of soil loss on productivity in temperate

and tropical soils indicates that the latter tend, as a class, to have a relatively high sensitivity and low resilience and, hence, present more difficult management problems.

Two examples may serve to illustrate further the implications of different degrees of sensitivity and resilience for land. The first concerns the middle hills of the Nepal Himalaya, where some of the world's worst induced erosion is said to be taking place (e.g. Eckholm 1976). It is now established that the Tibetan plateau has been uplifted some 1000 m over the past 100,000 years (Ives 1981). Over the whole period, this is a mean rate of 1 cm/year. The Himalayan face has been uplifted at a lower rate, creating high natural erodibility as the slope becomes steeper, but an estimate of current uplift in the middle hills is 1 mm/year (Iwata, Sharma and Yamanaka 1984). In a small catchment in central Nepal, Caine and Mool (1982) calculate an annual lowering rate from mass wasting of 1.2 cm/year, while Williams (1977, cited in Carson 1985) calculates total denudation rates in four large catchments ranging from 0.51 to 2.56 mm/year. Regional uplift and regional degradation are natural processes, and the effect of terracing for agriculture has often been to check natural surface erosion rates, though with no significant effect on the more sporadic and localized mass wasting processes (Carson 1985). The management of such terrain presents enormous problems. This is an example of land with high sensitivity and of variable resilience. We return to this example in chapter 2, section 5.

The second example is from the lowlands of western and central Europe, which would seem on *prima facie* grounds to present a much less sensitive environment, with geological stability, a climate of low erosivity, and low relief. However, the whole region is mantled by a loess-type periglacial *limon*, of low permeability and, in the absence of management designed to ensure such permeability, has been subject to substantial erosion, leading to the redeposition of colluvial material. Discussed further in chapter 7, this region has been shown to have quite high sensitivity and to be subject to episodic damage. Sensitivity is not always readily explained and the less obvious it is, the greater perhaps the danger that a relaxation of management might lead to damage. However, under better management, the land system was able to reproduce its capability and even to increase it as a result of the degree of its resilience.

#### 4.2 A summary

At the outset, the problem was posed as the search for social causes within the interaction between natural and human causes of degradation. In order to undertake this task, a definition of degradation was needed, which is a loss of capability to satisfy the demands made upon it. These may be competing, hypothetical or future ones, and it is important to specify against which of them a loss of capability is being measured. Noting that most processes of

both damage and reproduction are natural but that their operation is greatly influenced by human interference and artifice, the problem can be summarized by an equation in which degradation becomes a net function, both of human and natural forces, both of damage and repair.

This led us to the consideration of the role of land management and of the importance of the land manager – an issue which we sidestepped at this stage. In order to define the task of land management and the means of encapsulating the work of natural scientists, simple terms were required. *Sensitivity* to physical and other forms of damage and *resilience* of the site characteristics in the face of use were identified as the two most relevant characteristics.

#### Relationships between society and land degradation

Having defined our key terms, the next task is to outline the main characteristics of the relationship between land degradation and society, and then to draw conclusions about an appropriate method of analysis. We identify three main characteristics: the interactive effects of degradation and society through time; the crucial considerations of geographical scale and the role of social and economic organization; and the contradictions between social and environmental changes through time.

#### 1 Interactive effects

In many complex issues of social or physical change, there is a reflexive and two-way relationship between land degradation and society. To take the similar case of population growth and development, for example, rapid population growth can, under certain conditions, adversely affect economic development and the living standards of the majority of the population unless economy can be expanded at a comparable or greater rate. Conversely, however, many aspects of poverty lead couples to have large families, and encourage a high population growth rate. In the same way, land degradation can undermine and frustrate economic development, while low levels of economic development can in turn have a strong causal impact on incidence of land degradation. Blaikie (1985a: 117) offers examples of 'operate ecocide' by peasants and pastoralists under extreme pressure to survive, and chapter 2, section 4 in this book gives a further illustration.

These interactive effects also take place through time. A period of rapid degradation may reduce the range of options over the possible uses to which can be put in the future, unless there is effective repair. The future history of the affected region therefore takes a different course. This simple situation is somewhat complicated when establishing the impact of such degradation upon the future history of the relevant people who use, or would have used, the land. The problem revolves around the convenient

word 'relevant'. First of all, land degradation can affect, presumably adversely, the options of people living in the afflicted area, and future generations. However, if these future generations have the option of migrating elsewhere the issue becomes hypothetical. If, on the other hand, they do not have this option - perhaps because of national barriers as in the case of the Sotho of Lesotho, if the option of working in the South African gold mines is closed in the future - then the impact of degradation of a region on the present population becomes a very real question for analysis. This issue is one of 'option values' which is discussed in chapter 5.

### 5.2 Interaction and scale

The scale issue is crucial to the definition of land management because it focuses on the boundary problem of decision-making and of allocating costs and benefits. One person's degradation is another's accumulation, and this is equally true of uphill and downhill positions of a slope, regions, nations and even continents. For example, the 'hollow frontier' of Brazil in the early twentieth century, and that of the United States in the nineteenth, might be said to have contributed to the process of accumulation and the development of infrastructure on a national scale in the form of railways, roads and services. The fact of degradation on the settlement frontier had its effect on future options there, but the immediate effect of extracting short-term profits from the land was beneficial in the national context.

On a smaller scale, the physical transfer of fertility via riverborne silt and dissolved minerals, or by deliberate transportation of organic or mineral fertilizer from one place to another, makes it necessary to develop a more sophisticated set of criteria with which to analyse the impact of land degradation in one area upon the wider society. The exceptional case of Nauru has particular point here. The removal of rock phosphate from Nauru since 1900 has destroyed the agricultural capability of the island, which was never high, in the interests of overcoming phosphate deficiency in the soils of Australia and New Zealand. Latterly, the Nauruans have received good compensation for this loss, which they have invested mainly in the Australian economy, and on the proceeds of which they now largely live.

### 5.3 Contradictions between social and environmental change

The third aspect for debate concerns the possible contradictions between the criteria used for land degradation, and those for beneficial social change, or 'development', through time. An increase in cash incomes through commercial cropping and ranching can yield a temporary increase in rural incomes, maybe even over several generations, but can lead to degradation through lack of attention to management of the land, and hence to subsequent income reduction. Examples of this contradiction are legion. With the development of synthetic fertilizers, and their manufacture in larger

and larger quantities, it can be argued that those pioneers who put profit first and good land management second made the right decisions, since the deleterious consequences of their actions are now masked by inputs of industrial origin. Moreover, while it may be that the modern oil-based fertilizers will not always be available, and more certainly will not be available so cheaply as oil resources finally approach exhaustion, the optimists would maintain that substitutes will be invented as the need arises. It is impossible to refute this argument, other than by pointing to the lower long-term cost of adopting management strategies which rely more upon natural processes of regeneration and repair.

## The approach adopted in this book

### 1 Demands made by the society/land degradation relationship upon the method of analysis

Three characteristics of the relationship between land degradation and society have been identified: the importance of interactive and feedback effects through time, the importance of scale considerations, and the contradictions between social and environmental changes through time. These have to be recognized as placing difficult demands upon the way in which land degradation and society is studied.

One of the chief demands is a great deal of data, and there immediately are technical problems of definition, measurement and availability (these are discussed in chapter 3). The second set of data problems involves the relationship between physical changes in soil and vegetation and declines in productivity of the land (e.g. crop yields, livestock production). Again, this is partly a technical exercise, and much of the biophysical modelling of these relationships is beset by enormous uncertainties and errors (Amos 1972), but it is also an exercise which must try to distinguish the impact of social changes in soil and vegetation from the impact of other purely economic changes in the circumstances of the land manager. Thirdly, there are difficult problems in the quantification of flows between people and soils. These derive from several distinct sources: the problem of conversion of flows of qualitatively different types to a common measure of energy, nutrients, available calories for human consumption, and net or shadow prices are only sometimes interchangeable; more abstract technical problems of incorporating the 'value' of resources found in nature (page 12); and lastly the 'unit of account' problem discussed on page 14. Wide degrees of error can therefore be made in the assessment of the important causes and rate of degradation and the reduction in capability of the land. The ambiguity is compounded by the scantiness of data on farming and rural practices. Over long periods particularly, the causes of degradation usually involve social and economic changes which are difficult to measure,

even if it is possible to reconstruct qualitative processes (see chapters 9B and 10B). If, for example, it is suggested that onerous rates of taxation and rents were responsible for heavy-handed and exploitative management of the soil, the challenge is to 'prove it'. A rigorous explanation linking the cause and effect would also have to predict that a reduction in rates of taxation and rents would reduce exploitation of the soil. This account of the problems should not be a charter for sloppy reasoning and inadequate empirical verification, but it does indicate that the extent of rigour in any analysis is as much a matter of circumstance as it is of necessity.

What then is our response to these demands for data which probably cannot be met? Presented with these problems it looks as if the task of explanation outruns the prospect of empirical verification. Part of the response is an adaptation and development of the ideas of Thompson and Warburton (1985a, b) who suggest ways of 'getting to grips with uncertainty'. The first element in our approach is to accept 'plural perceptions, plural problem definitions, plural expectations and plural rationalities' (Thompson and Warburton 1985a: 123). There are competing social definitions of land degradation, and therefore the challenge of moving away from a single 'scientific' definition and measurement must be taken up. This means we must put the land manager 'centre stage' in the explanation, and learn from the land managers' perceptions of their problems. Thus land becomes a 'resource-in-use', inextricably related to the people and society that uses it. It also means that we avoid single hypothesis explanations of degradation (and these are critically reviewed in the next chapter). Degradation at one place and time will be conjunctural and complex. There are patterns that repeat themselves in human-environment relations, but their modelling can only be partial at best. Case-study material therefore becomes crucial, and is a dominant feature in this book. But it is easy to lapse into a mere recording of unique events full of 'emic' data, which are difficult to relate to each other. Therefore an approach is suggested which allows for complexity, uncertainty and great variety, and one which takes as its point of entry those data which are beset with *least* uncertainty - the direct relationship between the land-user and manager and the land itself.

The other response to uncertainty leads us in a different direction, but one which is not contradictory. This is to try and improve our means of measuring and evaluating land degradation. If outside institutions are to make any contribution to the reduction of land degradation and of the incomes of people who rely on the land for their livelihoods, they will have to know if there is a problem and how great it is. Therefore, reliable methods of measurement of land degradation are crucial. Of course data are not reliable; they are *constructed*, and considerable attention in this book is devoted to their ideological nature, but this does not detract from the necessity to improve techniques of measurement. To this end chapter 3 explores the problems and prospects. Also, we need a methodology to evaluate the importance of land degradation in economic terms and a contribution to this is offered in chapter

5. First of all, the theoretical basis of the approach to land degradation and society is outlined in the next section.

## 3.2 The approach of regional political ecology

The complexity of these relationships demands an approach which can encompass interactive effects, the contribution of different geographical scales and hierarchies of socioeconomic organizations (e.g. person, household, village, region, state, world) and the contradictions between social and environmental changes through time. Our approach can be described as *regional political ecology*. The adjective 'regional' is important because it is necessary to take account of environmental variability and the spatial variations in resilience and sensitivity of the land, as different demands are put on the land through time. The word 'regional' also implies the incorporation of environmental considerations into theories of regional growth and decline.

The circumstances in which land managers operate in their decision-making over land use and management can be considered in the context of core-periphery relations. Location-specific studies of the settlement frontiers in Brazil, the United States and Southeast Asia, as well as of agricultural decision-making in economically declining areas, provide considerable evidence for suggesting that declining regional economies provide an important context for lack of initiative and investment of labour and capital in managing land. Chapter 6 gives examples from hill and mountain areas of a link between the status of regional decline and the circumstances of decision-making in land management. Chapter 7 on the other hand provides evidence from eighteenth-century France to show that both the downswing in the upswing in a rural economy can almost equally press on the welfare and freedom of those who occupy the most vulnerable position in the social structure.

The phrase 'political ecology' combines the concerns of ecology and a widely defined political economy. Together this encompasses the constantly changing dialectic between society and land-based resources, and also within states and groups within society itself.

It also derives from political economy a concern with the role of the state. The state commonly tends to lend its power to dominant groups and classes, and thus may reinforce the tendency for accumulation by these dominant groups and marginalization of the losers, through such actions as taxation, land tenure policy and the allocation of resources. The agrarian policy of Europe provides abundant examples (Abel 1980; Kriedte 1983). Recent work on the relationship between cumulative soil losses and crop yield has shown a negative exponential relationship (Stocking and Hufschmidt *et al.* 1983: 146) which strongly encourages the state to allocate resources to protect productive and still capable land, rather than to repair already degraded land which has fallen to a low level of

the past, reaching a peak, at least in France, in the eighteenth century. Finding the evidence to favour a preponderantly human causation, it is hypothesized that pressures on the peasantry came to be translated into inadequate management of the land. Landlords, the emergent bourgeoisie and the state all contributed to these pressures. This historical example, and other historical material in this book, are introduced for a very specific set of reasons. Not only was the early-modern condition of the peasant and working classes in the west comparable with, or worse than, that of their modern counterparts in the Third World, but the pressures on them assumed a severity rarely encountered today. The historical examples thus provide something of an 'extreme' case of our thesis that damage to the land and damage to certain classes in society are interrelated. Moreover, they also provide long-term depth of material that is not generally available to us in the Third World or in countries of recent European settlements, and hence provide both an illustration of political ecology in time depth, and also a corrective to facile conclusions that might otherwise be drawn from the examination only of contemporary problems.

### The margin and marginality

The approach of regional political ecology makes considerable use of various models and ideas surrounding the concept of the margin and marginality, and the last substantive section in this chapter we turn to defining them, and to giving them to land degradation. There are three rather different although related uses of the term in neo-classical economics, in ecology and in political economy. In the following sections each of the three uses are examined, and in section 7.4 they are brought together, and the reader will recognize we have returned once again to the ground of regional political ecology.

#### *The economic concept of the margin*

The concept of the marginal unit of a factor of production, that last unit when brought into use yields exactly its own cost and no more, is central in the classical theory of rent. Ricardo (1951) developed the theory of rent in regard to qualities of land; when all land of the first, and by definition the best, quality has been brought into production, and land of the second quality is then employed, the cost of production on the latter will be higher than on the first. For this to be possible the price must rise, and so all land of the second quality will receive an unearned income in consequence of the operation of the second; the unearned income of labour inputs on the second quality of land is more intensively cultivated, the law of diminishing returns will apply. Hence the schedule of production will form a parabola, so that the optimum ratio land and labour will both be utilized fully, and at this point there is a shortage of the forces of natural growth relative to

productivity. Such a trend may be accentuated by the need of dominant groups to protect the source of major commercial crops. The allocation of state-controlled resources in rural development therefore usually disfavors the physical and social margin. This is shown for Latin America by Posner and MacPherson (1982) and for Nepal by Blaikie, Cameron and Seddon (1980). It may be added that the efforts of international agencies have hitherto tended to concentrate in the same direction, notwithstanding contrary statements of policy. These ideas are developed in an introductory fashion in section 7 of this chapter.

Extended examples of regional political ecology which consciously uses theoretical material from the core-periphery model, applied theories of the state, and the ecology of agricultural systems, are offered in chapter 2, section 4 and chapter 6, section 6. In the latter, it is hypothesized that many areas of the Third World suffer from a set of related symptoms which combine the results of land degradation, political and economic peripheralization, stagnant production, outmigration and poverty. However, there are clearly important variations in the politico-economic and physical histories of peripheral areas. Some areas, especially in hills and mountains, have avoided colonization and have preserved elements of ancient culture and social structure, such as segmented tribal organization and unformalized rules of land tenure. Other areas and their people have been intensively colonized and have attracted metropolitan capital into plantations, large farms and ranches, but are limited by sensitive and unresilient environments of a different type altogether. The distinction between these two is clearly drawn in chapter 6 and again in chapter 10.

However, there were and still are political economies which predate the world capitalist system, or remain only loosely articulated with it in modern times. Today, post-1945 Albania is an example and historically the Asian and tropical-American empires grew and differentiated on the basis mainly of internal division of labour and trade, with only peripheral dependence on external exchange. Such writers as Chevalier (1963) and Borah and Cook (1963) have shown how a class structure had evolved in central Mexico under the Aztec empire, how this was reflected in the management of land and the exaction of tribute, and how remoter groups brought under Aztec rule were incorporated into this system in a peripheral relationship. Degradation and erosion were substantial (Cook 1949). In this volume the more remarkable — because little stratified — case of the highlands of Papua New Guinea is analysed in chapter 8; here a political economy based on surplus production for competitive prestation evolved in the 300 or so years before there was any direct contact with the world political economic system, and a significant degree of land degradation was brought about under that isolated system.

In chapter 7 we undertake a more specific historical inquiry into the conditions of degradation in the past. We seek to explain how and why erosion of a type generally associated with sub-humid areas of southern Europe came to prevail in quite large parts of central and western Europe in

the input of labour. Further increases in demand will therefore make it necessary to bring in new and inferior land, and the last land to be brought into use, or to be intensified, will just repay the cost of production and no more; this is the margin.

Von Thunen (Hall 1966) noted that beyond the optimum point of intensification it is a combination of constant land and increasing labour that becomes less productive, so that it is the additional units of labour that will in fact earn less. Gossen (as cited in Heilmann 1945) noted that the value of any given unit of a quantity, wherever produced, is appraised like the marginal or last unit and thus has the same utility, and showed that the value of any individual unit produced must be equal to the marginal utility. The marginal unit is therefore that whose marginal cost is equal to the marginal utility, and if we are writing of land qualities, then this unit is the marginal land (Heilmann 1945: 186-7). Add to this Von Thunen's arguments about the effects of intensification as the margin is approached on the distribution of returns to the factors of production, and we also have a link with the political-economy view of the margin which is developed below.

### 7.2 The ecological concept of the margin

In principle, at least, the ecological concept of the margin is comparable with the neo-classical one. For a given plant, or association of plants such as a forest, the marginal unit of land is that where natural conditions will just permit the plant to survive. However, an ecological view cannot avoid the question of environmental variability, so that we have to define the margin in terms of expected adverse conditions, recognizing that in some years plants can grow well beyond their 'secure' domain. This being so, a marginal environment for plants is better interpreted as the area or zone within which there is expected killing stress, but over which a plant or plant association can expand when that stress is absent. The same concept applies to marginal habitats for wildlife, and by extension also to crops and livestock.

Discussion of the 'ecological margin' does not always follow this logical approach. Perhaps it is better to be more restrictive and to define the term by extrapolation of the neo-classical definition to take account of environmental variability. The Sahel, for example, is thus defined as a marginal zone within which droughts of great severity and length can be expected. Discussion of the 'advance' of the desert margin into this zone (Stebbing 1935; Rapp 1976) means essentially that its marginality is becoming accentuated as human interference assists natural forces in the elimination or pauperization of plant communities, and makes their re-establishment in good years less likely.

Ecological marginality need not relate only to 'natural' conditions. Agro-ecosystems created by people immediately acquire a new set of relevant environmental variables. In all irrigated land, the availability and the quality of water become paramount. A clear example of ecological marginality in the context of created agro-ecosystems is provided by the annually reconstructed

fields made in the gravelled beds of rivers in parts of the Mountain Province of the Philippines, while another is the gardens fed with human manure that were until recently encountered on embanked portions of the sea beach around the inlets which penetrate the New Territories of Hong Kong. Both were economically better than marginal, otherwise they would not have been constructed, but both were ecologically marginal at grave risk from storm and flood. We illustrate the more complex example of the *sawah*-rice terrace later.

### 7.3 The political-economic concept of marginality

The political-economy approach concerns the effect on people as well as on their productive activities of on-going changes within society at local and global levels. Use of the term in this context has arisen in the Latin American literature, where it was used to describe the sort of process described by many writers from Mariategui (1971) onward, and pithily summed up by Savenhagen:

The channeling of capital, raw materials, abundant foods, and manual labour coming from the backward zones permits the rapid development of these poles or focal points of growth, and condemns the supplying areas to an increasing stagnation and underdevelopment. (1969: 108)

At about the same time, Casanova (1970: 123) wrote of the 'marginal masses' who are outside the political system of Mexico, and of the 'marginal population' which is disorganized, uninformed and which can make demands only 'in the traditional forms of supplication, petition and complaint'. The term was quickly adopted (Parra 1972) to refer to a whole class of people who are excluded from employment, services, participation in decision-making, opportunity and secure housing (Brett 1973). Gaining wider currency, 'marginalization' has been used in the feminist literature to describe the exclusion of women from productive employment (Hartmann 1976; Young & Moser 1981), and in being widened to this and other contexts has perhaps lost something of the force contained in the original Latin American formulation.

### The relation between three concepts of the margin

Writing of Kenya, Wisner (1976) wrote of *marginals* created by colonialism and capitalism who, in the process of social allocation of space, were quite literally pushed into *marginal places*. However, socio-political and ecological economic marginality are not necessarily correlated in this way. 'Marginalized' peasants can, and do, occupy smallholdings on highly fertile land, while ecologically marginal land that is also near marginal in the classical sense can, if a holder has enough of it, offer the basis for a highly profitable commercial operation. Much of northern Australia is ecologically

marginal, but while most of it would be sub-marginal for commercial agriculture as has repeatedly been shown, it can support very profitable pastoral operations when coarsely divided into properties and chains of properties the size of small European countries. However, the Aboriginal people dispossessed of their land and now working on these estates share none of this affluence, and have been marginalized within the new relations of production.

If we control the comparison within a single mode or system of production, however, a relationship can more readily be established. An Asian rice-growing community has land sharply differentiated by fertility and hydrology, and its upland areas are sensitive under interference. When *sawah*-rice terraces are created, these new agro-ecosystems differ greatly in their ecological security. If they are on unstable slopes, the terrace walls may lose water readily by seepage. Under a high population density all the land capable of *sawah*-rice production has been taken up and converted; some of this is ecologically marginal even though economically secure in most years. Great differences in rent are yielded by the *sawah*-rice parcels. Some farmers without or with insufficient *sawah*, take up dry land for swidden cultivation on the ecologically marginal slopes, where they get good short-term returns of dry crops, but are at risk from erosion and loss of fertility. Those who are most marginalized in the socioeconomic sense have no land, and are forced to seek casual work from others. This is a hypothetical example, but is not unlike an upland West Java village (*kampung*) studied by members of the International Rice Research Institute (IRRI). They conclude

As growth of population presses hard on limited land resources under constant technology, cultivation frontiers are expanded to more marginal land and greater amounts of labor applied per unit of cultivated land; the cost of food production increases and food prices rise; in the long end (*sic*), laborers' income will decrease to a subsistence minimum barely sufficient to maintain stationary population and all the surplus will be captured by landlords as increased land rent. This is exactly what has occurred in the *Kampung*. (Kikuchi *et al.* 1980: 15)

It will be useful to summarize some of the postulated and demonstrated relationships. To clarify, we identify the three concepts of marginality as economic (EN), ecological (EC) and politicoeconomic (PE) in what follows.

Land managers can become marginalized (PE) through the imposition of taxes, corvée labour and other relations of surplus extraction. The responses they make may be reflected in land use and in investment decisions over the preservation of productivity of their land. Adversity of this sort can produce innovations which raise productivity – to pay for the extraction of surpluses – as well as safeguard future productivity. However, more extreme marginalization (PE), often involving a whole number of readjustments particularly a loss of labour power (through war, conscription or emigration), has frequently led to changes in land use and the inability to keep up

longer-term investments in soil and water conservation (e.g. repair of terraces and cleaning of irrigation and drainage ditches). The land then becomes economically marginal (EN) and the result is a decline in capability and marginality (EC) of the agro-ecosystem.

Spatial marginalization (PE) may also accompany these changes. Dominant classes may gain control and use more fertile land and force others to use more marginal land (EN). The attempts of the latter to make a living with reduced resources have often led to land degradation. Marginal land (EC) which has a high sensitivity and low resilience to even skilful or light interference by land managers can attract land uses, for this reason, which permanently damage the capability of the land. Here the emphasis rests not only upon the socially imposed marginality (PE) of the land manager, but also upon the intrinsic marginality (EC) of the land itself. Commercial ranching in the Australian interior is a prime example. If land degradation comes about as a result of either commercial exploitation or socially induced marginalization (PE) of land managers, a vicious circle of increasing impoverishment and further marginalization (EC) of land and land managers (EN) can sometimes result. Hence land degradation is both a result of *and* cause of social marginalization (PE). It can accentuate the physical marginality (EC) of land by reducing its present capability, and marginalize (EN) it for present alternative uses. Much of Ethiopia, the Sahel region as a whole, and other areas of low resilience find themselves in this position.

### Degradation, hazards and the environmental paradigm

The approach of regional political ecology taken in this book is compatible with the new directions in hazards and disaster research. Both approaches are an historical and a dynamic approach to human-environment relations. Nature is seen to be in constant flux, and measurement must constantly be related (see also chapter 3). Also, nature is not universally nor statically defined; resources 'become' resources when people define them as such (Kikie 1985c). The multiple definitions of natural resources and degradation by three groups of land-users and three government departments in Indonesian case study (chapter 9B, section 3.3) are a good illustration amongst others in this book. Both approaches emphasize underlying social rather than capricious nature in the explanation of calamitous events: uses, internal features and consequences (of natural disaster) are *not* explained by conditions or behaviour peculiar to calamitous events. Rather they are seen to depend upon the ongoing social order, its everyday relations to the habitat and the larger historical circumstances that shape or illustrate these matters. (Hewitt 1983: 25)

Three concluding chapters in Hewitt's book provide the basis of this 'native approach', linking the ongoing social order to hazardous events. In short, O'Keefe and Wisner (1983) build on the work of O'Keefe (1975)

and of Wisner (1976) who for a decade have linked disasters to processes of marginalization and proletarianization. The trigger events which start disasters or catastrophes have explanatory linkages with land degradation because both arise from the conjunction of physical and social processes. Sayer urged that we must start with the essential and necessary unity of society and nature, and that 'to start in the conventional manner with ... a separation followed by a listing of interactions would be to prejudice every other aspect of the exposition' (1980: 22). Approving this view, Watts goes on to argue that 'the subject matter of human ecology is accordingly *inner-actions with nature*' (1983: 234). This formulation is close to the idea of a 'resource-in-use' used earlier in this chapter. Also shared with the alternative approach in hazards research is an avoidance of relegating natural processes to a mere context or backdrop to hazards or degradation. Some radical literature has tended to do this and to imply that studies of climatic change in the Sahel, for example, are no more than a smokescreen and decoy to cover the tracks of the 'real' culprit - capitalism. It is vital to understand (as accurately as data, measurement and modelling will allow) the natural forces which create a variable management task to which decision-making, subsequent to political economic conditions of choice, has to respond.

### 9 The social scientist's contribution: the need for open minds

We set out initially to write this book from position papers which adopted respectively Marxist and behavioural approaches, in each case with qualifications. What happened instead was something unforeseen: large areas of agreement emerged between the two authors, and several of the contributors also. While a more abstract (and no doubt rigorous) analysis of the two positions would undoubtedly expose fundamental contradictions, there is a broad area within which the explanation of land degradation can draw upon similar themes. There is something to be said for declaring a truce on the more abstract structural differences in the interpretation of social change, however important these differences may be, if it allows cross-fertilization of approaches. There are certainly fundamental contradictions between the 'human adaptation', neo-classical and various Marxist approaches, to take these three only. However, they share the objectives of understanding and problem solving, and of bringing about change in the situation, albeit in different degrees and in different ways. While there are epistemological reasons why Marxists have not been too interested in 'decision-making' models, there is nothing inherently revisionist in building them. Likewise, there is no betrayal of the profession of neo-classical economics in trying to pursue the quantification of costs and benefits of degradation and conservation into the realms of politics and unquantifiable conjecture (as done in chapter 5). Nor is there any reason why the study of human behaviour should fail to take advantage of the insights of theory about

economic rationality or disregard the contradictions inherent in all social change and social formation.

There is a need for open minds, too, in the use of quantification and model building. There is an extraordinary schism between two self-perceived epistemological camps, the one which measures, creates its own data and uses 'bers' in model building, and the other which calls itself 'radical' and chews analysis of this sort as positivist, and the data as ideologically tainted and reductionist. Whilst this book amply shows that data do not simply exist but rather are constructed, it also argues strongly for technically better *and* more ideologically aware measurement of process, costs and benefits. Quantitative modelling of resources-in-use and land managers themselves need not be mindless number crunching. Nor need a central concern for the social meaning of degradation and for conscious ideological choice in explanation be dismissed as biased and not 'real' science.

Open minds assist in clarifying and sharing objectives. There are many blocks to open minds: the criteria for excellence and promotion differ between various practitioners (academics of different disciplines, consultants, administrators, politicians); there can be interdisciplinary rivalry between different academic departments (particularly between natural and social science); and more specific epistemological differences, mainly about domain and status of proof in discourse and research. Land degradation society, because of its complex and multidisciplinary nature, and its theoretical and practical elements, encounters most of these blocks.

For these blocks are not removed, the issue of land degradation will remain mired in controversy, uncertainty and incomprehension. What people do not understand, they tend to avoid; what is unclear, people cannot decide on. So it is with policy-makers and land degradation. While solutions will be multiple as the causes of land degradation, the general approach outlined here aims to unify but through an appreciation of plurality of cause and flexibility in explanation. For the discipline of geography at large and Carl Sauer put the problem and challenge perfectly more than

five years ago:

rely nothing could be more geographic than critical studies of the stage of surface and soil as expressions of abusive land occupation. On one hand are the pathological physical processes; on the other, the natural causes are to be studied. Next come the effects of continued change on survival of population and economy, with increasing tendency to generative alterations or replacement. Finally, there is the question of recovery or rehabilitation ... Geographers have given strangely little attention to man as a geomorphologic agent ... The theme was clearly stated as a formal problem of geography three-quarters of a century ago. Geographers have long given lecture courses on conservation of natural resources and considered the evils of soil erosion. But what have been done as investigators in the field, which may actually lie at the

doorsteps of their classrooms? Is the answer that soil students should study sheet wastage, geomorphologists gullies, agricultural economists failing agriculture, rural sociologists failing populations, and the geographer prepare lectures on what others investigate? (Sauer 18-19)

### 10 Summary and conclusion

All aspects of the relationship between land degradation and society are both social and physical - a commonplace statement that is self-evidently true, but not trivial. It means that degradation is perceptual and socially defined. There may well be competing perceptions and these can be put into the context of the political economy as a whole, in which different classes and groups perceive and use land and its resources in different ways. Our four central terms - land management, land degradation, resilience and sensitivity - are all defined in a social context, and with explicit reference to ongoing processes of social change. There are extremely severe problems of data availability and of verification and proof. The approach taken in this book must respond to this problem of uncertainty and does so by seeking a point of entry where uncertainty is least, at the point of the land manager. The land manager is then 'contented', and her or his actions explained within a set of dynamic human-environment relationships which we call regional political ecology. The various definitions of the margin and marginality are central to this approach.

It will be obvious that we avoid an ethical and fundamentalist approach to land degradation. The definition of degradation, and whether it is 'bad' or not are both related to the people who use land. The field of interest in this book does not include difficult environmental-ethical questions such as the extinction of endangered species, or conflicts between national parks and other human uses of the biome, where ethical judgements assume greater importance. The approach taken here is that land degradation is judged in terms of the altered benefits and costs that accrue to people at the time and in the future.

## Approaches to the study of land degradation

by *Blaikie and Harold Brookfield*

### Chains of explanation

We have described our approach to the explanation of land degradation in a specific area as regional political ecology, and essentially the approach was a chain of explanation. It starts with the land managers and their relations with the land (crop rotations, fuelwood use, stocking densities, capital investments and so on). Then the next link concerns their relations with each other, other land users, and groups in the wider society - affect them in any way, which in turn determines land management. Finally then, explanations will be highly conjunctural, although relying on political bases drawn from natural and social science. In this context we define the major 'single hypothesis' approaches to land degradation. After there are discernible patterns of social change and land degradation, models which would claim a degree of universality. The first is the notion of land degradation in terms of population pressure and is the concern of a number of influential theories. The second is very much limited and different in character and explains degradation in terms of perceptions and ignorance of land managers themselves - the problem lies with them. This chapter examines each of these models in turn in sections 2 and 3, and finishes with a case study which illustrates their nuances.

### Population and land degradation: attribution and generalization

It is tempting to find the cause of land degradation is somewhat akin to a 'Hercule Poirot' case, except that no criminal will ultimately confess, and Hercule Poirot is unable to assemble the suspects on a Nile steamer or in the dining room of the Snowbound Orient Express for the final confrontation. The analogy is not perfect. Murders are generally easier to identify than land degradation; the cause is often shared in different degrees between different people (e.g. accessory, etc.), as in each case of land degradation. However, any