1 Concern for land

With the rise in population placing ever-increasing pressures on scarce land, governments of developing countries should give high priority to rational land use, improved land management, and avoidance of degradation. At international level, public concern has been more with pollution aspects of the environment, and nature conservation, than with land as a productive resource. In developing countries, awareness by governments of the critical role played by land resources is poor, and institutions inadequately funded. Much progress has been made over the past 50 years in approaches and methods for land resource survey, evaluation, and management. What is needed now is more widespread and effective application of these methods. Sustainability, the combination of production with conservation, is a central concept in land resource management.

Management of land, of its soils, water, forests, pastures, and wildlife, has been central to human society from its earliest times. Land resources provide the basis for more than 95% of human food supplies, the greater part of clothing, and all needs for wood, both for fuel and construction. The developments of the industrial age have substituted coal, oil and minerals for some of the fuel, construction, and fibre needs, but have in no way removed the basic dependency of society upon the renewable resources of the land.

There has always been competition for land, sometimes reaching the level of conflict. In prehistoric times, among communities dependent on hunting and gathering, it would have shown in the kind of territoriality found amongst animal populations. As soon as the record of history begins, it is clear that there were great inequalities in land availability. Famine has never been absent, and migrations in search of better resources have extended from biblical times to the great world expansion from the nineteenth to the first half of the twentieth century.

Formerly, there was a solution to local problems of shortage of food and other basic necessities: to take more land into cultivation. Usually this was through clearance of forest, for forested lands are also the most fertile. In Europe in medieval times, in North America in the nineteenth century, and until quite recently in the tropical lands, forests and woodlands have receded, arable land has expanded, and land for nature has been constantly reduced. Even into the post-1945 period of planned development, new land settlement schemes were still possible as a solution to problems of crowding, small farms, and landlessness.

Most parts of the world are by now moving into a new era. The early taxation

surveys of India recorded 'culturable wasteland', which today would be called land that is cultivable but not cultivated. Almost all such land has now been taken up. In 1965, the Malaysian Government, with international agency support, embarked upon the Jengka Triangle project, the objective of which was to clear 2000 km^2 of primary rain forest and plant it with oil palm, as a means of settling people from the overcrowded rice-growing deltas. Today, world opinion and the policy of international agencies strongly oppose any such clearance. Malawi, in East Africa, was a crowded country at the time it gained independence in 1964, but cultivation still stopped short at the foot of the hills; ten years later it had become widespread on hillsides and on the steeply dissected slopes of the rift valley. In Jamaica, needs for food have led to cultivation of slopes on which one can hardly stand, leading to severe soil erosion.

The massive increase in population which has led to land shortage started with the Industrial Revolution and has been accelerated by improvements in health and the introduction, since the Second World War, of international action for famine relief. From 2500 million in 1950, world population doubled by 1987 and will pass 6000 million in 1998. The current rate of increase is 88 million a year or 240 000 a day. At present average levels of crop yield, food alone for these extra people calls for an additional 80 000 hectares of land, nearly 30 by 30 kilometres, every day. In much of Asia and the Middle East, and a growing number of countries elsewhere, such extra land is simply not there. The world is becoming a 'full house'.[1]

Barring catastrophe, a further population rise over the next 30 years of at least 2000 million, and most probably 2500 million, is inevitable. Nearly all of this increase will be in less-developed countries. Much of it will be in families who are already very poor, many of them chronically undernourished. Because there is little spare land remaining, most of the added production required to provide basic needs for these people will have to be achieved by higher productivity from existing land. Higher crop yields form the largest component, but increased productivity from livestock and forests are also required. The productive potential of the land must be conserved, preventing erosion and other forms of land degradation. Land must be retained for forestry, water supply, and conservation of nature, checking a threatened reduction in the diversity of plants and animals. Lastly, people need land for settlements, not only housing but transport, industry, and recreation.

In this crowded world, with growing populations, severely limited land, and strong competition for its use, it is clearly desirable that governments should place high among their priorities:

rational land use: using different types of land in ways best suited to their potential;

improved land management, in agriculture and forestry, so as to secure higher productivity;

avoidance of land degradation – soil erosion, forest clearance, pasture degradation, and the like – so as to conserve resources for the future;

good data to guide decisions on the above, and research to advance knowledge on which improvements can be based.

These needs and pressures should mean, therefore, that land resources and land use lie at the centre of national policies, particularly in the developing countries. Regrettably, this is not the case.

Awareness at the international level

There is no lack of environmental concern at the international level. The growth of awareness that took place from the late 1960s was brought into focus at the first United Nations Conference on the Environment, held in Stockholm in 1972, leading to the foundation of the United Nations Environment Programme (UNEP). Among developed countries, the environment became an active element of national policy, not only through 'green' political parties but through the pressure which people in democracies placed upon their governing institutions. A proper regard for environmental questions was conceived as being a matter of self-interest.

The self-interest, however, was predominantly that of the developed countries. This is still the case. The issues most often given attention are global warming, the 'ozone hole', the dangers of nuclear and chemical pollution, and loss of biodiversity. Forest clearance is also widely discussed, but with respect to the role of forests in assimilation of carbon dioxide and in preserving genetic resources, not for their functions of water catchment protection or timber production in developing countries themselves. Following the prolonged droughts in the Africa sahel in the 1970s, desertification came temporarily to the attention of the world, but impetus for this concern was lost, partly because of the poor basis of scientific information on which discussion was based.

In the 1980s, there were two international commissions, the outputs from which are generally referred to by the names of their leaders, the Brandt and Brundtland reports.[2] Both drew attention to the growing gap in wealth between rich and poor nations, with the message that reduction in poverty in the latter was in the interests of all. Whilst attracting attention, these reports did not succeed in increasing the level of foreign aid from the developed nations, which has continued to fall as a percentage of national income.

In 1992, governments of the world met in Rio de Janiero for the United Nations Conference on Environment and Development (UNCED). Besides a review of

INTERNATIONAL MILESTONES IN AWARENESS OF LAND, POPULATION, ENVIRONMENT, AND DEVELOPMENT

1972	UN Conference on the Human Environment, Stockholm, leading to establishment of the UN Environment Programme (UNEP).
1977	First UN Conference on Desertification, Nairobi.
1979	World Conference on Agrarian Reform and Rural Development (WCARRD), directing attention to land tenure reform and social issues.
1980	Report of the Brandt Commission, *North-South: a Programme for Survival*.
1985	Establishment of the International Board for Soils Research and Management (IBSRAM).
1987	Report of the Brundtland Commission, *Our Common Future*.
1990	Four research institutes in land resource management, for forestry, agroforestry, irrigation, and fisheries, are admitted to the international agricultural research system.
1992	UN Conference on Environment and Development (UNCED), Rio de Janiero; *Agenda 21*, programme of action for sustainable development.
1993	Population Summit of the World's Scientific Academies, New Delhi, *Joint statement*.
1994	Third UN Conference on Population and Development, Cairo, *Programme of Action*.
1996	Second World Food Summit, *Rome Declaration and Plan of Action*.

progress in the twenty years since the Stockholm meeting, this was for the purpose of drawing up a programme of action, *Agenda 21* (meaning an agenda for the twenty-first century).[3] As compared with the Stockholm meeting 20 years earlier, which focused upon the pollution aspects of environment, there was a partial change of emphasis. Following upon the Brandt and Brundtland reports, and a growing realization of the problems set by population and poverty, development was given equal place with environment. This led to a change of emphasis between the different aspects of the physical environment. Its role in providing natural resources for production was given more attention, relative to that of a sink for waste products and associated problems of pollution. In terms of space allotted, there are 6 chapters devoted to land resources as a basis for production, compared with 4 on pollution and wastes, 1 on biological diversity, and 2 on the resources which are 'global commons', the atmosphere and oceans.[4] This meeting also brought to wider attention the concept of sustainable development, the conservation of resources for use by future generations. *Agenda 21* marked a big step forward in bringing the role of land resources to wider attention.

Further progress, although not as much as had been hoped, was made at the Third UN Conference on Population and Development, held in Cairo in 1994. It had been preceded by a meeting of the world's scientific academies, who very firmly called for urgent action to be taken to limit population growth: 'Ultimate success in dealing with global social, economic, and environmental problems cannot be achieved without a stable world population.'[5] The UN meeting did not go as far as this. It main advance was the recognition that population questions cannot be treated in isolation, but are closely linked with environmental resources and economic development. It called for programmes to limit population growth, with emphasis on the education and status of women, but did not go as far as to suggest that natural resources might set limits to population-supporting capacities.

Compared with the UNCED conference, the outcome of the 1996 Second World Food Summit was disappointing, even retrograde, in its lack of emphasis on the land basis of food production. In the *Rome Declaration and Plan of Action*, the main points of emphasis are responsible government, poverty, the rural sector, participation and sustainability, disaster relief, and the role of women.[6] In this high-level document, the function of land resources appears only indirectly as sustainability, which is coupled with participation by land users. Land availability is considered in the technical background documents but, even in these, loss of production through land degradation occupies a very subsidiary place. The critical role of water in food production is given more prominence, as 1 out of 15 Technical Documents.[7]

In 1997, a further UN Earth Summit meeting was held, to review progress in the 5 years since the Rio conference. The primary concern was with the issue of halting global warming, through reduction of greenhouse gas emissions, linked with a further resolve to check loss of the world's forests. In recent years, media attention has become increasingly focused on global warming, perceived to affect adversely the interests of Western nations. It is no answer to say that it is the scientists' views, and discussions in committee rooms, that really matter; the media strongly influence (some would argue, reflect) public opinion, and politicians must respond to this in allocating aid for environmental and development purposes.

Environmental issues: the balance of concern

In summary, the major environmental issues fall into five groups:

1. Land resources: the role of environment as a resource for production.
2. The role of environment as a sink: waste disposal and pollution.
3. The 'global commons': atmosphere and oceans.
4. Conservation of nature: biological and genetic resources.
5. Non-renewable resources: energy and minerals.

There are substantial overlaps between these issues. Climate is a major land resource, hence global atmospheric change potentially affects production. The genetic resources of nature provide a basis for future advances in plant productivity. Pollution of soils and water is one cause of land degradation, whilst energy resources place constraints on agricultural technology.

Since the environmental movement first arose in the 1960s, Western countries have always directed their interests primarily at the pollution aspects of the environment, including the specific aspects of atmospheric change and its effects on climate. Land resources for production have never attracted as much attention. The existence of a world food problem is perceived, but developed countries rightly assume that they will not run short themselves. The argument of 'only one world', that in these days of modern communications and advanced armaments, the welfare of the Third World is inseparable from that of developed countries, has failed to be sufficiently convincing to bring about action in the form of aid. Since the 1950s, there has been a steady fall in development aid as a proportion of national wealth, and, since 1990, less of this has been directed towards agriculture and the rural sector.

Awareness at national level

If the need for research and investment into the conservation, management, and development of land resources is to be made, the initiative has to come from governments of the countries concerned. In industrialized countries, particularly those in which agriculture contributes only a few percent to the national wealth, it would be understandable if land resources did not play a major role in policy. In fact, many such countries have balanced and responsible policies in these fields. The United States took a lead in soil conservation programmes in the 1930s. Australia made surveys of the resources of its northern and central areas from the late 1940s onwards, and a comprehensive land inventory of Canada has been completed. Deforestation was reversed in Europe from the 1920s onward.

In developing countries, the needs are very much more urgent. Many have a high dependence on agriculture for both food needs and exports, and supplement their food production with substantial cereal imports. Some have low crop yields, and most encounter problems of land degradation. Many countries have an average farm size of less than one hectare, and populations will rise by at least another 50%. One might expect, therefore, that they would place land resources at the centre of national policies and planning.

The actual position is very different. Natural resource survey organizations and land use planning departments exist, but the information they collect does not weigh strongly in development planning. The information basis for decisions about

land is extremely poor. Many countries lack reliable data on even such basic facts as the areas cultivated and under forest. None have yet made systematic efforts to monitor changes in the condition of their soils, nor the extent of land degradation. The adoption of improved methods of soil management is held back by the weakness of the agricultural extension services. National development plans give due attention to agriculture and forestry, but rarely make more than passing reference to the land resources on which production in these sectors depends. Most national institutions for agricultural research are poorly funded. The wealth of soils, water resources, forests, and grazing lands is not taken into account in national budgeting. A forest may be cleared or a valley-floor pasture gullied, but these losses of natural capital do not appear in national accounts.

Landmarks of progress

Set against the negative aspects of awareness, there have been many substantial advances over the past quarter-century in knowledge of land resources, and their potential, management, and development in the Third World. Subsequent chapters review these, with an emphasis on what still remains to be done. With the objective of demonstrating the progress that has been made, a preview may be given of some major advances in approaches, methods, and knowledge at the international level. All advances are based on research, but their objective is practical action in land planning, development, and management. In the following list, general progress in each field has been linked to key publications of results, as landmarks of progress:[8]

1970	The *Soil map of the world* at 1:5 million scale provides a common classification and the first estimate of world soil resources.
1976	*A Framework for land evaluation* supplies a means to convert the results from resource surveys into estimates of land potential.
1977	*Guidelines for predicting crop water requirements* provides a basis for planning efficient water use in irrigation.
1978–81	The *Agro-ecological zones project* establishes a framework of reference for agro-climatological assessment, linked to a climatic database.
1980, 1990	The first and second *World forest resources assessments* show the extent and rate of deforestation. The first leads to establishment of the *Tropical forestry action plan*.
1981	The approach of rapid rural appraisal is formulated, later to develop into participatory rural appraisal, and diagnosis and design.
1984	*Land, food and people* summarizes results of the first comprehensive comparison between the food needs and the food-producing potential of developing countries.

1989	*Land husbandry: a framework for soil and water conservation* sets out the new, participatory, approach to soil conservation.
1989–93	A series of case studies, including Costa Rica, Java, and the Philippines, demonstrates how loss of land resources can be valued in economic terms, leading to moves towards national environmental accounting.
1990	The *Global assessment of soil degradation* (GLASOD) provides the first survey of the extent and severity of erosion and decline in soil fertility.
1991	*The earth as transformed by human action* reviews world changes in land use, leading to an International Geosphere-Biosphere Programme to study global changes in land use and cover.
1992	*The state of world rural poverty* directs attention to the links between poverty, land shortage, food security, and resource degradation. The World Bank is by now giving special attention to reduction of poverty, and the International Fund for Agricultural Development, set up in 1976, is exclusively for this purpose.
1993	With the publication of *Guidelines for land-use planning*, the sequence of approaches and methods for land development, from resource survey via land evaluation to practical land use planning, is completed.
1995	*World agriculture: towards 2010* makes 20–year projections for food and agriculture, the most comprehensive study of its kind to date; production is related to the land resource base.
1995	The World Bank and UN agencies begin a programme on *Land resource indicators*, recognizing the need to monitor changes in land resources.

This list of landmarks is necessarily selective. It does not include the advances made in applications of remote sensing and computerized information systems to land resource development. The inclusion of social factors, people's participation, and poverty, in a summary of land resources is deliberate and important; land cannot be considered in isolation from the people who depend on it and manage it.

Comparable summaries could be made of advances in particular countries, both at national and district levels. The state of knowledge would be more fragmentary. Because national organizations are so poorly funded, progress has often been dependent on opportunities provided by development projects. For most countries, however, it would be possible to list land resource inventories at a national level and in district-level project studies. Much real progress has been made in land resource management through co-operation between scientists, extension staff, and farmers.

Sustainability

The term sustainability was introduced relatively recently, although it has long been a basic concept in land resource management. Farmers have always sought to pass on land to their children in at least as good a condition as they inherited it. The *Agenda 21* report of the UN Rio meeting is subtitled, *A programme of action for sustainable development*, and there are now few development projects which do not include reference to sustainability. Like many ideas which come into vogue, it has on occasion been misused, its meaning widened to almost anything that a writer considered to be 'a good thing'. Properly employed, however, sustainability is a valid concept of the highest significance, fundamental to questions of land resources.

Sustainability, or sustainable land use, has been variously defined, although the FAO definition has gained common acceptance. The essential feature is that sustainable land use achieves production combined with conservation of the natural resources on which production depends. This is expressed in the simplified definition. It can be compressed still further into a pseudo-equation, 'Sustainability = Production + Conservation'. For a land use system to be sustainable requires, first,

SUSTAINABILITY

Formal definition

Sustainable agriculture and rural development is the management and conservation of the natural resource base, and the orientation of technological and institutional change, in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development conserves land, water, and plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable (based on FAO sources).

Simplified definitions

Sustainable land use is that which meets the needs for production of present land users, whilst conserving for future generations the basic resources on which that production depends.

Sustainability = Production + Conservation

that it should meet the needs of farmers and other land users; and, secondly, that it should achieve conservation of the whole range of natural resources, including climate, water, soils, landforms, forests, and pastures.

In this respect, there is a difference of emphasis from the environmental movement of the 1960s and after. In the latter, priority was given to conservation; if a human activity led to adverse changes to the environment, it was unacceptable. In

the concept of sustainability, it is significant that production is listed first. The priority of farmers has to be to meet their present needs for food and cash income. Land use planning starts from the premise that production needs must be met; it then proceeds to consider how this can be made compatible with resource conservation. If farmers are gaining their livelihood from fragile environments, such as steep slopes or semi-arid climates, it is unacceptable to forbid such land use. Instead, ways must be found of making it environmentally acceptable.

Objectives and plan

The objectives of the following account are:

- to improve awareness of the critical role played by land resources in the welfare of developing countries;
- to summarize the present state of knowledge about land resources, methods for their assessment, and their present condition and productive potential, now and in the future;
- to draw attention to problems in land resources, including land degradation, and the need for improvements in management if further loss of productive potential is to be prevented;
- to consider the improvements in policy, institutions, education, and practice that are needed to bring about such changes.

The book falls into five general sections. Chapter 2 sets out the major concerns in sustainable land management, the land resource issues. Chapters 3 to 6 cover the spectrum of methods employed in rural development, commencing with survey and leading, via evaluation and participation, to practical land use planning. Chapters 7 to 10 cover different aspects of the central issue of land degradation, the lowering of the productive potential of resources. Chapters 11 and 12 are concerned with methods for the management of land, and research directed at improving these; the potential of research to increase land productivity is also discussed.

The final section places land resources into the wider context of development. Chapter 13 covers 'the great debate', on whether the developing world will be able to feed its future population. Chapter 14 widens the discussion into population increase and its consequences, not as a separate issue but as one so closely related as to be an integral part of land resource development. The final chapter summarizes the present and future problems of land resources, including the dangers if action is not taken to improve knowledge, planning, and management. Finally, it asks what needs to be done to bring about such action, both internationally and in the developing countries themselves.