SUSTAINABLE DEVELOPMENT

An Imperative for Environmental Protection

Report by a Commonwealth Group of Experts

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Report by a Group of Experts on Environmental Concerns and the Commonwealth

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Foreword by the Commonwealth Secretary-General

Interest in environmental issues and concerns over the sustainability of development are intensifying in many governmental and other circles in the run up to the 1992 UN Conference on Environment and Development (UNCED). The Commonwealth is no exception to this trend and when its leaders meet this October in Harare for their biennial summit, environmental issues are likely to be a major topic in their deliberations. Commonwealth concerns over the environment are not, of course, new and at their last summit they adopted the Langkawi Declaration on Environment, a joint commitment to tackle environmental problems and a mandate for Commonwealth action. That action included requesting me to identify a group of experts to deal with environmental issues.

The Report which follows is the work of that Group. It identifies several issues on UNCED's agenda which are of special interest to the Commonwealth. The Report also attempts to answer the question of what, in practice, is meant by the widely accepted principle that development should be sustainable. It does so by elucidating the concept of sustainable development, concentrating on critical areas such as energy, land, forests, biodiversity, water and the oceans. It also highlights the need to build effective institutional arrangements, especially at the national level. In addition, the Report stresses the importance of additional financial resources and transfers of environmentally sound technology to strengthen the efforts of developing countries to put their development onto a sustainable path. Many of these countries are faced with difficult choices and have limited options because of financial, technical and human resource constraints. They should be enabled to meet not only their pressing short-term needs but their long-term requirements.

The increasing concentration of greenhouse gases in the atmosphere—the cause of global warming—is a grim indication of the unsustainability of many current economic activities. The 1989 Commonwealth Expert Group report on Climate Change did much to clarify the nature of the threats posed

by global warming and sea-level rise, and the rationale for national and international responses to address them. The new Report points to the areas where the international community must act soon to bring this problem under control.

I believe the Report makes a distinctive contribution to our understanding of the complexity of environmental issues. It does so not least through the light it sheds on two subjects which hitherto have too often been ignored: the environmental concerns of small states, and the gender aspects of environmental and development problems.

Small states, which constitute more than half the Commonwealth's membership, fear that their concerns are being pushed to the sidelines. Their environmental problems are admittedly not unique. But most small states are more vulnerable than larger countries to the chaos which environmental phenomena can cause. Smallness and vulnerability are directly related. Entire nations can become disaster 'zones' when tropical storms or tidal waves strike. The protection and proper management of coastal zones is important in all countries bordering the sea. But it is vital in island small states where coastal zones are of strategic importance to the entire economy. In 1985 a Commonwealth Expert Group's report had alerted the world to the special economic and security problems of small states. The present Report underscores the necessity of paying heed to these states' environmental concerns.

The Report also reminds us that, as with poverty, the related problems of environmental degradation have important gender dimensions. But women are not merely passive victims of environmental stress. In most countries they are playing vital roles—largely unrecognised—in fostering sustainable development. The Report shows how the constraints which in many countries prevent women from playing more effective roles in environmental management can be removed; and why there is an urgent need to ensure a greater role for women in decision-making on environmental and developmental issues at local, national and international levels.

An important message which the Report conveys is that it is in the common interest of all humanity to ensure that developmental and environmental goals are achieved in a harmonious way, and particularly that the solution of global environmental problems demands global co-operation. International negotiations on environmental problems are not a zero-sum game, with winners and losers. All nations stand to gain from effective and equitable agreements to protect the world's climate, its forests, its rich biological diversity, its soils and its oceans. But there are conflicts of interest between developed and developing countries, especially over issues like burden-sharing. The great challenge is to find ways of reconciling them at the UNCED, in the interest of our common future. I hope that the Commonwealth, with its established capacity for facilitating North/South consensus, can help that process.

I was fortunate in being able to constitute a group of experts with a wealth of expertise and experience from around the Commonwealth to undertake this Report. Under the able guidance of their Chairman, Mrs Pauline Marstrand, the members have completed a challenging task in a remarkably short period of time. I am pleased to present their Report to Commonwealth Governments and to make it available to the wider international community.

Emeka Anyaoku

August 1991

Letter of Presentation

Marlborough House
London

2 August 1991

H.E. Chief Emeka Anyaoku,
Commonwealth Secretary-General,
Commonwealth Secretariat,
Marlborough House,
London SW1Y 5HX.

Dear Secretary-General,

In accordance with the wishes of Commonwealth Heads of Government when they met in Kuala Lumpur in October 1989, you appointed us as a group of independent experts to consider a range of environmental issues of concern to Commonwealth members.

Our Terms of Reference required us to identify issues of special concern to the Commonwealth under consideration in the preparations for the United Nations Conference on Environment and Development (UNCED) and in the course of current and future international negotiations on environmental problems. We were to identify ways of facilitating the participation of developing countries in global agreements and in action to protect the environment. We were to give particular attention to issues of concern to small states and to consider the nature and extent of women's management of the natural environment, advising on ways to increase women's participation in decision-making on environmental matters.

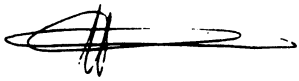
We now have the honour to present our Report, which we have signed in our personal capacities and not as representatives of governments, organisations

or nations. We hope it will be helpful to Commonwealth members and others in the course of the UNCED process, in discussion within the Commonwealth, and as a guide to national action.

We are grateful to you for the confidence you showed in appointing us to undertake this important task. We are also grateful to your staff for the way in which they have provided drafting, technical and administrative support to our work.

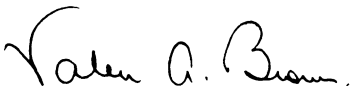
Yours sincerely,

Pauline K Marstrand



David J Attard

Rundheersing Bheenick



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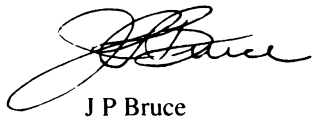

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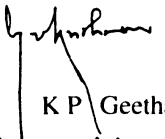

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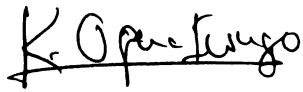

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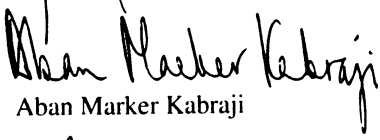

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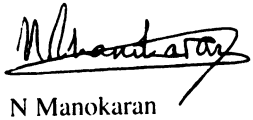

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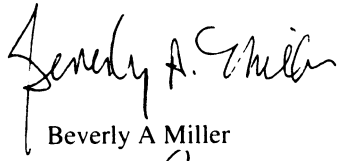

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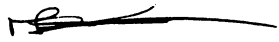

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Executive Summary and Major Recommendations

Abstract

The crux of our Report is a belief that in the long term, the future of life on Earth depends on caring for and conserving the environment—the natural resources of the planet, its land, air, water, biodiversity, forests and other life-support systems. This will only be possible if all countries, which means governments and their peoples, adopt and maintain policies and practices conducive to sustainable development.

2. Neither environmental conservation nor sustainable development practices will come free, or even in all cases cheaply. In aggregate, both will demand considerable additional resources which developing countries, whose full participation in the process is vital, do not possess. Our first major recommendation therefore has to be for additional financing, and on a net basis. This is needed to help developing countries in the many actions they will have to undertake to conserve the environment and follow sustainable development practices. Actions to adopt energy-efficient technologies, to practise sustainable forestry, to conserve biodiversity, to reduce and then reverse soil erosion on hillsides and desertification of drylands, are four examples of what we have in mind. Novel sources of funding, such as an international tax on the consumption of hydrocarbon fuels, adapted to take account of the developing countries' crucial need for economic growth, would buttress more conventional sources.

3. Another intrinsic part of the process concerns the transfer and development of environmentally benign technologies. This is especially important in such areas as renewable energy development. Our second recommendation is therefore directed to means to facilitate the acquisition, absorption, development and utilisation of technologies relevant to the adoption of sustainable development practices in developing countries.

4. The two recommendations above will both require a significant shift of

policy at the international level. Our third recommendation, therefore, is for a high-level deliberative process to be established, in the United Nations system, which will bring together, in an integrated way, concerns of both environment and development. Other changes in international institutions are required to facilitate operational effectiveness and integrated approaches. Institutions such as the World Bank, UNDP and UNEP, which are concerned with assisting developing countries to achieve sustainable development, should be strengthened and given more resources to carry out programmes on the environment and sustainable development.

5. There are many facets to environmental degradation but one of the most universal and fundamental is obviously climate change as a result of global warming. This could have results which would be cataclysmic for island small states and low lying coastal areas. It should be minimised at almost all costs. Our fourth recommendation therefore is the need for the international community to take all measures necessary to encourage all countries—especially in the developing world—to participate in the negotiations and reach early agreement on a framework convention on climate change; also to provide additional assistance to enable those countries particularly at risk to prepare for and be able to respond to the floods and other natural disasters which would result from climate change.

6. Small islands are particularly vulnerable to such hazards, and these and other small states are another of our special areas of focus. The coastal regions and offshore exclusive economic zones (EEZs) are especially important for these states. Our fifth recommendation concerns the need for greater technical assistance to enable them to develop, manage and, in the case of EEZs, police these areas; also to participate more effectively in international negotiations on issues affecting their interests.

7. We recognise that women are not merely victims of environmental degradation. As producers and managers of natural resources, they play a vital role in environmental conservation and sustainable development. But we are aware that their role is not always recognised in society, in the economy or in government. Our sixth recommendation concerns the need to take urgent action to enable women to play a greater role in decisions which affect sustainable development. Many facets are involved, and greater and more secure access to education and training and to productive resources (especially land) are two among many.

8. Finally, having already drawn attention to the changes in international institutional arrangements needed to effect the above actions, we recognise that parallel changes are required at a national level. Our last major recommendation is that all countries should establish a central ministry in government to coordinate the environmental aspects of all policy-related issues and to do so at such a level that effective action is assured. They should also

encourage and facilitate community-oriented approaches such as networking arrangements which bring together all the parties concerned—official and non-official—to address particular issues like the need for primary environmental care.

Introduction

9. In carrying out our remit we have come to recognise more than ever the crucial importance of certain elements in any consideration of sustainable development. Several themes therefore run through our Report. The first is that the awareness of the major environmental threats facing humanity is leading to an appreciation of the need to integrate environment and development, and of the growing interdependence between developed and developing countries and the imperative of international cooperation to ensure sustainable development, worldwide. Progress in taking effective action is still very slow however and the issue is becoming increasingly urgent. The Commonwealth, with its tradition of cooperation, should play a leading role to put world development on a sustainable basis. We hope that our Report and the concurrent one on "Change for the Better: Global Change and Economic Development" will provide a special opportunity for the Commonwealth to contribute in these vital areas.

10. The second theme is that the agenda of environmental concerns of vital interest to most Commonwealth members includes subjects which are usually not in the international spotlight. While problems such as ozone depletion, global warming, and loss of biodiversity tend to dominate international attention, the solution of everyday occurrences such as soil erosion, water sharing and pollution, shortages of fuelwood, and overfishing, among others, is perceived to be more urgent by many countries, especially in the developing world. We give them attention here.

11. A third theme is that action is required of both developed and developing countries, according to their respective resources and circumstances, in a strengthened system of global cooperation. But developed countries bear the primary responsibility for redressing the global environmental problems which they have largely created and are continuing to perpetuate. On the other hand, the solution of many environmental problems in developing countries lies primarily in local and national actions. However, the international community can assist them through sharing experiences and technology, and providing new and additional financial resources, complementing their actions with appropriate changes in trade and aid policies. Developing countries have an obligation to contribute to global solutions; but they need incentives and support to enhance their capability to pursue sustainable development and resist short-term pressures.

12. Our fourth theme is a belief that economic growth and development

(including human resource development) should be compatible with sustaining the environment. We reject the notion that, because present patterns may be unsustainable, growth and development should be slowed, arrested or even put into reverse. This would increase the vast international disparities in income and wealth, and would fail to provide the incomes and jobs needed by expanding populations. It would keep the poor and disadvantaged groups trapped in poverty. The challenge is to select patterns of growth and development which are sustainable—which respect and nurture the environment while delivering the economic benefits. Global capabilities in terms of capital and human resources and technological potential make this a possibility.

13. Fifthly, we indicate the important position of women in all countries in the achievement of sustainable development. Their crucial roles in households, in natural resource management, in other sectors of the economy and in human resource development, put them in a central position in helping to achieve sustainable development. Recognising this, we believe that all initiatives on sustainable development should include a gender perspective.

14. Sixthly, we find that small states are particularly exposed to some environmental problems, especially sea-level rise and degradation and pollution in coastal zones which inevitably form a substantial part of their habitat. But despite this exposure, these states are badly placed in getting their interests represented in international negotiations.

15. Finally we call for a transformation of economic perspectives in order to address sustainable development with the required urgency. This has major implications for policies on financing development, for fiscal and regulatory action to encourage sustainable practices, and for technology development and transfer to assist poorer communities. To take just one example, at present most industrial countries provide many price supports and grant many subsidies whose effects are to degrade the local and global environment. The excessive burning of fossil fuels is a case in point.

16. In the remainder of this chapter we summarise our conclusions and major recommendations on how we believe this challenge should be met. We start with the pursuit of sustainable development, dealing initially with some general principles and then concentrating on the vital areas. This is followed by chapters which focus on the possible effects of climate change, the special problems of small states,and the particular environmental concerns of women. We conclude with some comments and recommendations on the institutional changes needed nationally and internationally to ensure sustainable development.

Sustainable Development : Some General Considerations

17. There is broad agreement that the essence of sustainable development

is to keep choices open for future generations. Current economic growth and development must not be at the expense of future prospects. This requires marked changes in life-styles for some people and in ways of doing things for almost everyone. We set out six principles for sustainable development. First, that critical environmental assets be left intact and where there is doubt, the precautionary principle should apply. Secondly, that renewable resources be used in general only up to their sustainable yield levels. Thirdly, that national accounting systems be based on a full valuation of all activities and assets and reflect the depreciation of environmental assets, and that project assessments include environmental and social costs. Fourthly, that finite natural resources in plentiful supply be exploited subject to environmental appraisal and equity considerations, but that scarce ones be managed and substitutes sought assiduously. Fifthly, that the relationship between a community and its environment be considered an integral part of sustainable development. And sixthly, that considerations of equity (within and between countries) be taken into account in all decisions concerning environment and development.

18. The challenge is to translate these principles into policy and practice. This is not always straightforward. It will call on the judgement and resourcefulness of all those involved in managing development. *We recommend all governments to take early steps to translate these principles of sustainable development into practical policies appropriate to their particular environmental and developmental circumstances. This calls for a major change in economic perspectives. The Commonwealth should help its members in this transformation, which would require the evolution of a qualitative change in functional cooperation among its members.*

19. Industrialisation and the affluence which has accompanied it have been the cause of excessive rates of consumption of natural resources. They are also responsible for most of the world's environmental degradation, e.g. air and water pollution, ozone depletion, carbon emissions from fossil fuels, excessive logging of tropical timber, and the loss of rare animal and plant species. Since affluent societies have alternatives and resources available to make the necessary adjustments to their life-styles, most of these problems are more soluble than those stemming from poverty. Given political will it is possible for these societies to move to sustainable development. Getting the affluent to reduce their consumption and waste of many natural resources is vital.

20. At the other extreme, poverty is a major cause of environmental degradation in developing countries. Many poor people are compelled to take a short-term attitude towards the use of their resources, and lack access to the capital and credit necessary to conserve their assets. In some cases their consumption takes place at the expense of economic assets and therefore future living standards. High population density and growth against a back-

ground of an inequitable distribution of productive assets make sustainable development more difficult to achieve. Poor communities also tend to rely disproportionately on common property resources such as forests and pasture, which tend to become degraded. For such reasons, poverty worsens pressures on the environment. Its rapid alleviation is essential to reduce environmental stresses. We recognise that some communities have lived in harmony with their habitats for centuries and have evolved sustainable practices. But we are also aware that this harmony can be upset by natural and human events, such as droughts, wars, refugee movements, unsupportable population growth or a pace of change which is difficult to manage.

Sustainable Development: Some Critical Areas

21. Of the many areas relevant to devising sustainable development strategies, we have chosen half a dozen for closer attention. They are energy, land and agriculture, biodiversity, water, oceans, and forests. We appreciate there are many others, but consider these to be of fundamental importance to both the environment and development.

Energy resources and use

22. The achievement of sustainable development faces its sternest task in meeting the world's energy needs in ways which do not destroy local and global environments. Given the tremendous disparities existing in energy consumption and the pressing needs to relieve poverty through more rapid economic growth, developing countries will obviously have a growing demand for energy. But the present pattern and growth of world demand for commercial energy cannot continue without causing unacceptable pressures on the environment. Industrial countries, which consume a disproportionate share of the world's fossil fuels, account for around three-quarters of the carbon dioxide (CO_2) emissions which are the largest single contributor to global warming. Atmospheric concentrations of CO_2 could be stabilised at about 50 per cent above pre-industrial concentrations by the middle of the next century if continuous reductions of global net emissions of CO_2 at a rate of 1-2 per cent a year were initiated now. This will require swift and comprehensive action by industrial countries to reduce energy consumption, conserve energy and develop more energy-efficient technologies. Developing countries, too, for both financial and environmental reasons, will need to increase the efficiency with which they use fuel and power. They will require more capital and greater access to the relevant technologies to bring this about. The development of renewable energy resources needs to be accelerated world-wide. Subsidies for fossil fuels should be reduced. The market share of technologies to produce energy based on solar, wind, ocean, biomass and mini-hydro sources should be increased by changes in pricing policies and intensified research and development. Many of these sources would

bring particular benefits to women and some are especially suitable for small states.

23. *We therefore recommend a four-pronged attack on the global energy problem:*

- *industrial countries should use fiscal and other means to restrain their own use of energy, encourage its conservation, develop energy-efficient technologies and facilitate their transfer to developing countries. This last item should be an important priority in Commonwealth functional cooperation;*

- *developing countries should also improve their energy-efficiency through appropriate changes in policy, institutional structures and pricing. Their capacity to absorb, adapt and develop energy-efficient technologies should be strengthened;*

- *the development and use of renewable sources of energy should be encouraged by all countries through pricing policies (influenced by fiscal means), pilot projects, information exchanges, 'twinning' arrangements (with energy utilities in other countries), and aid policies; and*

- *an international tax on carbon emissions should be considered as one way not only of curbing the use of fossil fuels but also of providing resources to facilitate the achievement of sustainable development in developing countries.*

Land use and degradation

24. A high proportion of the world's productive land is subject to various degrees of degradation. In addition to their more general environmental costs, soil erosion and reduced fertility pose a clear threat to future food supplies. Even the maintenance of present levels of food production will be difficult in some regions. Modern systems of agricultural production, which were major contributors in solving the food problem for the present generation, are demanding in environmental management. Chemicals used in modern agriculture are a major source of environmental damage.

25. The causes of land degradation, as well as its solutions, vary according to circumstances, but there are three typical situations. The degradation of watersheds, which potentially affects half the world's population, can be traced most directly to unsuitable cultivation practices or deforestation; but its fundamental causes may be population growth, inequitable distribution of productive resources, especially land, economic decline and greater poverty, and farm policies that encourage soil-eroding crops. Some of these factors

are easier to change than others, but in general, governments have a wider range of powers at their disposal than is commonly realised.

26. The loss of fertility of many irrigated areas, because of salination and waterlogging, is especially serious in view of the fact that they account for one-third of the world's food production. Major increases in irrigated areas may not be feasible in future. Hence increasing existing yields through sustainable practices is vital. Current problems are caused by a mixture of factors, including the design and operational practices of the schemes, neglect of drainage and maintenance, and excessive use of water due to a failure to charge enough for it. Solutions lie in the realms of rehabilitation, redesign, better maintenance, improved financial and fiscal arrangements, and more effective management in general. It is especially important that all future irrigation schemes include adequate measures to stop salination.

27. Drylands, where some of the world's poorest people live, are particularly fragile environments. They are especially at risk from global climate change. Localised degradation can be attributed to overgrazing, the collection of fuelwood and the inappropriate encouragement of commercial farming. The breakdown of traditional methods of conservation and adaptive husbandry is an aggravating factor. Government projects in drylands, with or without aid, have a chequered record and we urge caution. The choice and design of projects, the creation of off-farm jobs, and the encouragement of alternatives to fuelwood need careful attention.

28. *We recommend that governments, especially of developing countries, should:*

- *stem the degradation of watersheds and hillsides by undertaking land conservation schemes, encouraging off-farm employment, providing incentives and resources for land conservation, improving security of tenure, and modifying pricing and other policies (e.g. input subsidies and tax incentives) to minimise adverse effects on the environment;*

- *enable irrigation schemes to produce at nearer their full capacity and arrest the decline in soil fertility by improving these schemes' design, strengthening their financial arrangements, improving their maintenance, and promoting the use of natural methods of pest control; and*

- *improve the welfare of those living on drylands, by diversifying employment opportunities for marginal farmers, developing credit programmes bearing in mind the specific needs of women, and designing projects (including aid projects) which give more emphasis to community-initiated, controlled and managed schemes (e.g. for irrigation and social forestry).*

Biodiversity

29. Biodiversity is important for sustainable development for several reasons. We stress two of them—its resilience to environmental shocks and its value in food production. Genetic manipulation is replacing selective breeding, and the patenting of organisms produced by this method should be limited by international measures. Developing countries should be assisted in carrying out their own plant and animal breeding.

30. Tropical forests and other habitats in developing countries are a great store-house of biological resources. Since conservation has costs, international cooperation and assistance is very important for the preservation of species. Biotechnology, which is not always very costly, should be supported in developing countries in order that the comparative advantage many of them possess in terms of biological resources could be used to their advantage.

31. *We recommend that governments should participate in the negotiations on an international convention to conserve biodiversity; increase international funding for this purpose; and intensify research to clarify priorities and assess the costs of restraining particular uses of biological resources. Assistance to developing countries could be very helpful in their development of biotechnology.*

Water resources

32. The supply and use of water will be a dominant issue in development in the 1990s. The problem of misuse and pollution is universal, though it has different facets. Water is becoming increasingly scarce and conflicts are emerging between countries and different kinds of users. Growing cities are able to satisfy their water needs only at increasing cost, and with greater environmental damage. The pollution of water by industrial effluents, untreated sewage, and agricultural run-off etc., is both a health risk and reduces the scope for recycling. Global warming is likely to aggravate the problems of managing water resources.

33. The water problem has three layers. The first is that a sizeable part of the present global population has an unsatisfactory water supply and inadequate sanitation. Improving their lot was the task of the UN International Decade for Drinking Water Supply and Sanitation. Despite progress, the task is unfinished. The second layer of the problem is to reform water consumption habits in order to make them more sustainable, and avoid the environmental costs which are so evident. The third is to assure water supplies for the future, when populations will be larger and needs greater.

34. There is great scope for reducing the waste of water which now occurs

in all sectors, such as agriculture, households, industry and municipal supply systems. This could be realised by a combination of physical investment, improved management, education, and exhortation, regulation and the greater use of the price mechanism. Pollution can likewise be reduced by a mixture of regulation, investment in abatement and treatment facilities, and price incentives.

35. *We recommend that all governments should develop comprehensive long-term plans for the integrated management and conservation of water resources. High priority should be given to improving water supply and sanitation, especially in rural areas, and the development of appropriate technologies, particularly for waste management. Changes in the level and structure of water charges should be pursued to promote conservation and more efficient use, and appropriate sanctions should be levied to deter pollution. Water management should be viewed in a comprehensive and integrated way, and greater attention given to institutional development to resolve the urgent problems involved. Consideration should be given to the international institutional aspects, and one possibility might be to set up an International Water Council within the UN system, as a means for global coordination, assessment and action.*

Oceans and coastal areas

36. Oceans play a critical role in weather patterns and provide a livelihood as well as food for many coastal peoples. Their resources should not be destroyed by wasteful exploitation and over-utilisation when humanity has so much more to learn about them. They are especially important for small island states, under which heading we consider them in more detail.

37. Coastal zones are significant areas of economic activity in all countries bordering the sea but they are especially important to island small states and to those low-lying countries which would be susceptible to sea-level rise or storm surges as a result of climate change.

Forests

38. Forests benefit the environment in many ways. They help regulate the climate, protect watersheds, supply subsistence and commercial products, and maintain biodiversity, to name but some. Deforestation is having grave effects, both globally and locally. Forests are the home of millions of people, and satisfy many of their needs. We emphasise the importance of sustainable management of forests for the welfare of local people and the benefit of national governments and the world at large. The removal of trees to accommodate population pressures and the expansion of subsistence agriculture are deep-seated problems in many countries. In some areas, especially semi-arid zones, deforestation is aggravated by the use of fuelwood and an extension of cattle ranching. In other regions, commercial logging and expanding cultiva-

tion are the major causes. There is a need to reassess a complex of policies covering land tenure, pricing and credit, and international trade in timber products. Commonwealth and wider international cooperation and assistance are vital to facilitate conservation and sustainable use, especially since deforestation has global consequences in relation to protecting world climate and conserving its biological resources.

39. *We recommend that:*

- *governments should seek to maintain a regularly updated audit of their forest resources and attempt to estimate the minimum viable limit below which forest cover should not be allowed to fall; undertake reforestation and afforestation programmes where necessary; estimate the many values of forests and bring them into play in all decisions on converting forests for other uses; review the terms of logging concessions and ensure that they reflect fully all environmental costs;*

- *governments of developed countries should reduce the escalation of tariffs and other barriers on imports of timber products, in order that the countries of origin can exploit smaller areas of forest but obtain at least the same return. They should also make additional resources available to timber conservation projects which confer important international benefits to the environment, and recognise that this may require new and additional financial mechanisms; and*

- *Commonwealth governments should exchange information on experiences in sustainable management of forests, and mobilise adequate resources to support the implementation of the Commonwealth-Government of Guyana Programme for Sustainable Tropical Forestry.*

Climate Change

40. Climate change due to global warming has potentially far-reaching consequences for all countries. Some changes, like sea-level rise, pose particularly serious dangers to island small states and countries with low-lying areas, which constitute a majority of the Commonwealth's membership. Developments during the past two years have generally confirmed the validity and relevance of the conclusions and recommendations of the 1989 Commonwealth Expert Group Report, "Climate Change—Meeting the Challenge" and the Langkawi Declaration adopted by Commonwealth Heads of Government the same year. There is now a broader scientific consensus, reflected in the conclusions of the Intergovernmental Panel on Climate Change and the Second World Climate Conference, that the problem of global warming is real. Should global emissions of greenhouse gases continue to increase at existing rates, the world would probably be 2°C—5°C warmer, and sea-levels 30cm—100cm higher, by the end of the next century.

41. There are still doubts on the timing, magnitude and, especially, regional patterns of climate change. Expanded research and monitoring are needed to reduce these uncertainties. But the world cannot afford to wait until all of them are resolved. The precautionary principle justifies action now, both to reduce emissions and to adapt to possible changes in climate, as urged by the 1989 Commonwealth Action Plan. An acceleration of the time-schedule for phasing out ozone-depleting chlorofluorocarbons would also help to slow down global warming.

42. We are pleased to note that industrial countries in the Commonwealth and elsewhere have announced targets for stabilising, and in some cases reducing, emissions of the major greenhouse gas, carbon dioxide. This is an important step towards developing an international response to global warming. Coordinated action is however needed and is being achieved through the UN Intergovernmental Negotiating Committee for a Framework Convention on Climate Change. The burden of measures to reduce greenhouse gas emissions will fall overwhelmingly on the industrialised world, which is currently responsible for three-quarters of the total and an even larger proportion on a historically cumulative basis. But, over time, restraints on emissions by developing countries—especially by those whose emissions are increasing at fast rates—will be essential for an effective global response. Actions by developing countries should be facilitated by greater flows of capital, information and transfers of technology, to enable them to move to more efficient energy-use.

43. Climate forecasting is currently hampered by the lack of data in many regions of the world, especially in the southern hemisphere. Many Commonwealth and other developing countries currently lack the capacity to make proper assessments of their national net emissions of greenhouse gases. This constrains their capacity to plan response strategies and impedes the development of an internationally accepted data base on greenhouse gas sources and sinks. Improved mechanisms for co-operation in monitoring, research and evaluation of climate change and its possible impacts are needed to reduce uncertainties, particularly at regional and national levels.

44. Both the Commonwealth Report and the IPCC's First Assessment Report have provided insights into possible impacts of climate change, on agriculture and forestry, on natural terrestrial ecosystems, on water resources, on human settlements and infrastructure, and on oceans and coastal zones. Each underscores the need to begin planning adaptation strategies, some of which are in any case required for other reasons. The possible impacts of climate change on small island and low-lying states are of particular concern.

45. The threat of sea-level rise necessitates the development of comprehensive plans for managing coastal zones. The possible increased frequency of extreme events like tropical storms calls for the strengthening of disaster

preparedness and response mechanisms in many countries. Most Commonwealth economies depend heavily on the agricultural sector, which makes the potential impacts of climate change a matter of serious concern. Though there is at present insufficient knowledge about how the phenomenon will affect the frequency of extreme events, an increase in the risk of drought is potentially the most serious impact on agriculture at both global and regional levels. Potential impacts on human health are also a matter of concern. Global warming may result in a poleward spread of diseases currently confined to tropical zones.

46. *We believe the 1989 Commonwealth Action Plan should continue to guide the actions of Commonwealth governments. In particular, we recommend that:*

- *the Commonwealth should continue to emphasise its support for early agreement on a global convention that is both effective in reducing global warming and equitable in distributing the burden of international response. International taxes on carbon emissions should be considered as a means both of curbing emissions and of mobilising additional resources to provide financial assistance and facilitate technology transfers on affordable terms to help developing countries to take appropriate action in this regard;*

- *priority should be given to strengthening national capacities—especially in small island and other low-lying countries—to monitor climate change and sea-level rise. Industrial countries in the Commonwealth and elsewhere which have not already done so, should contribute to the Special Fund for Climate and Atmospheric Environmental Studies of the WMO. All Commonwealth countries should participate in the new Global Climate Observing System;*

- *Commonwealth countries which have expertise in monitoring climate change and sea-level rise, and in assessing their resultant impacts, should provide more assistance to those developing countries most at risk; and*

- *within the framework of the UN International Decade for Natural Disaster Reduction, all Commonwealth countries, by the year 2000, should have in place: national assessments of disaster risks; national/local plans for reducing vulnerability to, and mitigating the impact of, disasters; and access to early-warning systems.*

Small States: Environment and Development

47. The particular physical, geographical and economic circumstances of Commonwealth small states, most of which are islands, make them especially susceptible to certain environmental problems. In island small states,

the extensive interface between land and sea increases the fragility of coastal ecosystems and the demands of coastal management. Consideration of small states as a microcosm indicates unique opportunities for research in environmental protection and conservation. For instance, the geographical situation of many small island states makes them ideal locations for establishing stations to observe and monitor global warming and climate change. However, these countries do not have the technical capacity and financial resources to undertake these activities themselves. But since by doing so they would be serving the whole of humanity, financing should be recognised as a global responsibility.

48. Climate change poses potentially serious threats to small states. In addition to the greater incidence of flooding from sea-level rise and storm surges, the dangers they face range from loss of land area—already in short supply—to increased exposure of freshwater and agriculture to salination. Agriculture and tourism, two important activities in small states, are especially vulnerable. With international assistance, these states need to begin to plan suitable strategies to adapt to their changing situations. Such strategies include construction of low-cost sea defences; stabilisation of natural hurricane banks and conservation of natural defences like mangroves; diversification of agriculture; redesign and relocation of vulnerable infrastructure; and conservation of water resources.

49. Coastal zones are usually the most productive parts of small states bordering the sea. But they are also areas of high environmental degradation, arising from both land-based and offshore sources of pollution. Yet many of the states concerned do not have the technical capacity to deal with the complexities of coastal zone management, nor with the even more demanding task of managing and protecting their 200 mile Exclusive Economic Zones (EEZs). The UN Convention on the Law of the Sea provides for a comprehensive enforceable framework for these and other purposes, and its early entry into force is vital for these states. Greater regional cooperation could also help them in these areas. The development of a worldwide network of protected coastal and marine areas, similar to that for terrestrial areas, would serve to replenish marine resources and maintain genetic diversity of key species. In many islands, rare and fragile coastal ecosystems are subject to a variety of hazards, which they cannot overcome without international assistance.

50. Good management is crucial in preventing over-exploitation of fisheries—a large source of income and a vital source of food in many small states. It is clearly in the interest of local communities that inshore fisheries are managed sustainably. Vesting exclusive user rights with local fishing communities would provide them with an incentive to manage fisheries sustainably and police them against outside encroachment. In respect of fisheries within small islands' EEZs, arrangements to lease fishing rights to

foreign vessels need to be carefully policed. International assistance to set up satellite surveillance systems for monitoring would make this task easier. Harmful practices like drift-net fishing hurt small islands, and need to be controlled through international conventions.

51. Pollution of freshwater supplies is a major problem in most small islands, which have few or no permanent streams or lakes. Lenses of freshwater are often small and easily depleted and contaminated. Groundwater and streams are readily polluted by mining, agriculture and manufacturing activities. Because of porous soils, the leaching of wastes into the groundwater lens has occurred in some atolls. Improving waste management and conserving water resources are major priorities.

52. The international movement of hazardous wastes for disposal is of particular concern to small states, especially to islands whose ecosystems can be irreversibly damaged by careless dumping—including dumping in the high-seas beyond EEZs. These states need international assistance to protect themselves against illegal dumping of wastes, and to make informed and cautious choices about whether they should import such wastes.

53. To determine the potential effects of environmental degradation on their development, and to design and implement appropriate mitigation measures, small states need better access to the relevant scientific and other technical information. They could be assisted in this by the establishment of facilities for data storage, retrieval and dissemination through regional institutions.

54. Above all, small states need help in improving the articulation and representation of their interests in international forums, and more opportunities to share experiences in evolving their environmental policies.

55. *We recommend that:*

- *natural hazard management in small states be made an integral part of planning in all sectors of government, and that mechanisms for early warning and disaster response be strengthened, through regional cooperation where appropriate;*

- *regional cooperation among island small states should be strengthened, with Commonwealth and other international support in coastal zone management and protection of EEZs (through joint surveillance mechanisms, for instance);*

- *the Commonwealth Secretariat organise meetings and provide technical and financial support to assist small states in their preparations for both the UNCED and the negotiating sessions of the UN Intergovernmental*

Negotiating Committee (for a climate change convention); and

- *small states increasingly avail themselves of the technical assistance on environmental issues which can be provided by the Commonwealth Fund for Technical Cooperation; these and other technical assistance services for small states in the environmental field should be expanded.*

Women, Environment and Development

56. What women do in their roles of producers and resource managers is central to the sustainability of the resource base, and thus to development. They have been playing a major role in environmental management, but this has often not been recognised or included in policy development and decision-making. Much of our analysis underscores the fundamental need to increase and support women's involvement at all levels of decision-making on environment and development issues.

57. Women's daily work and activities in the rural areas of many developing countries brings them into direct contact with natural resources, in their roles as food producers, water collectors, and fuel gatherers. As a result women have indigenous knowledge and this must be utilised if methods of sustainable natural resource management are to be developed. In developing countries most food for subsistence is grown by women, as part of a customary division of labour, and their ability to invest in conservation activities should be supported by secure land tenure or title or access to land.

58. In the case of forests, as with many other resources, women are the carers and guardians of the environment. Rural women rely heavily on trees for fuelwood, fodder, fruit etc., and as a result they also understand and appreciate the value of the many products and services the forest can provide for themselves and their families. Likewise, women typically spend much of their time fetching water or using it for washing and cooking. They are the first to experience difficulties with its supply and they understand how to maintain its quality if circumstances allow them to do so.

59. Womens' role as managers of household and natural resources needs to be supported for sustainable development. Greater access to education and training, the facilitation of exchanges between women, the availability of more information, and enhanced access to the decision-making processes will all help to empower women in managing natural resources. Women have a special interest in conserving the environment and there are many instances where their campaigns have led the way.

60. Local communities—and especially the women among them—are already doing much to foster sustainable development. Many have indepen-

dently developed working models of primary environmental care from which others could gain.

61. *We recommend that governments and relevant agencies should:*

- *recognise and build on the achievements of women and women's organisations in conserving the environment and the planet's natural resources, and thus in promoting sustainable development;*

- *facilitate and encourage the involvement of women and communities in all aspects of project design, planning and policy making on environmental matters, especially where this is externally initiated. This will involve conducting gender analyses at the early stages of project design and training staff in gender-awareness;*

- *take measures to secure women's (and men's) rights—traditional and other—to the use and ownership of resources, especially through security of land tenure or title;*

- *make good use of women's knowledge of local eco-systems and trees when planning or implementing reforestation or afforestation programmes;*

- *make a firm commitment to support women's efforts in resource management in developing countries, e.g. by allocating a proportion of their budgets to community initiatives for the rehabilitation and enhancement of the resource base;*

- *give special attention to providing women with education and training to support their roles in the community and in natural resources management —including the provision of exchange-based learning opportunities for women with other groups on a South-South, North-South and North-North basis; and*

- *disseminate more information on environmental pollutants, some of which are particularly injurious to women's health.*

Institutional Change for Sustainable Development

62. To implement the substantial proposals we have made in this Report, as well as the enhanced Programme of Action under Agenda 21 that UNCED is likely to adopt, will require institutional change at the national and international levels. Changes will also be needed to reflect the new salience of environmental matters and the integration required between them and development policies.

63. We are not able to generalise about the ideal institutional framework a country should adopt. Needs will vary, depending on countries' individual objectives and circumstances. Whatever institutional solutions governments do adopt, we suggest that they should be derived from addressing the objectives of long-term National Strategies for Sustainable Development (also known as National Conservation Strategies or Environmental Action Plans), which integrate environmental policies into all social, financial and development planning. Such strategies would help identify the most serious problems and make clear the interconnections between discrete problem areas.

64. To carry out and coordinate these strategies we believe that in most cases, a Ministry of the Environment should be established where one does not exist already. This should be headed by a Minister with cabinet status in order to give it sufficient authority to be effective in dealing with other ministries. The Ministry would participate in policy formulation, deal with standard-setting and monitoring, and maintain close collaboration with ministries and departments responsible for sectors such as forestry, mining, industry and water, as well as with those concerned with finance and economic planning.

65. We appreciate that many countries already have such a Ministry and that its work has meant some advance in the way environmental issues are dealt with. But these ministries are not contributing much to the new emphasis on sustainable development. Their work needs reorienting so that it follows a more holistic approach and integrates environment policy with development policy. This will be necessary if development is to become sustainable.

66. In most countries new mechanisms of coordination are needed in the environmental field. These would strengthen linkages between different levels of government and between the government, the private sector, NGOs and the general public. Access to relevant information, at the earliest stage of planning, is a prerequisite for effective participation by the public and by NGOs, in the development of environmental policy, and in the assessment of the environmental implications of policies and projects. Local community organisations (e.g. women's groups and farmers' co-operatives) need to be strengthened to give them a more persuasive voice in influencing environmental policies made at high levels.

67. Complementing the formal institutional structure represented by a Ministry or as an alternative at early stages of institutional development are networking systems. These work through multi-disciplinary groups by coordinating expertise and activities to address specific problems of environmental concern. We attach great importance to these systems. They are being used with success to get more attention for and action on sustainable development issues.

68. A number of other management components are needed to effect the strategies. We suggest they should include the development of:

- natural resource accounting. This would enable national accounting systems to reflect the depletion or degradation of national environmental capital (such as land, forests and water resources) and, where appropriate, social costs; and it would also enable comprehensive screening mechanisms to cover all development projects and programmes to establish whether they require an environmental impact assessment (EIA) and, if so, to ensure that the EIAs are implemented and followed up by regular monitoring;

- information brokerage. There is a considerable potential for making savings in resources among countries by exchanging information on the environment, particularly that which is in the public domain;

- education and training. This is a vital area for helping to overcome the environmental problems of developing countries, and greater international cooperation is required for this purpose; and

- technology transfer. The need here is to strengthen the indigenous capability of developing countries to make informed decisions when choosing environment-friendly technologies (especially foreign ones) and to absorb and apply them—in some cases after adaptation—effectively. There is also a need to facilitate the access of these countries to the more expensive technologies and related 'know-how' on terms which are affordable. Novel schemes, involving the provision of fiscal incentives to the private sector and the subsidisation of costs (with revenues raised through environment taxes), could be introduced to facilitate transfers to countries with the greatest needs. The technology dimension of sustainable development is important and requires improved assessment capabilities by government.

69. *At the international level, institutions should be strengthened, both technically and financially. But here, again, the shift of emphasis to sustainable development requires greater coordination of operations among all international institutions concerned with environmental action. This would include not only UN technical institutions such as UNEP but also the international financial institutions like the World Bank.*

70. *Integration between environment and development is also needed at the level of international deliberations. New institutional arrangements are required, to function at a high level in the United Nations.*

71. *The issues of institutional change and technology transfer are linked with the need for additional financial support to assist developing countries to move to sustainable development policies. Faster movement to the use of*

environmentally sound technologies is urgently required, and provides an important part of the rationale for increased assistance to developing countries. Additionality would guard against the resort to environmental conditionality.

72. *The establishment of new funding mechanisms to deal with specific problems has been one way of encouraging additionality. This should continue but with enhanced efforts to secure coordination of management.*

73. *Commonwealth functional co-operation needs to be strengthened to meet the critical requirements of many of its member developing countries for adequate professional, scientific, technological and institutional capabilities to tackle environmental problems.*

74. We hope Commonwealth governments will be able to facilitate global consensus on the issues of increased financing for environment and development, and favourable conditions for technology transfer, which are critical to UNCED's success. Though our Report is concerned largely with institutional development in a national context, we stress the importance of the Commonwealth's full involvement in shaping institutional changes required at the global level to facilitate effective and concerted action on environmental problems, in the context of development.

75. *We recommend that:*

- *all governments which have not yet done so, should seek to develop long-term National Strategies for Sustainable Development. These should integrate economic and environmental considerations and take account of inter-sectoral linkages, as well as recognise the varying nature of the institutional requirements concerned. In formulating such Strategies, governments should consult the private sector and relevant community organisations;*

- *Ministries of Environment should be established, where this has not already been done, and assured of a strong role in coordinating environmental concerns and, in close collaboration with Finance and Economic Planning Ministries, integrating these with development. They should also play a major role in standard-setting and monitoring;*

- *greater use should also be made of networking—bringing together multi-disciplinary groups to address specific problems, especially where a formal institutional structure is not yet in place;*

- *more support should be given to implementing the concept of Primary Environmental Care. This requires additional help for community-based*

projects with integrated approaches to environmentally-sound development;

- *special attention should be given to mobilising additional flows of official finance to developing countries so as to enable them to implement actions on environment and development agreed at the international level and to promote sustainable development domestically;*

- *incentives and regulatory policies should be put in place to foster a greater flow of private resources, especially to developing countries, in support of ventures which are environmentally sound;*

- *measures should be taken to promote the development and transfer to developing countries of environmentally-sound technologies. Apart from making available more information and modifying the treatment of intellectual property rights, this requires greater financial support;*

- *Commonwealth governments, and where appropriate the Commonwealth Secretariat, should take action to facilitate:*

  - *exchanges of information, especially on a South-South basis, in environmental management and planning, through workshops, seminars and study tours, and through environmental evaluation studies and reports;*

  - *the establishment of training courses in environment and development and the setting up of centres for R&D into related issues; and*

  - *the strengthening of existing, or the creation of new, networks among institutions in Commonwealth countries, for pooling and exchanging information in various other environmental fields, including evaluation and use of low-cost and low- or non-polluting technologies.*

  In all three areas, special attention should be given to the needs of small states and women; and

- *Commonwealth governments should extend their support to the establishment of effective global institutional arrangements for the implementation of decisions agreed at UNCED. They should support the establishment of a high-level, regular, deliberative process which integrates environmental and development issues; and the improved coordination of agencies including the international financial institutions, concerned with sustainable development programmes.*

Chapter 1

Introduction

The Background

1.1 Though not new to the Commonwealth's agenda, environmental issues commanded particular attention in the deliberations of Commonwealth Heads of Government when they met in Kuala Lumpur in 1989. This was hardly surprising at a time when environmental concerns were occupying the centre stage in international concerns—a situation which is likely to persist for some time to come. At that meeting, Commonwealth leaders unanimously adopted the Langkawi Declaration on the Environment, thereby expressing their collective resolve to support action on a broad agenda of critical environmental problems—ranging from ozone depletion to land degradation—through a programme of action at the national and international levels. One of those problems—climate change—was the subject of a report by a Commonwealth Group of Experts which Heads of Government discussed[1*]. They decided to ask the Commonwealth Secretary-General to identify a group of experts on the environment who could monitor and evaluate developments concerning climate change and deal with other environmental issues as needs arose.

1.2 Developments following the Malaysia meeting played an important part in progressively extending this mandate for the establishment of our Group. The preparatory process for the 1992 United Nations Conference on Environment and Development (UNCED) got underway, raising a number of other issues on which the Commonwealth has a strong interest. Indeed, virtually all the issues addressed in the Langkawi Declaration were on the agenda of the Preparatory Committee established for the UNCED. A particular factor which became clear early in the regional-level preparatory work for UNCED

[1*] All references in this Report are placed at the end of each Chapter.

was that it did not address the usual problems that small states face, that is, in getting the international system to pay attention to their special concerns. Since these states have large representation in the Commonwealth, pressure developed to assist them ensure that the UNCED process did pay some attention to their concerns.

1.3 Later, in Ottawa in October 1990, Commonwealth Ministers responsible for Women's Affairs considered, among other subjects, the gender dimensions of environmental problems and action. Considerable emphasis was given to the importance of recognising and strengthening women's roles in fostering sustainable development at all levels and of guarding against the propensity of some development activities to have disproportionately harmful implications for women. Ministers therefore asked the Secretary-General to convene a meeting of Commonwealth Experts on Women, the Environment and Development to discuss the issues and make appropriate recommendations to Commonwealth governments and the 1992 UNCED.

1.4 Paralleling these developments, the Managing Director of the Commonwealth Fund for Technical Cooperation (CFTC) was asked by the 1989 Heads of Government Meeting to report to the 1990 meeting of Commonwealth Senior Officials on the extent of support CFTC could offer to programmes addressing environmental concerns and how its capacity in this area might be strengthened. A study commissioned on this and used as an input in the Managing Director's report to Senior Officials was subsequently made available to us as well as to Commonwealth governments, for whom it should provide guidance in their requests for assistance on environmental issues.

The Group's Approach

1.5 In constituting our Group, the Secretary-General, therefore, assigned us terms of reference (set out in Annex 1 on page 150) which were broad and flexible enough to respond to all these needs and concerns expressed by Commonwealth governments. Broadly speaking, our mandate required us to examine issues on the UNCED agenda which are of special interest to the Commonwealth and which at the same time particularly address the problems of small states and the relationship between women-in-development and environmental concerns. The composition of our Group—in terms of both expertise and geographical representation—was determined bearing in mind the varied nature of our tasks.

1.6 At our first meeting in London in May 1991, in considering how we would approach those tasks, we were conscious of the urgency of completing

our Report in time for the Commonwealth Heads of Government meeting in Harare in October 1991 and of the quickening tempo of preparations for the UNCED. We agreed that, on balance, it was preferable to be selective in identifying issues of concern to the Commonwealth. We emphasise that in doing so, we did not intend in any way to diminish the importance of those environmental issues and problems which we decided not to cover. We have devised a set of principles which we believe are vital to the achievement of sustainable development (Chapter 2), and we have highlighted a number of areas critical to efforts in this regard (Chapter 3). Because climate change due to global warming will have far-reaching implications for many countries, cutting across virtually all economic and social sectors, we have in Chapter 4 addressed some of the key developments which have occurred since the publication of the Commonwealth Expert Group Report, "Climate Change: Meeting the Challenge". The special concerns of small states and the gender dimensions of environmental problems are discussed in Chapters 5 and 6 respectively. We hope that our analysis of the issues, and the recommendations we have made in both these areas, will contribute to their receiving greater attention both within the Commonwealth and globally, especially at the 1992 UNCED. Finally, in Chapter 7 we address issues which cut across all environmental and developmental problems. The development of effective institutional arrangements and policies, and the skilled human resources which lie behind them, are prerequisites for putting development on a sustainable path. This is especially so in developing countries. Financial and technological constraints must also be alleviated if these countries are to succeed in halting environmental degradation without jeopardising their economic growth and development.

1.7 We have proposed a number of measures which we hope will assist Commonwealth governments in developing effective responses—through both individual and joint action—to major environmental problems. Although our recommendations are in the main addressed to the Commonwealth, we believe they will also be of interest to the wider international community. We recognise that in certain areas the Commonwealth has resources, institutions and skills to assist its members to cope more effectively with the problems both of the environment and of development. But in others, the Commonwealth must act in concert with other nations, lending its collective support to international efforts, and relying on action by the wider international community to give greater resonance to its own actions.

1.8 We should mention that in the course of our work we received considerable help from our consultants, Mrs Suliana Siwatibau of UNDP (based in Vanuatu), Mr James Winpenny of the Overseas Development Institute (London), Ms Jennifer McCracken of the Institute for Environment and Development (London) and Ms Joan Davidson of Oxfam, UK. We are grateful to them all.

1.9 We hope that our Report will serve to clarify the basis for further action on the environment by Commonwealth governments, and also assist them in making an effective collective contribution to the 1992 UN Conference on Environment and Development.

Reference

1. *Climate Change: Meeting the Challenge*, Report by a Commonwealth Group of Experts, Commonwealth Secretariat, London, 1989.

Chapter 2

Sustainable Development: Some General Considerations

The Principles Involved

2.1 Conventional policies of development and methodologies of project appraisal have, in some instances, had the perverse effect of reducing the material wellbeing of the supposed recipients. Since the United Nations Conference on the Human Environment (Stockholm, 1972), there has been growing realisation that the introduction of some technologies and practices from developed countries does not always benefit developing countries, that actions impacting on the environment in one part of the world affect or have implications for all other parts, and that the knowledge of people at the grass roots merits respect and attention in the development process.

2.2 It was this background, and the growing awareness that environmental costs—especially as a result of the depletion or degradation of natural resources—were usually not taken into account in economic policies, that led to the concept of sustainable development as outlined in "Our Common Future", the Report of the World Commission on Environment and Development (the Brundtland Report) in 1987. This concept has required a re-examination of policies in several areas. For instance, traditional investment criteria favour projects which damage the environment while discouraging those with environmental benefits. In both cases this is because these costs and benefits do not feature in the appraisal. A factory might seem financially profitable and economically attractive, and be well maintained in engineering terms, yet it might be contaminating soil and poisoning rivers—costs which are felt by others, and which ultimately have to be redeemed.

2.3 Even worse, development might destroy some critical natural resource,

essential for life-support or the quality of life in the long term. The mine that destroys an original rainforest and the biodiversity it sustains, or which contaminates an aquifer with its chemical discharges, is in a sense using up natural capital, and depriving others of future benefits. None of this would normally appear in its balance sheet.

2.4 Sustainable development does not imply that a given process of economic growth, or a certain project, should be able to continue indefinitely. Technology, tastes and lifestyles change, especially in a period as long as a generation. Hence the appeal of the concept of sustainable development as formulated by the World Commission on Environment and Development, which stresses keeping options open for future generations. Among other things, this means caring for crucial parts of the natural environment, recognising that depletion of a particular resource may be justifiable in some cases, avoiding irreversible processes of natural degradation, and trying to match the exploitation of finite resources with the development of substitutes or replacement by alternative economic assets.

2.5 Most people accept the force of the principle of sustainable development. The challenge now is to put this principle into practice. We believe that it implies the following precepts:

i) *The 'precautionary principle': 'critical' environmental assets should be left intact. Where there is uncertainty about the effects of human actions on these assets, but grounds for thinking they could be substantial, the 'precautionary principle' should apply. Certain habitats, for instance, should be regarded as particularly vulnerable to development. Action must depend on the probability and extent of environmental damage and not only on its certainty.*

ii) *'Environmental accounting': for other, renewable, environmental assets (e.g. forests), the relevant principle is to use the resource at its sustainable yield level. For any use in excess of that level, the regeneration of the resource (including the human resource) or the maintenance of capital assets should be included as a cost to the project.*

iii) *'Full valuation': every effort should be made to*

(a) *devise and implement a national accounting system which includes a full valuation of all activities (especially the costs of environmental maintenance and repair and of resource depletion); and*

(b) *assign 'economic' values (i.e. values in addition to those of a purely financial nature) and take account of environmental and social costs and benefits when assessing projects or proposed changes of use of natural assets.*

The first is necessary to derive a more accurate assessment of a country's 'economic worth' and growth. The second is needed to produce a truer assessment of a project's net contribution to development. In both cases there is a need to take account, *inter alia*, of the fact that the economic performance of countries is misstated where their growth has been at the expense of depleting environmental assets, such as forests or soil fertility, or by polluting air and water in a way that stores up heavy future remedial costs, or by running down social assets such as support and educational systems, or by reducing the quality of life for some sections of society. It is important to bear in mind that the economic benefits accruing to some countries from particular actions create environmental costs for others.

iv) *'Relative scarcity': where finite natural resources are in plentiful supply, they can be exploited (subject to environmental appraisal and equity considerations) and their sales proceeds reinvested to ensure at least the maintenance of capital assets. However, scarce exhaustible resources require a different knowledge base and value system, involving managing the pace of extraction, encouraging research into substitutes, and creating alternative income sources for producers.*

v) *'The community': the relationship between a community and its environment, based on local knowledge and decision-making, is an integral part of sustainability and development. It has important implications for all environmental policies and strategies, as well as for future global security. Cultural diversity could be as important as the maintenance of biological resources.*

vi) *'Equity': sustainable development requires a greater degree of equity, both within countries or societies and between them. This is necessary because of the adverse effects on the environment which are caused both by marked affluence and by poverty. Greater gender equality is also necessary, as in many societies women are the prime users and carers of environmental assets (we refer to this in Chapter 6).*

Industrialisation, Affluence and the Environment

2.6 Conventional paths to industrialisation, and the affluence which in some countries has accompanied this process, have been responsible for most of the world's environmental degradation. Most emissions of greenhouse gases, responsible for the present trend of global warming, have been from countries that are now industrialised. These countries consume a disproportionate share of the world's resources, e.g. fossil fuels. They have also been the major polluters of other global commons like the oceans. Much of the urban air pollution in large conurbations is caused by emissions from private motor cars, and most of the rest is due to industrial production and the generation of electric power, which is disproportionately consumed by the more

affluent groups of the population. If the industrial sector is uncontrolled, it can crucially degrade the environment by the way it converts scarce environmental assets into goods and services. Although it can also help to clean up the environment, by developing the relevant technologies, processes and products, much more than this is required and entire industrial processes need to be reassessed if further degradation is not to occur.

2.7 The conversion of wetlands for commercial development and middle-income housing is an instance of encroachment on the environment caused by affluence. The same is broadly true of tropical hardwood timber, mining products and agricultural raw materials produced for export to developed country markets. In many cases these are produced in ways which impose serious costs to the local environment, which their affluent consumers escape. Much hazardous waste and water pollution is generated by industries producing goods for consumers in the higher income brackets.

2.8 *Governments should seek to ensure that industries generate as little toxic and other wastes as possible and make provision for treatment and/or storage facilities on site. They should minimise the transfer of hazardous waste from one country to another.* Small states are especially vulnerable to these hazards and we elaborate on these issues in Chapter 5.

2.9 Getting the affluent to reduce their consumption and waste of many resources is equally vital. There are many options for tackling the environmental problems resulting from affluence. They range from changes in lifestyles and community values, to regulation and administrative decrees, taxes, subsidies, deposit refund schemes, adjusting the prices of fuel, power and water, schemes for tradeable permits controlling air and water pollution, to more emphasis on developing less polluting products and processes. Applying these measures requires strong political will to overcome the powerful vested interests that are usually at stake. However, in facing their problems, wealthier societies usually have resources and choices lacking in their poorer counterparts.

Poverty and the Environment

2.10 The environmental problems faced by the poor are caused both by the affluence of others and by their own poverty. Examples of the first are the effect of chlorofluorocarbons (CFCs) on the ozone layer, the contribution of greenhouse gases to global warming, and the impact of large imports of tropical timber on deforestation and its adverse consequences. Wealthier countries can ease the environmental problems of poorer ones, as well as tackle their domestic problems, through their own actions. But in many cases, where the environmental problems are more localised (as in water pollution or soil erosion), the main burden of action will fall on poorer countries. The environmental problems associated with poverty are especially intractable.

2.11 Poor people have few savings, little access to capital and credit, and little if anything of a cushion between good times and bad. They are thus badly placed to invest in environmental conservation measures (such as preventing soil erosion of their fields) even if it is clearly in their long-term interest to do so. Such investments entail forgoing current income and taking a long view of future benefits. Many poor people, living from hand to mouth, are forced by external economic pressures, such as low international commodity prices and heavy debt servicing, into taking actions which place more weight on their short-term needs than on the long-term benefits which could be derived from different courses of action.

2.12 Lack of capital, high implicit discount rates and a foreshortened perspective on the future explain much of the environmental degradation caused by the poor. In particular situations, these factors may be reinforced by their lack of title to a resource such as land, or of tenure in its use, or the fact that it is a common property resource, such as grazing lands, open to all without sanctions on overuse.

2.13 We are aware that many poor communities have evolved models of sustainable behaviour over time. Poverty *per se* does not automatically imply degradation. However, where poor communities are hit by natural disasters, or are overstretched by population pressure, or where traditional systems of management and control are destroyed or overridden, the previous balance can break down. Some of the worst environmental degradation occurs in the vicinity of war, famine and refugee movements. It is exacerbated by the inequitable distribution of resources and access to resources and to the relevant decision-making processes, both nationally and internationally. Commonwealth countries could co-operate in resolving many of these problems through sharing their experiences.

2.14 The geographical concentration of the worst poverty causes serious localised degradation, whether in rural or peri-urban situations. This concentration has arguably increased over the last few decades. Of the 780 million who in 1987-88 were estimated to be the 'poorest of the poor', 370 million occupied areas judged to be of low agricultural potential, and 130 million lived in urban areas, the majority in urban slums. Around 470 million, 60 per cent of the poorest people in the developing world, lived in highly vulnerable ecological areas, susceptible to the effects of soil erosion, land degradation, floods and other ecological disasters[1].

2.15 Many forces, in particular national and international economic policies, propel the poor into environments that are inherently fragile. The net result of policies which entrench unequal land ownership, lack of tenure, low commodity prices, structural changes in agriculture, poverty and overpopulation is to drive the poor to the margins of cultivation, such as hill slopes or virgin forests, where they easily become the agents of soil erosion and defor-

estation. Alternatively, they may be impelled by similar forces to seek a living in cities, where they add to congestion and pollution in areas where public services are least able to cope. Overfishing and poaching are often caused by people deprived of secure livelihoods seeking supplements to their inadequate incomes.

2.16 The poor, especially in rural areas, also tend to be more reliant on 'common property' resources to which everyone has access, e.g. forests, rangelands, water points, and inshore fishing grounds. These resources are more prone to becoming degraded than those in private hands, or where there are effective communal controls. In South Asia and sub-Saharan Africa, where the worst poverty is concentrated, families draw heavily from the commons for their fuel, fodder and water. In dryland areas of India landless people derive a fifth of their annual income, together with a range of non-marketed goods, from the natural products of common areas[2]. Lacking other assets, such as property, buildings or equipment, the poor rely on their labour power, which itself is devalued by inadequate nutrition.

2.17 The availability of non-farm employment, either in rural areas or in the informal sector of cities, is a vital safety-valve—without it, rural poverty can cause serious environmental pressure. For all these reasons, the alleviation of poverty is essential in order to reduce environmental damage in developing countries.

Population and the Environment

2.18 At a local level, if household numbers increase without access to commensurate additional resources, then environmental damage is often caused. But nationally and internationally the damage is caused mainly by the excessive consumption of resources and generation of waste among the wealthy, sometimes exacerbated by high rates of population growth.

2.19 In almost all countries a large part of the increase in population will be urbanised, adding to existing urban problems and encroaching on adjacent land and natural resources—in many cases reducing the capacity to produce food when the very opposite is needed. This is particularly serious in small islands where fertile land is very scarce, and competes with building plans. The strongest single correlant to stabilising the growth of population is the educational level and economic status of women. We touch upon these matters in Chapter 6.

Economic Growth and Environmental Pressures

2.20 The consumption of natural resources as raw materials and the disposal of waste usually have a strong correlation with an economy's rate of growth. Both these processes can be carried out in a sustainable manner.

However, some of the countries whose economies have grown most rapidly have done so by exploiting certain resources in an unsustainable manner or at the cost of pollution levels that are becoming unbearable.

2.21 Most global environmental damage has been caused by the processes of economic growth and the patterns of consumption chosen by countries whose economies are now developed. To attempt to 'freeze' development, even if it were feasible, would deny most of the world's people any chance to attain life-styles and access to goods which most in the developed countries take for granted. Developing countries naturally wish to close the gap in living standards between themselves and the more developed countries. The huge gap between developed and developing countries in the per capita consumption of commercial energy (Table 3.1 on p.35) is a vivid example, although we recognise that existing disparities in the quality of life can be redressed without a concomitant increase in energy consumption. The difference in energy consumption between Sweden and the United States, two countries with comparable standards of living, shows what can be achieved.

2.22 On the specific issue of greenhouse gas emissions, it is clearly unfair to ask developing countries to shoulder the costs entailed in curbing future emissions in order to meet international ceilings, when the need for those ceilings has arisen largely because of emissions from the developed world. To the extent that industrial growth requires more energy—and we have already recognised that there is no necessary proportional correlation between the two—countries with large-scale industrial aspirations, such as India and China, would find restrictions on their growth particularly onerous. We take up this argument in Chapter 4.

2.23 It is, moreover, particularly difficult to reconcile lower economic growth with rapidly expanding populations, and with the need to raise the living standards of large and growing numbers of poor people in developing countries. Raising consumption levels of both public and private goods entails investment and the growth of productivity. Creating jobs for an expanding labour force cannot be best achieved in a stagnant economy. The resources needed by governments for public investment and the regular provision of services such as education and health will not be available except through expanding national income. Measures to increase the flow of finance and other resources to developing countries and to attenuate their external debt problems are an essential component not only of their economic recovery but of the investment needed to ensure that their future economic growth and economic and social development are sustainable.

2.24 Appropriate social and economic policies for growth and development to meet burgeoning needs, especially of the poor, in developing countries are vital. But we believe it is erroneous to think that environmental protection is a 'luxury'. The reason is that much of the economic 'growth' measured in a

conventional way looks much less impressive when its environmental costs are netted out. Indonesia's trend rate of growth, for instance, was marked down from 7 per cent to 4 per cent when account was taken of 'depreciation' due to the depletion of its soils, petroleum reserves and forests[3]. It would not be in the interests of those developing countries dependent on natural resources to degrade these assets to the detriment of long-term prosperity. On the other hand, alternative strategies based on the principles of sustainable development would deliver real income benefits. If valued correctly (a point we return to in Chapter 7), they would compare favourably with the measured achievements of conventional policies. For most developing countries high rates of economic growth are needed, but on a sustainable basis. Sustainable development must not be allowed to imply low rates of growth.

2.25 The global economy will have to expand rapidly to meet the needs and aspirations of a population which seems unlikely to stabilise below two to three times its current level. In this process, severe strains will be placed on its ability to deliver energy, food, and water, to absorb wastes without unacceptable pollution, and to continue providing life support. These strains will be all the more marked if the affluent do not reduce their consumption of natural resources.

References

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Chapter 3

Sustainable Development: Some Critical Areas

3.1 In this chapter we take up the challenge of devising sustainable development strategies in a number of vital areas: energy, land and agriculture, biodiversity, water, oceans and forests. We realise, of course, that these areas are not exclusive and that many others are important. But in a Report which cannot cover everything, we have chosen to focus on those areas which we believe are of fundamental importance to the environment and to development.

Energy Resources and Use

3.2 The energy sector is crucial to both. It is not only responsible for about half the greenhouse gas emissions causing global warming but is the major source of sulphur dioxide emissions which return to the earth as acid rain. It also contaminates the atmosphere with toxic metals such as lead and mercury. The achievement of sustainable development faces its sternest task in meeting the energy needs of the world in a manner which does not destroy local and global environments.

Global energy use

3.3 The present pattern of world demand for commercial energy (petroleum, gas, coal, nuclear and hydro) is depicted in Table 3.1 (page 35). This shows that developing countries accounted for 26 per cent of the total demand in 1990, when their per capita use was only 7 per cent of that of the USA and 15 per cent of that of Western Europe. Energy development and use in the industrial countries have accounted for most of the greenhouse gases which have accumulated in the atmosphere over several decades. The

Table 3.1
Consumption of Commercial Energy

By economic grouping (million barrels of oil equivalent energy per day)			Per capita (barrels of oil equivalent energy per year)	Ratio relative to US (per cent)
	1990*		1990*	
OECD	85	USA	58	100
Developing Countries	45	Western Europe	26	45
Eastern Europe & USSR	40	Developing countries	4	7
		Eastern Europe & USSR	36	62
	170			

* Estimates

Source: Dennis Anderson[1]

Intergovernmental Panel on Climate Change developed several scenarios of future carbon dioxide (CO_2) emissions from the energy sector. The scenario projecting the largest increases in energy consumption and emissions in the future was called the 'reference scenario'. The gross CO_2 emissions in various regions from the energy sector alone—projected to the year 2025—are given in Table 3.2 (page 36). In this projection, 44 per cent of total CO_2 emissions from the energy sector would be in developing countries by 2025, in contrast to 26 per cent in 1985. Per capita CO_2 emissions from the energy sector would rise from 3.12 to 4.65 (tonnes, carbon) in developed countries, and from 0.36 to 0.84 in developing countries.

3.4 The more than doubling of energy consumption by 2025 implied in Table 3.2 could be considered unsustainable both economically and environmentally. The IPCC thus developed several other possible scenarios of future CO_2 emissions from the energy sector, on the basis of various assumptions about the degrees of reduction in emissions as a result of government and private sector actions to improve energy-efficiency and switch to fuels which emit less CO_2.

3.5 Given the great existing disparities in energy consumption and the pressing need to relieve poverty and bring about the structural changes necessary to raise incomes and create jobs, developing countries obviously have a rapidly growing demand for energy services. But a rise of the magnitude implied in Table 3.2 would pose difficulties, for developing countries and for the world as a whole. It would be difficult to finance, it would lead to unacceptable local environmental pressures, it would possibly increase the risk of

Table 3.2
Gross Emissions of Carbon Dioxide from the Energy Sector*
(From the Reference Scenario)

	(billion tonnes carbon/year)					
	1985	*%*	*2000*	*%*	*2025*	*%*
Global total	5.15	(100)	7.30	(100)	12.43	(100)
Industrialised countries	3.83	(74)	4.95	(68)	6.95	(56)
North America	1.34	(26)	1.71	(23)	2.37	(19)
Western Europe	0.85	(16)	0.98	(13)	1.19	(10)
OEDC Pacific	0.31	(6)	0.48	(7)	0.62	(5)
Centrally Planned Europe	1.33	(26)	1.78	(24)	2.77	(22)
Developing countries	1.33	(26)	2.35	(32)	5.48	(44)
Africa	0.17	(3)	0.28	(4)	0.80	(6)
Centrally Planned Asia	0.54	(10)	0.88	(12)	1.80	(14)
Latin America	0.22	(4)	0.31	(4)	0.65	(5)
Middle East	0.13	(3)	0.31	(4)	0.67	(5)
South and East Asia	0.27	(5)	0.56	(8)	1.55	(12)

	1985		*2000*		*2025*	
	PC **	*CI* ***	*PC*	*CI*	*PC*	*CI*
Global total	1.06	15.7	1.22	15.8	1.56	16.0
Industrialised countries	3.12	16.3	3.65	16.1	4.65	16.0
North America	5.08	15.7	5.75	15.8	7.12	16.6
Western Europe	2.14	15.6	2.29	15.1	2.69	14.6
OECD Pacific	2.14	16.1	3.01	16.1	3.68	14.8
Non OECD Europe	3.19	17.5	3.78	16.9	5.02	16.4
Developing countries	0.36	14.2	0.51	15.2	0.84	16.0
Africa	0.29	12.3	0.32	13.2	0.54	15.2
Centrally Planned Asia	0.47	17.3	0.68	18.8	1.15	19.6
Latin America	0.55	11.5	0.61	11.4	0.91	11.8
Middle East	1.20	16.7	1.79	16.1	2.41	15.5
South and East Asia	0.19	12.3	0.32	14.3	0.64	15.6

* This table presents regional gross CO_2 emissions and does not include CFCs, methane, ozone, nitrous oxide and the effects of carbon sinks. Climate change critically depends on all greenhouse gas emissions from all economic sectors. *The table should therefore be interpreted with care.*

** PC – Per capita carbon emissions in tonnes carbon per person.

***CI – Carbon Intensity in kilograms carbon per gigajoule.

Source: IPCC[2]

environmental hazards, and it would aggravate the problem of global warming.

Funding constraints

3.6 Developing countries would find it difficult to obtain the economic and financial resources necessary to increase the output of energy from conventional sources at projected rates. At the World Energy Conference in Montreal in 1989 the capital resources projected to be demanded by the energy sector of developing countries were estimated to be four to five times greater than those likely to be available.

3.7 This is particularly true of electric power. Power projects have recently accounted for a quarter of public capital investments in developing countries, 2 per cent of their annual GNP. In 1986 the debt of developing country power utilities was $180 billion, one-fifth of developing countries' total debt. Servicing even that amount of borrowing is proving difficult.

3.8 Added to the high capital requirements of power systems are their heavy financial demands on the current account of the balance of payments where capital equipment and fossil fuel are purchased abroad. Many power utilities are in financial difficulties, and a burden on government budgets. In recent years the cost of servicing their growing debts has been aggravated by high interest rates and high fuel costs. Power tariffs are rarely increased to cover full costs, often as deliberate government policy to provide cheap energy for industry and agriculture. Moreover, some potential revenue is forfeited through failures in collection. In short, as the World Bank has pointed out, "The power sector is a voracious consumer of investment capital and it is expensive to operate"[3].

3.9 The problems of trying to continue to expand the power system at past rates are confronting many countries. In Pakistan, for example, the consumption of electricity has recently been growing at a rate whose continuation would imply increasing capacity from 7,000 MW at present to 35,000 MW in 2010, and require investment of $20 billion in hydro resources alone. This would absorb a large amount of investment capital which would be difficult to raise in view of Pakistan's present foreign exchange position and limitations on its foreign borrowing and access to aid. Hence Pakistan's interest in energy efficiency measures (see Box 3.1 overleaf).

Local environmental pressures

3.10 The supply and use of energy cause serious local environmental problems. The exploration, extraction, transport and refining of petroleum and coal have drastic environmental consequences. The burning of petrol in auto-

Box 3.1

Improving Energy Efficiency in Pakistan

Pakistan's power is supplied by two integrated utilities, the Karachi Electric Supply Company—which is based entirely on oil and gas—and the Water and Power Development Authority—which has 45 per cent of its capacity as hydro. The current trend growth of demand is 9 per cent per year. At this rate, demand would rise from 7000 MW to 35000 MW by 2010. Expanding supply to meet this projected level of demand would require unrealistically large foreign aid and borrowing. Increasing hydro capacity would also run into environmental objections and would require careful balancing of water use between the power and irrigation sectors.

A study by consultants has identified a number of areas where the supply of and demand for power could be better managed, providing substantial savings compared with the options of investing in new thermal or hydro capacity. The average capital cost of power from seven major new hydro schemes would be $1,400/kW, from new thermal generation units $850-1,000/kW, and from combined cycle plant $750/kW. In comparison, the rehabilitation of older thermal plant could recover 275 MW of capacity at a cost of $233/kW. Converting existing gas turbine plants to combined cycle operations through retrofitting steam cycle equipment could gain 163 MW at a cost of $515/kW. Improving the coordination of thermal and hydro systems, and integrating the operations of the two national systems could produce savings in the range of $50-100 million.

Losses in transmission and distribution waste 21 per cent of generated energy. Although this is lower than in many countries, it could be reduced to 10-15 per cent through such measures as improved reactive power compensation, uprating distribution transformers, improving customers' load factors, etc—all of which would effectively increase present capacity at less than the investment cost for new plant. There is also scope for adjusting tariffs to encourage energy conservation and shift peak load to off-peak times. Finally, the owners of private generators (including many industrial companies) could be encouraged to sell surplus power back to the grid by formulating suitable buy-back tariffs.

Source: Tony Wheeler[4]

mobiles causes local air pollution, including photochemical smog, in many cities, as well as contributing to global warming.

3.11 The generation of power by thermal, hydro or nuclear processes can have equally serious effects. Major hydroelectric schemes preempt large areas of land, cause resettlement and displacement of people and wildlife, irrevocably alter landscapes, change water regimes, etc. Thermal power stations cause local air and water pollution and acid rain. The various kinds of air pollution have been implicated in damage to health, the corrosion of materials and declining yields from agriculture, forestry and fisheries. Thermal power plants are major sources of sulphur dioxide and nitrogen oxide, and of toxic substances as well as particulates.

3.12 Apart from energy used in generating power, industry and motor transport, the use of wood is widespread, and causes its own set of environmental problems. In Africa woodfuel supplies much more than half of household energy needs. Cutting wood for rural use or for sale in cities is a major source of deforestation in arid and semi-arid areas of Africa and South Asia.

Regional environmental emergencies

3.13 The energy sector is a major cause of environmental hazards. Of particular concern at present are the oil well fires in Kuwait where about 5 million barrels of crude petroleum are burning each day. This is resulting in serious disruption of the regional climate due to huge clouds of smoke, as well as major emissions of CO_2, thereby contributing to the global atmospheric burden of greenhouse gases. It is also having serious effects on health and will impose economic and social costs for a long time to come.

3.14 The exploitation and transport of energy resources can cause serious environmental problems and emergencies. Oil spills from tankers and discharges of other contaminants are particularly damaging to island countries, many of which are in the Commonwealth. Contamination of beaches which sustain tourism and the destruction of aquatic ecosystems are some of the more serious effects. Many small states do not have the resources or the capability for pollution prevention and clean-up measures to cope with these hazards when they occur. *We therefore recommend that Commonwealth countries should examine ways of co-operating, on a regional basis, to prevent oil and toxic chemical spills, and to minimise the damage done when these emergencies occur. They should also support the relevant efforts of UN and other international agencies in this field.*

Global warming

3.15 Present trends in energy use are unsustainable because they imply

unacceptable risks to the global climate. Energy use is currently responsible for about half of global warming.

3.16 The contribution of different greenhouse gases to global warming depends on the rate at which they are emitted, and the lifetime of each gas, among other factors. It has been estimated that the relative cumulative effects of 1990 emissions on 'global warming potential' over 100 years for the different gases is: carbon dioxide 61 per cent; methane 15 per cent; nitrous oxide 4 per cent, CFCs and hydrochlorofluorocarbons (HCFCs) 11.5 per cent in total, and others 8.5 per cent.

3.17 The current contribution to global warming can be summed up as follows: energy use (direct and indirect) 46 per cent, deforestation 18 per cent, agriculture 9 per cent, and industry (mainly CFCs) 24 per cent[5]. Gross emissions of carbon dioxide from the energy sector are heavily concentrated in developed and industrialising countries: North America (26 per cent), the USSR and Eastern Europe (26 per cent), Western Europe (16 per cent), China (10 per cent) and Japan (6 per cent).

3.18 Developing countries, apart from China, contributed only 16 per cent in 1985. However, this is changing as these countries industrialise and increase their per capita energy use.

3.19 The Second World Climate Conference, taking into account the work of the IPCC, estimated that stabilising the atmospheric concentrations of CO_2 at about 50 per cent above pre-industrial concentrations by the middle of the next century would require continuous reductions of net global emissions by 1-2 per cent per year starting now. Since developing countries still account for a minor part of these emissions, the immediate onus for action falls on developed countries. They are by far the greater emitters, they are better able to absorb any net costs of remedial actions, and they have a stronger base for developing the required technological response. In Chapter 4 we make specific calls for leadership by developed countries in respect of action on global warming.

3.20 *We cannot stress too strongly the responsibilities of the developed countries for taking immediate action to reduce their own use of energy; encourage energy conservation; develop energy-efficient technologies; and facilitate the transfer, on concessional and preferential terms, of such technologies to developing countries. The developed countries should recognise their prime responsibility for global warming and create the 'headroom' needed to enable developing countries to achieve a rate of energy consumption consonant with higher living standards.*

3.21 Both regulatory and market or tax mechanisms must be considered by developed countries. Their governments should use the price mechanism not

only to reduce their countries' consumption of energy but to generate sufficient resources to provide much greater help to developing countries so that these countries can expand their use of commercial energy at a rate which increases living standards while using energy more efficiently. *We agree with those who advocate an international carbon tax in this connection. Its implementation must, however, recognise the relative responsibilities of developed and developing countries for accumulated greenhouse gas emissions and the priority that must be given to economic growth in developing countries.*

Energy efficiency

3.22 If past trends continue, it is likely that attempts to perpetuate present demand patterns and supply technologies in developing countries would become increasingly unviable, causing reduced economic growth and frustrated demand from all quarters. However, we believe there is great scope for alleviating future energy problems by improving the efficiency with which energy is supplied and used.

3.23 Although historically, growth in GNP has been correlated with growing energy use per head, the link has been broken in some developed countries. In the United States, per capita energy use fell by 12 per cent between 1973 and 1985 at a time when GNP rose by 17 per cent. In Britain, too, there was a similar occurrence. The means exist for developing countries to practise 'leap-frogging' by adopting state-of-the-art machinery and processes and conservation measures which reduce the energy input into GNP. But this is contingent on their having adequate and additional financial resources and access to the relevant technologies on affordable terms. One study found that the use of more efficient end-use technology by a typical developing country whose need for energy services were similar to those of Western Europe in the 1970s would lead to a total final energy use per head of 1 kilowatt, only 20 per cent more than the developing country average in 1980.[6]

3.24 In developing countries electricity has been the most rapidly growing form of energy consumption, responding to rising incomes, urbanisation, and industrialisation; currently it supplies about one-quarter of their final commercial energy demand. Improvements in housing conditions, and the acquisition of electrical consumer durables, translate into increasing demand for power. The growing urbanisation of populations increases the demand for power disproportionately, as does the growth of industry relative to agriculture.

3.25 These are natural developments, associated with necessary structural changes and rising living standards. In many situations there are good reasons for encouraging the further substitution of electricity for other kinds

of energy, including human effort, e.g. the use of electric pumps for irrigation and drinking water supply. Experience in some developing countries has shown that some of these needs can be met by local generation of electricity through such means as solar, wind, and mini-hydro power, which being potentially modular, have the advantage that capital inputs can be incremental.

3.26 There are often sound environmental and public health-related reasons for welcoming the substitution of commercial fuels for wood and cattle dung used for heating and cooking. Kerosene and liquefied petroleum gas (LPG) and biogas offer means for more efficient cooking and heating without the household pollution that risks family health, especially of women and children. Where such fuels can be made competitive with wood and charcoal, pressures for deforestation are reduced. If farmers can be provided with fuels superior to animal dung at prices which are affordable, the dung can be returned to the ground for improving soil fertility. Given such measures, the wider use of LPG in Nigeria, for example, would have major environmental and human benefits[7]. The wider availability of commercial fuels would be of great benefit in poor and populous countries such as Bangladesh, where the shortage of biomass limits the amount of cooking that takes place, with obvious effects on nutrition and health.

3.27 We believe these are powerful reasons for encouraging the use of various alternative energy supply techniques to meet some of the legitimate needs in developing countries. Over time and with adequate and additional resources, the growing need for energy can be reconciled with financial constraints and environmental pressures. Boxes 3.1 and 3.2 (pages 38 and 43) illustrate the scope for encouraging sustainable energy use and supply in two populous Commonwealth countries.

3.28 In the electric power sector, measures can be broadly divided into those concerned with the efficient use of power, and those focused on its more efficient production. We believe there is considerable room for improved end-use efficiency in both developing and developed countries. Industry is the largest user of power in developing countries and a major consumer in developed countries. The scope for energy-saving varies across sub-sectors. A new generation of energy-efficient industrial motors is available, and savings are possible from using motor speed controls. Low-cost energy-saving measures could save 2-4 per cent of costs in smelting aluminium, and 10-20 per cent for producing cement. Retrofitting and process improvements could produce cost savings of 5-13 per cent for smelting steel, and up to 85 per cent for processing sugar. Energy use in the fertilizer industry could also be reduced, by about 15 per cent. All these investments would have rapid pay-back periods[9].

3.29 In the commercial and residential areas the best scope for improving

Box 3.2

DEFENDUS Scenario in Karnataka, India

This energy scenario was produced as a response to an estimate of the cost of meeting Karnataka's power needs, assuming a continuation of present trends and use patterns. This estimate, contained in the Long-Range Plan for Power Projects in Karnataka (LRPPP), projected a need for 9.4 gigawatts of power by 2000, requiring the State to spend $17.4 billion, or 25 times its annual budget. The sum entailed, and the scale of the construction programme required, were clearly excessive, and the Plan was rejected by the State.

The DEFENDUS approach is development-focused, end use-oriented, and service-directed, blending conservation and local renewable sources into a least-cost mix. It is based on electrifying all homes in the State, the widespread installation of electric irrigation pumps, setting up decentralised energy centres in villages, and promoting industries to provide jobs. Even so, its needs for energy and power by the year 2000 would be only 38 per cent and 42 per cent respectively, of the LRPPP projections.

The savings would be achieved by a range of measures. Inefficient motors and incandescent bulbs would be replaced with more efficient motors and compact fluorescent lamps. Electric water heaters and stoves would be replaced by solar-powered water heaters and LPG stoves. Irrigation pump systems would be retrofitted with frictionless foot valves and better piping.

The generation of power would be by a least-cost mix of large conventional units and decentralised units, including some of a non-conventional nature. Mini-hydro plants and biomass-based rural energy centres would have an important place in the system, and major new investment in nuclear power stations, coal-fired thermal generators and major dams would be avoided. The system would draw entirely on proven, off-the-shelf technologies.

The DEFENDUS scenario would provide for Karnataka's needs at one-third the cost of the LRPPP, would deliver the energy sooner, more equitably, with less harm to the State's environment, and with a fraction of its emissions of greenhouse gases.

Source: Reddy and Goldemberg[8]

energy efficiency lies in lighting, air conditioning, insulation of buildings, water pumping and refrigeration. In water pumping, to take one example, the range of measures includes installing high efficiency motors, low-resistance foot valves, proper sizing of motors and pumps, electronic speed controls, efficient hydraulic parts, irrigation load management and improved maintenance.

3.30 A study by the Tata Energy Research Institute (TERI) in India demonstrated the sizable impact of merely changing light bulbs on the power situation in Bombay. Lighting is the major contributor to peak load demand for power. Incandescent bulbs are the least energy-efficient source of lighting, but are heavily used in residential quarters. The TERI estimated that replacing incandescent bulbs with 20 watt compact fluorescent bulbs would reduce peak load demand by 40 per cent, displacing the equivalent of 5000 MW and eliminating the need for load restrictions. The cost of the conversion would be handsomely rewarded by a rate of return of 50-55 per cent[10], although the higher costs of fluorescent bulbs would have to be taken into account, perhaps initially by a subsidy.

3.31 The more efficient use of fuel for household use would serve a number of valuable purposes. Better stoves, which used less energy to produce a given amount of heat, would lighten the workload of women, reduce household air pollution and thus benefit the health of women and their families, and reduce pressure for the deforestation of surrounding areas. At present the collection of firewood can absorb several hours per day of the time of women in poor communities.

3.32 Automobiles and trucks are substantial sources of greenhouse gas emissions (accounting for a quarter of the total in some countries), causes of photochemical smog and carriers of toxic trace metals. With rapidly growing numbers of vehicles, measures to reduce these emissions assume increasing importance. The most effective and feasible means of achieving such a goal is greatly to improve the efficiency of new vehicles in the market place through a combination of government regulations, price and tax policies. In North America, for example, most vehicle manufacturers have well-tested prototypes which sacrifice little comfort or safety, and which use less than half of the fuel used by currently available new vehicles. Increased support for public transport could also help to reduce emissions by lowering the number of engines in use.

3.33 The developing countries should be enabled to meet their growing needs for energy in more sustainable ways, which impose less damage on the local environment, are affordable, and which can deliver energy more efficiently and without sacrificing economic growth. Most of these countries can tap a range of measures to improve the efficiency with which energy is supplied and used, which are more cost-effective than previous supply

investments. In developed countries, energy-efficiency measures will have a much greater effect in improving global environmental conditions because of these countries' much larger use of energy.

3.34 *In order to improve energy efficiency, we recommend that:*

- *the price of energy should be adjusted to reflect better its true economic and environmental costs in supply and use. This would discourage wasteful use and encourage efficiency;*

- *national electric power and gas utilities should see their role increasingly as promoting energy efficiency, as opposed to maximising the supply and sale of electricity and gas. Utilities should evolve into energy-service companies advising on energy saving and encouraging consumers to use more efficient appliances, by grants, leasing or subsidised loans;*

- *energy supply programmes should be reoriented. Instead of focusing on specific supply-based projects, they should support goal-oriented programmes, such as electrifying more villages and households;*

- *developed countries should facilitate the transfer of energy-efficient technologies to, and between, developing countries by increasing their bilateral aid provision for this purpose, funded if necessary on a specific basis such as through a special carbon tax; and*

- *international aid agencies and national development banks should be much more ready to assist energy-efficiency projects, as compared to centralised energy supply schemes. At present concessional funding tends to go to the latter, leaving the former competing for funds on commercial terms.*

Renewable energy sources

3.35 Compared to the use of fossil fuels, renewable energy sources are, by definition, sustainable, and they contribute little, if anything, to global warming. The local environmental effect of, say, wind and solar schemes is minor compared to thermal or large-scale hydro-power generation. So far, however, wind and solar systems have had only isolated commercial applications in developing countries. But especially in island small states the natural conditions for producing these resources of energy are favourable and the costs of conventional energy and power are relatively high. Energy from biomass sources, such as farm crops and wastes, and timber , is more widely used in Africa, and methane production from cow dung is common in South Asia. Solar, wind, ocean-based and certain biomass energy technologies are becoming technically and commercially viable for developing countries on a much wider scale. One authoritative view is that "Electricity from wind, solar-thermal and biomass technologies is likely to be cost-competitive in the

1990s; electricity from photovoltaics and liquid fuels from biomass should be so by the turn of the century."[11]

3.36 We summarise the prospects for these renewable sources of energy (and mini-hydro schemes) in Annex 2 on page 152. Our conclusion is that the development of renewable energy sources should be given a major boost. We realise that fossil fuels and major hydroelectric schemes will continue to be relied on for satisfying large parts of demand for energy, but it is vital to increase the market share of energy based on solar, wind, ocean, biomass and mini-hydro sources. In many situations the technologies for producing such forms of energy are competitive with conventional types: given further research and development, and the more intensive exchange of data and experience, these non-conventional sources could make much deeper inroads into the market, with savings in both financial and environmental costs. Many of the methods would bring benefits to women, particularly in developing countries, enabling the substitution of commercial energy for the human effort which in many respects is provided largely by women. Some of them are specifically relevant to the needs of small and island states.

3.37 *We believe that the use of renewable energy resources should be encouraged. We recommend that:*

- *in energy planning, renewable sources should always be explored as the first choice to meet additional energy needs;*

- *governments should facilitate the adoption of renewable energy schemes, especially decentralised ones, through promoting their use in public buildings, offering tax relief to firms and households using renewable energy technologies, and freely exchanging information and experience with other countries;*

- *power and energy utilities should increasingly support and adopt renewable energy schemes. Countries with relevant know-how and experience should enter twinning arrangements with utilities in other Commonwealth countries;*

- *aid agencies should be more forthcoming in their support of renewable energy technologies, recognising their strong environmental attractions, their rapidly improving economic and commercial viability; and the reduced need for expensive fuel imports; and*

- *the prices, taxes and subsidies applying to the different types of energy sources and technologies should reflect their relative environmental, as well as economic and social, costs and benefits; where appropriate, duties on renewable energy technologies should be removed.*

Land Use and Degradation

3.38 Most of the developing world's population are directly dependent on the productivity of land for food, jobs and income, and the remainder depend on it for food and life-support. Although there has been progress in raising the productivity of land in some cases, in many important respects its potential for supporting growing populations has been reduced. Even today hundreds of millions of people receive inadequate nutrition, and grave doubts must be entertained about the ability of current land use practices to supply enough food to give future generations even minimum levels of nutrition.

3.39 Over the last forty years it has been estimated that the world has lost almost one-fifth of the topsoil from its cropland, one-fifth of its tropical rainforests (the destruction of temperate forests has been taking place for a far longer period and has been proportionately much greater), and tens of thousands of its plant and animal species. Yields in many important irrigated areas are falling, and the food situation in Africa has clearly deteriorated—grain production per head is 20 per cent below its 1967 level[12]. Good farm land is steadily being lost to the encroachment of cities, which is especially serious when the cities are located near prime agricultural land (e.g. Dhaka, Calcutta, Delhi).

3.40 A large part of the world's land is degraded. One estimate of the proportions involved is reproduced in Box 3.3 (overleaf). Moderate and severe land degradation, defined as a reduction in potential yield of 10-50 per cent and more than 50 per cent, respectively, affects 40 per cent of agricultural land in Africa and 44 per cent in Asia. The more developed regions are equally prone to degradation, especially Australia.

3.41 It has been estimated that in the 1980s the world's farmers lost a net amount of 240 billion tons of topsoil from cropped areas, which is equivalent to half the topsoil on US farms. If present trends continue, Africa would lose a quarter of its 1975 level of agricultural production by the year 2000[14].

3.42 In the long term the use of the earth's land resources needs to be optimised in relation to the many demands that will be placed on them. More immediately, and without losing sight of this aim, the current processes of degradation need to be halted and reversed. Although certain general causes are at work, there are many local factors that need to be taken into account.

3.43 This section examines the reasons for degradation in three important categories of land—watersheds and hilly areas, irrigated areas, and drylands—and in each it recommends measures to preserve and enhance the land's productive potential. Although the main focus of the discussion is on securing food supplies, this is not to ignore the function of land in providing income, jobs and industrial raw materials, which are touched on more briefly.

Box 3.3

Categories of Agricultural Land and Estimated Degradation in the Late 1970s

Agricultural land has been grouped into three categories according to its degree of degradation. The definition of 'slight' degradation is the reduction of its potential yield by less than 10 per cent; 'moderate' degradation is a reduction of 10-50 per cent; 'severe' degradation is a reduced potential of more than 50 per cent. The results, by major region, are set out below:

Continent	Slight	Moderate	Severe	Total
		(percent of land surface)		
Africa	60	23	17	100
Asia	56	28	16	100
Australia	38	55	7	100
Europe	69	25	6	100
N. America	70	23	7	100
S. America	73	17	10	100

Source: Lester R Brown[13].

Nor is it to ignore other matters such as gender roles which have important, if often underlying, influences as the following paragraph explains.

3.44 Where land use is small scale and community based, the relationship of the different community members to the environment and their interactions with it are often influenced by the gender roles assigned to them. Any land use or environmental projects therefore need to take gender roles and responsibilities into account. Male roles are typically specialised, usually as economic producers including paid workers, as leaders and as political agents for the family. Female roles are typically multi-skilled and overlapping, including paid and unpaid roles as caregivers, caretakers and educators. All roles are involved with direct personal relations and most of them are likely not to involve scientific or economic training. The implications of this divergence of responsibilities between the genders are that for integrated environmental management, men in general require access to education on human relationships and household economics; women on economic resource management, available technology and finance, and on ecology. Both require education in decision-making processes.

Watersheds and hilly areas

3.45 About half the world's population are potentially affected by watershed degradation—the 10 per cent who live on the slopes concerned, and the 40 per cent who occupy the adjacent lowland areas. In the tropical regions of the Western Hemisphere, for instance, between a quarter and a third of the population live on farms in hillside zones, and half these farms are on slopes greater than 20 degrees. Likewise the mountainous slopes of South-East Asia, the Himalayas, East and Central Africa and elsewhere are of vital agricultural importance to their respective countries.

3.46 Watersheds are threatened by many factors. The encroachment of farm populations, livestock grazing, firewood collection, commercial logging, major civil works such as dams and highways, and the conversion of forest to plantations are the major ones.

3.47 Serious erosion normally results from a change in vegetation cover, e.g. from deforestation, conversion from perennial to annual crops, grazing by livestock, etc. Gully erosion and soil creep have more dramatic effects and are typically caused by road building across slopes, careless logging, and a change in cropping from deep- to shallow-rooted varieties. Landslides are an extreme form, risking damage to property and loss of life and livestock as well as agricultural and sedimentation costs.

3.48 Many tropical hilly areas contain low productivity subsistence agriculture carried out amidst rapid population growth, poverty, and economic marginality. These rural populations are often difficult to reach with normal public services. The problem has been encapsulated as follows: "..environmental degradation is so widespread in hillside areas because the social and economic factors associated with underdevelopment are there combined with a land resource subject to rapid deterioration under improper human use"[15].

3.49 Poor people gravitate towards watersheds where they subsist on the margins of cultivation. Population pressure may add to this trend in countries where the density of settlement is already high and the cities cannot absorb all the migrants looking for work. Anything that reduces the capacity of existing cultivated areas to hold population and offer employment will also expel farmers to the marginal limits. The development of large-scale farming systems (e.g. by subsidies and tax incentives) and the substitution of capital for labour in agriculture (e.g. by tax incentives and artificially cheap imports of machinery) will have this effect.

3.50 Degradation is often prevalent in frontier conditions. Clearing land of its original vegetation is usually the surest way of staking claim to it and is thus a more profitable way of securing cultivable land than investing in conservation measures on existing plots. Government settlement and coloni-

sation policies have also been responsible for locating small farmers in unsuitable areas with inadequate support, with the result that land is degraded and then abandoned.

3.51 Small farmers often find it difficult to get access to good land in 'safe' ecological areas, because of a lack of cash, credit, or local political connections. Hence the people forced on to slopes subject to erosion are frequently those least able to take the longer view entailed in carrying out conservation measures.

3.52 Those areas that are better integrated with the national market respond most readily to policy and market signals which may themselves encourage degrading farm practices. This is important for crops which are potentially erosive. The decision whether or not to grow such crops (e.g. maize, cassava and tobacco) on slopes rather than crops less liable to cause erosion (e.g. tree crops, terraced rice) will depend heavily on their relative prices. These in turn may depend on official price-fixing, import controls, and (in the case of exports or import substitutes) the exchange rate.

3.53 Farm policies can strongly reinforce soil conservation. In Java, a densely farmed island with a high degree of commercial penetration typical of some other regions of Asia, it has been argued that: "Manipulation of selected non-staple prices would be a cost-effective means of encouraging more profitable and sustainable upland farming to complement stronger programmes for research, extension and credit. Continuation of restrictive import policies for perennial fruits and animal husbandry products will spread agro-forestry and forage systems. Price support or buffer stock schemes for tradeable crops such as cloves and coffee would also have a positive impact on soil conservation"[16]. Such interventions are, however, difficult to manage successfully.

3.54 Security of tenure is an obvious precondition of farmers taking the long-term perspective necessary for managing their land sustainably. As we note in Chapter 6, women may face special obstacles in obtaining security of tenure or access to land. Tenant farmers are less likely than freeholders, and squatters less likely than leaseholders, to make long-term investments in their land. Open access land is especially liable to be overused and eroded, where traditional and communal control is lacking, or has been undermined. Privatizing common property resources is not always the answer, since it often deprives poor people of access to vital inputs and forces them into a vicious circle of degradation elsewhere.

3.55 Although the traditional methods of managing common property resources are often adequate to ensure sustainable practices, this is not true of all forms of traditional landholding. In some South Pacific countries land held under customary ownership is showing signs of degradation, and

governments need to bring appropriate influence to bear, seeking the support and co-operation of land-owners in the preparation and implementation of land-use plans.

3.56 Labour used for conservation work (e.g. terracing, bunding) usually has an opportunity cost, either in the value of crops and livestock it could have produced, or in the off-farm wage employment it could have obtained. Where off-farm employment is plentiful, interest in conservation measures may be reduced. However, if farmers rely heavily on off-farm jobs, they may favour less labour-intensive techniques on their own farms, and consequently grow more perennial crops and trees. This is another good reason for promoting off-farm employment to help the environment.

3.57 *This brief review of land degradation in watersheds and hilly areas leads us to make a number of recommendations to help stem the problem and enhance the potential of such land. Action should be taken urgently as land degradation in these areas is the largest single pollutant of fresh and coastal waters. It is thus a global issue. We recommend that:*

- *each government should seek to complete a land resource audit and compile a prospective plan for land usage;*

- *land conservation schemes should be undertaken, maximising the incentives of villagers and farmers to take part. Governments should exchange information and experience about successful conservation schemes;*

- *construction projects in fragile environments should contain a high degree of environmental protection, and transport systems for logging operations should be carefully supervised;*

- *off-farm employment should be encouraged as a way of relieving rural poverty and providing incentives and resources for land conservation;*

- *security of tenure should be improved, by land reform, offering leases to squatters, and confirming users' rights to land;*

- *farm policies, such as relative crop prices, export taxes, import controls, and input subsidies, should be framed in a way that recognises that certain crops are potentially more degrading than others;*

- *encroachment on common property areas, such as grazing land and forest, should be discouraged;*

- *tax incentives and subsidies offered to commercial farmers, ranchers and loggers should be carefully examined for their potential environmental effects, including their repercussions on small farmers; and*

– *aid agencies should support studies into maximising the long-term potential of land for food production.*

Irrigated areas

3.58 One-third of the world's food is grown on the 17 per cent of its arable area (250 million hectares) that is irrigated. Many countries, including some populous ones such as India and Pakistan, rely on irrigation for more than half their food supplies.

3.59 The rapid expansion of the irrigated area witnessed over the last 30 years is unlikely to be repeated—the most suitable areas have already been irrigated and future schemes will incur increasing costs. Currently irrigated areas are performing well below their potential, because of poor management and design, and the waste of water. The scope this gives for improving the use of existing schemes could be a sign of hope.

3.60 Various levels of technology can be employed in irrigation schemes. In countries with low labour costs, low levels of technology are sometimes the best option, being capable of use on a small scale and being built up incrementally. The comparative costs and benefits of various types of technology in constructing irrigation schemes are worthy of further examination.

3.61 Salinity and waterlogging are seriously reducing the fertility of large areas of irrigated land. Salinity has reduced yields on 20 million hectares in India and has caused the abandonment of a further 7 million hectares. In Pakistan, salinity and/or waterlogging affect three-quarters of the irrigated area. The rise of the water-table is caused by various factors. The design of schemes and the way on-farm development is carried out may make it difficult for farmers to control the optimal timing and quantities of water used. There is excessive application by certain farmers with privileged access to supplies. This causes salinity as well as public health problems. It is encouraged by gross under-pricing of water and poor revenue collection techniques. There is widespread leakage during distribution, and inadequate drainage. The lack of financial autonomy of many public schemes, with the Treasury siphoning off whatever revenue is collected, is a common reason for the neglect of maintenance on irrigation structures. Overall, it is possible that three-fifths of the world's irrigated area is in need of upgrading.

3.62 Inadequate drainage can usually be traced to the low priority given to this aspect when irrigation schemes are designed. Major drainage works are often not required until some time after a scheme has been completed, but the situation needs to be carefully monitored and financial provision made for it.

3.63 An improvement in the financial position of irrigation authorities is urgently needed. Ideally they should be able to recover the full costs (includ-

ing capital) of irrigation and drainage schemes, but they should at least be able to fund essential maintenance and operating outlays. Increasing charges, relating water costs to usage, and improving revenue collection methods would signal the real cost of the water, though we do not underestimate the political problems of raising charges.

3.64 Agro-chemicals used as pesticides for the control of weeds and insects may accumulate in the topsoil, and harmfully affect plants. The use of such chemicals is not confined to irrigated farms, but their abuse is a major environmental issue in these areas. It can cause occupational diseases to the workers handling them, and to their families. Local atmospheric pollution from crop spraying affects a wider circle of people. The build up of chemical residues in the soil and on plants may then enter the food chain, and thence to all consumers of the foodstuffs. It is estimated that 10,000 people die and 400,000 suffer acutely from pesticide poisoning every year in developing countries—though not all these are on irrigation schemes. Most are farm-workers handling the chemicals, who suffer skin, eye and respiratory complaints, but the contamination easily spreads to their families and other villagers. Deformities in unborn children and breast-fed infants have been traced to the intake of pesticides by their mothers.

3.65 Many countries ban the use of the more dangerous chemicals, but such bans are widely evaded by farmers and plantation companies concerned to protect their investments. The use of pesticides is sometimes encouraged by government subsidies. A survey of pesticides in nine developing countries showed an average subsidy equivalent to 44 per cent of retail costs, while in some countries the proportion was over 80 per cent[17]. Pesticide requirements tend to increase over time, as their targets develop resistance. The vicious circle can, however, be broken by various forms of integrated pest management, which are much gentler in their environmental effects.

3.66 *To enable irrigation schemes to produce at nearer their true capacity, and to help arrest the decline in soil fertility, we see a need for:*

- *improved design and operation of irrigation schemes, including proper drainage, canal lining, field levelling and other aspects of on-farm development, to reduce the waste of water, seepage, and waterlogging, and to help farmers have more control over the application of their water;*

- *better financial arrangements—adequate funding, levying and collecting water charges at a rate sufficient to secure the cost of operation and maintenance, and eventually to fund drainage measures. This implies a degree of financial autonomy for the irrigation sector;*

- *adequate maintenance capability, preferably with some responsibility devolved to the users;*

- *a judicious balance between central direction and control, on the one hand, and the involvement of farmers and communities, on the other. The larger the scheme, the more important, and difficult, it is to get the balance right. Privately-owned and small schemes are easier to manage than publicly-owned and large schemes, respectively; and*

- *promotion of natural methods of pest control through integrated pest management, better husbandry, a reduction of subsidies on pesticides, and a ban on the production of the more persistent and dangerous types.*

Drylands

3.67 Drylands, normally defined as those receiving annual rainfall of 300-1500 mm, range from areas where one rain-fed arable crop per year can be expected, to areas on the fringes of the desert where supplementary sources of water would normally be needed to sustain regular farming. In 1975 it was estimated that the population of arid areas was 132 million, and that of semi-arid areas was 314 million. Both numbers would have risen since. Most of the people are very poor.

3.68 Deserts, on the other hand, receive less than 100 mm. of rainfall per year, and rain-fed farming is not normally feasible. Although even these areas sustain some wildlife and nomadic peoples, they are less important than drylands as life-support systems. Semi-arid areas are more important as human environments, and are often of political and strategic significance.

3.69 The evidence and causes of desertification are still under debate[18]. What is not in dispute is that there has been sizable local degradation from concentrations of people and animals. Drylands are particularly important for supporting cattle, but their ability to continue to cater for expanding numbers of livestock is in doubt. In Africa, it is estimated that the livestock population has risen to 543 million, compared to 272 million in 1950. In India the demand for fodder is expected soon to outstrip supply, affecting the condition and survival prospects of large numbers of cattle. Recently certain local governments in India have set up fodder relief camps for cattle threatened with starvation.

3.70 Climatic changes are partly responsible for the degradation which has occurred—by historical standards the last two decades have been unusually dry in Africa's Sahel, though it is too soon to conclude that this is the start of a long-term trend towards greater aridity. Population growth and migration are other potent causes. In the past population has adjusted to the carrying capacity of the land by temporary or permanent migrations, and by use of the bush fallow system. But recently, this process has been affected by large movements of refugees, especially in the Sahel, and by projects to stabilise populations in unsuitable areas.

3.71 The encroachment of arable cultivation into marginal areas has often resulted from population pressure and the resettlement of farmers on land really only suitable for livestock. The inappropriate introduction of mechanised farming has exposed land to the risk of wind erosion in several major areas.

3.72 Livestock often bring on desertification, by destroying young trees, overgrazing sparse pasture and treading down vegetation around water points and along trails. Although livestock numbers often adjust to carrying capacity, there is evidence of long-term increases in some countries (e.g. western Sudan, Zimbabwe, Lesotho). Control of the rinderpest disease has also tended to increase livestock numbers in previously infested areas. Many well-intentioned livestock projects have had undesirable local environmental effects, because they increased concentrations of livestock, even if only temporarily.

3.73 The destruction of trees for use as fuelwood is a cause of much degradation. As fuelwood becomes scarcer, crop residues and animal dung may be diverted from fertilising soil, and used as fuel. Soil yields decline, leading to less vegetation, and the use of crop residues to feed livestock. Soil fertility declines further and erosion sets in.

3.74 The above processes are often caused or aggravated by a breakdown in traditional methods of conservation and adaptive husbandry. One example is the decline of the bush-fallow system resulting from such factors as population pressure, war, drought, and refugee movements. In some cases governments remove powers and responsibility from local people, or undermine the authority of traditional leaders. Many of these difficulties have been exacerbated by artificial political boundaries and the privation brought about by war.

3.75 Large areas of dryland have also been degraded by the inappropriate encouragement of commercial farming. The subsidised import of machinery at heavily overvalued exchange rates and tax incentives on farm income have led to large areas of dryland being ploughed up, farmed for a few years, and then abandoned in the face of declining soil fertility.

3.76 We are persuaded that relative prices are a powerful influence on the balance of crops grown in an area. There may sometimes be a conflict of interest between incentive prices and sound resource management. The 'commercialisation' of agriculture in places like the Sahel bears a share of the responsibility for dryland degradation. Farmers have been growing export crops (cotton, groundnuts, etc.) to meet the cash needs of their households. Apart from any direct effects which such cultivation has on the soil, it reduces the scope for dry-season grazing, with its valuable manuring. In some cases cash cropping leads to the neglect of food production which is

largely carried out by women and small farmers. The result may be shifts in the distribution of income, to the detriment of households headed by women, and of women and children in other families.

3.77 Fuelwood pricing usually encourages the continued cutting of trees for wood and charcoal, compared with alternative fuels that are less environmentally damaging. Fees and charges levied on firewood and charcoal traders hardly ever cover the real cost of replacing and managing the forest resources. In most countries the prices of firewood and charcoal fail to signal their eventual long-term scarcity, which is concealed by periodic gluts of wood as new areas are opened up.

3.78 Drylands, containing as they do areas of great human poverty, have witnessed many well-intentioned aid projects. Very few of these appear to have been successful, and many have actually harmed the environment. *We urge governments to recognise the importance of mobile pastoralism and of transhumance for the preservation of dryland vegetation. In countries where traditional pastoralism is, or until recently was, practiced, future rural activities should be based on utilising and developing the knowledge of the local people.*

3.79 *New approaches to improving the welfare of those living on drylands are also needed, urgently. We recommend the:*

- *stimulation of alternative livelihoods for marginal farmers, either on- or off-farm;*
- *development of credit programmes, bearing in mind the specific needs of women, to help avoid the immiserating behaviour of farmers pressed for ready cash;*
- *restoration of powers of land management and control to local communities;*
- *design of aid projects which give more emphasis to small irrigation schemes, social forestry, water harvesting, pastoral restocking, and seed banks;*
- *preparation of drought preparedness schemes in all drylands; and*
- *encouragement of new or existing small scale projects, especially those initiated, controlled and managed by local communities and supported by NGOs.*

Biodiversity

3.80 Biological diversity encompasses variability in terms of genetics, species, and habitats. It is important to sustainable development for two

reasons. First, because a habitat containing many species and many strains of one species is more resilient to environmental shock, especially temperature change and water stress; and, secondly, because a diverse habitat provides a store of genetic material that has been of enormous importance to agriculture and animal husbandry, as well as to medicine and industry. Selective breeding of crops and livestock has improved yield and quality of many species, and the development of varieties with new desirable characteristics, such as resistance to disease, tolerance of temperature change, even production of new substances, depends on the maintenance of a widely diverse pool of genes. At present these genes reside for the most part in natural ecosystems. They cannot effectively be replaced by stored germ-plasm, and in any case, the countries of origin of the germ-plasm must be enabled to retain control over its use.

3.81 Genetic manipulation is replacing selective breeding in the rapid introduction of 'tailor made' varieties, and even of new species. Gene banks are maintained almost exclusively in developed countries. This is undesirable as it will lead to plant and animal breeders in these countries dominating world production of new varieties and species.

3.82 Commonwealth countries should initiate and support international measures to minimise patenting of organisms produced by genetic manipulation, and developing countries should be supported in carrying out their own plant and animal breeding, and genetic manipulation research. (The UNIDO International Centre for Genetic Engineering and Biotechnology could provide assistance.) Information on the scope and implications of genetic manipulation should be made available in popular form, together with information on expected and actual problems.

3.83 The costs and benefits of maintaining biodiversity fall on different people. A vivid example of this is where the pressure to save a threatened species of animal comes from groups in affluent countries, but where the cost of conserving it would be borne by poor farmers who need the land for subsistence. In some cases, these costs could be manageable, with suitable aid and adjustment. For example, the cost of conserving turtles in the Seychelles has been identified as falling on the few people involved in hunting and in processing the shells; a modest amount of aid through the Global Environment Facility could compensate them. But in other cases, the costs would be substantial.

3.84 *We believe it is in the common interest of developed and developing countries to arrest the loss of biodiversity. We recommend:*

- *Commonwealth governments to participate in the negotiation of the international convention to conserve biodiversity and ensure its rational use. Adequate provision should be made to meet the costs both of conserving*

biodiversity and of the opportunities forgone by such conservation, especially in developing countries;

- *an intensification of research into setting priorities for the conservation and sustainable utilisation of biodiversity between and within countries. This would recognise the costs to local communities in many cases from forfeiting alternative uses of the resources;*

- *further work on the economic and financial values of biological resources to local users, and to science;*

- *the pooling of experience of mechanisms for returning to local communities the value of the biodiversity of their habitats, as a means of improving their incentive to care for these resources; and*

- *governments to seek new partners, e.g. multinational companies, NGOs, charities, tourist enterprises, etc., to raise awareness and increase funding for the conservation and sustainable utilisation of biodiversity.*

Water Resources

3.85 Water occupies a unique position in environmental issues. Apart from being the environmental medium which is the 'sink' of all pollutants, water also has the greatest purifying capacity. But it can also be a virulent vehicle for the transmission of diseases, and in the developing countries up to 80 per cent of these are water-related. The availability of adequate quantities of water is the basic prerequisite for most socio-economic development—agriculture, industry, infrastructure, aquaculture, navigation, power generation, etc. The problem here is not so much one of water quantity in total, as of its unequal distribution across countries and continents. Many Commonwealth countries are already suffering from serious water shortages in terms of quantity; but they are also experiencing deficiencies in quality, level of service and coverage, as well as problems concerning costs.

3.86 Water scarcity is increasing, several developing countries now having less than 200 cubic metres of renewable water per person per year. The problem is not so much how much is needed but, rather, how much water is really available and how best to manage this beneficially. Only efficient use of water in all sectors can ensure sustainability. Reduction of leakages, recycling, the efficient allocation between competitive uses, and water source protection are all viable and necessary strategies. Regarding source protection, for instance, groundwater is the largest and least contaminated water source. Every effort should be made to preserve its quality by avoiding overpumping which may lead to salt intrusion and, as a result, more expensive treatment and supply.

3.87 Interbasin water transfers are being considered as a serious option for the augmentation of water resources in some Commonwealth countries. Where this is the case, it is important that the project is planned, implemented and managed in an environmentally sustainable manner.

3.88 The allocation of water is on occasion a source of serious tensions. Within countries it often causes the poor to lose out against the rich and it is therefore important that all environment impact assessments should include social implications. Between countries it may have important political implications. The division of the Nile waters, the use of the Euphrates, the sharing of the Indus, Brahmaputra and Zambesi flows have all required delicate negotiations, which will continue as the waters are used more and more intensively by partners. More than one-third of the 200 largest international river basins are not covered by international agreements and fewer than 30 have co-operative institutional arrangements.

Water pollution

3.89 The danger to the water environment emanates not only from quantity but also from quality. In the developing countries, water quality is threatened particularly from indiscriminate disposal of wastes and wastewaters from agriculture, industry and households. Because of the lack of pollution control infrastructures such as sewage treatment works and wastewater drainage systems, 'non-point sources' pose the major danger to polluting limited water sources. Nutrient enrichment of water sources which precipitate eutrophication is increasing in many tropical water bodies.

3.90 Many developing and some developed Commonwealth countries are not equipped with the necessary data base to assess water pollution. Legislative machinery and adequately trained technical manpower are also lacking for its effective control.

3.91 'Prevention is better than cure' is the rational operational principle in water pollution control. Many governments cannot afford the huge financial expenses associated with cleaning up polluted water. Policies to control water pollution must incorporate the 'polluter must pay' principle in order to ensure the efficient management of water resources.

3.92 There are few national schemes for taxing pollution, as opposed to administrative means for regulating it, backed up with adequate monitoring devices, fines and charges. Several West European countries have pollution taxes, with rebates for firms that clean up the effluent themselves. Some developing countries have administrative schemes and at least one—Thailand—is considering an innovative approach.

Water supply and sanitation

3.93 We are convinced that the supply and use of water is going to be a dominant issue in development during the 1990s. Water is vital for life-support, as an input to production, as a medium for assimilating waste, as a means of climatic regulation, and as a source of amenity and aesthetic pleasure. Yet serious problems are arising in its use, as are shown in Box 3.4 (page 61).

3.94 Although our viewpoint is mainly that of the need to obtain sufficient safe water and dispose of it safely after human use, we do not lose sight of other aspects of the water problem. The development of water systems has potentially major environmental impacts on all sectors—notably agriculture, industry, tourism, fisheries, and transport. Large dams, for instance, have a profound impact on the environment. Likewise, pollution affects health, biodiversity, fisheries and amenities, as well as water supply. This makes it important for water projects of all kinds to be accompanied by an environmental impact assessment that gives full weight to all environmental and social costs and benefits.

3.95 We recognise three main dimensions to the water problem. First, a sizable part of the present global population has unsatisfactory water supply and sanitation. There is thus a substantial backlog of provision in this sector. Secondly, existing use patterns for present populations are proving unsustainable, as we have pointed out earlier. But, thirdly, the growing needs of future populations—eventually perhaps three times the current size—have to be anticipated.

3.96 Despite progress made during the UN's International Decade for Drinking Water Supply and Sanitation, demographic and other factors have left many people still without access to water supply and basic sanitation. Worldwide, the UN estimated that in 1990, 243 million people in urban areas had no satisfactory water supply, and 377 million were without sanitation. Among the rural population the numbers were much higher, 989 million and 1,364 million, respectively.

3.97 Roughly three-quarters of the urban populations of Africa and the Western Pacific are provided with water supply and about two-thirds of those in South and East Asia. For urban sanitation, Africa is 80 per cent covered, the Western Pacific 94 per cent, but in South and East Asia the proportion is only about one-third. In rural areas the situation is much worse: in Africa only 27 per cent of the population has access to water supply, and 16 per cent to sanitation; in South and East Asia the respective proportions were 62 per cent and 13 per cent, and in the Western Pacific 52 per cent and 67 per cent[19].

Box 3.4

Water—a Universal Problem

* Growing water shortages in arid and semi-arid countries, e.g. in the Middle East and Mediterranean regions. Israel, Jordan and Egypt are expected to fully consume their renewable supplies before the year 2000. Conflicts between water use in the agriculture, household and tourism sectors are causing strains in Cyprus and Malta. Eighty countries are already said to be suffering from water shortages (Brundtland Report, 1987).

* Growing urban areas are able to satisfy their water needs with increasing difficulty and cost. Many major cities have depleted their aquifers to dangerously low levels, risking contamination, saline intrusion, and subsidence (Manila, Bangkok, Mexico City, Beijing). Sources of water for urban areas are having to be brought from further and further afield, at high cost, and with serious environmental consequences.

* In small islands, especially coral atolls, water is obtained partly from underground freshwater lenses. As these are drawn down, and as the sea encroaches (e.g. due to global warming) they become saline and eventually unusable. The problem is becoming acute in the Maldives and certain South Pacific islands.

* In irrigated areas the misuse of water and the absence of proper drainage has led to salination and water-logging, affecting the fertility of large areas vital for food supplies (e.g. the Indus Valley).

* In the course of global warming, the pattern of precipitation will change, evaporation will increase, and climatic variations increase. Water shortages in certain regions will be heightened. Most developing countries, being in the warmer climatic zones, could be net losers, especially when allowance is made for the effect of rising sea levels destroying fresh-water sources.

* The release of untreated waste water, household discharges, industrial effluent and agricultural run-off are causing pollution almost everywhere. Pollution has a direct effect on supply, where the contaminated water becomes unusable for drinking or irrigation, without expensive treatment.

3.98 Catching up with this backlog will confer important benefits to health and productivity. Women particularly will benefit, since they bear the brunt of collecting water and using it for washing and cooking for their families. According to one estimate by the World Bank some African women expend 40 per cent of their daily nutritional intake travelling to collect water. The absence of proper sanitation causes a high incidence of intestinal and other diseases. To illustrate the enormity of the backlog, less than 7 per cent of India's 3,119 towns and cities have sewerage and sewage treatment facilities, and only eight have full services.

3.99 Low-cost technologies for water supply, sanitation and sewage treatment exist and are well-tried. Their wider application has, in our view, been held up by national priorities, lack of funding, and problems in recovering costs.

3.100 There is substantial wastage of water in all countries. This is particularly scandalous in societies where wasteful consumption coexists with glaring shortage. Reducing waste is in most cases a far more cost-effective way of increasing effective supply than creating new supply systems, and it helps to conserve water resources where these are being depleted.

3.101 We believe that the greatest scope for economies lies in agriculture, which accounts for around 70 per cent of total water use. The waste of water on its way to farmers is excessively high in many schemes. Less than half of the water diverted from the Indus region reaches farmers' crops; some is lost from evaporation or seepage from unlined canals, and much of the rest leaks from village watercourses. We have already listed the causes.

3.102 Water is a commodity with enormous political, social and economic overtones, and we do not underestimate the difficulties of bringing about needed reforms in this sector. However, there are useful lessons to be learned from the experiences of developed countries with advanced irrigation sectors, such as Australia and the United States. Trading water is a case in point. Here farmers and other users with entrenched entitlements can trade their water rights with other farmers or users in other sectors where the water would have greater economic value. In this way, all parties benefit and scarce water is used to its full potential.

3.103 There is also typically a high level of water losses in municipal supply systems. The World Bank's experience is that in developing countries, technical losses in the transmission and distribution of water are often in the range 25-50 per cent, even without allowing for theft and faulty metering. In a reasonably efficient system such losses should normally be less than 20 per cent of gross production[20]. This differential illustrates the considerable scope for rehabilitating water supply systems and reforming institutions in this sector.

3.104 *We cannot overstress the importance of Commonwealth members taking stock of their water resources, identifying future strains, and sharing experience in the various methods of tackling the problems. Specifically, we recommend that:*

- *all governments should develop comprehensive long-term national plans for water management and conservation (the potential impact of global warming and climate change on water availability makes this imperative). The integrated management of water resources should be a central feature of development policy, and in many countries this might be accompanied by the formation of a unified agency. At an international level, consideration should be given to new institutional means to co-ordinate assessment and action on a global basis. The establishment of an International Water Council within the United Nations system is one possibility which might be examined;*

- *all governments should undertake systematic and comprehensive inventories of existing water resources. There should be continuous monitoring of the quantity and quality of all sizeable sources of water, using standard methods (especially important for shared resources);*

- *governments should give high priority to reducing the backlog in the provision of water supply and basic sanitation, following measures recommended during the UN's International Drinking Water Supply and Sanitation Decade;*

- *to this end, Commonwealth governments should consider requesting the Commonwealth Secretariat to help member countries to develop legislation for the management of water resources and control of water pollution; introduce appropriate technologies, especially for waste management; and establish institutions to enhance the implementation of their water supply and sanitation programmes. Knowledge of technologies for rain-water harvesting, and of the use of solar power for water pumping, purification and desalination, important in many member countries, should be shared on a systematic basis;*

- *governments should make specific budgetary allocations for schemes to improve the efficiency with which water is supplied and used;*

- *changes in the level and structure of water charges, and the development of water markets, should be pursued in order to promote the highest social value for water use;*

- *all effective methods for tackling pollution should be pursued, including regulation, charges, and innovative devices for controlling pollution, where appropriate. The experience of member countries in these areas should be exchanged on a systematic basis;*

- *developers should be required to include provision for adequate sewage and waste water facilities in every project plan, whether in rural or urban areas; and*

- *industrial users of water should be required to recycle it to the maximum extent technically feasible.*

Oceans

3.105 The ocean is the ultimate sink for whatever runs off the land or is circulated through the atmosphere as a result of human and other activities. Increasing pollution threatens the health of the oceans and of those communities who depend on the sea for their livelihood.

3.106 Oceans play a critical role in influencing both weather and climate patterns and changes. For island small states the ocean has also played a critical role in determining both the type and the diversity of biota that colonise and evolve in their territories. Rapid changes in both the quality of the ocean and its physical characteristics, including temperature, volume and wave size, profoundly affect not only the sensitive biota but also the human communities of island small states and coastal areas of larger land masses. For Pacific island peoples, for example, the ocean comprises by far the greater proportion of their physical environment, the land to water ratio being 1:55.6.

3.107 The ocean environment, particularly the ocean depths, remain little explored. The wasteful exploitation and excessive utilisation of ocean resources could destroy its biodiversity with untold effects. We refer to these issues in Chapter 5 on small states.

Coastal Zone Management

3.108 Coastal zones are significant areas of economic activity in all countries which border the sea but in those where the ratio of coastlines to land area is high (as in small islands) or where their coastlines are long (as in Australia and Canada), these zones are especially important. We consider the issues of coastal zone management in Chapter 5, but we should emphasise here their importance in all coastal states. Some face special problems as a result of their vulnerability to environmental changes such as sea-level rise. This would be extremely serious for those countries, such as Bangladesh, Guyana and the Netherlands, whose coastal zones are largely at or below mean sea level.

Forests

3.109 The destruction of natural forests is running far ahead of new plantings and the growth of secondary forests on cleared areas. Tropical moist closed forest currently covers about 1.2 billion hectares, half of it in the

Amazon basin. It is being removed at an average rate of almost 14 million hectares per year. We find this of grave concern, not only in terms of local environmental degradation but for its effect on the global climate. Temperate and boreal forests have been depleted to an even greater degree, with similar effects on the global climate.

3.110 Deforestation has several causes. In temperate and boreal zones it started even before the industrial revolution two hundred or more years ago and is still continuing. In South Asia it is mainly due to fuelwood gathering and overgrazing. In continental South-East Asia trees are lost mainly because of the expansion of agriculture from heavily populated rice-growing areas, and temporary cultivation by hill tribes. In certain countries in this region commercial logging is the prime culprit, reinforced by pioneering settlement. In Africa, deforestation is primarily due to the expansion of agricultural areas, the practice of temporary cultivation in areas of plentiful land, the uncontrolled grazing of livestock, and the collection of fuelwood, especially for urban use. In the tropical parts of Latin America the activities of cultivators and clearances by land-hungry peasants have been accompanied by government-inspired programmes of highway construction, frontier settlement, cattle ranching and commercial timber concessions.

3.111 In practical terms, the loss of primary forests is almost irreversible, since trees take 50-100 years to mature, and the original balance of species is unlikely to be recaptured by the growth of secondary forest on cleared areas. The impoverishment and loss of soils and destruction of biodiversity could be permanent, as well as leading to the dispersal and extinction of indigenous communities.

Forests and the environment

3.112 Much of the recent discussion of tropical deforestation has arisen from international concern about its effect on global climate and on biodiversity. This concern was reflected in the establishment of the Tropical Forestry Action Plan (TFAP) endorsed by Commonwealth Heads of Government in the Langkawi Declaration. The TFAP is being strengthened and we suggest that similar arrangements should be made for the exploitation of temperate and boreal forests.

3.113 But we would also emphasise the importance of the sustainable management of forests for the welfare of local people and the benefits this would bring to their national governments. Caring for the forests can also serve international purposes. The accruing mutual benefits are a strong argument for enhancing the flow of resources into this sector, both through national aid programmes and through new and additional financial mechanisms. In this regard we commend the President of Guyana for his offer of an area of tropical forest in that country for a pilot project, under

Commonwealth auspices, to demonstrate methods of sustainable tropical forestry and of conserving biodiversity. We welcome the progress being made by the Government of Guyana and the Commonwealth Secretariat, in collaboration with other international organisation and donors, in implementing this project (see Box 3.5 on page 67) and urge strong international support for it.

3.114 At this point we feel that it is worth briefly recapitulating the many ways in which forests benefit the environment—climatic regulation, watershed protection, the supply of subsistence and commercial products, havens for biodiversity, etc.

3.115 Trees and forest soils hold 20 to 100 times more carbon than the crops and soils that replace them. This is released into the atmosphere when forests are burned. Deforestation not only affects the global climate; it can also result in micro climatic effects locally.

3.116 Forest cover helps to preserve the stability of slopes, inhibits soil erosion, encourages cloud formation and precipitation, regulates water flows and moderates downstream deposition and silting. Logging, even on a selective basis, can aggravate soil erosion through the construction of tracks and clearings.

3.117 Forests help to retain tropical soils and nourish them in other ways. Many of these soils are thin and barren and the trees growing in them store a high proportion of total nutrients above ground in their own biomass. Such forests are an efficient way of creating biomass from unpromising soils. Their removal to make way for crops or pasture often causes rapid soil degradation and the failure of these alternative land-use regimes.

3.118 As we noted earlier, tropical forests contain an enormous diversity of plant and animal species. Most of these species are practically unknown, yet where they have been analysed, important gains to science, medicine, and agriculture have been made. A quarter of all prescribed drugs sold in the United States are based on tropical plants. Most of the 1,300 or so medicinal plants known to Amazon Indians remain unknown to outside scientists. They constitute a potentially rich store of genetic material for pharmaceuticals and other medical products, as well as products and pest-control methods for agriculture. Two dozen major crops have already been improved with wild germplasm, mainly to make them more disease resistant.

3.119 Forests are the home to millions of people, and satisfy most of their needs. The livelihoods of many rural women depend on forest products. For those who have no regular contact with official or commercial society the loss of the forest can cut them off from their means of livelihood. Many fail to make the adjustment to a new way of life, and either die or are pauperised.

Box 3.5

The Commonwealth-Government of Guyana Programme for Sustainable Tropical Forestry

The Commonwealth Group of Experts appointed to explore the offer made by President Hoyte at the Commonwealth Heads of Government Meeting in Malaysia in 1989, proposed that the 360,000 hectares of rainforest offered, be used both for sustainable development and conservation. The Programme recommended, which is now being implemented, has the following goals :

- The maintenance of about two-fifths of the project area as a wilderness preserve. The preservation of the forest in its pristine purity would provide opportunities to study the natural processes through which biological diversity evolves in a tropical rainforest.

- The management—on the basis of ecological sustainability and environmental accounting—of the remainder of the project area to provide economic benefits in the form of forest products, mining, medicinal and industrial raw materials, and eco-tourism.

- The organisation of an International Centre for Research and Training in the sustainable management of tropical rainforests.

- The promotion of environmental literacy through formal and non-formal means, particularly on the symbiotic linkages between forests and the quality of life on earth.

The Commonwealth Secretariat and the Government of Guyana are coordinating an international collaborative effort to implement the Programme, which has the potential to yield many insights of benefit to other tropical countries.

Forest products can be important to household food security. They diversify the diet, provide minerals and nutrients, fodder for livestock and fuel for cooking, and provide seasonal balance in food supplies. In South-East Asia there are almost 30 million forest-dwellers who are vitally dependent on non-timber forest products[21]. The growth of nature-based tourism could also be an important alternative source of income in certain regions.

3.120 The value of tropical timber exports has distracted attention from the many other forest products that are collected and sold, often for export.

These products include essential oils, resins, medical substances, rattan, rubber, flowers, bamboo, tannin, gums, honey and beeswax. Their export earns a significant proportion of the foreign exchange receipts of several Asian countries.

3.121 Deforestation to accommodate population pressure and the expansion of subsistence agriculture is a deep-seated problem. But where farmers and settlers are induced to encroach on virgin forest this may indicate a failure of agricultural strategy. It points to the need for rethinking a complex of issues, including tenure, pricing, and credit, that lie behind the presence of farmers at the cultivable margins.

3.122 In semi-arid areas much deforestation is due to the use of fuelwood. In Africa, the overwhelming proportion of households use wood for cooking, and in the poorer countries household consumption of energy from fuelwood is up to ten times that from commercial sources. The collection of fuelwood over and above that of dead trees and branches will continue until its price rises relative to that of commercial substitutes, though improved heating and cooking devices will also be necessary.

3.123 Many countries grant title to land only when claimants can demonstrate that they have cleared it of trees. This is a perverse incentive, which can—and on occasions should—be changed. We would stress the positive importance of tenure in forestry management. If settlers have property rights to a forest they have some incentive to look after it. But often these rights are lost or overridden, as in the nationalisation of forests. This may be done in order to protect the trees, but its effect is often to accelerate the degradation of the forest, since management is neglected, and encroachments go unpunished. Nationalised forests all too often become open-access areas, and degradation is inevitable.

3.124 The destruction of forests for unsustainable commercial logging and ranching is largely a product of government concessions and incentives. Fiscal and credit incentives to ranchers and large-scale farmers may make clearance of large areas of forest inevitable. The terms of timber concessions are often highly advantageous to the concession holder and offer strong incentives to cut down trees. The stumpage value of a tree—the value of standing timber before any cutting, transport or processing costs are incurred—is a form of economic rent. Only rarely do forestry revenue systems appropriate anything near this rent, so heavy exploitation continues to be profitable. The structure of royalties usually encourages concessionaires to 'high-grade' their tracts, extracting only high value timber but devastating the rest to get to it. Concessions of limited duration, less than the natural regeneration cycle, deprive timber companies of any incentive to take a longer view and harvest their tracts on a sustainable basis. Ghana's royalty structure is one of the few that encourages careful and selective cutting.

3.125 Trade barriers imposed by developed countries on imports of processed tropical timber have encouraged the unsustainable investment and patterns of exploitation in timber producing countries. Tariff escalation (successively higher rates of duty on higher levels of processing) together with non-tariff measures have discouraged the development of efficient timber processing operations in the countries of origin. One result has been the artificial growth of processing industries behind tariff barriers in the developed countries themselves, entailing much waste of timber. Removal of tariff and other trade barriers on processed timber by developed countries would mean that developing countries could increase their unit price and thus reduce the area of forest logged for export and still obtain the same quantum of receipts.

3.126 Foresters are actively exploring the scope for 'sustainable yield management' of remaining forest tracts. At present Queensland, Australia, offers one of the few successful examples of this practice. A broader concept—multiple use management, or MUM—may be more appropriate where the local community has strong interests at stake. MUM would entail recognising the interests of local people, involving them in decisions affecting the forest, preserving the resource base that yields non-timber products, and helping the local collection and marketing of these items.

3.127 The most satisfactory way of ensuring the participation and involvement of local people in land-use development projects is to give legal recognition to their traditional claims to ownership of the land and its resources. The failure to recognise these rights and claims can have serious social and political repercussions. Similar considerations apply in the establishment of national parks. Here governments should take steps to recognise and take account of the needs of local people, and we are pleased to hear that these procedures are already underway in Nigeria, Papua New Guinea and Zambia, among other countries.

3.128 *Taking account of these and other factors leads us to recommend that:*

- *all governments should seek to maintain a regularly updated audit of their forest resources and attempt to estimate the minimum viable limit below which native forest cover should not be allowed to fall; reforestation and afforestation should be undertaken where necessary and consideration given to planting trees in urban areas to reduce air pollution and provide other benefits;*

- *the many sources of value—local, national and global—of tropical, temperate and boreal forests should be estimated and brought into consideration before any decisions are taken on converting such forests for other*

use. The value of services supplied by standing forests should be taken fully into account;

- *governments should review the terms of logging concessions to ensure that companies pay amounts which fully reflect the environmental costs of deforestation. At the very least these companies should pay the full stumpage value, and the structure of the fee should encourage careful and selective exploitation;*

- *import barriers by consumer countries which presently discourage adding value to tropical timber in developing countries should be abolished so that the increased revenues so derived could provide these timber producing countries with an incentive to reduce to a minimum the area of natural forest set aside for timber harvesting;*

- *the experiences of Commonwealth countries with pilot schemes for the sustainable yield management of forests (e.g. Australia, Malaysia, Ghana) should be exchanged with others, and the system for such exchanges should be strengthened through the Commonwealth Forestry Association;*

- *adequate resources should be mobilised to support the implementation of the Commonwealth-Government of Guyana Programme for Sustainable Tropical Forestry;*

- *where the conservation of timber confers important international benefits (e.g. for biodiversity and climate protection), this should be recognised in additional aid flows. It may require the establishment of new and additional financial mechanisms; and*

- *governments establishing national parks should pay due regard to the needs of local people and of their potential role as conservers of the habitat.*

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Chapter 4

Climate Change

4.1 The Commonwealth comprises countries from virtually every major climatic region. Climate change due to global warming will affect all its members, though not uniformly. Some effects, like sea-level rise, pose particularly serious dangers to island small states and countries with low-lying areas. These constitute a majority of the Commonwealth's membership. The 1989 Commonwealth Expert Group Report, "Climate Change—Meeting the Challenge", contributed to understanding the problems of climate change both from the Commonwealth's standpoint, and in a wider international context. Developments during the past two years have generally confirmed its prognosis on global warming and sea-level rise; its assessment of possible impacts of climate change; and the validity of its conclusions and recommendations for policy responses, both by the Commonwealth and by the wider international community. We have focused our attention selectively on some of the key developments and issues.

Key Developments

4.2 Although uncertainties remain, there is now a much broader international scientific consensus that the problem of global warming is real. Its seriousness and the need for precautions warrant effective international responses. The latest in a series of international assessments of climate change was completed last year by the Intergovernmental Panel on Climate Change (IPCC), to whose work a number of Commonwealth countries made important contributions.

4.3 More than 300 leading scientists from around 50 countries working for the IPCC concluded that human activities are aggravating the greenhouse effect. This will result in additional warming of the earth's surface. Should global emissions continue to increase at existing rates—in other words, 'business as usual'—there would be a doubling of carbon dioxide (CO_2) concen-

trations from pre-industrial levels by about 2025, with continuing increases thereafter. The scientists predicted that the result would be an average global warming over the next century of 0.3°C per decade, ranging from 0.2°C to 0.5°C. It means the Earth would be 2°C to 5°C warmer by the end of the next century.

4.4 This rate of warming would be greater than that seen over the past 10,000 years. It could cause sea-levels to rise by around 30cm—100cm by the year 2100. The main scientific uncertainties are reflected in this range of predictions.[1] One of the most important uncertainties concerns the rate of uptake and release of CO_2 by the oceans and by land ecosystems, including forests and grasslands. In November 1990, scientists and specialists from 120 countries, participating in the scientific and technical sessions of the Second World Climate Conference (SWCC) in Geneva, agreed that the IPCC's scientific conclusions now reflect the international consensus.

4.5 There are likely to be significant regional variations in relation both to temperature increases and to the rise in sea-levels. The IPCC acknowledged that there are many uncertainties in some aspects, particularly with regard to the timing, magnitude and regional patterns of climate change. This is due to an incomplete understanding of the sources and sinks of greenhouse gases, which affect predictions of future concentrations; of clouds, which strongly influence the magnitude of climate change; of the oceans, which influence the timing and patterns of climate change; and of polar ice sheets, which affect predictions of sea-level rise. But the IPCC was confident that these uncertainties could gradually be reduced by further research, assuming that countries fully support international efforts in this field.

4.6 Some of these uncertainties may mean a warmer world than the averages predicted by the models. Scientists at the SWCC agreed that, "Although many of the response or feedback processes are poorly understood, it appears likely that, as climate warms, these feedbacks will lead to an overall increase rather than a decrease in greenhouse gas concentrations".[2] Expanding international research in order to reduce the uncertainties should therefore command a high priority. But the SWCC took the approach—which the Commonwealth Expert Group also favoured—that the world cannot afford to wait until all uncertainties have been resolved. It must take action sooner rather than later. The scientific session of the SWCC noted that in order to stabilise CO_2 concentrations by the middle of the twenty-first century at about 50 per cent above pre-industrial concentrations, a continuous world-wide reduction of net CO_2 emissions by 1 to 2 per cent per year, starting now, would be required. A 15 to 20 per cent total reduction in methane emissions would stabilise atmospheric concentrations of that gas.

4.7 Significantly, the SWCC concluded that "technically feasible and cost-effective opportunities exist to reduce CO_2 emissions in all countries. Such

opportunities for emissions reductions are sufficient to allow many industrialised countries to stabilise CO_2 emissions from the energy sector and to reduce these emissions by at least 20 per cent by 2005".[3] These opportunities are greatest in the energy sector. This sector accounted for almost half the increase in the greenhouse effect which took place in the 1980s due to human activities, and it will account for two-thirds after the virtual elimination of CFCs. There is much scope for increasing the efficiency of energy use and for developing renewable sources of energy (see Chapter 3).

4.8 The Action Plan for the Commonwealth proposed by the Expert Group[4] stressed that it was essential to develop national strategies to slow down the increases in atmospheric concentrations of greenhouse gases and eventually to bring them to stability. Chlorofluorocarbons (CFCs), which accounted for 24 per cent of the incremental greenhouse effect due to human activities in the 1980s, are now to be phased out by the year 2000 under amendments to the Montreal Protocol agreed in June 1990; so will halons and carbon tetrachloride. Methyl chloroform is to be phased out by 2005. Developing countries will be allowed an additional 10 years to achieve these targets. Recent observations which indicate that the rate of stratospheric ozone depletion over the northern hemisphere is about twice that calculated in earlier estimates, suggest that it would be desirable to speed up the phase out of CFCs. We believe that Commonwealth developed countries should therefore consider pressing for an earlier CFC phase out date at the next meeting of the parties to the Montreal Protocol in 1992. It will also be essential to ensure that CFC substitutes now being developed (e.g. HCFCs—hydrochlorofluorocarbons, and HFCs—hydrofluorocarbons) do not exacerbate global warming. There is mounting concern that the HCFCs and HFCs currently being developed by chemical industries will do more damage to the ozone layer and the atmosphere than was thought previously.

4.9 The Ministerial Declaration of the SWCC agreed that the ultimate objective should be to stabilise other greenhouse gas concentrations at a level that would prevent dangerous human interference with the climate. As a first step, emissions of gases not controlled by the Montreal Protocol need to be stabilised. Such commitments should be equitably differentiated according to countries' responsibilities and their levels of development. The Declaration urged all developed countries to establish targets, or feasible national strategies, to stabilise and then reduce their emissions of greenhouse gases by the time of the 1992 UNCED. We note that several industrial countries have committed themselves to stabilising CO_2 emissions at or below 1990 levels by the years 2000 or 2005. Among them, some—notably Germany, Australia, New Zealand and the Netherlands—have announced that they intend to reduce emissions by the year 2005, in Germany's case by 30 per cent (see Box 4.1 on p. 76).

4.10 Commonwealth developed countries are drawing up plans to achieve

Box 4.1

Emission Reduction Targets Adopted by Industrial Countries (as at the end of 1990)

Country/ Organisation	Targets	CO_2 Emissions Total* (million tonnes C)	CO_2 Emissions Per capita** (tonnes C)
Australia	20% cut of CO_2, & N_2O and CH_4 from 1988 levels by 2005	55.4	3.5
Austria	20% cut in CO_2 from 1988 levels by 2005	<50	<1.0
Belgium	5% cut in CO_2 from 1990 levels by 2000	<50	<1.0
Canada	Hold "net" CO_2 emissions at 1990 levels by 2000	82.9	3.2
Denmark	20% cut in CO_2 from 1988 level by 2000	<50	<1.0
EC†	Hold CO_2 at 1990 levels by 2000		
EFTA†	Hold CO_2 at 1990 levels by 2000		
Finland	EFTA target	<50	<1.0
France	EC target	108.5	2.0
Germany***	30% cut in CO_2 from 1987 levels by 2005	272.8	8.3
Greece	EC target	<50	<1.0
Ireland	EC target	<50	<1.0
Iceland	EFTA target	<50	<1.0
Italy	EC target	<98.1	<1.7
Japan	Hold per capita CO_2 at 1990 level by 2000	256.4	2.1

their targets. For instance, an Australian Senate Committee has formulated a 10-year action plan to cut emissions. This will work through improved energy efficiency and the development of alternative energy technologies. The plan includes fuel-efficiency standards and incentives for transport, industrial and domestic energy-use targets, and appliance labelling and stan-

Luxemburg	Hold CO_2 at 1990 levels by 2000; 20% cut by 2005	<50	<1.0
Netherlands	Hold CO_2 at 1989/1990 levels by 1994/1995; 3–5% cut from 1989/1990 levels by 2000	34.5	2.4
New Zealand	20% cut in CO_2 from 1990 levels by 2000	<50	<1.0
Norway	Hold CO_2 at 1989 levels by 2000	<50	<1.0
Portugal	EC target	<50	<1.0
Spain	EC target	51.7	1.3
Sweden	Hold CO_2 at 1987/1988 levels by 2000	<50	<1.0
Switzerland	EFTA target	<50	<1.0
UK	Hold CO_2 at 1990 levels by 2005	154.0	2.7

Notes:

† The conclusions of the Second Ministerial Conference of EFTA and EC on the Environment, 5 November 1990, state: "Ministers and the Commissioner . . . invite all industrialized countries to take actions similar to those decided by the EC with its member states, by the EFTA countries and by certain other industrialized countries aimed at stabilizing CO_2 emissions by the year 2000 in general at the 1990 level, as expressed in the Noordwijk and Bergen Declarations."

* From W C Clark, ed., Usable Knowledge for Managing Global Climate Change, Stockholm Environment Institute, 1990, p74. These are preliminary estimates; mean annual release for 1980–1986 estimated as 5.0 Gt/year. Figures not given for emissions less than 1% of world total (50 million tonnes).

** Ibid, page 76. Mean annual release for 1980–1986.

*** Includes former German Democratic Republic (DDR).

Units: (1 metric tonne = 1.102 US ton).
The symbol < denotes 'less than'

Source: based on Atmosphere[5]

dards. There will also be tax incentives and low-interest loans to promote the development of renewable energy resources and of new energy-saving technologies.

4.11 New Zealand is also developing a strategy to reduce emissions from

the energy sector through a combination of instruments. These include carbon taxes and charges; tradeable permits; efficiency standards; and grants and subsidies. Canada is studying the feasibility of a 20 per cent cut in its CO_2 emissions by 2005. Its five-year 'Green Plan' proposes initiatives which will stabilise greenhouse gas emissions, and promote conservation and efficiency in energy use.

4.12 The British Government's recent White Paper on the Environment provides for specific measures to increase energy efficiency.[6] Among these are the promotion of combined heat and power schemes (co-generation), the use of energy-efficient lighting, and the encouragement of energy-labelling of houses and appliances. The White Paper will also stimulate the use of renewable energy resources.

4.13 These initiatives by Commonwealth and other industrial countries constitute a major step forward in developing an international response to global warming. But there is clearly a need for co-ordinated action. This is being concerted through negotiations on an international convention to protect the world's climate.

Negotiations on a Global Convention on Climate Change

4.14 In their Langkawi Declaration, Commonwealth leaders called for the early conclusion of an international convention to protect and conserve the global climate. They applauded the efforts of member governments which were helping to advance the negotiation of a framework convention under the UN's auspices. Some Commonwealth governments played pivotal roles in facilitating the decision by the UN General Assembly at its 45th session in 1990, to establish an Intergovernmental Negotiating Committee (INC), under the UN's auspices. Its mandate was to prepare "an effective framework convention on climate change, containing appropriate commitments, and any related instruments as might be agreed upon". The General Assembly considered that the INC's negotiations should be completed in time for a framework convention to be opened for signature at UNCED in June 1992.

4.15 The INC has agreed on its main tasks. It is to negotiate specific commitments to limit and reduce net emissions of CO_2 and other greenhouse gases; to protect and enhance natural sinks and reservoirs for carbon; to address the special situation of developing countries, taking into account their development needs; and to provide additional financial help to developing countries to meet the extra cost of fulfilling their commitments, and to facilitate transfers of technology to them on favourable terms. The INC will also negotiate the institutional and legal mechanisms needed to implement these commitments, as well as those in areas like scientific co-operation, monitor ing and information.

4.16 The INC's negotiations, which are now well underway, have revealed that a number of complex—and in many cases controversial—issues will need to be resolved. A fundamental one is whether specific obligations and commitments will be negotiated by mid-1992. A significant number of developed and developing countries are in favour of this. But some would prefer to defer the negotiation of specific commitments. Agreement must soon be reached upon several critical issues. They include: targets for stabilising and then reducing net emissions and a decision on whether they should address all greenhouse gases in aggregate or apply to each one individually;* the methodology for calculating and accounting for net emissions of individual countries; differentiating between the obligations of developed and developing countries; commitments on financial assistance and technology transfer to help developing countries; and whether, in view of the special role of forests in regulating the world's climate, an agreement on forests should be negotiated as part of a convention on climate change. There are differing views on this last point. Commonwealth governments could play a valuable role in facilitating the development of a consensus on these issues.

4.17 We do not propose to debate the specific pros and cons of alternative approaches to tackling them. We believe that the Commonwealth must continue to emphasise its support for early agreement on an international convention that is both effective in responding to the challenge of global warming and climate change, and equitable in distributing the burden of international response.

4.18 We reiterate the view taken by the Commonwealth Expert Group, that because developing countries need to achieve rapid and sustainable economic growth to address the immediate and immense task of reducing poverty which climate change could make more difficult, they cannot be expected to curb their economies in order to help alleviate a global problem which they have, in any event, done little to create. Their co-operation is, however, necessary. This should be encouraged by measures which increase their economic growth in ways which reduce energy consumption per unit of output. The burden of measures to reduce emissions will therefore fall overwhelmingly on the developed world, which is responsible for three-quarters of all emissions of greenhouse gases and an even larger proportion on a historically cumulative basis. To accommodate development needs, in developing countries with relatively low energy consumption, net emissions may have to increase in the short term. This will necessitate larger reductions of emissions in industrial countries. But, over time, increased restraint on emissions by developing countries—especially by those whose emissions are increasing at faster rates—will be essential for an effective and global response to climate change. Action by developing countries could be acceler-

* Recent scientific evidence suggests that the changes in the radiation balance caused by CO_2 have characteristics different from those caused by the trace greenhouse gases.[7]

ated if they are assisted with capital flows, and technology transfer to enable them to 'leap-frog' to more efficient energy-use.

4.19 A key factor influencing the degree to which this partnership can be secured will be the willingness and ability of industrial countries to take action. They need to mobilise adequate financial resources, additional to existing official development assistance, to help developing countries to finance initial capital costs and, where necessary, the incremental costs of taking action to reduce their greenhouse gas emissions and adapt to climate change; and to facilitate transfers from both developed and developing countries of the necessary technologies and "know how" which developing countries will need, particularly in the energy, industrial and agricultural sectors.

4.20 We believe that the establishment of the Interim Multilateral Fund, a modest effort to assist developing countries implement their obligations under the Montreal Protocol, is an important precedent for dealing with financial resources and technology transfer issues in relation to a convention on climate change. Further research is needed to estimate more precisely the sums involved, which would depend on the balance of policy measures and investment projects, the relative contributions of the public and private sectors, and how far this new spending displaced existing programmes, among other factors. Some of the additional resources needed could be mobilised by levying international taxes on carbon emissions. For instance it has been proposed that a levy of only $1 per barrel of oil-equivalent, or $6 per ton of coal equivalent, would generate an income of $50 billion per year which could be channelled to assist developing countries in achieving economic development while minimising their greenhouse gas emissions.[8] Norway's proposal to allocate part of the revenues raised through national carbon taxes in developed countries for a climate fund to help developing countries is another example. *We recommend that Commonwealth countries should support a tax on emissions and the need to transfer part of the resulting revenues to assist developing countries to meet the extra costs involved in adopting energy-saving methods and meet obligations that might be involved under a climate change convention.*

4.21 Financial, human resource and technical constraints are hindering effective participation by Commonwealth and other developing countries in the INC. The problems are particularly serious for small states and low income countries which are finding it difficult to ensure that their concerns receive adequate attention. The Commonwealth can help to alleviate some of these constraints. In Chapter 5 we have made a specific recommendation to promote effective participation of the Commonwealth's small member states in the INC process.

Monitoring Climate Change

4.22 A particularly important element of the Action Plan for the Commonwealth is the need for co-operation in research, evaluation and monitoring of climate change and sea-level rise and their possible impacts. Such cooperation can reduce the uncertainty about how particular Commonwealth countries, or groups of countries, will be affected by them. Firmer knowledge is vital for the proper national planning of response and adaptation. Enhanced monitoring is essential not only for national planning, but also to improve the capacity of world climate models to predict changes at regional and national levels. Forecasting is currently hampered by the lack of climatological data and observations in many regions of the world, especially in the southern hemisphere.

4.23 The Commonwealth Report on Climate Change identified specific monitoring and information needs in several member countries. Some progress has been made in meeting those needs. For instance, in respect of climatological networks and data processing, out of the 17 Commonwealth countries listed as not having WMO-CLICOM systems by the end of 1989, in one country—Guyana—there are now firm plans to install one. The Bahamas, Cyprus and St Lucia have requested systems under the World Meteorological Organisation's (WMO's) Voluntary Co-operation Programme, and Antigua and Barbuda, and St Kitts and Nevis, have access to a CLICOM system based in Barbados. The expansion of the WMO-CLICOM system would make a significant improvement to the recording and processing of climatological data around the world.

4.24 Expansion of the WMO's network of Global Atmosphere Watch Stations for ozone and greenhouse gas monitoring is also important, both in the Commonwealth context and globally.

4.25 The WMO has recently opened a Special Fund for Climate and Atmospheric Environmental Studies to provide equipment and training to secure wider participation of developing countries in these and other climate monitoring and data collection activities under the World Climate Programme. The Fund should have adequate resources to meet priority needs. *We urge all Commonwealth and other industrial countries which have not already done so, to contribute to this Fund. We also recommend that all Commonwealth countries should participate in the new Global Climate Observing System (GCOS) which has been recently created to provide observations to monitor the climate system and detect climate change.* We urge*

* The GCOS, approved by the WMO's Eleventh Congress, will be based on an improved World Weather Watch network and a Global Ocean Observing System. The existing Global Sea-Level Observing System (GLOSS) will be an important component of the GCOS which will be co-ordinated by the WMO, UNESCO's Intergovernmental Oceanographic Commission (ICO) and the International Council of Scientific Unions (ICSU).

all member Governments to use climatological information in their national development planning.

4.26 Expanding the network of sea-level data gathering stations under the Global Sea-Level Observing System (which will be a component of the new GCOS) also deserves priority. All Commonwealth island small states and countries with low-lying areas must have the capability to monitor sea-level rise. They need to plan on the basis of reasonably reliable forecasts of rising sea levels. Many of them will need technical assistance and training to develop these capacities. *We recommend that the Commonwealth Secretariat should organise training workshops on sea-level rise monitoring for small island states and other countries with the greatest needs. These workshops could be run in collaboration with the international bodies concerned, such as the Intergovernmental Oceanographic Commission.*

4.27 *Member countries which have significant expertise in monitoring climate change and sea-level rise, and in climate impact assessment, could also consider providing more assistance on a bilateral and multilateral basis.* Some important initiatives have already been taken:

- Under a South Pacific Sea-level and Climate Monitoring project, the Australian Government is helping 11 South Pacific countries to install and operate sea-level monitoring equipment and has funded a 'Climate Change Information Officer' to provide expert advice to the South Pacific Forum countries. A Climate Monitoring and Impact Assessment Study is being undertaken by the WMO with Australian funding as a separate but complementary project.

- Pursuant to Prime Minister Hawke's initiative at the Kuala Lumpur Commonwealth summit, the Australian Government has launched a climate impact assessment and management programme for Commonwealth developing countries. Through a combination of study tours and courses, research programmes and workshops, the participating countries will develop a core of indigenous expertise in various aspects of climate modelling and impact assessment.

- Other Commonwealth countries, including India and Canada, could offer technical assistance in coastal zone management and climate-related issues.

4.28 Many Commonwealth and other developing countries currently lack the capacity to make proper assessments of their national net emissions of greenhouse gases. This is not only an obvious constraint on the ability of individual countries to plan their response strategies. It also impedes the development of an internationally acceptable data base on greenhouse gas

sources and sinks. There is therefore an urgent need to mobilise financial and technical assistance to help developing countries undertake such assessments. *We recommend that cooperation be strengthened among Commonwealth governments and institutions to carry out the research needed to develop more accurate estimates of the sources of, and costs of limiting, greenhouse gas emissions and adapting to climate change in individual countries. Studies have already been initiated in many Commonwealth countries.*

4.29 Further work in these areas is currently being conducted by the IPCC. It includes studies of different scenarios for greenhouse gas emissions, predictions of climate change at regional and national levels, and associated impact studies; energy and forestry-related issues; and sea-level rise and coastal zone management. In their Langkawi Declaration, Commonwealth governments agreed to support the work of the IPCC. This support should continue.

Impacts of Climate Change and Planning of Adaptation Strategies

4.30 Further research, and improved data collection and monitoring, will reduce uncertainties about the possible impacts of climate change. This will be particularly true at regional and national levels. But both the Commonwealth Report and the IPCC's First Assessment Report have given insights into the possible impacts at different levels, on agriculture and forestry, on natural terrestrial ecosystems, on water resources, on human settlements and infrastructure, and on ocean and coastal zones. Both reports also underscore the need to begin planning adaptation strategies. Some of these are in any case needed for other reasons. In many cases, the impacts of climate change are expected to be felt most severely in regions already under stress. These are mainly the developing countries, which are more dependent on agriculture and natural resources and have less capacity to adjust.

4.31 Because of the nature of the Commonwealth's membership, the possible impacts of climate change on small island and low-lying states have been of particular concern to us. As the Commonwealth Report pointed out, sea-level rise could have far-reaching social and economic effects on low-lying coastal areas, as in Guyana, Bangladesh, Maldives, Kiribati, Tuvalu and other countries, which would also be subject to flooding from storm surges (see Box 4.2 on p. 84). Fragile ecosystems like mangroves, coral reefs and marshes, which now protect coastal areas, would be threatened. A one metre rise in sea-level would flood 15 per cent of Bangladesh, directly affecting ten million people. Small island atolls which rarely exceed 2 to 3 metres in height face greater risk of inundation, erosion of barrier reefs and defences, and intrusion of saltwater in freshwater reserves. Low-lying coastal areas such as those of Guyana—where 90 per cent of the country's population live—are already at or below mean sea-level. They could face both flooding

Box 4.2

Atolls Fear Ocean's Grim New Face

Polynesians on the three atolls of the central Pacific territory of Tokelau noticed that the sea that they had known intimately for hundreds of years had begun to behave 'strangely'. Instead of gentle swells, the waves had become short and aggressive "as if they were taking bites out of the land", said a woman on Nukunono atoll, only 2.9 square miles in area. That night a cyclone struck and the waves covered virtually the entire atoll, only a few feet above sea level at its highest elevation. Huts of the several hundred inhabitants, the coconut palms, the breadfruit trees and the taro patches were washed away. "We went to the highest part of the island, which was the church, and crushed inside," said the island's schoolteacher. "We placed our children on our shoulders and some tried to pray. The water reached our chests, washing through the church, and we wondered if this was the end. But as day broke the waves began to recede—by then our homes had been wrecked."

Since that disaster in 1987, the islands were hit by another storm, Cyclone Ofa, in January 1990. According to Falani Aukuso, former director of education in Tokelau, although the natural catastrophes could not be directly attributed to global warming, the Tokelauans were concerned about the possible rising of sea levels. To the subsistence economies of the Pacific islands, he said, there are problems enough without facing a new fear. "People on the Tokelau atolls are frightened", he said. "They are afraid Tokelau will be one of the first island groups in the Pacific to disappear. Because of the general abuse of the ocean through pollution and use of pesticides, the older people are seeing seasonally irregular fish patterns and the unexplained dying of the coral," he said.

At the 22nd annual meeting of the 15-nation South Pacific Forum in July 1991, delegates described global warming and the rising sea level as "the most serious environmental threats to the Pacific region". Their Communiqué noted that: "The cultural, economic and physical survival of Pacific nations is at great risk." The Communiqué emphasised the urgency of securing international action to control the adverse effects of climate change by 'immediate' reductions in emissions of greenhouse gases like carbon dioxide. It noted the primary responsibility of industrial countries for reducing them.

Source: Based on Pringle[9]

and disruption of traditional drainage systems. In these low-lying countries, climate change and sea-level rise have serious implications not only for agriculture, but also for freshwater supplies and human settlements. Factories, power plants and airports, the disposal of hazardous wastes and tourism would all be affected. We take up these and other issues in Chapter 5.

Protection against sea-level rise

4.32 For these (and other) Commonwealth countries, we believe that the planning of adaptation strategies is particularly necessary in coastal zone management (see Chapter 5). Advance planning would help to avoid or mitigate adverse impacts which might occur in future. Even if the world did succeed in stabilising greenhouse gas concentrations by the year 2030, sea levels are predicted to continue to rise throughout the next century. The range of options in adjusting to rising sea-levels will need to be carefully assessed. Major new sea defences are likely to be very expensive and, in any event, impractical on small coral islands and in shifting deltas.

4.33 A study done by the IPCC estimated that the overall cost of protecting 360,000 km of coastline, worldwide, against a one metre rise in sea-level would be in excess of US$500 billion. Annual costs as a percentage of GNP for small islands, and small island groups, could be as high as 34 per cent of annual GNP.* Case studies prepared for the Commonwealth Expert Group on Climate Change suggested a variety of ways in which low-lying islands could adapt with external help. They would need a diversification of food supplies, improved water collection, re-design of dwellings, protection of their natural defences, and more effective preparation for disasters.

4.34 The IPCC has recommended an initial five-year international programme to help developing countries implement coastal zone management plans by the year 2000. We urge the international community to launch such a programme expeditiously. *We recommend that all the Commonwealth countries concerned should develop comprehensive coastal zone management plans, taking account of projections of sea-level rise and storm surges.* These should ensure that risks to populations are minimised and important coastal ecosystems are protected and maintained. They should also ensure that coastal development does not increase vulnerability to sea-level rise. Many Commonwealth developing countries will need external financial and technical assistance to develop these plans. *We recommend that the Commonwealth Science Council should strengthen its coastal zone management programmes.*

* The estimated total cost is not discounted and does not reflect present coastal defence needs or impacts of saltwater intrusion or flooding of unprotected lands.[10]

Strengthening disaster preparedness and response

4.35 The danger that global warming may increase the intensity and frequency of tropical storms, which only develop at present over seas that are warmer than about 26°C, also warrants the strengthening of precautions in low-lying countries. Although climate models still give no consistent indication about the impact of climate change on the intensity of tropical storms, recent events like the tropical cyclones which caused such devastation in Bangladesh in May 1991, have underscored the need for proper planning, regardless of uncertainties. The frequency of floods in some areas and of drought in others, related to climate change, also emphasise the need to improve preparedness for all types of disasters. This requires action in three areas: improving early-warning systems; reducing vulnerability to climate-related disasters through careful planning of human settlements and economic and other infrastructure in coastal areas; and improving national and international responses to provide immediate relief to affected populations when disasters strike, and strengthening the capacity of countries to cope with the longer-term consequences—especially economic—of such disasters. In some developing countries, the longer lasting economic effects of a single major disaster can set back economic progress by many years.

4.36 *We recommend that within the framework of the UN International Decade for Natural Disaster Reduction (IDNDR), all Commonwealth countries, by the year 2000, should have in place:*

- *national assessments of risk due to climate-related and other natural disasters;*

- *national and/or local plans for reducing vulnerability to disasters and mitigating their impact when they occur; and*

- *access to global, regional, national and local warning systems.*

4.37 *We also recommend that all Commonwealth countries which have not done so, should establish national committees to assist co-ordination and implementation of activities during the IDNDR. The Commonwealth Science Council's programme of workshops on disaster preparedness and mitigation, focusing on training and information-sharing should be strengthened in co-ordination with training programmes initiated during the IDNDR.*

Adaptation in resource use and management

4.38 It will be prudent for all countries to consider adaptation options which address the potential impacts of climate change on food security, water availability, natural and managed ecosystems, land, and biodiversity. The possible impacts of climate change on agriculture are a matter of particu-

lar concern. The majority of Commonwealth economies depend on the agricultural sector. This is particularly so for developing countries in semi-arid tropical areas and in regions where agriculture on marginal lands relies on rainfall levels and distribution.

4.39 Important uncertainties remain regarding predictions of the magnitude and nature of potential impacts of changing climate and higher CO_2 levels on food security, both globally and in specific regions. The two broad sets of regions which appear to be most vulnerable to climate variability and change are some semi-arid, tropical and subtropical regions, which include Commonwealth countries such as Botswana, Tanzania, India and Pakistan, and some humid tropical and equatorial regions. In addition, certain regions (e.g. central Canada and eastern Australia) that are currently net exporters of cereals could find their output reduced as a result of climate changes. Any decrease in production in these regions could have a marked effect on future global food prices and patterns of agricultural trade.[11]

4.40 The capacity of agriculture to adjust to climate change will vary considerably between different regions, countries and sectors. In regions where climate is already highly variable, farmers may be able to adjust more quickly than where it is more stable. But in developing countries, and especially in some marginal types of agriculture, such experience in adaptation may be much smaller. The availability of new varieties of crops is an important long-term factor which will affect the ability of farmers to adjust their cropping patterns. In Chapter 3 we discussed this in more detail in the context of biodiversity (see paras 3.80-3.84).

4.41 We need to know more about the potential impacts of climate change on agriculture and food security at regional and national levels. *We agree with the recommendation by the Commonwealth Expert Group on Climate Change, that priority should be given by national, regional and global agricultural research programmes to enlarging long-term options for adjustment to climate change.* We need to gather and conserve our knowledge of plants, animals and agricultural practices that have been valuable under conditions of uncertainty and climatic variability.

4.42 *Research should be focused in particular on crop varieties which could derive maximum benefit from higher CO_2 concentrations in the atmosphere. Furthermore, governments should incorporate a greater awareness of the implications of climate change in agricultural extension, training and credit schemes. Studies should be undertaken on how farmers can be helped to cope with climatic variability through farm management techniques that incorporate efficient use of water and soil, and which encourage crop diversification. Finally, in countries which are already at risk due to drought, the strengthening of early warning systems and food security systems, should command a high priority.*

4.43 We believe that institutions like the Commonwealth Agricultural Bureaux International (CABI) can serve as useful focal points to promote these activities in a Commonwealth context.

Impacts on health

4.44 The possible impacts of climate change on human health are also of concern. Global warming could spread airborne and water-borne communicable diseases. It could cause faster reproduction and survival of pathogenic bacteria, viruses, parasites and their vectors, in a wider geographical zone. Global warming may result in a poleward spread of diseases such as hookworm infections and river blindness. It could increase the occurrence of diseases like yellow fever and malaria at higher elevations in the tropics, and cause the emergence of new strains. For example, the warming of the Madagascar Highlands by an average 0.8°C may be one explanation for the emergence of a new type of malaria which has caused the deaths of thousands of people.

4.45 Many diseases are a side effect of malnutrition and dehydration. These could be aggravated by adverse impacts of climate change on water supply and agriculture, especially in developing countries where poverty and disease are already associated with adverse environmental conditions. Droughts, floods or other extreme events would make these problems worse. An increase in heat-related deaths and illnesses would also ensue if global warming were to lead to a greater number of heatwaves. Finally, global warming and atmospheric ozone depletion are likely to worsen air pollution, especially in populous and polluted urban areas. Changes in photochemical reaction rates amongst chemical pollutants in the atmosphere may increase oxidant levels, to the detriment of human health.[12]

4.46 *In view of these dangers related to the impact of climate change on health, we recommend greater research and the advance planning of suitable adaptation and response strategies.* Research should focus on the adaptability of vulnerable human populations, especially their more susceptible members, to the incidence of increased heat stress, and on the potential for vector-borne and viral diseases to spread geographically. In the most vulnerable countries and regions, national health planning should develop the capacity to respond to such contingencies, especially to the outbreak of new diseases.

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Chapter 5

Small States: Environment and Development

5.1 Small states, especially the islands among them, have certain characteristics which make them particularly susceptible to some kinds of environmental problems. These characteristics include biological features such as rare ecosystems containing valuable genetic resources; topographical features such as steep slopes in close proximity to the sea in volcanic islands, and a flat terrain devoid of watersheds in atoll islands; small variability in climate and soil, encouraging specialisation of agricultural production; fragility of small ecosystems to pests, diseases and certain human activities; proneness in some cases to natural hazards such as earthquakes, floods, droughts and hurricanes; limited technical, financial and administrative capacity to cope with consequences of climate changes; and the closeness of local society.

5.2 The severity of the problems which arise from these characteristics can be better understood by considering small states as a microcosm of the planet Earth. In island small states the extensive interface between land and sea increases the fragility of coastal ecosystems and the demands of coastal management. This is compounded by bio-physical proximity of terrestrial and marine systems, resulting in conflicting developmental pressures. Sea-level rise, storm surges and hurricanes exacerbated by global warming are particular threats to island small states. Limited land area also results in some cases in high pressures of population on resources and on the environment. Resource shortages can encourage deforestation and soil degradation, and both, together with sea water intrusion, can impair what for some small countries is already limited availability of fresh water. For island small states, other problems can arise from the marine environment. Oil spills and other marine pollution destroy coral reefs and mangroves, both of which are neces-

sary for coastal protection. Sewage and other waste disposal can also pose special difficulties. Then there is the large reliance on fisheries and other resources within Exclusive Economic Zones (EEZs), which for small countries are still inadequately managed and protected. Most of these issues are relevant to small islands of large countries as well.

5.3 Consideration of small states as a microcosm also indicates the unique opportunities they provide for research in environmental protection and conservation. For instance, many of these countries provide unique locations for stations to observe and monitor signs of global warming and climate change. They also provide opportunities for rejuvenation of the global heritage in areas such as natural gene banks. However, these countries do not have the technical capacity and financial resources to undertake these tasks. Since by undertaking these activities small states would be serving the whole of humanity, financing them should be recognised as a global responsibility. The current negotiations under UNCED provide an opportunity to make it obligatory for the major industrial countries to provide additional financial resources for these purposes.

5.4 Many of these issues are dealt with in other chapters. Here we concentrate on those which are particularly important for small states. But before doing so, we should also acknowledge that small states, although ecologically linked, are often geographically isolated. There is an acute need for support and exchange of experience with others in a similar predicament. Their individual and collective voices need amplification in order to be heard on the world stage.

5.5 There is a typical set of issues that affects small states with particular severity. It includes: the threatened rise in sea level due to climate change; the greater demands on coastal zone management; the fragility of water resources and the risk of their contamination; risks from the movement of hazardous waste; problems of managing the impact of tourism; supervising the use of EEZs; controlling waste management; and dealing with the population pressures which often arise from limited land space. Attention is also needed to remedying the weaknesses of these states in the international system, and especially to ways in which they can be assisted to get their interests better articulated and represented in international forums.

5.6 These problems are exacerbated by certain of the socio-cultural characteristics of many small states. Decisions relating to recruitment and promotion are not based mainly on efficiency criteria due to the closeness of local society in these countries. This also affects political processes.

5.7 In Chapter 4, we discussed the scientific evidence on global warming and its major consequences, together with the kinds of remedial action that

are required at this stage. Here we examine those aspects and actions which have special relevance to small states.

Major Economic Activities

Agriculture

5.8 Agriculture and tourism, two important areas of economic activity in small states, are especially vulnerable to the environment. In the case of agriculture, climate change could have serious consequences beyond land degradation and salination problems, because of the tendency towards specialisation in a few crops.

5.9 This tendency is encouraged not only by the difficulty small states have in meeting the scale requirements of large export markets but also because these states have little variability in climate and soils. Changes of climate can have particularly severe impacts on the one or two commercial crops that are grown, and if the countries concerned have difficulty in adapting, then their products would become increasingly uneconomic. However, if the change in climate is gradual, it would allow time to adjust, either through the development of more adaptable varieties or through a switch to other crops. But even successful adjustments have costs, and these could be economically debilitating for small states. Where climate change causes an increasing incidence of hurricanes, vulnerable countries such as those in the Caribbean Sea and in the Indian and Pacific oceans would face increased burdens from wind damage. These burdens are already severe, since for small states, damage to agriculture can be extensive and even cover the whole country.

Tourism

5.10 In the case of tourism, the threat arises mainly because of the large impact of sea-level rise and storm surges on beaches and coastal areas, on which the sector greatly depends. Where climate becomes less pleasant, there can also be adverse effects. Tourism also impacts on the environment. Some of these impacts are favourable and provide revenue to improve the landscape and other aspects of the environment, but others have costs caused by aggravated problems such as waste management and marine pollution.

5.11 Maximising the benefits from tourism often requires the careful management of coastal zones (see Box 5.1 opposite). The coasts of islands and small coastal states are subject to pollution from oil leaks and spills and from various discharges of contaminants from tankers. They are also polluted by the careless disposal of domestic and industrial wastes. Apart from erosion, the unregulated mining of beach sand for construction purposes has contributed to the loss of beaches, as in the Maldives. In Barbados, it has been reported that beaches on the island's west coast are disappearing at the

Box 5.1

Mauritius: Protection of the Marine Environment

Mauritius has a booming tourist sector. But this could change if the lagoon, reef and estuarine ecosystems which are under constant threat of pollution from agriculture, domestic waste and indiscriminate fishing practices, suffer irreversible damage. The economic consequences of such an eventuality can be immense for an island economy which is heavily dependent on tourism for foreign exchange.

Concerned about these issues since the early 1980s, the Government of Mauritius has undertaken several initiatives to minimise the effects of environmental damage and to manage marine resources in a sustainable manner. The main aim of these initiatives is to monitor and collect information about changes in the marine environment in order to facilitate the development of policy measures necessary to resolve major pollution problems.

The initiatives include a study on the impact of sand quarrying and removal on the lagoonal ecosystem which has been used as the basis for Government regulations on sand extraction from the ocean bed; training for local scientific and technical staff in diving techniques and in collecting samples for laboratory testing to check pollution levels; a study on the effects of pollution on the geology and on the ecology of coral reefs; and a three-year project currently underway for developing a data base to monitor variations in the marine environment.

These initiatives have helped the Government in developing an Environmental Action Programme as well as comprehensive environmental legislation as part of a concerted approach to environmental management.

Source: Bheenick[1].

rate of 1.5 metres every ten years[2]. This is largely a result of the pollution of inshore waters and the loss of reefs through the growth of algae. In the absence of reefs, beach sand is eroded, and vegetation barriers are depleted. The problem is caused partly by the presence of hotels, houses and infrastructure too close to the shoreline, and partly by the release of untreated sewage and effluent. Barbados is preparing a comprehensive national programme of coastal zone management which recognises the interaction of natural and man-made events and contains measures for pollution control, amongst other elements.

5.12 Environmental change and social disadvantage can go hand in hand under the inducement of tourism. For instance, in the Pacific, fishing at sea is the role of men, fishing from the beach is the role of women. As the beaches are taken over by tourists, women are displaced, and may be pressured into socially undesirable occupations.

Fisheries

5.13 Coastal zones represent an important part of the world in which environmental degradation is taking place. Fisheries are being depleted, marine pollution is increasing and so is the destruction of coral reefs, mangroves and marshes. Coastal waters and the continental shelf are vital sources of food, yielding more than 90 per cent of the world's fishing catch. Chemical pollution and pathogens from sewage are posing health risks to bathers and consumers of sea-food. In some countries many stocks of shell-fish are being declared unfit for human consumption.

5.14 Fisheries are a crucial resource to be reckoned in global food supplies, as well as a large source of income and jobs. Fishing is an important economic activity in most island states. There is still much dependence on artisanal fisheries which account for about half the world's fish catch. Both deep-sea and offshore resources need careful management if they are not to be depleted—the risks of over-fishing are evident everywhere.

5.15 Fish are also a vital source of protein to many growing coastal populations. Fisheries—both deep-sea and within the EEZ—require good management to prevent over-exploitation. International control is still inadequate in relation to deep-sea fishing and the use of drift nets and other wasteful methods. Traditional agriculture is unable to provide full-time work to all workers, and fishing is a good complement, especially for island and coastal states. Many marginal communities are forced by poverty to continue fishing even when this jeopardises future catches.

5.16 Sometimes there is competition between locally-based artisanal fishing communities and long-range fleets of vessels using industrial methods. Both outside encroachment and excessive numbers of local fishery workers arise in the absence, or breakdown, of adequate management to control access to a fishery. Fish stocks can also be reduced by destructive fishing techniques and marine pollution.Perversely, many aid projects aimed at improving the fishing industry have been inappropriate, and have had the effect of reducing the returns from fishing, an activity which exploits a finite local resource. Women's role in fisheries needs to be recognised and protected.

5.17 It is clearly in the interest of the local population that inshore fisheries be managed sustainably. We are aware of various management options. One of the more promising policy interventions would be the creation of local property rights over fisheries. Exclusive user rights could be vested in local communities, who would have the incentive to conserve and manage their fisheries and protect them against outside encroachment or internal violation. There are also examples of local people having exclusive use of the managed reef fisheries[3]. There has been widespread interest in New Zealand's use of fishing catch quotas, sold for an annual fee. Part of the proceeds are used to buy back quotas from fishermen, thus reducing the total fishing effort.

5.18 Open sea fishing is another vital source of income and food to many island small states. The creation of 200-mile EEZs amounts to forming property rights within countries' waters, which they can either exploit or lease. A number of South Pacific states have accorded fishing rights in their waters to foreign fleets. Ideally, quotas should be fixed within sustainable yields, though in this sector this is a very elusive concept. These arrangements need to be well policed—also no easy matter where the EEZ extends across thousands of square miles of open sea. Climate change and variations in sea temperatures induced under certain circumstances can result in movements of species upon which the local population has become highly dependent for food.

5.19 While local development and enforcement of fisheries management regulations should receive high priority, the methods for supervising and enforcing these regulations are almost entirely lacking. In view of increased poaching, reliance must be put on the international supervision and enforcement of ocean management. For this purpose, an international framework could be developed, similar to the provisions of the International Whaling Commission, to ensure that the usage of high seas is sustainable.

5.20 International cooperation has a role to play in developing specific, environmentally-sound opportunities for using marine resources. *We recommend:*

- *the exchange of experience between member states, drawing on relevant sources of international expertise about the various options of managing inshore waters and artisanal fisheries, e.g. saleable quotas, the creation of local property rights, the formation of users' clubs; and*

- *aid to the fisheries sector which takes account of the need to avoid aggravating the depletion of fisheries.*

5.21 *We also recommend that small states pay particular attention to:*

- *realising the potential of seaweed and other marine algae for food, fuel, animal feed, fertilizers and mulch;*

- *promoting artisanal fisheries, in view of the contribution they can make locally to improvements in nutrition, and internationally to conservation; and*

- *preparing sea-use maps comparable to land-use maps. These should present data on a number of aspects including coastal erosion sites, pollution-prone environments and sea-area zoning.*

Major Eco-development Issues

Climate change and its implications

5.22 Chapter 4 indicated the extent to which some Commonwealth small states are vulnerable to sea-level rise. Because of the large impact flowing not only from this phenomenon but also from storm surges and the possible increasing incidence of hurricanes, we detail below the main consequences for small states:

- loss of land area—which is already in short supply—due to sea encroachment and coastal erosion, leading to reduced shore length and changed shorelines;

- encroachment of the sea into beaches and coastal areas on which tourism greatly depends and on which there is already much tourist-related infrastructure;

- decreased groundwater capacity resulting from reduced land area and salt water intrusion from rising seas;

- increased exposure of freshwater and agriculture to salination;

- reduced food production due to less land area and increased salination, thus increasing dependence on food imports and aggravating food insecurity, exacerbated by population pressure;

- greater incidence of flooding from sea-level rise and storm surges;

- increasing need for human resettlement and precautionary planning of land settlement schemes; and

- increased demand for emigration to continental countries and the growth of 'ecological' refugees[4].

5.23 For some of these refugees, the cost of settling into an entirely new environment and a new culture could add dearly to the psychological and social strains expected of a displaced community. The host countries are likely to have insufficient support services to accommodate new arrivals. Competition for scarce resources and facilities will intensify. The problems must be addressed sooner rather than later if the ecological refugees created by climate change are to be assured of food and shelter from their future host country or community. The climate change convention now under negotiation offers an excellent opportunity to begin to put in place provision of humanitarian assistance to ecological refugees.

5.24 In Chapter 4 we also stressed the importance of research, evaluation and monitoring of climate change and sea-level rise in individual countries. Some progress is being made in this and some international support has been forthcoming. However, because of the possible larger impact of climate change and sea-level rise on small states, especially island ones, their needs are frequently more urgent than those of other countries.

5.25 Besides technical support that the Commonwealth might give in general meteorological work, it might be useful for the Commonwealth Secretariat to assist in informing small member states about the assistance that might be available from relevant donor agencies. The Secretariat might also assist these states and other members which might need this kind of assistance by arranging training workshops on issues connected with monitoring sea-level rise and climate change.

5.26 Beyond research, evaluation and monitoring, some adjustment and other anticipatory action must also begin in physical planning and economic policy, especially where it is needed for other reasons or can serve other purposes. Here, again, because of the large possible impact of climate change on small states, these aspects require significant attention.

5.27 There are some areas in which adjustment and other anticipatory action can begin in small states, although the remaining uncertainty and other pressing problems must also be taken into account. The reality is that where action is required because of longer-term damage, low-income countries will have to be assisted, since many of them are faced with more immediate and severe problems.

5.28 The construction of sea-defences will be a necessary adjustment to sea-level rise. When urban land is intensively occupied for industrial or commercial purposes and land lease values reflect this use, the construction of sea defences with some associated land reclamation may be cost-effective. According to certain estimates, costs of sea defence construction in Tonga amounted to US$6 million in 1988, while the potential losses from inundation in three areas of the capital city alone were estimated at about US$20

million[5]; in Dominica the cost of building a new sea wall to protect the downtown area of the capital has been put at £4-5 million, which represents a large share of the public investment budget. Such schemes will become increasingly needed if scientific predictions on sea-level movements are borne out. The expense they usually involve, however, means that there is need for more research into low-cost options. Sea defences typify the engineering approach to hazards, but socio-economic adjustments should permeate all aspects of national life.

5.29 For most small states, rising sea levels will not create new conditions but worsen those which are already affecting the environment. Flooding, coastal erosion, and tropical cyclones are not new phenomena, though their incidence is likely to increase and larger numbers of people are likely to be affected. Hazard management must be made an integral part of administration in all sectors of government, not the exclusive domain of a separate department, and thereby absolving the others of their crucial responsibilities. Mechanisms for early warning, disaster management, access to resources, and improved regional and international cooperation require greater attention. The International Decade for Natural Disaster Reduction (1990 to 1999) provides an international framework for this[6].

5.30 Some adjustments have already been made by certain countries for reasons unrelated to sea-level rise. In Tuvalu, salination of agricultural land has been damaging the taro crops. In response, sweet potatoes have been introduced which can be grown hydroponically in coral sand at ground level, thus making them less vulnerable to salt water. Because of frequent flooding, regulations have been introduced requiring the floors of new houses to be raised above ground level—a return to the traditional style—which is an eminently suitable response to increased flood risk.

5.31 In addition to adjustments in the agricultural and housing sectors, other measures likely to be necessary include:

- improved rainwater conservation and management;
- health and environmental health programmes;
- stabilisation of the natural hurricane banks and measures for preventing coastal erosion, including the conservation of natural protective features such as mangroves and reefs; and
- special consideration for people already disadvantaged, such as those in poverty and female heads of households.

5.32 These measures would not only give protection against the initial impact of hazards but also reduce social and economic vulnerability to their effects. Maintaining housing and other buildings also helps environmental

health management. Locally maintained water and food supplies are crucial for self-reliant survival. Global warming reinforces the argument that hazards are a natural component of the environment and are better included as a part of, not separated from, environmental management. The extent and severity of natural disasters could be reduced and contained by the wide-ranging adjustments which are possible.

Coastal zone management

5.33 Although we are considering this issue in a chapter on small states, it has considerable relevance to other countries as well. The symptomatic issues of environmental degradation occur in these states' coastal zones. These issues include threats to coastal water quality and coral reefs from sewage, petroleum and industrial discharges, beach erosion, destruction of mangrove swamps either by pollution, garbage dumps or deliberate clearance, unplanned and uncontrolled hotel constructions on beach front property, construction of marinas and deep water harbours, and increasing visits by cruise boats which leave behind debris and sewage. At the same time, in island small states the coastal zone supports the bulk of the community. It provides the air and sea ports, and major transportation routes by road. But it is also the receptacle of the consequences of land-based activities such as agriculture or industry, resulting in run-off containing eroded soil and pesticide and fertiliser residues, as well as of industrial and domestic wastes. Indeed, in small states which are either islands or have low lying coasts the entire country is effectively a coastal zone.

5.34 Many island small states do not yet have the technical capacity to deal with the complex relationships involved in coastal zone management. The United Nations Convention on the Law of the Sea (UNCLOS) provides a comprehensive enforceable framework for conservation and sustainable use of the seas; but while some nations are applying the treaty already, it has not been ratified by a sufficient number to make it globally effective. All countries should ratify UNCLOS as early as possible. Regional cooperation would help small states to improve coastal zone management and marine protection.

5.35 Because of the importance of coastal zones, both from a narrow economic standpoint and in relation to preserving biodiversity, there is need to develop a world-wide network of protected coastal and marine areas similar to protected terrestrial areas. These are necessary in order to protect coastal and marine ecosystems. The protected areas would serve to replenish marine resources, and should aim to maintain genetic diversity of key species. A global plan for such protected areas should be agreed at UNCED.

Exclusive economic zones (EEZs)

5.36 Under UNCLOS, most small states, particularly small islands, have

acquired exclusive economic rights to vast areas of ocean. However, these countries lack the financial and human capabilities for sustainable exploitation of resources in the EEZs. Many of them are also unable to provide adequate protection against illegal intruders into their EEZs. While international conventions are increasingly bringing in controls to deal with problems such as oil spillage, developing countries which are less well placed to police and take preventative action in relation to violations, remain exposed. Stricter enforcement is required. Regional cooperation would help these countries to improve the management of EEZs. It would also help them through joint programmes of surveillance and development of EEZs. Such cooperation could also include training programmes to train trainers required in terms of enforcing the surveillance and other concerned programmes. The recent Caribbean Oceanographic Research Expedition (CORE) project sponsored by the Commonwealth Science Council is an example of initiatives which should be encouraged and supported.

5.37 *We recommend that small states should:*

- *pool their experience and resources concerning management, research and development, monitoring and policing their EEZs, and all aspects of negotiations with owners of foreign fishing fleets, on a regional basis where this is possible; and*

- *cooperate more closely, among themselves and with others, in developing the satellite surveillance systems that could provide essential information to the countries most concerned.*

Freshwater resources

5.38 The pollution of water resources is a major environmental problem in most islands, which usually have few or no permanent streams or lakes. The lenses of freshwater are often small and easily depleted and contaminated. Wells and bores are readily invaded by saltwater and become unusable for most purposes. Where surface drainage exists, deforestation causes the loss of 'permanent' streams. Groundwater and streams are easily polluted by human activities such as mining, agriculture and manufacturing (e.g. tailings, agro-chemicals, industrial effluents). Human, animal and household wastes are other major environmental contaminants in most islands. Because of the porous soils, the leaching of wastes into the groundwater lens has occurred in some atolls. The indiscriminate disposal of household wastes has led to the pollution of the environment and created more breeding areas for flies and insects. Waste disposal into lagoons damages sea life. Stringent regulations and their effective enforcement are not adequate to solve this problem. To resolve it, appropriate technology to treat the waste needs to be transferred on concessional terms from developed to developing countries.

5.39 As islands develop, tourism and manufacturing compete with agricultural and domestic requirements for water. Tourists use more water than local people do, sometimes up to five times as much, adding to pressure on potable water supplies. Desalination has its attractions as a means of meeting the water needs of low islands in the Pacific and the Indian Oceans; but it involves high capital costs, high energy requirements, and complex technology. Maldives is using excess heat capacity generated by power plants in desalination plants. However, we feel that more attention should be given to building less expensive water-storage tanks, increasing the number of man-made catchment areas, developing additional sources of groundwater, and encouraging the use of simple technologies operated by solar energy. Water recycling can be considered in certain instances. In the Caribbean countries, pricing policies can be considered to prevent wastage. The maintenance of the quantity and quality of water supplies depends as much on watershed protection and management as on the maintenance of water-supply collection and distribution systems.

Hazardous waste

5.40 The international movement of hazardous wastes for disposal is a matter of particular concern to small states, whose ecosystems can become irreversibly and extensively damaged by careless dumping. As the industrial countries that generate the waste apply stricter environmental controls, the costs of disposing of toxic substances are spiralling, and sites in developing countries become tempting outlets. There are instances of large cash offers being made to Caribbean and South Pacific islands to receive toxic and hazardous waste, including municipal sludge. There are also cases of illegal dumping of such wastes. Waste disposal at sea is especially dangerous for islands, which are necessarily more vulnerable than other states to marine pollution.

5.41 We endorse the general principle that as little hazardous waste as possible should be moved from country to country, in order to minimize the risk of accident and the possibility of illegal dumping. Waste should be disposed of—or rendered harmless—as close as possible to its place of generation. Detoxification should be carried out in a manner causing least harm to the local environment. Adherence of more countries to more stringent enforcement of the Basel Convention, which regulates the international movement of hazardous and toxic wastes, is needed. The OAU has banned this trade among member countries.

5.42 A major problem is the handling of nationally generated waste products in small quantities. A way of overcoming this problem is providing small states with access to cleaner and more appropriate technologies to cope with a complex problem. In the long term, industrial processes and products

should evolve technically and economically towards the minimum generation of harmful by-products and residues.

5.43 For the present, there will have to be some exceptions to these statements of principle—e.g. technologically advanced countries which have the specialised facilities for safely and profitably disposing of hazardous waste, and small countries where current methods of disposal are difficult to avoid because it is uneconomic to install specialised treatment units for a small throughput of material.

Ecosystems and biodiversity

5.44 Many small islands provide sanctuaries for life forms which, except for the isolation provided by their special environments, might have perished through destruction by pests, diseases and human agency. Rare and fragile ecosystems containing valuable genetic resources are in particular evidence on the coasts of islands. They are subject to a variety of hazards. Development leads to the unplanned use of coastal zones and the growth of offshore activities, with an adverse impact on the environment. Damage to one ecosystem could have an adverse impact on others; the removal of forest cover could lead to the destructive siltation of ecosystems in coastal and estuarine areas. Protecting such ecosystems will require resources and forfeit immediate revenue, and hence is likely to be given low priority in countries in the throes of development. The preservation of sanctuaries in the form of protected areas (see para 5.35) for the unexplored genetic resources of humankind will require special international assistance.

Enhancing Education, Training and Information

5.45 Because traditional societies operated within the constraints posed by nature and because the social system evolved in association with traditional resource use, conservation practices were developed in many small states. These practices still exist to some extent. Their adoption can play an important role in the sustainable use of island resources. Custom can provide the basis for environmental education and development of an environmental ethic, and modern resource uses can profitably draw principles or guidelines from traditional practices.

5.46 The pressures for modernisation have led to the neglect of traditional methods of environmental protection and the decline of people's environmental consciousness. In most small states the environment has no place in modern educational curricula. The creation of environmental consciousness among decision-makers and the general public is vital for the effective development of environmental conservation policies. In this context, equal recognition should be given to the gender roles of women and men.

We recommend that environmental education and training programmes should be developed, relevant to the circumstances of small states.

5.47 *International agencies should also support these activities by:*

- *holding regular in-house programmes on environmental training;*

- *designing programmes to be incorporated into the educational curricula of island and other small states; and*

- *producing and widely disseminating audio-visual as well as other material for educational purposes.*

5.48 To determine the potential effects of environmental degradation on development and to design and implement appropriate mitigation measures, small states must have access to relevant information. At present, information available to them is marginal, most data networks are sectoral and much material is not accessible to decision-makers, especially in small countries. While continuing efforts are needed to develop data networks on environmental issues, attention should be given to assisting small states to contribute to the process, especially in relation to accessing such information. We note that the Commonwealth Secretariat has been endeavouring to assist in this connection through its publications, especially its quarterly 'International Development Policies' which includes a section on the Environment. Small states could be assisted further through centres to provide data storage, dissemination and network services, set up at regional institutions.

Strengthening Development Assistance

5.49 Small states do not have the resources necessary for their environmental protection. The frequent occurrence of natural disasters in these states urgently requires a regional approach to disaster preparedness, including risk assessment, mitigation measures, disaster insurance, relief and rehabilitation. There are some mechanisms in place in both the Caribbean and the Pacific but assistance is required on a much larger scale in order to make them effective. Existing communications networks and programmes to promote public awareness need to be strengthened, especially in areas such as training, monitoring and prediction. *In the light of the scientific consensus on the likelihood of global warming and the threat of sea-level rise, and its effects on island small states, regional organisations in the Pacific and Indian Oceans and in the Caribbean should monitor the situation and develop a programme of action for cooperation and exchange of information on strategies and policies on the concerned issues.*

5.50 In terms of international negotiations on the environment, small states have so far been on the periphery. There is a major need for them to articu-

late and represent their interests better in international forums, and to have more opportunities for sharing experiences in evolving their environmental policies. On the one hand, the present organisation of UNCED does not give adequate scope for the interests of these states to be taken forward in the preparatory process. On the other hand, they can provide an invaluable role in the conservation of the global environment. But small states are being marginalised in both the international and the regional forums which are part of the UNCED preparatory process. The same applies to the Intergovernmental Negotiating Committee (INC) set up under UN auspices to negotiate an international convention on climate change (see Chapter 4). This fact should be recognised by the international community.

5.51 An alliance of small island states (AOSIS) has been formed to articulate their position on environment at recent meetings of the UNCED Preparatory Committee and of the INC, as well as in other forums. To make an impact, however, AOSIS's coordination and technical capacity will have to be strengthened. *The Commonwealth Secretariat could be helpful in this connection. We recommend that it takes early action to organise meetings and provide technical and financial support to assist small states in their preparations for both UNCED and INC sessions. This could be done through Commonwealth consultations organised just before meetings of the UNCED Preparatory Committee and of the INC. We welcome the fact that the recent study on the Commonwealth Fund for Technical Co-operation (CFTC) and Environmental Issues outlines some specific services which CFTC could offer. We recommend that these and other technical assistance services for small states in the environmental field should be expanded.*

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Chapter 6

Women, Environment and Development

6.1 What women do in their roles as producers and resource managers is central to the sustainability of the natural resource base. Women everywhere have the main responsibility for household resource management, education of the young and caring for the family. In developing countries they spend the greater part of their time tending, gathering, conserving and using natural resources. They are directly dependent upon the natural resource base and sustainable natural systems are fundamental for the survival of their families[1]. Women generally use these resources wisely and sustainably where they are allowed to do so; they are experienced and knowledgeable natural resource managers, and they have fought many campaigns to safeguard environments from exploitation[2].

6.2 Our main concerns in this chapter are the identification of strategies to support women as environmental managers, by providing them with the tools and resources to enhance their work for sustainable development, and finding ways of building upon their indigenous knowledge. Much of what we say here underscores the fundamental need to increase and support women's involvement at all levels of decision-making on environmental and developmental issues, so that they can bring their knowledge of the environment and their understanding of their communities' needs to bear on the policy-making process. We have also considered some of the mechanisms which could be deployed to support women's own initiatives in environmental management for sustainable development, and we explore how women can develop and share their perspectives through interaction with NGOs and governments and exchanges between women at local and international levels.

6.3 In planning sustainable development projects and programmes, and in ensuring that women and their dependents benefit from such developments,

all countries should pay attention to the need to utilise women's knowledge of local ecosystems and of the economic uses of domestic and natural resources. The different economic roles of men and women often mean that they have differing priorities, both of which must be recognised if sustainable development is to be achieved.

6.4 The ways in which women manage and interact with their environment greatly depends on their social relationships, especially with men. The power relations in which they are involved determine their ability and obligation to manage and control the use of local natural resources. Understanding issues of environment and development requires consideration of the work and activities of both women and men.

6.5 We recognise that women are by no means a homogeneous group, with a common set of priorities and problems. Some are more dependent on natural resources and more vulnerable to environmental degradation than others, but we draw attention to women's major environmental roles in all societies and their particular contributions to sustainable development.

6.6 In many developing countries women are the major managers of local environmental resources. In their roles of food producers, water collectors, and fuel gatherers, rural women are in frequent and direct contact with land, water and forest resources. Women have direct knowledge of these resources and have access to traditional knowledge and practices which help to maintain the natural resource base. But their skills in natural resource management need to be supported. They may lack appropriate training and technologies. They need opportunities to provide an income for their families without undermining their environment. A re-orientation of development policies is required to take account of gender differences in natural resource management.

6.7 The economic contribution of women is known to be substantial. Women's role in food security is central and they produce more than half the food in the developing world and as much as three-quarters in Africa. They play a major role in the storage, processing, and marketing of food and cash crops, and they often have charge of small livestock. Women constitute about one-quarter of the industrial labour force in the developing world and an even higher proportion in many of the expanding export industries of some developing countries. They also work in the large and growing informal sectors of both rural and urban areas. But their economic contribution goes much further. Women usually have primary responsibility for the care of children and the elderly and for many household chores. They often spend several hours every day fetching household water and fuelwood (which constitutes 90 per cent of the household fuel used in Africa). Because much of women's work is done at home or outside the formal economy, it is not fully recognised in official statistics or by policy-makers.

6.8 Women's economic options in relation to those of men vary widely in different cultures and economies. In the early stages of economic development, women tend to bear many children and to work in or near the home, whereas men have a greater choice of occupation. Generally, however, as economic development opens up more opportunities for education and employment, women's choices expand: couples tend to have fewer children, and women tend to enter the formal labour force, in which earnings are higher. Economic development can widen the options for women, enabling them to earn more, learn more, and secure better health for themselves and their children.

6.9 In both industrial and developing countries, women's ability to realise their economic potential depends upon their health and educational status, and their access to information, resources and markets. The existence of gender divisions of labour in households, and sometimes legal and social discrimination, constrains women's choices and restricts the contribution they can make to sustainable development. Action is required both to provide women with a wider range of personal options and to increase the effectiveness of their already substantial involvement in economic activities and in work to develop and sustain the human resource base.

Women and Sustainable Development

6.10 Where they have sufficient opportunities to do so, women are already playing important and effective roles in environmental management and conservation, especially when working together in groups. Among the best-known examples are the Chipko movement in India and the Greenbelt movement in Kenya (see Boxes 6.1 and 6.2 on pages 108 and 109). Many other women's groups throughout the world are also actively improving the environment, not only in rural areas, but also in urban centres.

6.11 To participate more fully in sustainable development, women need to be released from various constraints. They need to have legal rights to natural resources including land, water, trees, crops and livestock, as well as control over how these are managed. Secure land tenure will facilitate their access to capital, credit, and appropriate education, extension services and technology. In addition, women need to be able to choose their family size. More attention should be focused on relieving them of the conflicting demands on their labour. Supporting women generates other benefits, including better economic performance, improved family welfare, greater alleviation of poverty and slower growth of population.

Women and Land Management

6.12 Women are at the centre of food production for subsistence in many regions of the world. Their access to land is central to food security, not

Box 6.1

Chipko in Gadkharkh Village, India

Most men have migrated from this small Himalayan village to the cities in search of employment. Women bear the multiple burdens of domestic work. They care for children, tend the fields and animals, and collect fodder, water and fuelwood. During the 1970s, commercial felling on Forest Department land removed much of the oak and other broadleaved trees on which the women depended; springs dried up and water was hard to find.

The Chipko movement began here at the end of the decade, and a temporary ban on felling was secured. But two problems remained. First, deforested land was replanted with fast-growing pine, eucalyptus and poplar for commercial harvesting, replacing the hardwoods valued by the women for fodder and fuel. Second, there was no replanting on many tracts of deforested land, nor on the village lots which are for local use. Control of these village lots lay in the hands of men in the village councils, who neglected them—although the rights to use and care for the village forests were vested in women.

In 1982, after a series of village meetings, a women's forum was created which began a savings fund to provide interest-free loans for its members. A year later, having learnt from this initiative, the women felt bold enough to take up the issue of forest rights and try to revive the old village forests. They succeeded in driving off illegal wood collectors and started a small nursery to produce hardwood saplings for planting in the village forests. Twice a year now, students come to help the women in 'planting camps'. By 1987 a village woodlot was opened for the removal of fodder grass and fuelwood for the neediest families. The women's forum has pioneered the use of energy-efficient ovens and pressure cookers among its members. The women of Gadkharkh are now helping other villages to revitalise their forests.

Source: Renu Wadehra[3]

simply because of their role in agricultural production, but because they utilise the nutritional products of non-cultivated lands such as forest fruits, and wild plants.

6.13 Women constitute 76 per cent of the number of people active in agriculture in Africa, 68 per cent in Asia, and 23 per cent in the Caribbean[5].

Box 6.2

The Greenbelt Movement in Kenya

The objectives of the Greenbelt Movement were inspired by the local needs and problems of Kenya but they apply to many other countries and communities in Africa and around the world.

The objectives are many and varied, and each comes from a particular need.

The Movement endeavours to meet the needs of communities by harnessing local capabilities, expertise and resources and engaging the community to be the main driving force.

As part of the Movement, women produce tree seedlings that are subsequently released to small-scale farmers and public institutions such as schools and churches. Thus, women are paid for the tree seedlings and this creates an income-generating activity for them. Ultimately, it improves their economic position.

The Movement promotes self-employment. It works to assist thousands of unemployed and underemployed to employ themselves in the promotion of tree planting and environmental conservation in their areas.

As a Greenbelt member, a woman compiles a report at the end of each month and on the basis of the reports, she receives a small allowance as a token of appreciation.

The Movement has created more than 600 tree nurseries in communities throughout the country. About seven million trees currently growing in Kenya were planted by members. More than 50,000 Kenyans, mostly women, have been or still are members.

The Greenbelt Movement is a successful example of a truly community-based project. Although it was conceived by and is directed by women, both men and children have enthusiastically participated.

Source: Wangari Maathai[4]

While women often produce food to feed their families, either on separate fields or as specific crops on the same field, men usually grow cash crops, and control the resultant income.

6.14 Even where women and men farm the same crops, the tasks they perform are often different and complementary. Women are more involved in activities such as weeding, post-harvest storage, seed selection, preservation, and processing of crops. Many of their agricultural activities are tiring and tiresome as they have not benefited from the mechanisation that many of the male-dominated activities have experienced.

6.15 Women's workload, as growers of food and as hired labourers for cash crop production, has increased due to several factors. These include male migration to the cities or mines for work, increased pressures on family budgets, and an overall expansion of agricultural production.

6.16 A study in Tanzania which compared the positions of Haya women who were landowners with those who farmed but did not own their own land, revealed that the former displayed impressive entrepreneurial and agricultural skills, had a higher standard of living, received income from cash crops and hired male labourers[6].

6.17 Yet according to UN statistics, women own no more than one per cent of the world's land, and even where they have access to land for farming, their tenure is often costly and uncertain. Without ownership or secure tenure, women cannot invest in long-term conservation practices.

6.18 We believe that one of the fundamental constraints faced by women is their inferior status by law and by custom in many countries. Indeed, many women effectively remain legal minors throughout their lives, so they cannot act on their own behalf. Without equal legal status, women are prevented from owning, or controlling the use of, land and other natural resources. However, the gender division varies among ethnic groups as well as among countries. For example in Siaya District, Kenya, trees on household land are considered the property of the headman, regardless of who plants or tends them. By contrast, Moslem women on the Kenyan coast can inherit coconut and cashew trees that are grown on the land of male relatives. The women own the trees as well as the harvested crop, and men's use of the land must not interfere with the profitable management of the trees[7].

6.19 Land ownership (usufruct) and control are determined by law, by tradition, or by a combination of the two. Privatisation of land and commercialisation of agriculture in many countries tend to decrease women's access to land, as it is often automatically registered with the men, regardless of existing land use rights[8]. Some projects have also had other detrimental impacts on women (see Box 6.3 opposite).

6.20 If married women's access to land is hampered by land ownership constraints, the position of divorced, separated, or abandoned women is even worse. Women whose husbands have migrated may face the same constraints

Box 6.3

Women and the Kano River Project in Nigeria

A 120,000 acre gravity-flow irrigation scheme in Northern Nigeria was set up with the goals of increasing national food supply, providing employment opportunities and improving living standards through the provision of clinics, schools, roads, water and sanitation. All land ownership prior to the scheme was registered and the land was reallocated to the owners after the infrastructure was in place. Although previously many plots were owned communally, only the 'senior owners' (almost always men) were registered. Nearly one-third of the male farmers lost almost all of their land, as did roughly the same proportion of women farmers. But those women who continued to have access to land were now given the worst plots by their husbands.

Increased irrigation led to a greater emphasis on dry-season crops. Wet-season crops received fewer inputs and their output declined. Crop diversity was severely reduced as cropping patterns shifted from local staple foods to the cash income-generating wheat and tomatoes. Sorghum and millet grown by women in the wet season suffered the most.

Some women in the area were able to take advantage of the increase in wheat production by selling wheat to migrant workers in the project area. Others however had to work more on their husband's farms and could not find time for income-earning activities for themselves. Although the project did bring employment to the area, the permanent jobs in construction and administration were filled by men. Women were hired as seasonal or casual labour on the farms.

The project also resulted in wide-scale destruction of forest, with a consequent reduction in the availability of fuelwood and wild plants for the poor. Women had more difficulty gathering fuel and lost income due to lower sales of fuelwood.

Source : Jackson[9]

if land is in their husbands' names only. *We believe it is vital to secure women's and men's traditional rights to resources and resource use; to recognise and formalise these rights, and especially to strengthen women's security of tenure. Where restrictive customs limit the rights of women, ways should be found to minimise these restrictions.*

6.21 The poorest rural households in developing countries, many of which are headed by women, are being made landless or are forced to farm poorer, less productive lands. To scratch a living from their meagre plots, these households often have no alternative but to abandon traditional practices which conserve the land and use harmful methods of production. Fallow periods are shortened or omitted in the struggle for a continuous supply of food. Soil fertility declines year by year. Steep slopes are intensively cultivated and the land degrades. Scarce fuelwood is replaced by the burning of crop and animal wastes which could otherwise be used to maintain soil quality, thus threatening agricultural yields.

6.22 Women's ability to use land for sustainable production and avoid this downward spiral of poverty and land degradation is influenced by patterns of land use. Traditional rights of access to land for the farmers and communities who depend upon it need to be secured to enable them to continue to gain their livelihoods and care for the environment which sustains them. *We recommend that Commonwealth Governments should oppose the exercise of state or private power to deprive communities of their rights to land, and that studies of the options available for securing and formalising these rights be undertaken so that modern and appropriate ways can be found of giving communities secure title to land.*

6.23 Projects to introduce or increase the production of cash crops can have profoundly disruptive effects upon a community's food security. In some instances these projects may be desired by the community but steps must be taken to ensure that food production is not marginalised. Such projects must be planned with the full participation of men and women in the community, so that provision can be made for food production to continue on good quality land.

6.24 Where land has already become acidified and degraded, attention should be paid to supporting communities bearing the high costs of reclamation. Such investment is usually focused on commercially farmed land, to the neglect of subsistence agriculture and the detriment of food security. There are many instances where women have voluntarily donated their time to large-scale land rehabilitation schemes when they, their families and their communities will benefit directly. One example is given in Box 6.4 opposite.

Women as Users of Forest Resources

6.25 Rural communities rely on forested areas for a wealth of goods and services: wild plants and game to supplement their diet, fodder and shade for their livestock, and medicines, fuelwood and construction timber for their own use or for sale. Women make extensive use of the species of natural forests for their household incomes and food security. Many of these products are to be found only in natural forests, and as a result women have a

Box 6.4

Mwethya Groups in Kenya

The Katheka soil and water conservation project is an example of a women's initiative to combat accelerated resource degradation. In this dry area, the terrain is rugged and difficult to work. The people lack access to basic services such as water and electricity. Although problems of resource degradation go back to the 1920s, it was in the 1970s that extensive grazing caused massive soil erosion and human survival in the area was put at risk by declining food production.

Twice a week members of the 15 'Mwethya' groups go to work on one member's farm and once a week they carry out communal projects such as the construction of gabions or the rehabilitation of dams, or the maintenance of terrace to prevent land degradation. Each group repairs 1,500—4,000 metres of bench terrace each year. Another activity is water conservation, which has led to improved crop yields; tree planting is also increasing. Besides resource conservation, the women have embarked on income generating activities such as basket weaving and brick making.

This success has been achieved without much external support and the technologies employed have been simple and maintained by a local artisan. Recently the community has organised to resist an external threat from contractors mining sand from the river bed—which interferes with local water resources.

Source : Commonwealth Secretariat[10]

particular interest in the maintenance and planting of indigenous trees. Reforestation programmes based on a single species remove a crucial natural resource from the community.

6.26 People in rural areas have extensive traditional knowledge of the uses of trees, and the rationale for sustainable forestry. A study in Sierra Leone, for instance, found that women knew 31 uses of trees on fallow land and in forests. They also knew which forest products would be produced in a particular fallow year. Men identified eight different uses[11]. As a study in northern Ghana has shown, these differences in knowledge are based mainly on the gender division of labour within the household (see Box 6.5 overleaf). In general, women and men have distinct areas of knowledge of particular environments, plant species, their ecology and uses. Women's traditional prac-

Box 6.5

Women's and Men's Knowledge of Trees

A study in northern Ghana found that the knowledge of trees among women and men derived from the gender division of labour within households. Consequently, women tended to be more knowledgeable about certain classifications than did men. Men were more conversant with fodder trees, shrubs and grasses, and with trees associated with the conjuring of rain; both men and women were aware of ecologically related trees, particularly those that characterised watersheds. Women were more knowledgeable about species variations and the multiple uses of a tree, as the following example shows:

Doo, *Parkia Clappertoniana*
Doo, the tree, is used for fuelwood and charcoal.
Dori, the edible fruit, is used for butter.
Zuni, the seed, is used for kpallgu, food.
Dozim, the flower, is used for food.
Wula, the roots, are used for sponges.
Leaves are used for medicines.
Shell husks are used for fuel.
Bark is used for medicines.
Trunk is used for fuelwood.

Women are very perceptive about the use of trees for fuelwood, as the following example shows:

tices in gathering forest products, for example, do not disrupt sensitive forest ecosystems, and the biodiversity of natural forests can be maintained.

6.27 *When planning and implementing afforestation programmes and projects, the authorities should make good use of women's knowledge of local ecosystems and the economic uses of trees, and they should also ensure that local women benefit from these types of development.*

6.28 Deforestation is increasing worldwide due to commercial logging, agricultural development, migration and resettlement, and demand for charcoal (see Chapter 3). It has environmental consequences which impinge directly on the lives of poor women. Their workloads are increased as they must travel further to seek fodder, water and fuel. Hence they have less time

Local name	Taxonomy	Reasons why used
Nylmsa	Azadlrachta ludica	Highly combustible
Shia	Anogelssus leiocarpus	Burns steadily
Taanga	Butyrogspernum parkil	Burns whether wet or dry
Sampienga	Not identified	Burns with a steady flame
Sigiri	Pseudocedrela kotscavl	Burns steadily
Mango	Magnifera indica	Highly combustible
Gaa	Diospros mespiliforms	Not quite good
Lanjina	Prosopis africana	Burns steadily
Niee	Pterocarpus erinaceus	Burns steadily
Korli	Terminaiia avicen naoides	Best for fuelwood
Doo	Parkia clappertoniana	Burns whether wet or dry
Yulinga	Combretum lampro carpum	Burns quite well
Kpalga	Afzella africana	Readily available

Source: Elizabeth Ardayfio-Schandorf[12]

for income-generation and other activities to improve their standards of living or to invest in natural resource management. Fuelwood shortages pose them serious difficulties, although in most cases the women themselves do not damage living trees but collect their fuelwood from dead branches and twigs. Most of women's problems would be avoided if they had control over the resources they use.

6.29 In cases where forests have been cleared for settlement, new settlers need both security of tenure and access to local knowledge of their new environment to enable them to avoid further degrading fragile ecosystems. In this case the local knowledge of forest users, often women, will be crucial to the development of methods of sustainable use, and the restoration of forest resources.

Women as Managers and Users of Water

6.30 Women use water for many purposes, some of which are polluting. They are generally aware of the need to maintain water quality and to teach their children hygienic and non-contaminating sanitation habits. But restricted availability of water or the unavoidability of using it at source mean that they may be forced the endanger a resource upon which they depend. This can constitute a serious risk to their own health, and to that of their dependents and households.

6.31 In the urban areas of developing countries, it is estimated that only one-quarter of the people have access to an in-house or courtyard source of water—in some rural areas safe drinking water is only readily available to one-tenth of the population. So limited is the access to water that some rural women spend hours every day collecting it. The situation can be as bad in urban areas (see Box 6.6 opposite).

6.32 Apart from water's familiar domestic uses, it plays an important role in maintaining food security. For this and other reasons it is vital that women, as end users, are consulted in the planning of water projects, or in development schemes which will impinge upon local water resources. We note the achievements of the UNDP PROWESS programme in giving women a full say in the provision of water and wish to see this approach replicated and continued.

Women and Fisheries

6.33 Women in many countries play an important role, often recognised unofficially, in subsistence fisheries. For many of them, harvests from lakes, rivers and coastal waters also provide an important source of incomes through sales, whether as food or as items of trade for tourists. In the absence of alternative sources of cash income, and with increasing destruction of coastal habitats for development, overfishing often results—both to satisfy subsistence needs and to secure additional cash. The sale of shells and corals for the tourist industry also threatens the health of the coastal marine ecosystem that provides these resources. Small-scale aquaculture (both marine and freshwater) needs to be encouraged in order to relieve the heavy exploitation of inshore fisheries on which women depend. Several developed Commonwealth countries including Australia have begun multinational programmes of mariculture. *The Commonwealth should encourage and support such programmes, especially in small states. These programmes should be preceded by research that includes the investigation of the fishery activities of women and the compilation of traditional knowledge and management practices of fishery resources.*

Box 6.6

Urban Women Queue for Drinking Water

After the rains failed for three consecutive seasons, in 1981—1983 in Tamil Nadu, the lakes and wells supplying water to the city of Madras dried up and the water board was forced to limit tap water supplies to alternate days only. The poorer women of Madras had to extend their working day to 24 hours, in order to collect water for their families. Since the water was supplied during the night, the women would sleep only on alternate nights, while they spent the other night waiting in line at the taps. Usha, a 13 year-old girl, for instance, suffered this ordeal: Starting at 6 a.m she worked four hours as a domestic servant before returning home to do the same tasks for her family. Then, after two more hours' work at her employer's house and helping her mother cook the evening meal, Usha had to stay up until 5 a.m to collect enough water for two days. Returning home she started a day's work again, sleeping at 11 pm that night.

Source: Kishwar & Vanita[13]

Opening up Options for Women

Supporting women's own initiatives

6.34 Women and women's groups are in the forefront of many experiments in sustainable agriculture. They have been instrumental in introducing more flexible cropping patterns, widening species, diversifying crops, recycling organic nutrients and other techniques for long-term resource conservation. Traditional methods of interplanting and crop rotation have been blended by women with new styles of agroforestry[14]. It is clear from case studies that women are active and creative in finding sustainable methods of using their environments. However, their work would be enhanced if certain obstacles were removed, and agencies, governments and NGOs paid more attention to supporting women's efforts.

6.35 Mechanisms need to be developed to direct financial support to women's own initiatives in environmental care. One example of such a mechanism is the Local Initiative Support Fund set up by 'Environment Liaison Centre International' (see Box 7.4 on p.133).

6.36 *We urge Commonwealth governments to make a commitment to support women's efforts in resource management in developing countries.*

One possibility might be for developing country governments to commit some proportion of their national budgets (say one per cent) to community initiatives for the rehabilitation and enhancement of the resource base; and for developed country governments to commit, say, 5 per cent of their incremental aid to local initiatives for environmental rehabilitation and enhancement of the resource base. Such support should be channelled through community-based and locally operating groups and organisations. It would need to be evaluated, and perhaps three years after implementation would be an appropriate time to do this.

Empowering Women

6.37 There are significant inequalities in access to productive resources which prevent many women in developing countries from fulfilling their potential in environmental management, and sometimes even from meeting their basic needs[15]. These inequalities range from disparities in educational opportunities, to gender biases in agricultural extension practices. They affect women's positions adversely vis-a-vis those of men, making it increasingly difficult for them to take autonomous decisions. Since the obstacles which women face in relation to access to credit, extension services, and healthcare, as well as the impact of structural adjustment programmes have been well explored elsewhere[16], we focus here upon four key themes for the empowerment of women—education, information, decision-making and leadership.

Education and information

6.38 We believe that increasing access to formal education is an important step towards securing women's socio-economic progress in both rural and urban areas. Raising women's literacy is in many ways a prerequisite to improving their socio-economic status and increasing their influence on decision-and policy-making on all matters affecting their welfare. Women account for two-thirds of the world's illiterates. Primary and secondary school enrolment ratios show that girls have much less access to formal education than do boys who, in some countries, attend school ten times more frequently than girls of a similar age.

6.39 But evidence from a variety of socio-economic settings suggests that the economic returns from female education (measured as proportional increases in wages) are substantial and comparable to those from male education. Moreover, because the mother's influence on family health and size is greater than the father's, maternal education may also have a greater effect on children's learning and thus on the productivity of future generations.

6.40 *We believe it imperative to improve relevant education and training opportunities for women. This could be done by providing literacy classes and skills training to them at times, frequencies and locations convenient for*

them; and to recruit, train and adequately reward more female teachers to serve their own communities.

6.41 The roles which have brought women into close working contact with the environment have allowed them to develop intimate knowledge of local living conditions and natural resources. This is particularly true of developing countries, where women are important custodians of traditional knowledge about natural resource conservation; but in industrial countries, too, women and their organisations possess considerable environmental knowledge which often remains outside formal systems of education.

6.42 One way of capturing and supplementing this knowledge, to the benefit of the environment and of women themselves, is by training women as environmental monitors. This would facilitate the movement of some women into decision-making positions on environmental issues and provide a vital link between planners, technicians and local communities' own knowledge base. It could also strengthen the assessment procedures carried out in environmental impact assessment. *We recommend that governments train more women as local extension agents, activists and monitors of environmental protection.*

6.43 Communities have much to learn from each other's environmental experiences. Those in developing countries, for example, have much to contribute to the evolution of new attitudes in industrial countries, to the utilisation of natural resources. It is vital to disseminate this knowledge (which, of course, is not confined to women), and to use it in the formulation of environmental policies.

6.44 *We recommend that governments and the international agencies concerned should sponsor and host international exchanges between female project workers and female environmentalists. This would enable them to share their skills and experience in environmental management in different ecological zones, especially in developing countries. Such exchanges, on a South-South, North-South and North-North basis, might be promoted partly through a bursary scheme*

6.45 Women and communities also need access to information, especially about environmental hazards. Such information is often denied to them, although it may be important for their daily lives. Plantation workers, for example, are frequently exposed to agrochemicals, especially pesticides which endanger their health and their children's well-being. These agro chemicals may also damage local ecosystems, particularly if wrongly applied.

6.46 *Governments should facilitate the dissemination of information on environmental pollutants and environmental health issues to user groups.*

Women should play a part in defining their own needs for such information. Public education campaigns should be targeted at women, to inform them of the health hazards of agrochemicals and pesticides.

Decision-making and leadership

6.47 New approaches to 'women, the environment and development' have now been made possible by women themselves. The disadvantages faced by women have been widely recognised. What is important now is that governments, NGOs and the international community provide the mechanisms by which women can continue and strengthen their work for sustainable development at a grass-roots level. Women have taken the lead in many environmental conservation projects and campaigns, and have great knowledge of methods of sustainable natural resource management. They now require the policy support, inputs and recognition to maximise the effectiveness of their efforts.

6.48 We cannot stress too strongly that the involvement of women, as well as of men, in all decision-making stages of a development project is central to its success and to ensuring that its benefits are directed to the community. Cultural barriers to women attending meetings with men, restrictions on women's time and mobility, and lower levels of literacy must be overcome to allow women to participate on an equitable basis in the decisions taken and to share in the benefits thereby generated. Case studies have shown that when women's participation was high (i.e. substantial numbers of women received training, credit and extension), projects were much more likely to achieve their objectives than when participation was low. But 'token' participation by women hampered the achievement of project objectives[17].

6.49 We also emphasise that participation must not be interpreted to mean that women are merely used as a source of free or cheap labour to implement environmental rehabilitation or conservation work. This tendency is strong in many labour-intensive natural resource management projects. As one researcher puts it, "participation often becomes confused with mobilisation of muscle"[18]. Genuine participation implies equity between men and women in decisions pertaining to labour, funding and management. Where women constitute most of the workforce or carry most of the responsibility, this could mean them exercising a leadership role. *We recommend that governments, agencies and communities seek to develop mechanisms to facilitate the full participation of local women in all levels of policy-making and decision-taking.*

Further Action

6.50 Putting into practice appropriate development strategies to benefit women, men and the environment will require organisational and other

changes in the ways in which development assistance is provided. We recognise that bold actions are needed, by governments, multilateral and bilateral aid agencies, and by non-governmental organisations.

6.51 Both 'environment' and 'women' are receiving more attention in development policy and international assistance. But the need now is for donor agencies to recognise and use the close links between them—at policy and project levels—to reinforce action for overall sustainable development, and to improve the position of women.

6.52 The issues we have raised in this chapter underscore the need for the further development of gender-based analyses of contributions to environmental management, of the use of environmental resources, and of environmental impact and risks. We stress that such analyses are not the same as traditional gender analyses oriented towards affirmative action for women. We therefore endorse the UNCED Secretariat's request that all countries complete the audit on 'the role of women in sustainable development'. Such audits would serve to clarify the policies and actions needed at the national and international levels to strengthen women's roles in fostering sustainable development.

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Chapter 7

Institutional Change for Sustainable Development

7.1 Previous chapters of our Report have drawn up a substantial agenda for action by all parties concerned. We turn finally to the issue of how to develop appropriate institutions and policies for implementing these actions. In dealing with institutions we define these in their broadest sense, as the relationships, rules and frameworks which govern the daily management of society. In addressing environmental issues we view these within the context of sustainable development in terms of "an economy that is developing sustainably, adapts and improves in knowledge, organisation, technical efficiency and wisdom; and does this without consuming, coopting or diverting, beyond some point, an ever greater percentage of the matter and energy of the ecosystem, stopping at a scale at which the ecosystem can continue to function and renew itself year after year."[1]

7.2 The environment is an all-encompassing issue which calls into question the way in which its different facets are now handled. Currently, in many countries, national policies and institutions are generally too compartmentalised for a satisfactory treatment of environmental and developmental problems in an integrated manner. In Chapter 5 we noted, for example, how the need for coastal zone management and a coordinated response to sea-level rise cut across traditional organizational boundaries.

7.3 It has become a common chorus that sustainable development and environmental management are intersectoral in nature and require multidisciplinary and holistic approaches to problem-solving and programme development. Societies and their policy-makers are required to adopt a new *locus standi* if they are fully to integrate environmental concerns and development policies across all sectors and all levels of activity. The starting point,

we suggest, for bringing in the required institutional and social changes is devising and implementing National Strategies for Sustainable Development (NSSD) (also known as National Conservation Strategies (NCS) or Environmental Action Plans (EAP)).

7.4 NSSDs are invaluable in that they provide consistent guidelines on the balance between resource exploitation and conservation. They can thus be used not only to help identify the most serious environmental and other problems in following a path of sustainable development, and establish priorities for doing so, but also to make clear the interconnections between discrete problem areas (e.g. between land-use, deforestation and degradation of watersheds) which otherwise are often treated on a case-by-case basis. In small states and islands, for example, we observed in Chapter 5 that a single environmental problem, such as coastal pollution, might entail adjustments with ramifications throughout the economy. NSSDs can include capital projects and thereby give clearer indications of projects to potential investors, e.g. in resource industries. In that connection we note that a number of countries have begun to seek financing so as to develop environmental investment portfolios[2]. Some have also started to undertake long-term global prospective studies, whose findings, we suggest, should be integrated as far as possible into NSSDs.

7.5 To attain sustainable development, NSSDs should also take into account the social dimensions of development and the differential impact of policies and programmes upon groups within society. Gender-analysis techniques will provide an important tool for helping to achieve this, and so will participatory government and development processes.

7.6 The national institutional arrangements needed to address the environmental and other issues related to sustainable development should be directed by and evolve out of the National Strategy or Plan. They are therefore likely to vary according to the socio-economic characteristics and environmental concerns of individual countries. Box 7.1 on pages 126-127 provides details of one case—the Environmental Action Plan for Mauritius.

7.7 Governments should be primarily responsible for drawing up NSSDs, but they should be undertaken in consultation with the private sector, NGOs and the general public. Special efforts should be made to ensure that women and their organisations are involved in these consultations. We acknowledge that NGOs, many of which are active at the local level, are often very effective in environmental management, and we suggest that, where appropriate, governments might recognise or at least give greater recognition to their roles, while enabling them to retain their independent status. Environmental impact assessment of development projects should be undertaken with technical support from NGOs and the private sector where they have the relevant expertise.

Necessary Components for Developing and Managing National Strategies for Sustainable Development

7.8 We recognise that there are several possible routes to developing NSSDs, and that institutional needs will vary among countries, depending on factors such as levels of economic development, types of economic structure, geographical and population size, level of development of human resources, scale of environmental problems, and so on. However, general components of management to effect National Strategies would include certain arrangements which we discuss below.

Institutional arrangements

7.9 National institutional arrangements for sustainable development are still in great need of advancement in most countries. Formal arrangements are being complemented with less formal networking and ad hoc arrangements to deal with specific problems. We consider networking systems later (see paras.7.20-7.24).

7.10 The usual approach to effective environmental action is of establishing or extending formal institutional structures and mechanisms, within and outside government, to create and implement a comprehensive and integrated policy-making system for this purpose. Existing government structures vary greatly. Within central government, some countries have established major ministries of the environment, with responsibilities not only for policy, coordination and research, but also for management of environmental resources (water, air and land) as well as for environmental conservation and the management of certain major sectors of government related to the environment—such as health, housing and transport. Other countries have simply extended existing ministries, with broad responsibility for policy planning and coordination (including coordination between levels of government), but without any programme management responsibilities. Between the two, a wide variety of structures exist,[4] as can be seen from Box 7.2 on page 128 which outlines institutional arrangements for integrated development planning in Latin America.

7.11 One of the criticisms of formalised structures, is that they tend to treat environmental issues as separate and distinct, and lack the flexibility needed to deal with a variety of cross-sectoral issues. This has hindered the integration of environmental concerns into development programmes.

7.12 *In considering the establishment of a formal institutional framework, we feel that it would be desirable for countries which have not already done so, to consider setting up a Ministry of the Environment.* Because of the central importance of the subject and its multifaceted nature, we believe that such a Ministry should be headed by a Minister with a seat in the Cabinet.

Box 7.1

An Environmental Action Plan for Mauritius

Mauritius was among the earliest Commonwealth developing countries to develop an Environmental Action Plan (EAP). The quickening pace of industrial and tourist development in the early 1980s, and associated urbanisation, had started to exert noticeable pressure on the environment. Reports of environmental degradation in a prime tourist resort in the north of the island had made newspaper headlines. Evidence of damage to the marine ecosystem, including coral reefs and fish habitats, was growing. The problem was compounded by the diffusion of regulatory authority and the division of often overlapping responsibilities for environmental protection among several government ministries and departments, including independently-elected government bodies. An action-oriented EAP was clearly called for.

The idea of tackling the emerging environmental problem head-on had already surfaced during regular consultations between the World Bank and Government in mid-1987. The country was then gradually emerging from its active adjustment phase supported by World Bank and IMF programmes, but the Government was sufficiently worried to pinpoint the environment as a major issue in its policy dialogue with the Bank. It sought Bank assistance outside the framework of any project or programme loan—not even the faintest contours of an environmental project were yet in sight—to make an inventory of all existing legislation pertaining to the environment and advise on institutional reform in the area. Subsequently, a National Environment Committee was set up to address the issue in a comprehensive manner, with a remit to identify weaknesses in the existing framework and make proposals for an action plan to address the critical environmental issues facing the nation.

UNDP provided financial support for a technical assistance team fielded by the World Bank to work closely with Mauritian nationals to develop an EAP, covering all sectors of the economy. By end-February 1988, the National Environment Committee had completed its work and produced a set of recommendations for enhancing the effectiveness of the institutional and legislative structure. These were incorporated in the comprehensive EAP document prepared by the technical assistance team under the title "Economic Development with Environmental Management: Studies for Mauritius".

The broad outline of the draft EAP received Government approval. But there was one major proviso. The details of the proposed EAP had first

to be discussed at a National Technical Seminar on the Environment to seek national consensus on its scope and contents to ensure that it reflected the views of all segments of Mauritian society. This was in keeping with the well-entrenched democratic traditions of Mauritius and was rooted in the belief that an EAP which had popular support stood a better chance of being implemented successfully.

Government also moved fast to reform the institutional mechanism. A National Environmental Commission (NEC), chaired by the Prime Minister, was set up to monitor the implementation of the EAP and resolve inter-ministerial and cross-sectoral problems. A Department of the Environment was set up, thereby putting an end to a certain amount of confusion that had characterised the earlier approach to environmental management problems. In parallel, work began on an Environmental Protection Bill to provide for a comprehensive legal framework and suitable operating mechanisms to protect the environment.

The National Technical Seminar on the Environment was held in September 1988. It brought together some 150 participants from both the public and the private sector, NGOs and international aid agency representatives. The national EAP was given its final form by a joint Government of Mauritius/World Bank team in the light of the seminar discussions and recommendations. A comprehensive Environmental Investment Programme was also formulated. It comprised the following main components: institutional strengthening; the preparation of a National Physical Development Plan and sectoral Master Plans for sewerage and solid waste management, respectively; the development of a programme to monitor pesticide and fertilizer use and its impact; and the conservation of the country's biodiversity.

The EAP, and the investment programme underlying it, were presented at a Donors' Meeting in Paris in early 1989. Several environmental management projects have since been initiated with the support of major donors and lending institutions, including some regional projects necessitating close cooperation with neighbouring islands, both Commonwealth and non-Commonwealth. To bolster the comprehensive approach enshrined in the EAP, the *Environmental Protection Act* was duly passed by the Legislative Assembly in June 1991. With these measures in place, economic development can continue apace without endangering the island's environment.

Source: based on material from Bheenick[3].

Box 7.2

Institutional Arrangements for Integrated Development Planning

A wealth of experience has been accumulated in Latin America on the subject of integrated development planning focused on natural resources. Some of the arrangements that have worked in a variety of settings are described below, with comments on their strengths and weaknesses.

- Setting up a task force of national agencies to prepare a plan and disbanding it when the plan is complete. This works well for planning, but obviously does not serve for implementation.

- Assigning the responsibility for preparing the plan to a major sectoral ministry or agency which will work under the aegis of the national planning agency. This assures better follow-up while the planning recommendations are being implemented, but its effectiveness is frequently constrained by the limits of the sectoral agency's mandate.

- Placing the responsibility for preparing the plan with an agency specialised in renewable natural resources or environment. Most such agencies in Latin America have a broad mandate and sometimes a spatial orientation comparable to a regional development organisation. However, few of them have financial or political power and some have legal mandates that put them at odds with other sectoral agencies.

- Designating a regional development corporation or a similar institution as the agency responsible for the integrated plan. When adequately funded, this can prove to be one of the best institutional arrangements. There are few such agencies, however.

- Establishing a national or regional study team (independently funded) that can evolve into a regional development or resource management institution when the study is completed. This usually involves an initiative by the national planning agency, a substantial budget commitment by government, and a tentative decision to establish a new institution. It has been successful in a few cases, though mounting a large institution-building effort during a planning study is difficult.

Source : based on Erocal.[5]

Only in this way could the Ministry be assured of effectiveness in dealing with those departments which either had access to greater funding or had more narrowly operational responsibilities. The Ministry would make policy and coordinate all issues having an environmental aspect. It might need to provide advice and facilitate coordination in introducing and administering economic instruments such as pollution charges and compensatory mechanisms. In this it would collaborate with legal, financial, and other relevant operational departments/ministries, responsible for such sectors as forestry, mining, industry and water, as well as with ministries of finance or economic development. The Ministry should also have a technical capability—preferably in-house, so as to assess the quality of consultants' work—to deal with standard-setting and monitoring. The latter activity is especially important, not only to maintain environmental standards, but to ensure that continued environmental evaluation is carried out after projects have been implemented.

7.13 We note that there is growing support for decentralised planning and implementation as a means of improving environmental management. Experience in Latin America indicates that approaches are better integrated and more practical when carried out at the local level. The planning units may be physical regions (such as river basins) or political units (such as provinces or municipalities). In these cases, a phased approach to integrative planning and systematic incorporation of environmental issues would begin with an initial overview of the region, within the context of the country's national development plan, followed by more detailed analysis of priority areas for development[6].

7.14 In addition to developing expertise in the public sector, we propose that governments should encourage private (and public) financing institutions in particular, and the private sector in general, to set up within enterprises 'environmental cells' of people with knowledge of environmental issues, and especially of environmental impact assessment, to ensure that environmental considerations are built into investment decisions. In addition, private enterprises should be persuaded to undertake environmental audits, and to provide information on the environmental consequences of their activities to government environmental management and planning bodies.

Coordinating mechanisms

7.15 Whatever institutional approach a country adopts, we believe mechanisms will be needed to improve coordination:

- between government ministries, departments and statutory agencies;

- between the above and local authorities (which frequently play a crucial role in environmental management in such areas as land-use planning, water resource management and environmental health);

– between all levels of government, the private sector, especially NGOs, and the public; and

– between regional authorities and institutions.

Countries without suitable regional organisations on which to base coordinating mechanisms might consider ways of establishing them.

7.16 A number of countries have already established coordinating mechanisms at various levels of government. These include Cabinet committees, inter-departmental committees of senior officials concerned with environmental matters, and standing and ad hoc advisory groups to consider specific problems or programmes. The last of these is an effective way of involving the private sector and NGOs in environmental policy-making.

7.17 Government departments, NGOs and other agencies working in the community should explore suitable coordinating mechanisms between themselves. People operating in the urban informal sector and with small and marginal farmers and pastoralists in the rural sector can influence day-to-day activities which have a large aggregate impact on the environment, but they usually remain beyond the reach of existing institutional arrangements. NGOs and other community groups can help bridge this gap. Public media and agencies delivering informal education and training can also reach some of these target groups; so can agricultural and technological extension services.

7.18 Every country has its own customs and practices which influence the openness of governmental processes and the degree of access to public information. Access to relevant information, at the earliest possible stage of planning, is a prerequisite for effective participation by the public and NGOs in the development of environmental policy and the assessment of the environmental implications of proposed policies and projects. The same applies to freedom for the general public and NGOs to monitor performance, through access to published assessments and audits. More generally, the mass media could be used to help increase public awareness of environmental issues. *Commonwealth governments, national media, educational institutions and relevant NGOs should do more, and cooperate where possible, to inform the public in their countries of the facts relating to environmental problems, the rationale of public policy responses, and the actions citizens themselves might take to address them.*

7.19 Local community organisations (e.g. women's groups and farmer's cooperatives) need to be strengthened to enable them to have a more persuasive voice in influencing environmental policies made at higher levels. This will serve to increase the effectiveness and relevance of those policies to local needs and conditions. Where such organisations do not exist, it would

be important for assistance to be provided to help those concerned (including urban slum-dwellers) to form effective organisations. Boxes 7.3 and 7.4 on pages 132 and 133 indicate the way in which some community groups are being involved in development projects which are integrating environmental aspects.

Networking systems

7.20 The development of networking involves coordinating and bringing together the expertise in, and activities of, existing institutional structures, to address specific areas of environmental concern. Examples of such concerns would include land degradation; degradation and depletion of freshwater resources; destruction of natural habitats; and urban, industrial and agricultural pollution. An existing Commonwealth Secretariat programme, Institutional Development for Environmental Action (IDEA), which is part of the Commonwealth Consultative Group on Technology Management (CCGTM), is a good example of this approach in practice (see Box 7.5 on pages 134-135). It is developing such networks in some member countries to address a number of environmental problems of immediate concern.

7.21 Networking systems do not replace existing specialised management and administrative arrangements but they do augment them. They are not necessarily ad hoc but rely on particular components and processes which attempt to ensure that the network system is comprehensive, versatile and coordinative.

7.22 Criteria for an adequate networking system include the following:

- inclusion of policy-makers, agencies and services, non-governmental and community organisations, consumers of services, political interests and representatives of affected communities;

- promotion of fresh alliances between interest groups;

- inclusion of methods of conflict management and conflict resolution;

- respect for, and equitable consideration of, age, ethnicity and gender; and

- all interactions directed towards the mutual advantage of the parties concerned.

Figure 7.1 (page 136) represents the various stages of environmental management, the networking task appropriate to each, and the desired outcome.

Box 7.3

Nigeria: Community Action to Prevent Erosion and Improve Soil Fertility

In tackling the problem of 'sheet erosion' which decreases the productivity of local soils and is an early phase of deep erosion, the central theme was the involvement of the rural population and their recognition of environmental protection as a self-interest activity. The studies carried out by the project concerned the extent of local erosion, local eating habits, nutritional status of the population, market situation, traditional agricultural methods, and other socio-anthropological factors and phenomena. The results of these studies proved extremely important in both finding the best ways of communicating with the local farmers and developing the agricultural practices tested in the project. It should be stressed that indigenous farming systems in Africa offer a wealth of experience for ecologically-stable production.

The project promoted the organisation of 28 groups of farmers, and at its end, 17 of them had converted themselves into production cooperatives. The groups contained a good percentage of young people and women. Each group provided a field of about one hectare as a demonstration plot. Local extension officers, trained by expatriate technicians, demonstrated a variety of erosion-control techniques to the farmers. These included terracing, contour bunds, mulching, crop rotation, minimum tillage, cover cropping, etc. The officers also provided small incentives (for instance selected seed varieties, fertilisers and pesticides) to help spread the techniques in individual fields. The techniques proved useful in increasing production and maintaining soil fertility (as demonstrated by run-off plots). Some food processing technologies (cassava grating machines, maize shellers, palm kernel breakers) were also introduced. The crops used in the project were cassava, yams, maize, cowpeas and melons. The crop rotations and the soil conversion techniques promoted by the project diminished soil losses, improved soil structure, and increased water retention capacity, the pH content of organic material in the soil. On average, the yields obtained in the demonstration plots and in the fields of the private farmers who adopted the techniques were three times larger than those obtained using traditional methods. Eight hundred farmers participated actively in the activities and, at the end of the project, 2,000 more applications had to be left unanswered.

Source: based on Borrini[7].

Box 7.4

Reaching Community Groups

The Environment Liaison Centre International (ELCI), which facilitates collaboration between the UN and some 6,000 NGOs, has initiated a Local Initiative Support Fund designed to provide direct links with community groups and to strengthen them in their efforts towards securing sustainable livelihoods. ELCI has realised that answers to environmentally sustainable livelihoods and development lie as much with grassroots people as with other actors. Yet, these groups are often left unassisted because of their isolation and, in the financial context in particular, outside of what is called the 'donor culture'. They cannot write proposals either because they are illiterate or the formats prove too complicated for them. On the other hand, donors who may wish to assist such groups find it inefficient and cumbersome to deal with many small requests. ELCI took the responsibility on behalf of these important members of its constituency.

A workshop attended by a number of NGOs and local people discussed the Fund and suggested the best way of operationalising it was to consider providing grants to initiatives if they : make a clearly defined attempt to incorporate environmental considerations, in order to produce sustainable benefits; allow the development of experience useful to others and contain elements that could be replicated by groups and NGOs elsewhere; involve women in planning and implementation, and pay attention to the impact on women of the activities to be undertaken; use (or attempt to use) indigenous knowledge or introduce new technologies to local communities in a way that is sensitive to local culture and controlled by the local community; and are aimed at or initiated by disadvantaged groups (especially women and youth).

The NGOs through whom operations are to be carried out on behalf of ELCI have to be based in the countries where communities will be supported; and build on local knowledge and resources.

Each NGO receives an agreed amount of between $10,000 and $20,000 which is distributed as grants to communities, the largest grant not exceeding $3000; the communities, in turn, inform ELCI of the use to which the funds have been put, ELCI being accountable to the donors. So far eleven intermediaries from Africa, Asia/Pacific and Latin America are each reaching 10-15 communities.

Source: based on material from Muntemba[8].

Box 7.5

Institutional Development for Environmental Action

The importance of technical assistance at this time of environmental stress cannot be overstated. There is a world shortage of expertise in environmental problem-solving in developing countries. Many developed countries have considerable skills in finding solutions to industrial and urban pollution; or using high-technology systems for baseline data and monitoring. Not only are many of these problems irrelevant to developing countries (depending as they do on natural resource exploitation, and agrarian systems), but there is both a lack of funds to pay for high-technology and a shortage of skilled manpower to execute such systems. The immediate solution is to use alternative techniques for baseline studies, EIA, environmental management and pollution control. The long-term objective must be the development of training systems suitable for the countries concerned.

In this area, the exchange of information becomes extremely important. The Commonwealth has taken an initiative in this respect, and this now needs to be extended and refined. The creation of the Commonwealth Consultative Group on Technology Management (CCGTM) as a result of a decision at the Commonwealth Heads of Government meeting in Kuala Lumpur (1989), provides a system by which appropriate technical assistance can be provided between Commonwealth members. CCGTM operates a Commonwealth network comprising senior managers and scientists who are prepared to give part of their time to share their experience with other Commonwealth members. In the environmental field this assistance comes under the general programme on Institutional Development for Environmental Action (IDEA).

The IDEA Programme, which is funded by the UK Overseas Development Administration, consists of five components: management and action projects, research methodology, networking and information services, environmental advisory services, and training. It emphasises an integrated network approach in dealing with environmental problems through concerted action in each of these areas. Activities under IDEA currently include projects in watershed management (in Ghana, Zambia and Zimbabwe); waste management (Malaysia and Nigeria); and natural resources management (Guyana and

Mauritius). Core project teams have been set up, led by experts from countries undertaking the projects. Through technical workshops and information-sharing these experts act as a catalyst for an expanding network of environmental expertise. Project teams are backed up by a small, but geographically broad-based and inter-disciplinary, support team. IDEA projects emphasise a 'hands-on', practical approach to environmental management. In addition, networking provides a system of communication between individuals without organising them into an inflexible hierarchical structure; it also enables a variety of perspectives and a diversity of expertise to be brought to bear on a particular problem.

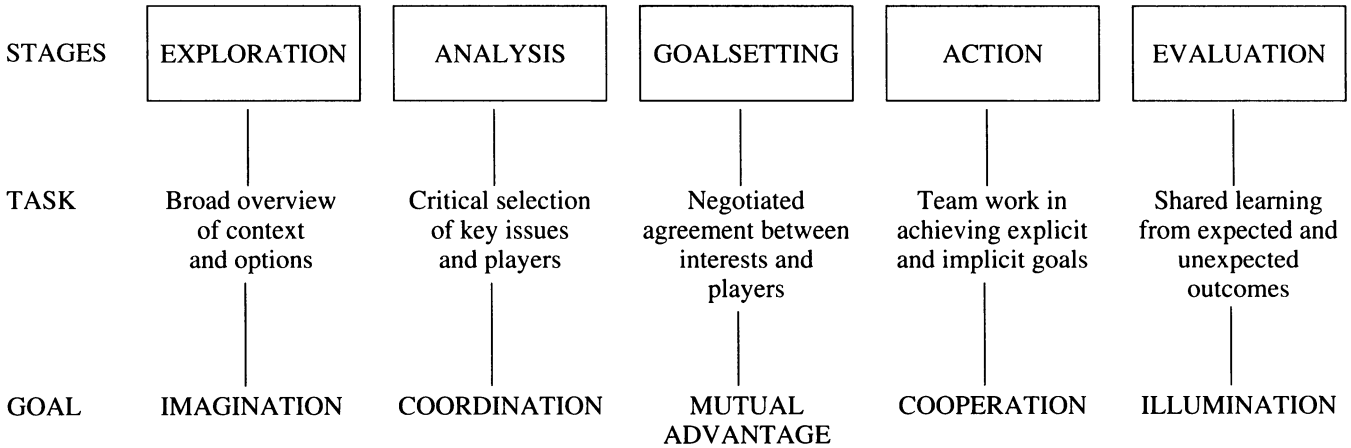
Although many developing countries face environmental problems of enormous magnitude, the IDEA teams have found little practical value in beginning on a grand scale in those countries where management capability is limited. IDEA projects therefore initiate action at the managerial/scientific level, gradually building up management capability and confidence. They are neither 'top-down' nor 'bottom-up', but combine both approaches in ways that are relevant to a country's and a project team's task. The major areas of integration addressed in the projects are between : all levels of government; public and private sectors; government and the university/scientific community; and the policy-making level and the community level, particularly small scale, 'backyard' businesses and pastoralists, for example. IDEA projects also offer the possibility of involving women's groups and other community-based NGOs in actions to address local environmental problems. As well as overcoming the specific problem addressed, projects are also intended to serve as models for use elsewhere.

Operating within the wider CCGTM network, the IDEA network has the potential to assist member countries, on request, in several ways, especially in the areas of environmental information systems, improved techniques for environmental monitoring and assessment, and the acquisition and application of clean technologies. There is much to be said for using informal processes to prepare the ground for relatively novel approaches, before they are enshrined in formal structures, which may prove difficult to adapt.

Source: based on material from CCGTM[9].

Figure 7.1

Networking in Environmental Management: Stages and Tasks



Source: Brown, et al.[10]

7.23 *Primary Environment Care* is an environmental management strategy through which local communities, with or without external support, organise themselves and strengthen, enrich and apply their own means and capacities. Projects in Nigeria, Sri Lanka and northern Italy have followed the steps of environmental management in Figure 7.1. These have enabled communities to develop a capacity to:

- organise and combine into an environmental team;
- influence development priorities, in partnership with national authorities and funding agencies;
- integrate expertise, local knowledge and local environmental values; and
- gain access to resources, including their own natural resources, financial resources and environmentally sound technologies.

Projects have included agro-forestry, health, urban development, disaster prevention, and community water and sanitation projects. The skills required for successful projects include negotiation with agencies and authorities; mediation between conflicting interests and groups; and monitoring and evaluating projects by both communities and agencies. Examples of networking in health services, at the sub-regional level in the Caribbean and in city services among urban communities are given in Boxes 7.6 below and 7.7 overleaf.

Box 7.6

Sub-Regional Institutional Arrangements in the Caribbean Community (CARICOM)

In recognition of the similarities of environmental problems facing CARICOM and its neighbouring States, the Caribbean Community established the Caribbean Environmental Health Institute for the purpose of providing technical and advisory services to member states in all areas of environmental monitoring, research and management.

In order to fulfil effectively and optimally its mandate, the Institute has set up environmental monitoring units in each of its member states. It implements its work programmes through formal focal points and working with functional nodes. In order not to duplicate existing capacity in the region, the Institute has set up a collaborative institutional network through which it accesses necessary and available expertise.

Source: based on material by Singh[11].

Box 7.7

The Healthy Cities Global Network

Healthy Cities is a global network of 300 communities worldwide, including urban and rural communities. The focus is on the integration and coordination of fragmented city services and their orientation towards the communities' goals. The network is based on cities helping each other to achieve five management goals, viz. an integrated policy including education, housing, welfare and economic aspects; an enhanced social and physical environment, publicly monitored to evaluate progress; strengthened contributions from all community groups; development of individual skills in advocacy, mediation and negotiation; and agencies and services re-oriented towards prevention, rather than remedy, of environmental degradation.

Source: Brown[12].

7.24 We recognise advantages and disadvantages in the network approach. On the positive side, it largely avoids the problems of administrative rigidity and duplication existing in some of those developed countries which initially responded to environmental problems by creating formal structures. It also enables countries to focus efforts and resources on high-priority problem areas, without having to undertake country-wide environmental assessments. On the negative side, there is a risk that coverage might be fragmentary. It will be essential for networks to be comprehensively integrated into the NSSD. For small states and other less-developed countries, it is appropriate to begin to address environmental problems through the route of network-systems. By building up expertise in relevant areas, these countries can gradually develop a more permanent, integrated institutional framework, capable of devising and implementing reactive and curative policy measures as well as anticipatory and preventative ones. For developed countries, incorporating networking into the governance of sustainable development allows for synthesising of existing fragmented and even competing agencies and interests.

Environmental accounting and impact assessment

7.25 An important task of environmental ministries or departments is to promote the reform of national accounting systems to take account of resource depletion and the full social costs resulting from environmental damage. We noted in Chapter 3 the importance of having data on national economic performance which take into account environmental costs. In most

national accounting systems, only that which has a monetary value, because it is capable of being bought and sold, tends to be recognised as having an economic value. However, prudent economic management requires that environmental capital (such as land, forests and water resources) should not be run down, to the detriment of a country's future economic growth. *We strongly urge that all national accounting systems should aim to reflect the depletion and degradation of natural resources.*

7.26 We believe it important for countries to stay abreast of developments in natural resource and social accounting (especially ongoing work by the UN Statistical Office on the UN System of National Accounts) relevant to their circumstances. We commend the United Nations, notably the UNDP, for its efforts to develop better methods of measuring human progress, and the World Bank for its work in developing an index of sustainable economic welfare. *We recommend that countries with expertise in natural resource and social accounting techniques share their knowledge and resources with others.*

7.27 We also noted in Chapter 2 the importance of attaching economic values to the environmental effects arising from individual projects. The use of environmental impact assessment (EIA) and risk analysis techniques should improve the quality of decision-making. *We recommend that environmental agencies take steps to promulgate the use of these techniques in planning and spending departments.*

7.28 Even if a central environmental department or ministry is set up, this does not derogate from the importance of having environmental awareness permeate all policy-making and spending departments. Undertaking an EIA is especially vital for those dealing with land-use, agriculture, forestry, fishing, industry, technology, energy and health, as well as those responsible for framing overall macro-economic policy. EIAs have to be incorporated in project planning at an early stage. Sustainable development requires that they should not be 'added on' when a project is nearing completion or is already in operation. In addition this is likely to render modification both difficult and costly. *We suggest that all projects should be screened to establish whether EIAs are needed, that impact assessments be carried out in all cases where this has been deemed necessary, and that they are followed up by regular monitoring.*

7.29 EIA techniques developed in industrial countries may not always be appropriate for application in developing countries. They can also be very costly. In many cases although no formal baseline data are available to carry out EIA exercises, local communities often possess the knowledge to provide an accurate assessment of the initial ecological conditions prevailing in their localities. Greater use of this knowledge should be made in underaking EIAs, not only by national authorities but also when they are being done by exter-

nal agencies. This would help to build a more accurate picture of local environmental conditions and develop a pool of expertise at the grass roots which could continue to monitor subsequent effects.

7.30 *We suggest that one mechanism for undertaking regular EIAs would be to establish on a national (or in the case of small economies, on a sub-regional) basis, multi-disciplinary teams to screen projects and to carry out assessments as they are required by governments and investors. We further suggest that any necessary environmental corrective measures be stated in the original contract as part of the investor's legal responsibility, although it is likely their continuous monitoring by government would be necessary to ensure that these were fully implemented and maintained. In this regard a useful role for the Commonwealth Secretariat could be to build up a pool of consultants, drawn from such teams, and to act as a clearing-house in responding to requests by member governments for assistance in this area.* However, it is suggested that where appropriate, whenever external consultants are provided, local counterparts are involved to ensure that local conditions are taken into account. The expertise being developed under the Secretariat's IDEA programme (outlined in Box 7.5 on page 134-135) could include undertaking EIAs, on request.

Information brokerage

7.31 There is considerable scope for information exchange among Commonwealth countries on a wide variety of issues relating to management of the environment. Some of these are referred to below, under the section on Commonwealth Cooperation. However, in addition, we believe there is considerable potential for savings among Commonwealth countries faced with similar environmental problems, through the exchange of studies and reports on environmental impact assessment and environmental projects, particularly those undertaken in the public domain or where information does not necessitate confidentially. *We recommend the setting up of a mechanism within the Secretariat—perhaps in the CCGTM—to act as a clearing house to facilitate such exchanges within the Commonwealth.*

Education, training and R&D

7.32 Lack of appropriate training is a particular problem in tackling the intersectoral, interdisciplinary problems of the environment, especially in developing countries. Technical personnel trained in one engineering or scientific discipline are frequently unable to cope with managing these multi-faceted problems. To address them, an integrated academic discipline on sustainable development is needed. This should embrace many subjects. They might include : the economic system; the ecosystem, the laws of thermodynamics, general systems theory, information science, cybernetics, ecological economics, politics of planning, management of uncertainty,

theory of democracy, history and meaning of development, and science of human behaviour. Appropriately tailored study of these subjects could form the theoretical part of an academic programme on sustainable development. Some techniques would need to be developed or refined to utilise the theoretical knowledge gained in order to solve real problems and offer opportunities for the development of policy objectives and timely interventions. These techniques would include environmental impact assessment, environmental accounting (physical and monetary approaches), and environmental cost-benefit analysis (i.e. integrating sustainability into these analyses).

7.33 To complement this type of training, considerable research is currently being undertaken in universities and elsewhere to devise methods to enable all decision-making bodies concerned with the environment and/or sustainable development to make an integrative approach which links specialist fields, professions, community interests and government agencies.

7.34 *It would be valuable if the Commonwealth Secretariat could assist developing countries in this specialised area by facilitating or promoting : the provision of short-term training courses, perhaps through the Fellowships and Training Programme; the establishment of new integrative teaching and research departments or faculties; and the setting up of new centres of research and development into environmental management which aim to demonstrate and teach integrative methods.*

International Issues

7.35 So far in this chapter, we have been concerned mainly with institutional development (and related issues) in the national context. Elsewhere in our Report we have stressed the importance of regional cooperation, especially among smaller countries and island small states, in facilitating coastal zone management, river basin and sea management, and research and development to introduce environmentally sound technologies. In this context, regional integration movements like those in the Commonwealth Caribbean could be helpful in tackling some of these problems.

7.36 UNCED provides a great opportunity to review global institutions in the light of the increased salience that must be given to the environment and the need for integration between environment and development issues. This, of course, will be vital to the implementation of Agenda 21 which UNCED is expected to adopt. Since 'substance should determine form', we do not propose to speculate on the details, but confine ourselves to noting the need for some important general changes.

7.37 Environment and development issues must be merged, both at the deliberative and at the operational level. We recognise therefore the strong need for an appropriate deliberative forum for regular discussion of these

issues, i.e. of sustainable development, in an integrated way and at a high level in the UN system.

7.38 Increased coordination is also required between international institutions responsible for the environment and for development. These include not only institutions like UNEP and UNDP which are directly under the UN, but also the financial institutions such as the World Bank and Regional Development Banks. In some cases rationalisation is also required within the UN system and between it and other international organisations. *We believe all governments should support the goal of strengthening the mandate and capacity of the United Nations system to integrate environment and development issues and activities. UNEP has achieved major advances within its limited remit and resources. Its activities should be strengthened, adequately resourced (especially through increased funding for its Environment Fund) and more closely integrated with development.*

7.39 We also note that many important international agreements on the environment, under which programmes and activities are now carried out, have inadequate provisions for enforcement and implementation. They include the Montreal Protocol on Substances that Deplete the Ozone Layer (1987), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973), the Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar, 1971), and the International Convention for the Regulation of Whaling (1946). *We urge governments to fulfil their agreed commitments and support efforts to strengthen existing international agreements and, where necessary, to do so in ways which secure wider acceptance of them.*

7.40 *In any event, governments should extend their full support for international efforts to ensure that effective institutional arrangements will be secured at a global level for the implementation of decisions agreed at UNCED.*

Financial Requirements

7.41 It is clear that in the past, in both developed and developing countries, action on development was in many cases not taken on a sustainable basis. All countries need to move to a sustainable development path. For the developed countries and some developing countries, given the political will, increasing awareness of environmental dangers, and possibilities for improved technologies, the capacity exists to put development on an environmentally sound basis. But many developing countries require increased financial inflows and greater effectiveness in aid utilisation to enable them to cope with their environmental problems.

7.42 Increased international provision is being made in some areas: $200

million (for an initial period of three years starting from 1991) has become available under the Interim Multilateral Fund for the Implementation of the Montreal Protocol to assist the adoption of CFC substitutes; $1.2-$1.5 billion in concessional financing has been made available under the Global Environment Facility (GEF) to assist in the resolution of global problems, e.g. global warming, deforestation and the loss of biodiversity; and greater attention is being given to sustainable development in the financial flows from the World Bank, Regional Development Banks and bilateral donor agencies. Yet compared with needs, these funds are comparatively small. *They should be strengthened.* Additional resources will also be required to support the conventions on climate change and on biodiversity, which are currently being negotiated.

7.43 For many developing countries the necessity for increased financial inflows is urgent, not only to tackle a backlog of massive domestic problems such as soil erosion, deforestation, water pollution and desertification, but also to enable these countries to contribute to alleviating global problems such as ozone depletion, global warming and marine pollution. For countries threatened with immediate survival problems, action for sustainable development may be impossible without incentives through increased provision of external resources.

7.44 The reality, however, is that aid as a proportion of the GNP of donor countries has on average been declining. Unless these and other resource transfers are increased significantly, there is a danger of environmental action being forced upon developing countries through the increasing adoption of unacceptable environmental conditionality. This would be contrary to the cooperation required between developed and developing countries in recognition of the increased awareness of interdependence, especially in relation to the need for sustainable development on a global basis. *We recommend that the opportunity current circumstances provide for focusing on the environment be taken to advance the cause of sustainable development. This will require a large increase in resource provision. Reduced military spending in both developed and developing countries may be one way of achieving it.*

7.45 *We believe that net transfers of resources to developing countries must again become positive if sustainable development is to be attained. This requires greater effort to reduce the burden of indebtedness. In this connection, we support early international adoption of the Trinidad and Tobago terms proposed by Britain and adopted at the Commonwealth Finance Ministers Meeting in 1990 in respect of the low-income debt-distressed countries. We recommend increasing use of debt-for-nature swaps. This has the advantages of both reducing indebtedness and contributing to environmental conservation.*

7.46 But international assistance with too great an emphasis on environ-

mental conservation can be at the expense of sustainable development if overall aid is not increased. Environmental conservation now requires a reconsideration of the quantum of aid, with a view to all donor countries reaching internationally agreed targets as soon as possible. The private sector must also be encouraged to contribute more, and this may be achieved through a mixture of incentives and regulatory action, with greater attention to environmentally benign technologies in R & D.

7.47 We also feel that perceptions of aid should change. For instance, in evaluating projects, donors should take into account their implications for human development and for community support systems, which in some societies are the principal responsibilities of women. Furthermore, development assistance programmes should take into account local realities and give consideration to indigenous solutions where appropriate.

Facilitating Technology Transfer

7.48 From a policy standpoint, questions of environmental conservation and sustainable development add to the complexity of technology transfer. There is need to reconcile the requirements for technologies which would maintain or enhance a country's international competitiveness with those which are environmentally benign. Such matters would have to be resolved on a country-specific basis. Sufficient data and expertise are required to make these decisions on an informed basis. Efforts should be made to reconcile these objectives in arranging technology transfers for all domestic and externally supported projects. Two aspects of technology transfer are specially worthy of consideration.

7.49 There are a number of advanced technologies (many of them very costly)—including electronics, biotechnology, and new materials—which are environment-friendly because of their low material-input and energy requirements, or their value in countering environmental damage. The use of genetically-engineered bacteria to treat waste and oil spillage is a case in point. In addition there are also relatively simple and less costly technologies (e.g. solar powered crop driers, biogas and more efficient wood-burning stoves). It is important to enhance the indigenous capability of developing countries to make informed decisions when choosing from among the environment-friendly technologies (especially foreign ones) on offer, and to absorb and apply them—in some cases after adaptation—effectively. *We recommend that donor governments should strengthen their assistance to developing countries in these areas. It would be particularly useful if they were to promote the dissemination of information on low-cost and low- or non-polluting technologies. Given the dominant role of the private sector in technology development, incentives need to be given to encourage technology transfers to those operating in developing countries.*

7.50 The second aspect concerns the need to facilitate developing countries' access to the more expensive technologies and related 'know-how' on terms which are affordable. Many developing countries take the view that they should have access to such technologies on a preferential, non-commercial basis and that appropriate bilateral and multilateral arrangements should be established for this purpose. This raises difficulties where technologies are not owned by governments. Many industrial countries believe that transfers should be on commercial terms. We recognise that reconciling conflicting views on this issue will be crucial to facilitating a successful outcome at the UNCED.

7.51 A variety of innovative measures have been put forward to facilitate technology transfer. They include: the transfer of intellectual property rights of environmentally sound technologies (ESTs) to an international organisation which would allow access to developing countries on favourable terms for local production purposes; the creation of mechanisms for transferring ESTs which are in the public domain, e.g. in waste management and public transport (which should not be as difficult as those in the private domain); the provision of fiscal incentives to the private sector to facilitate the transfer of relevant environmental technologies to developing countries; and, possibly, the use of a proportion of carbon taxes levied in developed countries for subsidising the cost of transferring ESTs to developing countries.

7.52 Finally, we recognise that such innovative means for technology transfer may have high costs. This brings us back to the wider, and equally difficult, question of mobilising substantial additional financial resources to assist sustainable development in developing countries. We have already referred to this but have no hesitation in repeating it as it is, in our view, of critical importance to the future of the global environment.

Commonwealth Cooperation

7.53 In many of the areas discussed above, in addition to the potential of the IDEA network and the wider CCGTM network which could be further developed, there are other avenues for strengthening multilateral and bilateral cooperation among Commonwealth countries. *These should be explored. They include promoting, through workshops, seminars and study tours, exchanges of information and experience and training, especially on a South-South basis, on environmental management and planning in similar and different conditions. Specific areas which might be addressed include environmental evaluation and impact assessment; environmental monitoring and forecasting; natural resources accounting; and development and use of environmentally safe technologies.* These exchanges could involve policy makers, technical experts, and NGOs including women's and other community organisations operating at the grass roots. We welcome the fact that the Langkawi Scholarships Programme, funded by Canada and administered by

the CFTC, is supporting training-oriented programmes in environmental management.

7.54 *In addition, action should be taken to strengthen existing networks, or create new ones, for pooling and exchanging information between institutions in Commonwealth countries.* In this chapter we have already referred to information brokerage as a component of managing National Strategies for Sustainable Development, and in Chapter 5 we noted that international pooling of information is especially vital for small states, particularly in respect of planning strategies to adapt to sea-level rise. We note that the Commonwealth Secretariat and the Commonwealth Science Council are already active in creating such networks in different areas. For instance, the Commonwealth Science Council is facilitating information exchanges and coordination in the management and disposal of hazardous wastes through a network of six regional centres. The Secretariat has undertaken various studies on the environment[13] and related matters. For instance, its Economic Affairs Division has analysed the economic impact of natural disasters and the policy options for dealing with them[14].

7.55 Further action could include strengthening the existing capacity to provide technical assistance for environmental projects. We are aware that CFTC is becoming active in this field, particularly in terms of environmental assessment and the provision of experts in a wide range of related areas, including marine pollution, forest conservation and wildlife preservation. *We support the findings of the report commissioned on strengthening the CFTC's capacity to respond to requests of an environmental nature, that it could usefully develop its capacity to provide 'niche' services, e.g. assistance to small states or the development of environmental guidelines for small-scale industries, which could derive particular benefit from its ability to respond quickly and provide value-for-money.*

7.56 'Twinning' of institutions is a device that is growing in importance and is highly relevant to management of the environment. It offers a flexible and long-term partnership for the exchange of expertise and experience. In Chapter 3 we noted the usefulness of twinning between power and energy utilities to promote energy efficiency as one example among many. *We recommend that the Secretariat fosters arrangements to twin institutions which have environmental responsibilities and expertise. Exchanges should be arranged both among developing countries and between them and developed countries.*

7.57 We cannot over-emphasise the critical need (cutting across all environmental sectors) in many Commonwealth and other developing countries for adequate professional, scientific, technological and institutional capabilities to tackle environmental problems. These needs are especially acute in small states, which have difficulties in attracting and keeping specialised

Box 7.8

Technology Transfer

A recent study of Technology Transfer Opportunities for Reducing Greenhouse Gas Emissions, prepared for the Australian Department of Arts, Sport, Environment, Tourism and Territories, has identified a wide range of available technologies which can play a role in reducing greenhouse gas emissions.

The technologies can be divided into two broad categories, energy and non-energy related. The energy-related technologies fall into three groups:

- technologies for the more efficient extraction and transformation of fossil fuels;

- technologies for the supply of energy from non-fossil sources; and

- technologies for more efficient energy use.

A fourth group not generally used by developed countries but with special relevance to developing countries comprise technologies for the supply and use of cooking and heating energy in low-income households.

On a wider scale it is evident that several environmentally sound technologies, including those in the Australian study, which are available in many developed countries are not easily accessible to developing countries. To make them so would require international cooperation to ensure that environmentally sound technologies will be accessible to developing countries expeditiously and on a fair and favourable basis.

It is in this area of international cooperation that the Commonwealth Secretariat can play a vital role, through instituting mechanisms to:

- *identify opportunities for technology transfer through matching the source of technology generation within member countries with the locality for its application; and*

- *act as a broker between the interested parties to ensure the transfer of technology on equitable and affordable terms.*

Source: based on material from COFFEY and Trotz[15].

skills, and in financing research and development. Alleviating these constraints, which impinge on a country's capacity to participate in international environmental cooperation and to integrate environmental considerations into development policies and practices, should be an important priority in Commonwealth functional cooperation.

7.58 We have already emphasised the importance of technology transfer. *We believe that Commonwealth donor governments (and the industrially more advanced developing member countries) should consider establishing novel means for transferring environmentally-sound technologies to those developing countries with the greatest needs. These means might include using fiscal incentives to encourage private industries to make transfers, and/or governments, acting individually or in concert, subsidising the costs to developing countries of importing such technologies, perhaps by apportioning part of their own environmental tax revenues (e.g. from carbon taxes) for this purpose, where these exist or are contemplated.* As one example, we set out in Box 7.8 on page 147 proposals concerning Commonwealth action to assist in the transfer of technologies to reduce 'greenhouse' gas emissions in Commonwealth developing countries).

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Annex 1

Terms of Reference of the Group of Experts

At the Kuala Lumpur Meeting held in October 1989, Commonwealth Heads of Government requested the Secretary-General to identify a group of experts on the environment who could monitor and evaluate developments concerning climate change, taking into account the work of the Inter-governmental Panel on Climate Change, and deal with other environmental issues as needs arise.

At the same meeting, Heads adopted the Langkawi Declaration in which they committed themselves to a programme of action which would, inter alia, facilitate their participation in relevant international agreements relating to the environment and the promotion of new and innovative instruments which will attract widespread support for conserving the global environment.

Commonwealth Ministers responsible for Women's Affairs, at their Meeting in Ottawa in October 1990, considered among other subjects the question of how to integrate women into decision-making on environmental matters and promote their greater involvement in local, national and international efforts to conserve the environment. Ministers emphasised that women's perspectives on environmental issues should receive adequate international attention. They asked the Secretary-General to convene a meeting of Commonwealth Experts on Women, the Environment and Development to discuss these issues and make recommendations to the 1992 UNCED and the preparatory process leading up to it.

To meet these requests for work to assist Commonwealth governments, and particularly in relation to the 1992 UNCED, the Expert Group will examine all issues on the UNCED agenda of special interest to the Commonwealth

and at the same time give particular attention to the problems of small states and the relationship between women-in-development and environmental concerns, on both of which Commonwealth governments have expressed keen interest.

The Expert Group will advise Commonwealth governments on ways to assist implementation of the Langkawi Declaration and to facilitate effective Commonwealth participation in the 1992 UNCED. In particular, the Group will:

(a) clarify the main issues before UNCED, identifying those which are of special concern to the Commonwealth;

(b) identify major issues of concern to Commonwealth countries in the context of ongoing and future international negotiations on environmental problems (e.g. biodiversity, climate change, tropical forests, international traffic in hazardous wastes, marine pollution etc.);

(c) identify ways of facilitating the participation of Commonwealth and other developing countries in global agreements and assisting their efforts to undertake adequate action on conserving the environment, with special attention to financing and technology transfer arrangements;

(d) give particular attention to issues of special concern to small states and how their interests can best be promoted at UNCED; and

(e) consider the nature and extent of women's management of the natural environment, particularly measures to improve their effectiveness as natural resource managers and their ability to benefit from this role, and advise on mechanisms which will facilitate the greater participation of women in decision-making on environmental matters at both domestic and international levels.

The Group will make specific recommendations in the above areas, for consideration by Commonwealth governments and the wider international community.

Annex 2

Renewable Energy Sources

Solar energy schemes come in two basic types. In the first, photovoltaic (PV) panels convert sunlight into electricity through the photo-electric effect on semi-conductor materials. In the second, thermal-solar, solar radiation is focused onto a heat exchanger containing heat-absorbing fluid which can raise steam to power turbo-generators. Alternatively, it can heat water directly, as in households or public buildings. Currently, the largest project of the first type has a capacity of 7.5 megawatts (MW), and of the second, 10 MW. Both are in the USA. India is also undertaking major solar power projects. There is a high level of commercial interest[1].

In developing countries, especially in regions of high insolation such as the Caribbean and Mediterranean, solar technologies are mainly being used for heating water in houses and public buildings such as hospitals and schools. The larger schemes are more land-extensive, but they still compare very favourably with hydro projects, and are flexible in their choice of site and size of unit, since the technology is modular. Costs are falling rapidly—from $200,000 per peak kilowatt of capacity (kWp) for PVs in 1970 to $6000/kWp in 1990, and projected to be $2,100/kWp in 2000, and $1000/kWp in the long term. The decline in costs has been due to economies of scale in production, technical progress in producing components and materials, and improvements in the efficiency of conversion.

At these investment costs, and with their low operating costs, solar power schemes will be both economically and environmentally attractive over the next generation to developing countries with sufficient insolation. PV systems are cost-effective for applications far from existing power lines, such as isolated settlements or installations, or for rural electrification where the cost of extending the grid would be prohibitive. Small-scale PV systems for lighting, telecommunications, water pumping and refrigeration have been

introduced to isolated rural locations in several Commonwealth countries in the South Pacific. PV is competitive with diesel generators at capacities below 20 kW. The technology could penetrate the market for diesel-powered water pumps operating at low kW capacity—of which India has 4-5 million. In sub-Saharan Africa, photovoltaic pumps provide water at the lowest cost for villages with up to 2000 people. For villages with a higher population, the cost of diesel-pumped and solar-pumped water is roughly equal[2].

In regions with large seasonal variations in sunshine, solar systems can be combined with diesel generators in 'mini-utility' systems for providing the power needs of remote locations. Such a system operates in an island off Australia, and is potentially applicable to African villages and South Pacific and other islands.

Wind-generated electric power is close to becoming competitive with thermal generation (in the USA the gap has narrowed to 2 cents per kWh). Wind generation units are available in small sizes and mass-production is possible. Many other technical improvements are possible, and the US Department of Energy estimate that over the next two decades the cost of wind power at sites with a moderate wind regime could fall to 3.5 cents per kWh[3].

Mini-hydro schemes tap water power without the environmental costs associated with major dams. They can either be run-of-the-river or based on small impoundments, are viable on a small scale, have negligible operating costs, are easy to maintain, and are ideal for small and isolated communities. According to one estimate in 1990 by the US Agency for International Development, the capacity of small stand-alone hydro-plants in developing countries, serving community and agricultural complexes, will reach 29,000 MW in 1991, three times the installed capacity in 1983. World-wide potential for small hydro-plants exceeds 100,000 MW.

Biomass fuel, especially wood, is the predominant form of energy for cooking and heating in the poorer developing countries. Biomass is widely available, versatile (for power generation, gaseous, liquid or solid fuel), the technology is well established, and it is a form of stored energy. As a substitute for petroleum, the use of biomass for liquid fuels is still substantially more expensive.

However, biomass is more attractive in generating electricity. Wood and agricultural waste can fuel steam-turbine co-generation systems to produce both heat and power. A plentiful source of biomass at low cost is essential, as in the residues of sugar cane production. In Brazil the production of ethanol from sugar cane is competitive with imported oil when the latter is at $24 per barrel—and further cost reductions are likely[4]. In the 80 developing countries producing sugar cane it has been estimated that gasifier-gas turbine systems

could produce half the power that is now generated from all sources. The main qualification to this scenario is that biomass used in power generation should not be at the expense of local people's fodder, fuel and building material, unless acceptable substitutes could be provided. Vegetation for biomass energy production should be continually replanted to avoid net contributions of CO_2 emissions to the atmosphere.

Ocean energy could potentially be harnessed in many small islands and coastal areas, either through utilising tidal differences, waves, or ocean temperature differences (through Ocean-Thermal Energy Conversion—OTEC). Although no technology for these three options is as yet commercially available or economically viable, further research and development on all three should be supported. Concomitantly, data collection on the potential for ocean energy, particularly for small island developing countries, should be systematically carried out wherever this has not already been done.

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Annex 3

Group of Experts on Environmental Concerns and the Commonwealth

Members of the Group

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Professor David J Attard	Chairman, Maritime Jurisdiction Commission, Office of the Prime Minister, Malta
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Ms Noor Farida Ariffin	Director
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SUSTAINABLE DEVELOPMENT

An Imperative for Environmental Protection

The crux of our Report is a belief that in the long term, the future of life on Earth depends on caring for and conserving the environment – the natural resources of the planet, its land, air, water, biodiversity, forests and other life-support systems. This will only be possible if all countries, which means governments and their peoples, adopt and maintain policies and practices conducive to sustainable development.

Neither environmental conservation nor sustainable development practices will come free, or even in all cases cheaply. In aggregate, both will demand considerable additional resources which developing countries, whose full participation in the process is vital, do not possess . . . Novel sources of funding, such as an international tax on the consumption of hydrocarbon fuels, adapted to take account of the developing countries' crucial need for economic growth, would buttress more conventional sources.

From the Report

I believe the Report makes a distinctive contribution to our understanding of the complexity of environmental issues. It does so not least through the light shed on two subjects which hitherto have too often been ignored: the environmental concerns of small states, and the gender aspects of environmental and development problems.

An important message which the Report conveys is that it is in the common interest of all humanity to ensure that developmental and environmental goals are achieved in a harmonious way, and particularly that the solution of global environmental problems demands global co-operation. International negotiations on environmental problems are not a zero-sum game, with winners and losers. All nations stand to gain from effective and equitable agreements to protect the world's climate, its forests, its rich biological diversity, its soils and its oceans.

From the Foreword by the Commonwealth Secretary-General

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