Environmental Change and Human Health
in Countries of Africa, the Caribbean and the Pacific

**Gordon McGranahan, Simon Lewin,
Taryn Fransen, Caroline Hunt,
Marianne Kjellén, Jules Pretty,
Carolyn Stephens, Ivar Virgin**

Stockholm Environment Institute
Box 2142
SE-103 14 Stockholm
Sweden
Tel: +46 8 412 14 00
Fax: +46 8 723 03 48
Home page: http://www.sei.se

Responsible Editor: Karin Hultcrantz (SEI)
Project Coordinator: Marianne Kjellén (SEI)
Layout and cover: Helena Forslund (SEI)
Editorial team: Caroline Hunt (LSHTM), Marianne Kjellén (SEI),
Simon Lewin (LSHTM), Gordon McGranahan (SEI)
and Carolyn Stephens (LSHTM)

Recommended Citation: McGranahan, G., Lewin, S., Fransen, T.,
Hunt, C., Kjellén, M., Pretty, J., Stephens, C., Virgin, I. 1999.
Environmental Change and Human Health in Countries of Africa, the Caribbean and the Pacific. Stockholm Environment Institute,
Stockholm, 214 p.

Cover photo: Family Eating, Helena Forslund/SEI
Tropical Strom, National Geographic/GreatShots
Woman in the Field, Charlotte Thege/PHOENIX

ISBN: 91 88714 69 1

Foreword

The European Commission (Directorate-General for Development) and The Swedish International Development Co-operation Agency supported this report by the Stockholm Environment Institute and the London School of Hygiene and Tropical Medicine. It adds a regional dimension to the global review of environment and health presented in the latest biennial report of the World Resources Institute, *World Resources 1998-99*. The choice of region reflects the European Union's longstanding commitment to assisting the African, Caribbean and Pacific (ACP) signatories of the Lomé Convention in their pursuit of sustainable development.

This report provides ample evidence that protecting human health is one of the most compelling reasons for pursuing environmental improvements, especially in conditions of poverty. While ACP countries contribute relatively little to global resource depletion or waste generation, their average burden of disease is very high and a disturbingly large share of that burden is related to environmental conditions. Addressing these environmental threats to health means reducing poverty, and promoting sustainable development.

Healthy living environments and sustainable agriculture that ensures food security are immediate priorities, and both can contribute to poverty reduction. Looking towards the future, it is also important to prevent development initiatives from damaging people's health. This requires enhanced integration of social and health aspects into the appraisal of public and private investment projects and programmes. For this integration sound and efficient regulatory frameworks and sufficient capacity in the ACP countries are needed. Another challenge is to respond effectively to supranational health threats and to global environmental risks, such as increasing regional water scarcity and international climate change.

The report also demonstrates that there is much that can be done to achieve these aims through the full integration of environmental aspects into health sector support programmes. New forms of inter-sectoral collaboration, and engagement with civil society, are needed. People in all walks of life need a better understanding of environmental conditions and how they affect health. Policy-makers and donors need to consider the environmental and health consequences of their actions, and bring environment and health into the development mainstream. This calls for devising more strategic approaches to preventive environmental health management.

It is hoped that this report will reach a large audience, in particular in the partner countries in the ACP region, and will contribute to debate and, more importantly, to act in support of better environmental stewardship and good health. In the context of one co-operation policy under the Lomé IV Convention and the successor agreement that is currently under negotiation, the report will hopefully inform the preparation of future regional and country strategies.

Paol Nielson
Commissioner for Development
and Humanitarian Aid
European Commission

Maj-Inger Klingvall
Minister for Development Co-operation
Ministry for Foreign Affairs, Sweden

Acknowledgements

This report has 8 authors and 18 identified contributors, as well as several hundred references. But even these numbers underestimate the extent to which this has been a collective effort.

The report builds on the work undertaken at the World Resources Institute (WRI) for World Resources 1998-99, under the editorship of Leslie Roberts. In addition to providing a sound base from which to start, the WRI team were kind enough to provide a data set enabling tables pertinent to the ACP countries to be appended to this report.

Extremely valuable and often very comprehensive reviews were received from the following external reviewers: Elizabeth Ardayfio-Schandorf, Department of Geography and Resource Development, University of Ghana; Martin Birley, Liverpool School of Tropical Medicine, United Kingdom; Juliette Bynoe-Sutherland, Ministry of Health, Barbados; Maria Teresa Cerqueira, PAHO/WHO, United States; Thomas Egwang, Med Biotech Laboratories, Kampala, Uganda; George Jambiya, Department of Geography, University of Dar es Salaam, Tanzania; Japhet K. Kiara, Ministry of Agriculture, Nairobi, Kenya; Jainend Kumar, Ministry of Agriculture, Fisheries and Forestry, Suva, Fiji; Gerald Leach, Stockholm Environment Institute, Sweden; Angela Mathee, South African Medical Research Council, Johannesburg, South Africa; David McCoy, London School of Hygiene and Tropical Medicine, United Kingdom; Don Robotham, City University of New York, United States; Jacob Songsore, Department of Geography and Resource Development, University of Ghana; André Soton, Centre Régional pour le Developpement et la Santé, Cotonou, Benin; Christian Bawa Yamba, The Nordic Africa Institute, Uppsala, Sweden.

Valuable comments and contributions were also received more informally from a number of people, Ingrid Kökeritz, Stockholm Environment Institute; Shalini Bhargava, Stockholm Environment Institute and David Gibbon, Department of Rural Development Studies, Swedish University of Agricultural Sciences.

Maps were produced by Simon Stevenson, London School of Hygiene and Tropical Medicine.

For language editing, we had excellent support from Jane Seymour for the review copy and Moyra S. Gough of WriteRight for the final version.

Helena Forslund made invaluable contributions, both in organising and creating the layout of the final publication, under the supervision of Karin Hultcrantz.

Amos Tincani of the European Union had the original idea for this publication, and Artur Runge-Metzger helped guide the project through to completion. Margareta Tullberg at Sida has also provided support during the process.

The analysis and policy recommendations in this report represent the views of the authors and do not necessarily reflect the views of the funders or affiliated organisations. As always, the authors bear responsibility for the remaining errors. If responsibility is to be apportioned, the SEI team bears more responsibility for Chapters 4-**6,** the LSHTM team for Chapters 2-3, and we all share at least some responsibility for Chapters 1 and **7.**

List of Authors

Gordon McGranahan (Stockholm Environment Institute)
Simon Lewin (London School of Hygiene and Tropical Medicine)
Taryn Fransen (Stockholm Environment Institute)
Caroline Hunt (London School of Hygiene and Tropical Medicine)
Marianne Kjellén (Stockholm Environment Institute)
Jules Pretty (Centre for Environment and Society, University of Essex / Stockholm Environment Institute)
Carolyn Stephens (London School of Hygiene and Tropical Medicine)
Ivar Virgin (Stockholm Environment Institute)

List of Contributors

Dela Attipoe, Public Health Department (1995-1998), Accra Metropolitan Assembly, Ghana.
(Box 5.6 & 7.2)
Martin Birley, Liverpool School of Tropical Medicine, United Kingdom.
(Box 7.7)
Debbie Bradshaw, Centre for Epidemiological Research in Southern Africa, Medical Research Council of South Africa.
(Box 2.2)
Thomas Egwang, Med Biotech Laboratories, Kampala, Uganda.
(Box 3.3 & 6.1)
Anders Ellegård, Bioquest, Gothenburg, Sweden.
(Energy and Health)
Cirre Fall, ENDA- Relais pour le Developpement Urbain Participe Dakar, Senegal.
(Box 7.5)
Kevin Gray, Stockholm Environment Institute, Sweden.
(Box 1.1)
A. D. Harries, Technical Adviser to the Malawi TB Programme, c/o British High Commission, Lilongwe, Malawi.
(Box 7.3)
George Jambiya, Department of Geography, University of Dar es Salaam, Tanzania.
(Box 7.4)
Melissa Leach, Institute of Development Studies, University of Sussex, United Kingdom.
(Box 1.4)
Nadine Nannan, Centre for Epidemiological Research in Southern Africa, Medical Research Council of South Africa.
(Box 2.2)
Ogonda Onwuchekwa MD, MSc Environmental Epidemiology.
(Box 1.1 & 3.4)
Don Robotham, City University of New York, United States.
(Box 1.2)
David Satterhwaite, International Institute for Environment and Development, IIED, UK.
(Urban Services, Housing and Health)
Jane Seymour, Editor / Researcher in Environmental Health, London, United Kingdom.
(Box 4.6)
Ronald Subida, University of the Phillipines and London School of Hygiene and Tropical Medicine.
(Small Island States Health, literature review)
Erica Toft, Erica Toft Konsult HB, Sweden.
(Box 4.5)
Marc Vézina, International Water and Sanitation Reference Centre (IRC), The Nederlands.
(Box 5.5)

Table of Contents

List of Boxes

List of Figures

List of Tables

Executive Summary

Executive Summary

Background to this Report

Internationally, the links between environmental degradation and human health are receiving greater attention. There is increasing recognition that environmental and health-related issues need to be integrated into the mainstream of the development agenda. For this to occur, decision-makers at every level, from heads of state to householders, need to become more aware of how and when their actions are likely to affect the environment and health. Thus, whilst this report addresses issues of particular concern to the environment and health sectors, it is also of relevance to other sectors.

This report was financially supported by the European Community and the Swedish International Development Cooperation Agency (Sida) to provide a companion report to the World Resource's Institute's World Resources Report, 1998-99, focusing on the ACP group of states – the countries in Africa, the Caribbean and the Pacific that are signatories to the Lomé Convention. The overall objective of the report is to inform debate on improving environment and health in the ACP region. More specifically, the report is intended to assist ACP governments and Northern donors in developing assistance programmes that address the major environmental problems now threatening the health of ACP residents, and avoid the health-threatening environmental damage that can accompany inappropriate development initiatives.

Audience

This executive summary has been written for those with an active interest in mainstreaming environmental and health issues, but without the time to read the full report. This could include senior officials in Health and Environment Ministries within the ACP, in the health and environment divisions of international development organisations, and in large NGOs. The executive summary focuses on why environment and health issues are important, and indicates priorities for action. The justification for the claims made in the executive summary is provided in the main body of the report.

The full report is intended for a more diverse audience, including:

- Policy analysts and donors responsible for developing policy papers or programmes addressing environmental and health issues (in the ACP);
- Specialists and practitioners working on particular aspects of environmental and health issues, and wishing to understand the broader context or consequences of their work;
- Writers and others preparing more popular material on these issues;
- Students interested in understanding environmental and health problems in developing countries.

Aims of the Report

This report aims to first briefly describe the broad global, economic, political, social, institutional context in which ACP countries currently find themselves (Chapter 1). It then describes the health status and key health threats in ACP countries in an environmental context (Chapters 2 and 3). Chapters 4 to 6 review environmental developments in the region and they ways in which they are influencing health. Finally, environmental health priorities and measures which can be taken to improve environmental health in ACP countries are identified (Chapter 7).

Scope of the Report

The focus of this report is on health burdens in the ACP, and the environmental problems that contribute to them. Less attention is paid to health burdens that are not clearly linked to environmental problems, and environmental problems that do not contribute appreciably to ill health. Health and the environment are defined relatively narrowly, largely in physical terms. The 'environment' is taken to mean physical (not social) surroundings, and 'environmental problems' generally refer to deficiencies brought about inadvertently by human

activity: pollution, resource depletion, ecosystem destruction and the like. 'Health' is taken to be a state of well being, with an emphasis on freedom from physical health problems brought on by environmental inadequacies or problems. In terms of action, the report is primarily concerned with what can be done within the ACP countries themselves.

Environmental and Health Issues – a Shared Agenda

This report argues that the environmental and health sectors of ACP countries need to work closely to develop a shared agenda for environmental health for the following reasons:

- Environmental and health problems overlap, especially in low-income ACP countries. In comparisons with most other parts of the world, it is apparent that:
  - A larger share of the burden of disease arises from (physical) environmental threats, rather than, for example, from lifestyle choices;
  - A larger share of (physical) environmental burdens affects health directly, rather than, for example, depleting the global resource base.

The link between environment and health is, therefore, more immediate than in many more affluent parts of the world, and environmental interventions hence have the potential to dramatically reduce the burden of disease and increase quality of life.

- The environmental and health sectors are often weak players in a policy arena dominated by economic and political considerations. Many of the actions which degrade the environment and threaten health are taken by players outside of the narrowly defined health and environmental sectors.
- Conceived and implemented sectorally, environmental initiatives tend to over-emphasise regulative measures, whilst health initiatives tend to overemphasise curative measures.
- Pursued independently, there is a danger that health and environmental agendas will conflict:
  - Local environmental health problems will be treated by means of displacement, thus displacing or delaying (rather than eliminating) environmental burdens;
  - Environmental capital will be protected by denying the most vulnerable groups access to the resources and environmental services they need to protect their health.
- Pursued jointly, health and environmental agendas can be made complementary:
  - Health prevention can move 'upstream' and take advantage of the multi-sectoral approach to environmental improvement;
  - Environmental improvement can become grounded in issues of local concern, and take advantage of the local presence of health professionals.

Report Findings

Background to the ACP countries

The ACP grouping is based on a series of aid and trade agreements (the Lomé Conventions) between the European Union and the 71 signatories (as listed in Appendix 1).

The ACP region is extremely varied: its countries include small island states where tourism dominates the economy, and continental countries characterised by a dependence on subsistence agriculture. Although many ACP countries are rich in natural resources, the transition from colonies to independent countries left many nations with a weak infrastructure and political instability. More recently, economic globalisation has undermined traditional approaches to poverty alleviation, environmental protection and health improvement. Debt, structural adjustment and worsening terms of trade have also taken a heavy toll on governance and infrastructure. At the same time, international aid to the region has decreased.

The ACP countries include a large and growing share of the World's poor. Human development indicators suggest that poverty and inequality in ACP-Africa are increasing. Conflicts and large-scale migration have exacerbated the situation in numerous countries. Persistent poverty remains the most

important barrier to environmental health improvement, and action taken in support of environmental and health issues must, therefore, also support poverty alleviation and respond to the challenges of globalisation. Issues such as debt relief and improved terms of trade between the ACP and developed countries could play an important part in poverty alleviation.

Many of the environmental health problems of ACP countries can be grouped into two categories, the first of which remains dominant in most areas:

- A persistent poverty cluster: long-standing environmental health problems, such as unsanitary conditions, smoky fuels, and food insecurity, that conventional development has failed to solve (or in some cases has made worse);
- A conventional development cluster: emerging environmental and health problems, ranging from hazardous industrial pollution to the health- threatening aspects of global climate change, which conventional development has helped to bring about.

Sustainable development entails addressing the problems associated with persistent poverty, without adding appreciably to those resulting from conventional development. Neither the health nor the environmental sector can meet this twofold challenge alone. Uneven development and rapid population growth within the ACP, coupled with new global environmental threats originating largely outside of the ACP, are contributing to the challenge. Building local capacity and improving governance are critical to meeting these challenges, and to ensuring that targeted initiatives are effective in addressing local environmental and health priorities.

Demographic and health trends

The twentieth century has witnessed substantial improvements in global health and well being. These improvements have not, however, been uniformly distributed. Most ACP countries still lag far behind both other developing countries and developed countries with regard to indicators of health status. Environmental factors, often linked to poverty, remain a major cause of death and disease.

Demographic indicators, such as fertility rates and infant mortality rates, are some of the highest in the world in ACP countries. Although the demographic transition is under way (to varying degrees throughout the region), it is likely to take several decades before the ACP-Africa demographic profile begins to approximate that of other developing regions, such as Latin America or Asia.

Health conditions in the ACP countries have improved substantially over the past 50 years, but are still amongst the worst in the world. ACP-Africa contains approximately 11% of the global population, but accounts for 21% of the global burden of disease.

The burden of disease within the ACP region is not equally distributed. There are large inequalities in health between and within countries, but in general, the poor, and poor children in particular, bear a disproportionate burden of disease.

There are worrying indications that both the economic hardships of the 1980s and 1990s and the HIV/AIDS epidemic have adversely affected health conditions in some countries, particularly those in ACP-Africa.

Whilst the importance of non-communicable diseases and injuries is increasing, communicable diseases, most of which are environmentally related, still take the largest toll of human health. In 1990, two-thirds of the disease burden in ACP-Africa was attributable to communicable, maternal, perinatal and nutritional conditions. By 2020, this figure should drop considerably, but these conditions are still expected to account for some 40% of the disease burden.

Injuries account for 15% of the burden of disease in ACP-Africa, and this proportion continues to rise. Mental health problems are another neglected, but important, area for intervention.

Key health threats in an environmental context

Approximately one-third of the total burden of disease in ACP Africa is associated with environmental factors, manifested in the high prevalence of environmentally related deaths

and disabilities. The poorer countries of ACP Caribbean and Pacific are likely to experience similar burdens. Healthier living environments and improved food security could mitigate this burden.

Whilst demographic changes are focusing attention on adult health, the 'unfinished agenda' of communicable diseases should not be neglected. Many of the most important communicable diseases in ACP countries - diarrhoeal disease, tuberculosis, malaria and acute respiratory infections - have strong environmental linkages. Improvements in environmental conditions are crucial to controlling these infections.

Water and sanitation related diseases are still extremely important in many of the countries included in this review. 10% of the disease burden in ACP Africa can be attributed to inadequate water, sanitation and hygiene, with children bearing most of this burden. Wealthier households and urban households are more likely to have access to water and sanitation services than poorer and rural households. The provision of adequate water and sanitation thus remains extremely important in improving health and reducing disease in many ACP countries. Integrated approaches to service provision, which include hygiene promotion, are likely to give the greatest health benefits and will also maximise operational synergies by ensuring that households have adequate water for good hygiene practices. Improvements in water supply have also been shown to bring substantial economic benefits to households.

Approximately 32% of the burden of disease in ACP Africa can be attributed to protein-energy malnutrition. Trends indicate that the number of underweight children in ACP Africa may be rising. Key groups for intervention include women and children, who often experience the worst living conditions in both rural and urban societies. Improvements in food security for the poorest households, combined with attention to the status of women, female education, and increasing the income of poor households, have all been shown to contribute to reducing mal- and under-nutrition and reducing the burden of disease.

Acute respiratory infections were the most common cause of death in developing regions in the 1990s. Estimates suggest that over 50% of respiratory infections are associated with environmental exposures related to poor housing conditions, overcrowding, poor hygiene and indoor and outdoor air pollution.

Tuberculosis remains a major contributor to the burden of disease in the ACP countries and is related to poor living environments, poverty and poor access to effective treatment. This burden is expected to rise by 2010, mainly due to rising HIV prevalence and demographic changes.

Injuries are growing as a contributor to the burden of disease in the region, due to increases in road traffic accidents, wars and violence. The effects of armed conflicts in the region on health and environment are very substantial. Urban violence is also growing as a public health threat, and in both cases, the poor are at greatest risk. ACP-Africa has experienced by far the highest levels of population movement resulting from wars, famines and other environmental and political changes, when compared with other regions. This has had important demographic and health impacts, and deserves more attention.

In all ACP countries, the poor continue to bear the largest proportion of the disease burden. Diseases such as tuberculosis, acute respiratory tract infections and diarrhoeal disease are closely linked to environmental conditions most often encountered in poor areas, and not only are they compounded by other aspects of poverty, but the unequal distribution of resources helps to ensure that these health inequalities are maintained. Low quality and insufficient food increases the risk of disease.

The poor are often unable to protect themselves from the effects of natural and human-made disasters, which may further exacerbate poverty and disease. This is of particular concern in relation to the effects of global warming.

Some of the key health threats reviewed are linked to household-level behavioural patterns. Further research into the social and behavioural aspects of health and disease is required in order to develop programmes that encourage healthy practices at the household level.

Agricultural change, rural livelihoods and health

From an ACP perspective, the environmental aspects of agriculture are of special concern to health because they are closely related to food security and malnutrition. Agriculture remains the predominant means of survival in most ACP countries and the majority of the population is still employed or active in the agricultural sector.

An increase in people's access to food is important if ACP countries are to improve the health of their growing populations. Increasing the food production levels is not, however, the same as ensuring food security, as these increases may not benefit the most food-insecure groups. For weaker social groups, security and stability of land ownership are important in ensuring food security. Efforts to strengthen and assist low-cost sustainable agriculture will be important in improving food security and health in ACP countries, and would include activities such as maintaining crop genetic diversity, resolving land tenure problems and implementing policies to empower rural women.

Mortality and illness due to pesticide exposure are more common in ACP countries than in industrialised ones, relative to the small amount of pesticides used. Older and more toxic compounds (off-patent pesticides) still dominate the market in many countries, as they are far less costly than new ones. Policies and actions limiting the use of toxic pesticides, including the development of Integrated Pest Management (IPM), will be important in limiting pesticide poisonings and facilitating sustainable agriculture.

Many ACP countries suffer from an inadequate replenishment of nutrients removed by agriculture and land degradation. This is most acute in ACP-Africa where, in many countries, nutrient removal exceeds nutrient replenishment by a factor of three to four. The region still accounts for less than 1% of global fertiliser use, with very low rates of fertiliser use per hectare, and in large parts of ACP-Africa, there is virtually no chemical fertiliser usage at all. There is thus great scope for increasing the productivity of African land by using more fertiliser, including biological nitrification, and because of the current low fertiliser usage, a potential increase in the use of fertiliser is not expected to pose a significant health problem.

Land conversion and irrigation schemes can affect disease vectors and may increase disease transmission, and an increased awareness of the health-related effects of land use changes is needed. Health impact assessment of irrigation schemes and forest conversion should be an important part of project development.

The erosion of crop genetic diversity represents a serious threat to food security for low-income farmers.

Genetic engineering is changing the pace of agricultural development, and has the technological potential to reduce malnutrition in ACP countries. There are major institutional barriers preventing biotechnology from benefiting poor, small-scale farmers, however, who are also most vulnerable to the risks of biotechnology.

Urbanisation and healthy living environments

Urbanisation can be beneficial or harmful to people's health. Much depends upon how the physical environmental changes that accompany urbanisation are handled, but for most ACP countries, the problems that pose the greatest threat to health in the urban environment are those that low-income citizens face in and around their homes.

Rapid urban growth is likely to be a feature of most ACP countries for the coming decades. Governments cannot prevent rapid urbanisation with policies and legislation, but they can help ensure that urbanisation benefits human health, in that the quality of urbanisation is more critical to health than the rate of urbanisation. Unmanaged urban development creates very unhealthy living environments, whilst good local environmental management and service provision, in both urban and rural areas, can greatly reduce the burden of disease.

The most severe environmental health problems are closely interrelated and found predominantly in low-income homes and neighbourhoods. They include poor access to water, inadequate sanitation, contaminated food, uncollected waste, smoky kitchens and a range of insect vectors

(the *persistent poverty cluster*). Important environmental amenities, such as water and sanitation, are lagging behind population growth in many urban areas.

Cooking with smoky fuels may be contributing significantly to respiratory problems, in particular for women and children. These problems are compounded by other factors such as poverty, poor housing, overcrowding, and air pollution from other sources.

The relative lack of industrial development has meant a low average exposure to chemical pollution in the general population. Where it does occur, however, exposure levels can be very high, posing a threat to industrial workers and nearby (often low-income) residents (the *conventional development cluster*).

The rapidly growing *informal economy* of smaller and less regulated enterprises contributes appreciably to health by providing livelihoods, but can, in some circumstances, pose serious environmental health threats.

Environmental deterioration and lack of services in low-income areas are an environmental and health priority. Neither conventional public service delivery, nor private service delivery, can meet the challenge alone. Improvements that build on the strengths of both private and public sectors, and support the contribution of local residents and their organisations, are more likely to succeed. Strategies to address current deficiencies are also more likely to be successful if they:

a. develop local capacities and give priority to forging good relationships between residents and service providers;
b. build on positive synergies, giving priority to environmental improvements that alleviate poverty (which in turn increases the local capacity to manage the environment);
c. draw upon and enhance both scientific and local knowledge of environmental and health issues;
d. improve housing security;
e. respond to the diverse needs of different groups.

Regulations and impact assessments can play an important role in controlling pollution, especially in the formal economy. Conventional regulations are, however, difficult to apply efficiently in the informal economy, and can easily become self-defeating. All stakeholders need a better understanding of environmental health risks in order to support more participatory solutions.

Global Environmental Change

Unlike the environmental problems described above, global environmental change is largely the result of activity outside of the ACP countries. Only about 2% of global carbon emissions originate in the ACP of which three countries contribute approximately 80% of the industrial emissions, namely South Africa, Nigeria and Trindad and Tobago. As ACP countries do not contribute appreciably to the emissions of greenhouse gases or ozone-destroying chemicals, their main concerns should be to ensure that international agreements are equitable as well as strict, and that vulnerability in the ACP is reduced. Developed countries, which produce the bulk of carbon emissions, need to take greater responsibility for their environment and health impacts.

The projected effects of climate change are worldwide, with uncertain regional and local implications. Major effects may include an increase in temperatures and the frequency of extreme weather events, coupled with a rise in sea level.

The health threats of climate change include malnutrition arising from agricultural disruption and the increased incidence of infectious diseases spread by insects and other vectors advantaged by climate change, coupled with the direct loss of lives and livelihoods from rising sea levels and extreme weather events.

The ACP is likely to suffer disproportionately from global climate change due to geography (small islands and semi-arid regions are especially vulnerable), the presence of already food-insecure populations and a lack of capacity for adaptation. They thus have a particularly substantial stake in limiting the global

emissions of greenhouse gases, which may also extend to ozone depleting substances.

The health risks of stratospheric ozone depletion include skin cancer, which is less of a risk for the dark-skinned majority of ACP residents, but also extend to eye diseases, immune system damage and ecological and climatic effects that may potentially undermine food security.

Environment and health – a shared agenda

Poverty lies at the heart of the environmental challenge for most ACP countries. Moreover, this poverty exacerbates the links between environmental degradation and ill health - the affluent can often afford to delay or displace environmental impacts, whilst the poor, more typically, have to bear the consequences in the form of ill health.

Two of the principal means by which environmental burdens threaten health in the ACP are the *undermining of food security* and the *creation of unhealthy living environments*. These are particularly important with regard to the large cluster of environmental health problems associated with poverty, including a large share of infectious diseases and malnutrition.

This report clearly confirms that 'a clean environment supports good health, whilst a degraded environment increases the likelihood of death and disease'. Better health is one of the strongest reasons for taking measures to improve the environment in many ACP countries, in that the link between the environment and health in these countries is far more immediate than in many more affluent parts of the world, and environmental interventions have the potential to dramatically reduce the burden of disease and increase quality of life. It is also important that a better environment and better health be pursued in tandem as a means of achieving sustainable development.

Key actions on the shared agenda to improve environmental health should, therefore, focus on the following:

- *improving food security*
- *achieving healthy living environments.*

Other areas for intervention include:

- *reducing the environmental health impacts of development initiatives*
- *ensuring equitable control strategies for global environmental health burdens.*

Interventions, especially in relation to food security and healthy living environments, should be designed to promote the equitable participation of women, enhance the livelihoods of the poorest, and improve local capacity through education and institutional support. Interventions also need to address underlying issues such as tenure, local social networks and issues relating to demand. Conventional supply-side approaches (such as attempts to increase food production or the supply of water and other environmental services) that ignore underlying issues often fail to reach those most in need.

Improving food security: The key actions should include:

- The support and promotion of sustainable agricultural practices, especially in areas where food security is currently at risk. This would include minimising the use of external and non-renewable inputs that have the potential to damage the environment or harm the health of farmers and consumers, and targeting the use of the remaining inputs with a view to minimising costs;
- Ensuring the full participation of farmers and other rural people in all processes of problem analysis, technology development, adaptation and extension, to create increased self-reliance and ensure greater use of local knowledge and practices;
- Integrating natural processes (such as nutrient cycling, nitrogen fixation, and pest-predator relationships) into agricultural production processes, to promote profitable and efficient food production;
- Protecting nature's goods and services, and other public goods of the countryside;.

- Redirecting biotechnology to reduce risks and better serve the needs of small cultivators, subsistence food producers, and the malnourished.

Achieving healthy living environments: The key actions should include:

- Increasing the capacity of local residents to manage their own environments, recognising that this capacity depends upon adequate livelihoods, housing security, gender equity, knowledge of environmental-health links, the quality of local governance and the availability of micro-finance;
- Improving the provision of water, sanitation and other environmental services to low-income households, urban and rural alike.

To be avoided:

- skewed subsidies favouring the better-off;
- poor relationships between residents and service providers;
- under-financed and over-constrained utilities;
- an excessive reliance on imported capital-intensive technologies;
- poor maintenance of existing infrastructure.

To be encouraged are approaches that are:

- based on a good understanding of existing formal and informal systems of provision;
- sensitive to local needs and priorities;
- making efficient use of the range of technologies available;
- involving residents in critical decisions;
- informed by both scientific and local knowledge of environmental health links;
- implementing housing programmes that assist low-income households, especially in urban areas, to build, buy or extend their own homes. Many of the considerations that apply to environmental service provision also apply here.

Reducing the environmental health impacts of development initiatives: Health and social impact assessments need to be included in established procedures of impact investigation to safeguard health and environmental status. Over time, more strategic approaches to preventive environmental health management also need to be devised.

Ensuring equitable control strategies for global environmental health burdens: An effective international platform is needed so that ACP countries can represent and promote their environmental and health concerns with regard to the impacts of global environmental change. Environmental problems such as climate change, for example, are largely attributed to northern activities, but may have a severe effect on ACP residents. The main preventative actions need to be taken elsewhere, but adaptive measures need to be explored and developed. ACP countries have a collective interest in helping to ensure that action is taken internationally to reduce the risks. Also they have an interest in ensuring that the 'polluter-pays' principle is applied, and that their currently low contributions do not translate into inequitable rights to the global commons.

Chapter 1
Background

Chapter 1 Background

Aims of the Chapter

- To identify the goals and approach taken in this report.
- To describe the economic setting within which the ACP's environmental and health problems must be addressed.
- To introduce some of the underlying forces influencing environmental change and health in the ACP.

Main Points

- This report is intended to inform discussions on environmental and health issues in the ACP, and ways of addressing them.
- The ACP countries include a large and growing share of the world's poor.
- Economic globalisation is undermining traditional approaches to poverty alleviation, environmental protection and health improvement within the ACP.
- Persistent poverty remains the most important barrier to environmental health improvement in the ACP.
- Uneven modernisation and rapid population growth within the ACP, along with new global environmental threats originating largely outside of the ACP, are contributing to the challenge of managing environmental change to promote human health.

Policy Implications

- Environment and health need to be brought into the development mainstream.
- Action taken in support of environment and health must also support poverty alleviation, and respond to the challenges of globalisation.
- Building local capacity and improving governance are critical to meeting these challenges, and ensuring that more targeted initiatives are effective in meeting local environment and health priorities.

1.1 Introduction to the Report

Internationally, the links between environmental degradation and human health are receiving more, well deserved attention. Recent publications from the World Health Organization (World Health Organization, 1997) and the World Resources Institute (World Resources Institute, 1998) have provided global summaries. This report focuses on the ACP group of states – the countries in Africa, the Caribbean and the Pacific that are signatories to the Lomé Conventions. ACP countries suffer disproportionately from environmental health problems. Their burden of disease is especially high, and a particularly large share of that burden is associated with environmental factors. Many of their environmental health problems can be grouped into two categories, the first of which still dominates in most ACP countries:

1. A **persistent poverty cluster** - long-standing environmental health problems, such as unsanitary conditions, smoky fuels, and food insecurity, that conventional development has failed to solve (or in some cases has made worse).

2. A **conventional development cluster** – emerging environmental and health problems, ranging from hazardous industrial pollution to the health-threatening aspects of global climate change, which conventional development has helped to bring about.

Sustainable development entails addressing the persistent poverty cluster, without adding appreciably to the conventional development cluster. Neither the health nor the environment sector can meet this twofold challenge alone. If health and environmental improvements are

pursued independently, the health agenda is likely to overemphasise curative measures, while the environmental agenda is likely to emphasise long-term sustainability at the expense of poor people's needs today. The health and the environmental sectors have critically important roles to play in fostering environmental health improvements, and can be far more effective when working in collaboration. One of these roles is to help ensure that influential players outside of the health and environment sectors also take these issues into account. Ultimately, it is the combined efforts of all sectors of society, including civil society and local government, that will transform environmental and health conditions, hopefully for the better.

1.1.1 Purpose

The overall objective of this report is to help provide the basis for a more informed debate on improving the environment and health within the ACP. The executive summary focuses on why environmental and health issues are important, and suggests priorities for action. The full report places more emphasis on the nature of the problems, how they are changing, and the challenges they pose. It is intended to help bridge the gap between science and policy, by presenting research findings in a policy-relevant form. It also situates the environmental and health problems of the ACP countries within the context of contemporary development trends, challenges and policies.

The report reflects the increasing recognition that environment and health issues need to be brought into the mainstream of the development agenda in a more integrated fashion. Even in Europe and North America, public concern has recently pushed health higher up on the environmental agenda. Health is a comparatively more serious environmental concern in developing countries, where few can afford to displace environmental burdens onto future generations or distant populations. The European Community and Sida financially supported this report as a companion to recent global studies, focusing on issues of particular relevance to the ACP.

If environment and health issues are to enter the mainstream of development policy, decision makers at every level, from heads of state to householders, need to be more aware of how and when their actions are likely to affect the environment and health. Specialists in particular aspects of health and the environment need to understand the broader context of their work. People writing policy documents or preparing presentations for the media need reliable sources upon which to draw. Only a few are likely to read a report of this length and detail. There is a growing demand for more relevant information on and analysis of environmental and health issues, however, and this report is a response to that demand.

More specifically, the report is intended to assist ACP governments and Northern donors in developing assistance programs that improve environmental and health conditions. Here, the goal is to identify issues which are of particular concern from an ACP perspective, and indicate where development assistance could play a supportive role. It is not to recommend particular activities, or to contribute to debates about the future of the Lomé agreements that define the ACP grouping (see section 1.2.1 below).

1.1.2 Scope

The focus of this report is on health burdens in the ACP, and the environmental problems that contribute to them. Health burdens that are not clearly linked to environmental problems, and environmental problems that do not contribute appreciably to ill-health, receive little attention. The terms 'health' and 'environment' are used narrowly, to refer primarily to physical conditions. The 'environment' is taken to mean physical (not social) surroundings, and 'environmental problems' generally refer to deficiencies brought about inadvertently by human activity: pollution, resource depletion, ecosystem destruction and the like. 'Health' is taken to mean physical and mental well being, and the emphasis is placed on biophysical health problems brought on by environmental inadequacies. Biophysical health is, however, treated as means for people to achieve their aspirations, rather than simply an end in itself,

and the report supports the goals implicit in WHO's broader definitions of health.[1]

However defined, health and environmental problems cannot be isolated from their social, economic and political context, particularly if the goal is to inform action. Issues of poverty, governance, and development policy are thus within the scope of this report to the extent that they determine why environmental and health problems emerge and persist, and how conditions can be improved. Moreover, since the concepts of the environment and health are being defined relatively narrowly, it is especially important to consider how actions taken in support of the environment and health contribute to or detract from other developmental goals.

Environmental health problems associated with poverty are given special attention. This is not only because they account for most of the environmental health burden in the ACP, but also because they help distinguish the environment and health challenge in the ACP from that in the North, whose problems tend to dominate the international policy debates.

In terms of action, the report is primarily concerned with what can be done within the ACP countries themselves. Opportunities for improving the environment and people's health in ACP countries through better international economic regimes, decreasing Northern contribution to global environmental degradation, or policy shifts outside of the ACP are not considered. It must be recognised, however, that global processes are radically changing the environmental and health challenges being faced within the ACP. Development assistance is only one, relatively small aspect of the way in which Northern policies are affecting environmental and health issues in the ACP.

Despite these limitations on the scope of this report, a wide range of problems are examined, ranging, for example, from sanitation problems in urban neighbourhoods to the possible effects of global climate changes on food security and malnutrition. The common feature is that virtually all of these problems involve environmental damage arising from human actions, and which put public health at risk. More attention is generally given to preventable environmental problems whose resolution would yield large health benefits in ACP countries. Food security is, for example, given considerable attention because malnutrition is a major health burden in the region, and one which environmental improvements could do much to resolve. Ambient air pollution, on the other hand, is given little attention because it is a lesser burden already discussed in some detail in the global reports.

The region itself is extremely varied: its countries include small island states economically dominated by tourism, and continental countries with a large share of the population engaged in subsistence agriculture. By emphasising issues of importance to health in the ACP as a whole, the report is inevitably more relevant to ACP-Africa than to the ACP-Caribbean and Pacific. Among the ACP-Caribbean and Pacific, it is more relevant to the larger and poorer islands of Papua New Guinea and Hispaniola than to the smaller and more affluent islands such as Barbados and the Bahamas.

There are a number of serious health problems in the ACP which would be considered to be environmentally-related under a broader set of definitions, but which are largely excluded from this report. Violence and HIV infection, for example, present critical challenges for many ACP countries, but are only mentioned in the chapters on health (2 and 3). Mental illness, traffic accidents and smoking are increasingly important health burdens, but again are not deemed to be sufficiently

[1] The well-known WHO definition of health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO, 1988) emphasises health as a positive quality and is extremely wide in scope (Curtis and Taket, 1996). Another WHO definition explicitly relates health to the physical and social environment, identifying it with 'the extent to which an individual or group is able to realise aspirations and satisfy needs, and to change or cope with the environment. Health is therefore seen as a resource for everyday life, not the objective of living; it is a positive concept encompassing social and personal resources as well as physical capacities' (WHO/EURO, 1984).

'environmental' to consider in the context of environmental change (chapters 4-6).

1.1.3 Intended Audience

The executive summary is primarily intended for policy makers with an interest in mainstreaming environmental and health issues. This includes senior officials in Health and Environment Ministries within the ACP, in the health and environment divisions of international development organisations, and in large NGOs.

The full report, which may be read straight through but which can also be used as reference material, is intended for a more diverse audience, including:

- Policy analysts responsible for developing official policy papers or programmes addressing environment and health issues.

- Specialists and practitioners working on particular aspects of environment and health, who wish to understand the broader context or consequences of their work.

- Writers and others preparing more popular material on these issues.

- Students interested in understanding environmental and health problems as seen in developing countries.

1.1.4 Structure

This report comprises seven chapters. The remainder of this chapter examines some of the processes and forces which are influencing environmental and health issues in the ACP, and summarises some of the ways in which environmental change and health are related. The following two chapters delineate the demographic and health situation in the ACP region. Chapter 2 assesses the overall health and demographic situation, and reviews recent trends, projected changes, and existing health differentials among different groups of people. Chapter 3 reviews the key threats to human health in ACP states, with the emphasis on environmental health threats. The subsequent three chapters review environmental developments in the region, the way in which they are affecting health, and the kind of shifts that would improve the health outlook. They focus on agricultural change and food security (chapter 4), urbanisation and health threats in the living environment (chapter 5), and the potential threats posed by global environmental changes (chapter 6). The final chapter (7) draws together the conclusions from the report and argues that a common agenda on environment and health is needed, prioritising food security and healthy living environments, and coordinating action to prevent growing environmental health threats from other quarters.

The report has two appendices. Appendix 1 gives a complete listing of the countries that constitute the ACP group of states. Appendix 2 includes tables extracted from the 1998-99 World Resources Report, focusing on ACP countries. When not otherwise referenced, figures in the main report refer to this Appendix.

1.2 The ACP and the Economic Context

This section first describes the ACP grouping, and the convention that unites them. It then examines the economic context which helps define the environment and health challenges many of these countries face, looking in turn at the persistence of poverty and the relevance of economic globalisation, including the structural adjustment programmes that have accompanied globalisation.

1.2.1 The ACP Grouping

The ACP group of states comprises the 71 signatories to the current Lomé Convention in Africa (48 countries), the Caribbean (15) and the Pacific (8). Their locations are shown in Figure 1.1. The Lomé Conventions, summarised in Box 1.1, are a series of aid and trade preference agreements between the European Union and the ACP countries, most of which were formerly European colonies. There have been a series of four conventions signed, and since the current convention is due to expire in 2000, new arrangements are under consideration (European Commission, 1996). ACP-EU relations, and the place of development assistance, have changed considerably since the first convention was signed in the mid 1970s. Many of the ACP countries do,

nevertheless, still have close economic ties with the European Union countries.

The ACP countries are estimated to account for slightly more than 1% of the Gross World Product, despite containing more than 10% of the population. At slightly over $500, the GNP per capita in ACP-Africa is less than half that of the ACP-Caribbean and Pacific estimate of $1,200.[2] Remove South Africa, and the ACP-Africa average falls below $300.[3] Such measures of the monitored production of marketable commodities, valued at international exchange rates, exaggerate international disparities in consumption. Many residents of low-income countries obtain an appreciable share of their goods outside of the market and, when they do purchase basic necessities, prices in dollar equivalents are comparatively low. Nevertheless, there is no doubt that the ACP contains a large and growing share of the world's poor.

Economic growth in recent decades has been disappointing, particularly in Africa. Whereas the Gross World Product grew at about 3% per annum between 1985 and 1995, the Gross ACP Product grew at less than 2% - lower than the population growth rate. Not all ACP economies have fared badly. A number of the ACP-Caribbean and Pacific economies have benefited from the global economic upswing, and some ACP-African economies have grown far more rapidly than the average. Between 1995 and 1997, the economies of ACP-African countries picked up, averaging about 4% annually, with GDP per capita increasing for the first time in many years (Fischer *et al.*, 1998). However, this only just begins to compensate for the longer term decline, and the economic challenges are as daunting as ever.

Over 80% of ACP's export earnings still come from primary commodities, and more than 40% of their exports go to the EU. The EU also remains one of the principal sources of development assistance for the ACP, and in 1996-97 the EU member countries disbursed about $8.7 billion in official development assistance to ACP-Africa, out of a total of $12.8 billion from all OECD donor countries (OECD Development Assistance Committee, 1999, Table 32).

Overall development assistance to the ACP has been declining, however. Judging by statistics published by the OECD Development Assistance Committee, which cover all of the major donors, net disbursements to ACP-Africa (valued in $1996), including flows through multilateral organisations, fell by over 20% between 1986-87 and 1996-97. Contributions of the EU member states to ACP-Africa fell by about the same percentage. Whilst figures on ACP-Caribbean and ACP-Pacific are not broken out in these summary statistics, it is safe to assume that overall ACP development assistance has followed similar trends. One of the few exceptions is in the Official Development Assistance of the European Community, which includes the European Development Fund and contributions from more than twenty different budgetlines of the annual budget of the European Community. Gross disbursements to ACP-Africa from these sources increased by over 50% in real terms over this same period, reaching approximately $2.5 billion in 1996-97 countries (OECD Development Assistance Committee, 1999, Table 34 and DAC deflators). Since overall contributions of the EU member countries has been declining, this implies a sharp rise in the relative importance of European Community's assistance activities.

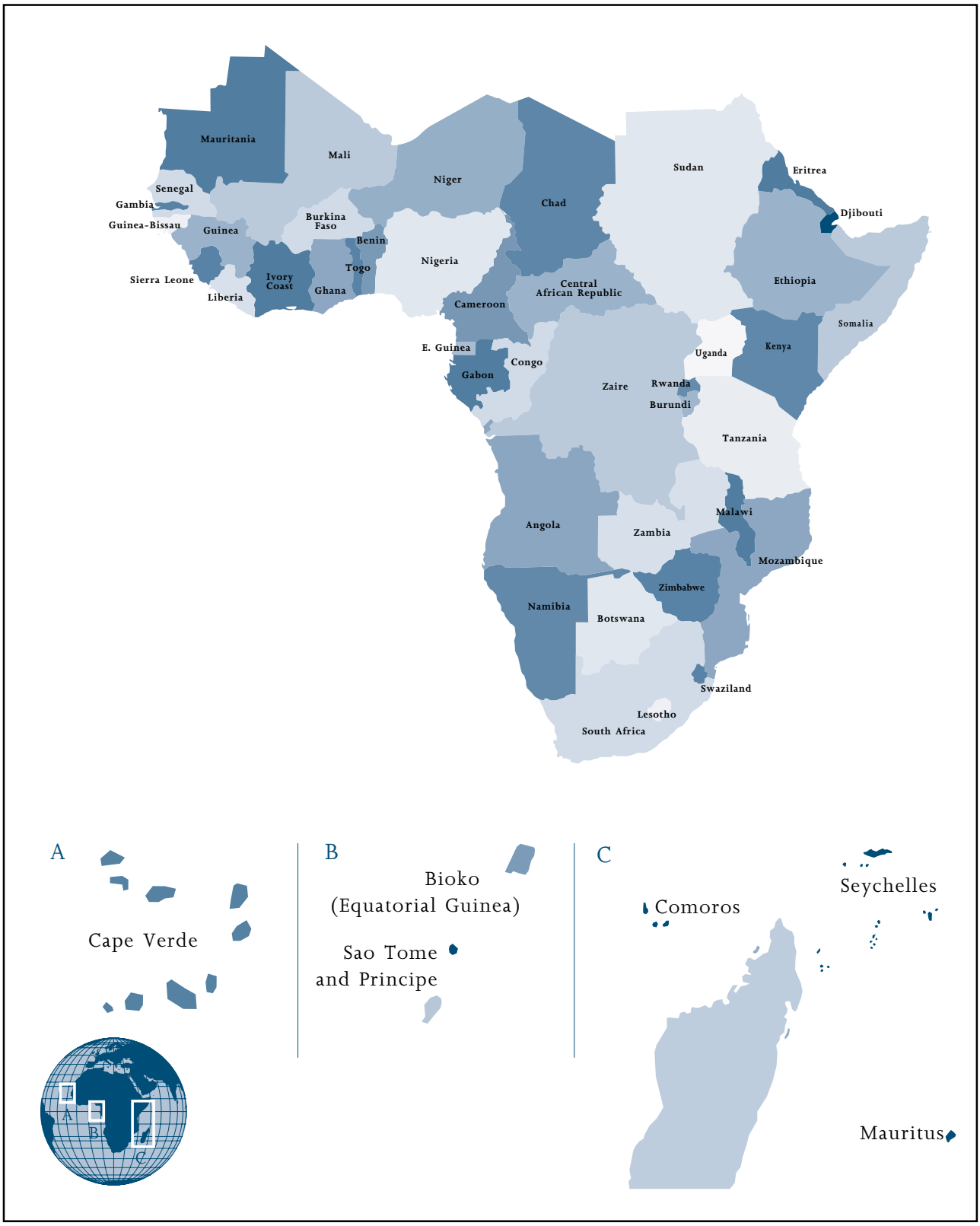
Declining development assistance and limited foreign direct investment have exacerbated the external debt burdens suffered by many ACP states. In the mid 1990s, the ACP was receiving official development assistance of roughly $18 billion, and spending some $12 billion annually in servicing debts. The ACP

continued on page 21

[2] These are averages weighted by population. Since in not only ACP-Africa but in ACP-Caribbean and ACP-Pacific, some of the smaller countries have the highest incomes, arithmetic averages tend to be somewhat higher.

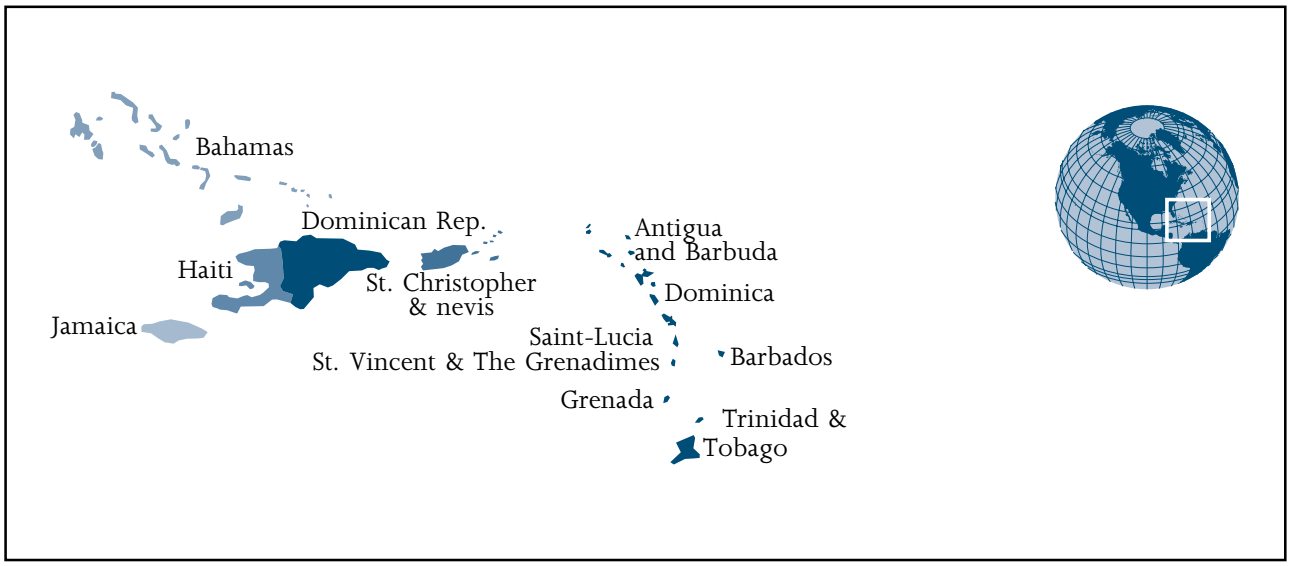
[3] Forty of the 62 countries classified as Low Income Countries by the World Bank (World Bank, 1998) are ACP countries, and all but two of these are in Sub-Saharan Africa. The remaining ACP countries, with the exception of the Bahamas, are classified as Middle Income.

Figure 1.1 a) ACP Countries in Africa and Small Island States off the African Coast.



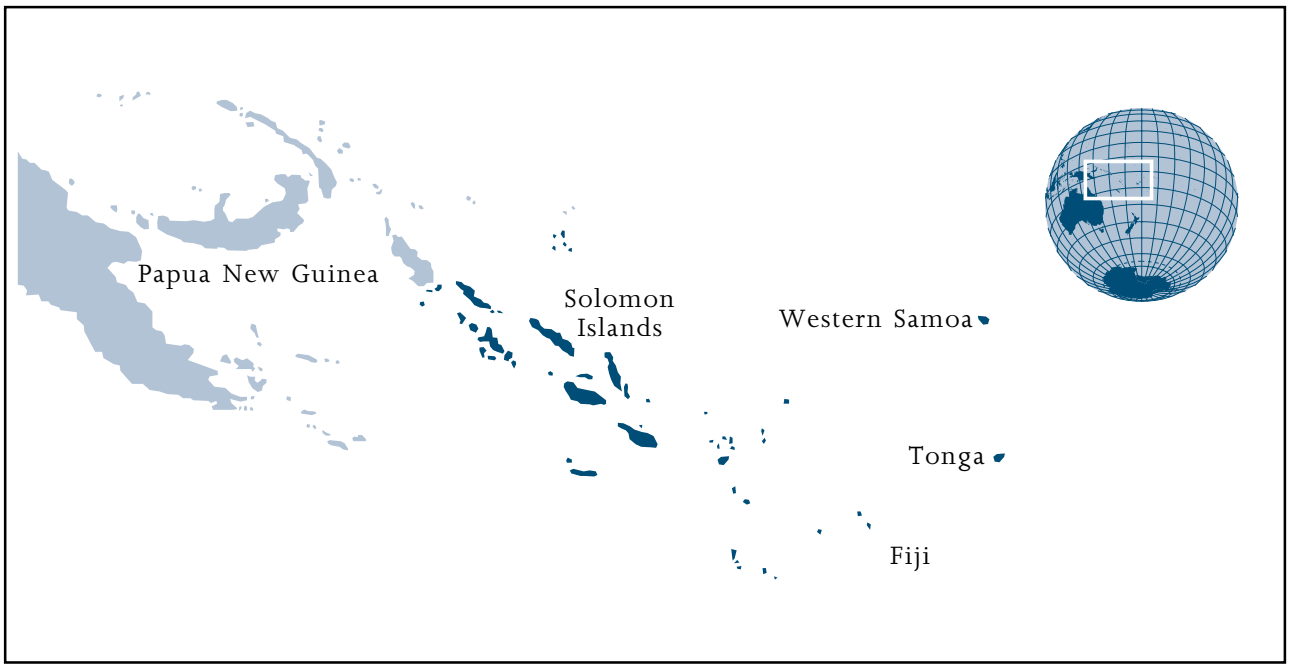
Source: Energy as a Tool for Sustainable Development for African, Caribbean and Pacific Countries. Editor Uno Farinelli. UNDP, 1999.

Figure 1.1 b) ACP Countries in the Caribbean.



Source: Energy as a Tool for Sustainable Development for African, Caribbean and Pacific Countries. Editor Uno Farinelli. UNDP, 1999.

Figure 1.1 c) ACP Countries in the Pacific.



Source: Energy as a Tool for Sustainable Development for African, Caribbean and Pacific Countries. Editor Uno Farinelli. UNDP, 1999.

Box 1.1 The Lomé Conventions

The Lomé Conventions are a set of agreements addressing trade and investment issues entered into between the members of the European Union and the members of the ACP states. The Lomé Conventions have tried to address the need to strengthen economic and social infrastructures in the ACP states, by means of rural development and training programmes, coupled with industrial development, and marketing and sales promotion schemes.

Primarily, the conventions provide general tariff preferences and specific preferences for certain export commodities from ACP countries. European Union exports are not given reciprocal access to the ACP markets. These preferences are designed to circumvent the tariffs and other barriers that protect EU markets and to stimulate growth and development in the exporting ACP states.

The areas covered by the Lomé Conventions include:

- Commodities;
- Manufactured and semi-manufactured goods;
- Technology transfer and economic development;
- Helping the least developed of the developing countries, and developing both island and land-locked countries;
- Trade relations among countries with different economic and social systems;
- Institutional issues.

The Lomé Conventions also include instruments such as Stabex and Sysmin that attempt to offset the instability and the downward trend of commodity prices in real terms. Stabex operates as a compensatory mechanism, as well as providing budgetary support, in order to stabilise export earnings of ACP countries that suffer earnings shortfalls. Sysmin is an instrument designed to support mining development in ACP countries, with particular emphasis on maintaining competitiveness and furthering economic diversification.

There have been four Lomé Conventions. Lomé I was signed in February 28, 1975, came into effect on 1 April 1976 and lasted for 5 years. Lomé II was signed on 31 October 1979, came into effect on 1 January 1981 and expired on 28 February 1985. The differences in Lomé II included an increase in the number of signatories and in the number of products protected through the Stabex scheme, together with a reduction in the requirements needed to take part in the Stabex scheme. Lomé II also saw the introduction of the Sysmin scheme, the establishment of the Technical Centre for Agricultural and Rural Co-operation, an increase in intra-ACP co-operation, and an increase in the allocated budget.

The Lomé III Convention, which was signed on 8 December 1984, came into effect on 1 May 1986 and expired on 28 February 1990. In addition to a further increase in the number of signatories, Lomé III also meant greater trade co-operation, an increase in the number of goods protected by the Stabex and Sysmin schemes, and several new titles added to the list of things covered by the preceding convention. The new titles included the protection of private investment, transport and communications; cultural and social co-operation; and more regional co-operation. The budget allocated to projects under the convention was also increased.

The Lomé IV Convention[1] was signed on 15 December 1989, came into effect on 1 March 1990 and, in contrast to the other conventions, is valid for a ten-year period. In addition to modifying existing titles, a new title on the protection and preservation of the environment was added, in the light of an increased interest in the problems of drought and desertification. There was also an increase in the amount of money allocated to projects under this convention.

Under Lomé IV, cooperation under the ACP-EU regime is intended to support efforts designed to achieve comprehensive, self-reliant and self-sustained development. It is to be based on development that achieves a "sustainable balance between its economic objectives, the rational management of the environment and the enhancement of natural and human resources." The parties are to "attach special importance to environmental protection and the preservation and the restoration of natural equilibria in ACP states."[2] Lomé IV specifically mentions numerous environmental principles, including the preventive principle, which calls on the parties to take a "preventive approach aimed at avoiding harmful effects on the environment as a result of any programme or operation."[3] EU member states are specifically prohibited from directly or indirectly exporting hazardous or radioactive waste from the EU to the ACP states.[4]

In light of the expiry of the Lomé IV agreement in February 2000, negotiations began on a successor agreement to Lomé IV in September 1998. The ACP and the EU have agreed on the idea of building a strengthening partnership and a deeper political dialogue. This partnership would aim to bring about a further reduction in poverty, and to promote both sustainable development and the continued integration of ACP states into the global economy. Political and public support for the Lomé Conventions within the EU appears to be dwindling, however, due to doubts about the effectiveness and efficiency of the convention, shifts in interests towards Eastern Europe and North Africa, and the general downward pressure on aid budgets in the European Union.

Based on Contributions from Ogonda Onwuchekwa MD, MSc. Environmental Epidemiology and Kevin Gray, Stockholm Environment Institute.

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[1] *African, Caribbean and Pacific States-European Economic Community: Fourth Lomé Convention (Lomé IV)* (15 December 1989, in force 1 September 1991) (1990) 29 I.L.M. 783, Art. 4.
[2] Art. 14. Under Article 33, the protection and the enhancement of environmental and natural resources, the halting of the deterioration of land and forests, the restoration of ecological balances, the preservation of natural resources, and their rational exploitation, are basic objectives which the parties are to achieve in order to bring about an immediate improvement in living conditions and to safeguard those of future generations (Art. 33).
[3] Art. 35.
[4] Art. 39(1). ACP states are specifically required to prohibit the direct or indirect import of hazardous and radioactive waste from the EU or from any other country.

continued from page 17

countries as a whole have also seen a decrease in their share of international trade, despite the tariff preferences given to them by the European Union. Moreover, the overall increase in foreign direct investment has not favoured ACP countries. Direct foreign investment in the ACP was only on the order of $3 billion a year in the mid 1990s (in contrast to $47 billion in Asia).

Whilst the latest Lomé convention remains important for most ACP countries, it has, in many respects, been overtaken by other international developments (Stephens *et al.*, 1999). Economic globalisation, and the international agreements that have helped promote it, are redefining ACP-EU relations. Conflict between the EU and the United States over the banana protocol is an indication of a more fundamental tension between the EU's relationship with the ACP and other global negotiations. Within this changing landscape, it is difficult to foresee how the Lomé arrangements will evolve.

One likelihood of particular relevance to this report is that environmental issues will become an increasingly important aspect of the ACP's development and international relations. Historically, environmental issues have not been prominent in the Lomé conventions. In 1990, however, in the wake of the Rio Conference environmental issues have been given a higher priority in the Lomé IV Convention.

Environmental screening and impact assessments are an integral part of co-operation. Trade in hazardous waste is prohibited by the Convention, the fight against desertification and other forms of land degradation are emphasised, and a special Annex has been added related to the sustainable management of tropical forests (see Box 1.1). The local environmental problems that have a major influence on the health of ACP residents are generally not well represented in international environmental agreements. They are, however, central in terms of the broader development goals to which the Lomé conventions aspire, and it is in conditions of economic deprivation, in particular, that the health burdens of environmental problems come to the fore.

1.2.2 Persistence of Poverty

Globally, whilst the percentage of the world's population living in economic poverty may be falling, the actual number of poor people is reported to be rising, and the gap between rich and poor to be expanding (World Resources Institute, 1998). The persistence of poverty, despite rapid global economic growth, quite rightly raises questions about the quality of this growth, and its relationship to broader aspirations for human development. At the national level, however, whilst poverty persists in the face of economic growth, it often gets worse in times of economic stagnation and crisis. The economic difficulties of many ACP countries thus makes the challenge of alleviating poverty all the greater. Economic growth may not be the best, and is certainly not the only means of reducing poverty. But it is part of almost any optimistic vision for the poor in ACP countries.

Of all the major regions of the world, economic poverty is both most pervasive and deepest in ACP-Africa (Ravallion and Chen, 1997). Research also indicates that the extent of economic poverty has been increasing in Africa, Latin America and Eastern and Central Europe, whilst it has been declining in East Asia, South Asia, the Middle East, and North Africa.

Such claims gloss over the difficulties inherent in defining and measuring poverty, as well as the enormous variety of people who can be classified as poor.[4] Some of the most critical differences in environmental conditions and health exist among people who are poor, but live very differently. Even within the same household, people can face very different circumstances depending on the season, the stage in the household's lifecycle, the individual's age and position in the household, and numerous other factors. One of the reasons that poor people are notoriously risk-averse is that they want to avoid the often health-threatening changes that can accompany a superficially minor decline in circumstances.

The urban and rural poor in ACP countries often face many of the same environmental problems, and their livelihoods are often intertwined. Urban crowding can exacerbate local environmental threats, but access to environmental services, such as water and sanitation, are often particularly lacking in poor rural areas. The livelihoods of rural dwellers tend to depend more on food production, but the urban poor can face even more severe problems accessing food when their livelihoods are undermined. Moreover, many urban and rural settlements span the rural-urban divide, with residents engaged in both traditionally urban and rural activities, or maintaining ties with family members resident elsewhere. Urban dwellers often get a significant share of their food directly from agriculture. Rural dwellers often receive remittances, and a foothold in the city, through their urban relatives. But in both urban and rural contexts, poverty is a threat to health.

Most poor people in ACP countries are rural dwellers; often subsistence farmers, involved in buying and selling goods, but not producing exclusively for the market. Urban

[4] Most statistics rely on measures of private consumption, and these measures are typically very imperfect. More importantly, they ignore the non-marketed benefits from common property resources, state-provided goods, human capital and other assets. It is also sometimes argued that less tangible aspects of poverty, such as vulnerability and loss of dignity should be taken into account. (Baulch, 1996).

poverty is growing rapidly, however, and there are indications that it is underestimated in official statistics (Satterthwaite, 1997). In the following chapters on environmental and health trends, rural poverty is central to the discussion of agricultural change, whilst urban poverty is central to the discussion of urbanisation. There are, however, close links between urban and rural poverty, and it should be kept in mind that the rural-urban distinction means something different in, for example, small island states than in large agrarian countries.

Overall, it is hard to overestimate the importance of poverty for health. Poverty is probably the best single predictor of ill health (World Health Organization, 1996), in large part because it is associated with malnutrition, environmental hazards that threaten health, and inadequate health care. Even in affluent countries, however, where the physical environmental hazards associated with poverty are largely absent, health is still closely linked to income (Kunst *et al.*, 1998; Marmot and Smith, 1997; Montgomery *et al.*, 1996). Indeed, the health patterns of affluent countries suggest that social aspects of relative poverty can contribute appreciably to ill health (Wilkinson, 1994). These social aspects may also be very important, though harder to discern, in low-income countries where poverty is simultaneously associated with a wide range of physical threats to health. Moreover, as discussed in more detail below, the physical hazards associated with poverty are not simply a reflection of economic scarcity. Many environmental burdens and amenities are not distributed through the market, but even so, the poor tend to be extremely disadvantaged.

1.2.3 Globalisation and Economic Change

Human activities around the world are becoming ever more closely interconnected, environmentally, economically and even socially. With regard to climate change, to take the most obvious environmental example, greenhouse gas emissions from around the world are combining, and threatening to increase the average temperature globally, with numerous local repercussions (Jepma and Munasinghe, 1998). In the economic sphere, an increasing share of production is traded internationally, international investment and financial flows are growing ever more rapidly, and nation states have less and less scope to pursue independent economic policies. Socially, not only are people and ideas from different parts of the world being brought into closer proximity, but there is an increasing consciousness of the world as a whole (Yearley, 1996). The possible health impacts of global environmental change are examined in Chapter 6. This section is concerned primarily with economic globalisation, with some asides on the social dimension.

Globalisation is not a neutral process. Contributions to greenhouse gas emissions are concentrated in affluent countries, whereas the burden borne is likely to be especially heavy in small island states, for example. Cultural influence is closely tied to commerce, both in the sense that the culture of the more affluent tends to dominate, and in the sense that commercialisation is itself a cultural process. Economic globalisation has losers as well as winners. Trans-national corporations are clearly benefiting from economic globalisation, and have been important proponents of free trade and other policy shifts in favour of globalisation. Most ACP countries have been losers, and a number of ACP governments are understandably sceptical of the supposed economic benefits of embracing globalisation. This scepticism was been eloquently expressed by the Ugandan Finance Minister, Basoga Nsadhu, during discussions at the World Trade Organization (WTO) in 1996 (Coates, 1998).

> *'We were told if we had democracy we would get funds. We had democracy and no funds came. We were told if we had structural adjustment, foreign direct investment would come. We had Structural Adjustment Programmes, but no funds came. We were told if we had trade liberalisation and privatisation, investment would come, but none came. Now we are told we will get funds if there is a multilateral investment agreement. You are trying to cheat Africa.'*

continued on page 27

Box 1.2 Globalisation: A Pivotal Process for Health and the Environment

Without a firm grasp of the globalisation processes unfolding in the world today, it is difficult to develop effective policies for Health and the Environment in the ACP countries, or in the European Union for that matter. By profoundly shaping the economic and social conditions under which we live, including health and environmental conditions, globalisation brings new issues to the fore which compel us as individuals, social strata, ethnicities and nations to shift the focus of our health, environmental and overall social policies.

The Main Economic Processes

One needs to isolate some of the critical processes involved in globalisation, in order to fully appreciate the impact it is already having and will surely continue to have even more powerfully in the future. Given the publicity accorded to the "banana war" between the European Union, the United States and the ACP countries, it is often assumed that the most important aspect of globalisation is the new imperatives of worldwide free trade. Free trade in goods is a major feature of globalisation, but the free movement of capital is a central issue.

The defining feature of economic globalisation is precisely this: the freedom of movement of capital across nearly all national frontiers, with three key financial centres, namely New York, London and Tokyo providing the axes of this international capital market. Closely aligned to this international capital market are the international currency market and the freedom to buy and sell foreign currencies on the open market, without any exchange controls or other legal impediments maintained by states.

A major feature which has made this international capital and currency market a reality is the global electronic and information revolution, leading to the widespread influence of the Internet, the growth of private intranets and the enormous expansion in e-mail as a means of communication. What this means is that any change in the economic or political conditions in a particular country, whether Developed or Developing, is instantaneously communicated across the globe. Given this power to transfer huge sums of money and information electronically - and instantaneously - capital managers and currency speculators can act decisively by moving huge volumes of funds from what they consider to be at-risk countries to what they consider to be safe economies, long before national Ministries of Finance and Cabinets, not to mention the local citizenry, have the chance to act.

These central features of globalisation, which were initially confined to the major countries of the developed world, primarily the United Kingdom under Mrs. Thatcher, and the United States, have spread to most of the developing world. They are now commonplace in Latin America and the Caribbean, and in most parts of Africa and Asia. Although they may seem far away from people's everyday lives and from health and the environmental issues, they actually have a distinctly direct and powerful affect.

Any country which, in the eyes of these international money managers, develops an overvalued currency, or has too large a deficit in its national or foreign accounts, such that it seems unlikely that it will be able to service foreign loans, debts or foreign investments, or too high a rate of inflation which, of course, undermines the worth of these same foreign investments, or even too high a level of taxation, is in for a rude awakening. They will be compelled to change course, to devalue, to cut their budget deficits, to raise interest rates, and essentially, either structurally adjust their economies or face dire economic consequences. Previously, the International Monetary Fund prescribed these adjustments; nowdays, they are merely imposed by the international money markets. Capital simply flees, bringing about local economic crisis.

This new reality has been learnt by Mexico, Sweden, Malaysia, South Korea, Russia and Brazil, and many others, in a variety of ways, but always at the cost of economic stagnation, social hardship and dislocation. Even Germany and France, with their intractably high levels of unemployment, have been subject to the imposition by global capital of essentially the same harsh disciplines.

The Impact on the Developed World

One major way in which these dramatic changes show themselves, especially in the economy of the United States, is in the shift in the composition of the labour force. The service sector (both producer and consumer services) continues to grow and now completely overshadows the manufacturing sector as the major employer of labour. This does not mean manufacturing has become unimportant, but it does mean that it increasingly the high-end manufacturing and manufacturing with a high technical content (usually informatics or biotechnology) spheres which predominate.

Another very important way in which these changes show themselves is in the growth of new inequalities of both income and wealth in the Developed countries. This huge service sector is by no stretch of the imagination homogenous. I am not referring to the well-known increased concentration of wealth and income in the uppermost 1% in the last ten years, but to the growth of inequalities lower down on the social ladder. The transformation of the economy wrought by the deployment of information technology, in the broadest sense, in an unregulated marketplace has widened the gap between different strata of middle and the working class. It has even opened up significant income and social benefit differences between employees within the same occupational group. Two people may thus both be waiters, but one is a waiter in a luxury restaurant on Park Avenue in Manhattan, whilst the other works in a small establishment in the Bronx. The differences in income, quality of life and the environment are likely to be huge.

One evident consequence of globalisation in the economies of the developed world is this accelerated differentiation of incomes and benefits throughout a wide range of occupational groups. It seems to be fragmenting society, not just into classes and strata, but into substrata and sub-substrata, increasing social inequality at the detailed level and thereby sharply undermining social solidarity, and, one may add, the political consensus supporting society-wide health, environmental and general social policies.

The Impact on the Developing World

What about the impact on the developing world? Clearly these economies are far more vulnerable to international capital movements and to the competitive pressures of the new networked, re-engineered super multinationals. In the new international division of labour, so-called low-end manufacturing (garments, electronic assembly) are increasingly outsourced to the developing world, where labour is cheap and relatively unregulated. Their local markets are usually too small and poor, and developing countries consequently have to pursue a policy of export-led development in order to compete, sending these low-priced light manufactured goods to the markets of the developed world, thereby further displacing labour in those societies at the same time they are also subsidising the developed world. Their cheap exports are a key reason for the low rates of inflation in the developed world and they make a fundamental contribution to social stability by providing a wide range of everyday manufactured staples for the working and middle class population of the developed world at remarkably low prices. In return for this access to the markets of the developed world, developing countries have to deregulate their own markets and open them to the more technologically advanced exports of the developed countries.

In the Developing World, too, the impact of this process sharply increases inequalities. Those in favoured occupations in the new service sectors in the Developing countries

(tourism and to some extent informatics) prosper, as do, to a lesser extent, those in the old enclave of raw materials sectors connected to mining. Those employed in manufacturing in the export protection zones usually earn a subsistence wage, whilst those who remain in sectors unable to compete in the global economy (for example bananas) are simply marginalised. This new global marginalisation applies particularly to the billions involved in the rural economy and comprises the major danger posed to the Developing World by globalisation.

Entire regions of the world (sub-Saharan Africa in particular) have been experiencing this awful reality of global marginalisation for a number of years now - they have few marketable raw materials, are unable to supply cheap manufactured goods, and offer no profitable investment opportunities. They are simply not **players** in the global marketplace. They are not, however, the only part of the Developing World facing a similar threat: the Caribbean is also at very real risk. If the greatest threat to the Developing World in times gone by was posed by exploitation, the even more forbidding threat posed today is that of global marginalisation.

As rural societies become globally and nationally marginalised two things are likely to follow. Firstly, a more drastic exploitation of the physical environment is likely, simply as a desperate act of survival, whilst inter-rural conflicts over declining rural resources (packaged as **ethnic** or **tribal**) are also likely to erupt and to spiral downwards into chronic internecine violence and ethnic cleansing. Secondly, the scale of rural-urban migration and primary and secondary urbanisation is likely to grow also.

Unemployment and underemployment are, therefore, likely to increase and in a context of growing social inequality, this inevitably means increased crime and violence, weakened social solidarity and instability. Health and environmental conditions in both town and country are likely to deteriorate sharply because even in a best case scenario, raw materials exports and low-end manufacturing will certainly be unable to yield the revenues which governments need to finance improvements in health and environment systems. So, what can be done?

What can be done?

There can be little doubt that the technical revolution which is at the root of the globalisation process offers the prospect of eliminating poverty and, in fact, of drawing all of the groups in the world into a global community. Certain critical steps must, however, be taken for the majority of peoples in the Developing World (and in the Developed World also) to truly benefit in a sustainable manner.

Firstly, urgent steps must be taken to prevent the threat of the global marginalisation of the Developing World, and of Africa in particular. Essentially, what this means is helping developing countries to become **players** and to earn higher incomes (as individuals, firms and nations) in the global economy, in a sustainable manner. Increasing capacity in the Developing World, rather than welfare assistance to alleviate poverty, thus becomes the key task.

This means radically improving education systems at every level, but higher education in particular. It also means ensuring the ability to develop and maintain a modern infrastructure in support of these activities. Research and especially development (technical imitation and innovation) capacities in the Developing World must be strengthened.

Secondly, the capacity of the State in the Developing World must be enhanced, modernised and made transparent. Low institutional capacity is now universally recognised as a very serious obstacle to development. Every penny of public revenues and developmental assistance must be used effectively, firstly as a requirement in its own right and secondly in order to sustain political support at home and abroad for these re-distributive activities. Broad social strata in both the Developed and Developed

Worlds need to understand, however, that inequalities will never be significantly reduced, solely by raising educational levels. Re-distribution of incomes and widespread public provision (one can debate the precise mechanisms) will be essential. Public support can and needs to be won for an understanding of this reality. This is the third point.

Fourthly, developing countries must be given longer periods of adjustment to the forces of the globally deregulated market. These economies will need subsidies and protection for a considerable period while they build up their internal capacity. Further, the means of regulating the international capital and money markets need to be discussed and devised. Various ways of achieving this without undermining the market mechanism have been proposed and these need to be pursued to the point of implementation, thereby ensuring that the fruits of the unprecedented growth in human capability which spring from the revolution in information technology are used for the general benefit of society and are widely available to people throughout the world.

Fifthly, developed countries must provide the environmental space on the global commons for the developing countries to move into economic parity with the Developed World. International agreements restricting the abuse of the global environment are necessary, and they must look towards a future where resources and sinks are equitably distributed. Mechanisms are needed to ensure that environmental restrictions do not cement the economic status quo, or further heighten inequalities, but rather, provide opportunities for sustainable economic development.

Finally, coping with globalisation must not divert attention from fundamental human rights and needs that cannot be met by economic development alone. The environmental and health problems discussed in this report are a case in point.

Contributed by Don Robotham, City University of New York.

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continued from page 23

As described in Box 1.2, globalisation, and its economic aspects in particular, is changing the nature of the environmental and health challenges faced by the ACP countries. To date, few of the ACP economies, especially in ACP-Africa, have benefited appreciably from the recent growth in the global economy, often portrayed as the positive side of economic globalisation. But they have, nevertheless, been adversely affected by global economic phenomena such as the oil crisis of the 1970s and the high interest rates of the 1980s (both of which contributed to the debt crisis). Structural adjustment programmes have been implemented in a large number of ACP countries, at least in part to make these countries more competitive within the global economy. Here too, unfortunately, the environmental and health costs have been more evident than the benefits.

Well over half of the countries of ACP-Africa have initiated a structural adjustment programme, involving some combination of currency devaluation, trade liberalisation, price reform, privatisation and supportive institutional changes (Engberg-Pederson *et al.*,

1996), usually designed under the auspices of the International Monetary Fund (IMF) and/or the World Bank. Virtually all ACP countries have adopted at least some of the neo-liberal policies that underlie these adjustment programmes.

Structural adjustment policies generally adhere to the principles of orthodox market economics, but were adopted as a response to a number of events:

- In the 1960s and early 1970s, newly independent developing countries invested heavily in social, health and infrastructure programmes, often borrowing funds from commercial banks to finance these programmes. Revenue from exports of commodities financed repayments on these loans.
- Following the oil price rise of 1973-4, oil-importing developing countries were faced with very large balance of trade deficits. Oil revenues had created abundant financial liquidity internationally. Deficit countries were, therefore, able to borrow from commercial banks at low interest rates to finance these deficits. About $20 billion a year was transferred to developing countries in the 1970s. Commodity prices also remained high and these countries were, therefore, able to invest and consume as before with little incentive to 'adjust' to the new situation.
- This led to rising levels of debt, which seemed sustainable as long as interest rates were low, commodity prices high and commercial banks willing to continue lending and 'rolling over' old debts.
- In 1979 there were further increases in oil prices and increased borrowing was necessary. Recession in the developed countries in the early 1980s led to decreases in commodity prices -which continued for much of the decade- and to increases in interest rates. Commercial banks became less willing to lend to developing countries, as the prospects for repayment seemed poor, and by the mid-1980s almost all commercial lending had ceased (Stewart, 1995).
- With decreasing commodity prices, terms of trade for many ACP countries deteriorated and debt service as a proportion of exports increased rapidly. Countries developed large current account deficits and, as they were not able to secure finance from commercial sources, they approached the IMF and World Bank for loans. These loans were conditional on the countries introducing certain policy changes referred to as 'structural adjustments'. Consequently the IMF and the World Bank became major policy makers in the majority of African and Latin American countries in the 1980s.

The problems described above were particularly acute for ACP-Africa, which has higher debts than any other developing region. Between 1990 and 1993, the region transferred $13.4 billion annually to external creditors – around four times as much as is spent on health services. As many countries have not been able to make their scheduled repayments, arrears on loans have accumulated rapidly and, since 1988, about two-thirds of increase in debt stock for ACP-Africa is due to the accumulation of interest on arrears. It is difficult to separate the effects of structural adjustment from those of debt, as one of the purposes of adjustment is to ensure that indebted countries are able to generate funds to repay loans.

Structural adjustment includes a wide range of policy reforms designed to establish a basis for market-led economic growth. Adjustment usually starts with an IMF stabilisation programme which includes cutting government expenditure, mainly by reducing public sector wages, raising interest rates, controlling money supply, correcting over-valued currencies through devaluation, restricting imports and expanding exports. World Bank programmes, which usually follow, include liberalising import regulations to increase exposure to foreign competition and removing domestic market 'distortions' such as labour protection, food subsidies and state control of agricultural and other marketing. More recently, the Bank has also become involved in social sector reform, including health financing and the redesign of social safety nets.

Because of their pervasive and prolonged nature, structural adjustment policies have had major effects, not only on the macro-economy, but also on the social sector and the incomes of the poor (UNCTAD, 1998). Proponents

Box 1.3 Health and Structural Adjustment in Rural and Urban Zimbabwe

Zimbabwe implemented a World Bank structural adjustment programme in 1991. The package of reforms included currency devaluation, trade liberalisation, cuts in social expenditure- including spending on health care and food subsidies - and attempts to recover the costs of health care through the enforcement of user-fee collection at government health facilities. The decreases in per capita health expenditure following adjustment, combined with high inflation rates, increasing user fees (see Table 1.1) and economic hardship among low income groups, raise concerns regarding the impact of adjustment measures on health in Zimbabwe. The poor performance and inadequate funding of the Social Development Fund, set up as a safety net to protect the vulnerable from the adverse effects of adjustment, add to these concerns.

Table 1.1 Changes in user-fee policies in Zimbabwe, 1991-1995.

Date or period	Change
Early 1991	Enforcement of user-fee collection at the start of ESAP[1]
Late 1991	Fee increase at mission hospitals
November 1992	User-fee exemption level raised from ZWD[2] 150 to ZWD 400
January 1993	Temporary abolition of fees at rural health centres
June 1993	Reinstitution of fees at rural health centres
January 1994	Substantial increase in fees at all health institutions
March 1995	Abolition of fees at rural health centres

Household surveys have been conducted since 1993 and analysed for the first three years (1993-1995) for one urban and one rural area of the country, in order to measure the changes occurring in public health and health services during the implementation of the structural adjustment programme. A number of important issues have been highlighted by these surveys:

- Household income
  - Households constituting the poorest two quartiles, in both the rural and urban sites, reported decreases in income during the study period.
  - Households in the wealthiest quartile reported increases in income.
  - There was a steady diversification in reported sources of income, peaking in 1995.

- Cost of medical care
  - Reduction of expenditure on medical care was reported by about a quarter of households in both areas in 1994.
  - In the urban areas, the cost per treatment increased by nearly 100% between 1993 and 1994 and then decreased by around 10% in 1995.
  - For rural areas, the average cost per treatment increased, despite the abolition of rural health centre fees in 1995.

- Child nutritional status
  - Levels of wasting, indicating acute food deprivation, increased in both rural and urban areas between 1993 and 1994. While wasting improved in the urban area thereafter, it was not substantially reversed in the rural area.
  - The overall prevalence of stunting, which reflects longer term adverse influences, did not appear to have changed in the urban area and had improved in the rural area over the study period.

The study indicates that user-fees for health services may be adversely affecting health care utilisation. The belief that the poor, and particularly the rural poor, would benefit from adjustment does not appear to be supported by the experience of Zimbabwe. These results, elaborated in the sources listed below, confirm the view that governments, NGOs and international agencies need to pay more attention to the potential adverse effects of macro-economic changes and, where these changes are unavoidable, to put in place more effective mechanisms to mitigate their effects on the poor.

[1] Economic and Structural Adjustment Programme.
[2] Zimbabwe dollars.

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initially claimed that the poor would benefit, since economic growth would increase. Economic growth did not respond as anticipated, however in either quantity or quality. By the mid-1980s, evidence of increasing poverty in countries undergoing adjustment led the World Bank and other international institutions to acknowledge the need to take the social consequences of adjustment into account. In response, attempts were made to incorporate such concerns, most notably in Africa through the 'Social Dimensions of Adjustment in Africa' (SDA) programme. For the most part, however, the funds devoted to such efforts have been minimal. Between 1988 and 1993, when it was effectively abandoned, for example, the SDA programme received some US$ 141 million, as against the US$ 4 billion committed for adjustment programmes (Engberg-Pederson *et al.*, 1996, page 58).

Spending on health, welfare and education, as a proportion of government spending, fell in 10 out of the 13 countries for which data are available between 1981 and 1990. Data on changes in access to health services are fragmentary, but access is reported to have fallen in 50% of countries. Use of health services has been adversely affected by a combination of reduced resources (including drugs), reduced incomes and rising user charges (Ekwempu *et al.*, 1990). Decreases in service use appear to have been most marked for poor households (see Box 1.3 on Structural Adjustment and Health in Zimbabwe). These decreases in access are not yet reflected in increases in indicators such as infant or child mortality rates, but maternal mortality rates, which might act as a more acute indicator of reduced access to care, have increased in certain countries. Studies in Zimbabwe have shown that women's attendance at antenatal clinics is particularly sensitive to increased fees (Watkins, 1995, citing Hongoro et al, 1994).

Some of the environmental impacts of structural adjustment have also been criticised, and structural adjustment has thus been faulted for not addressing problems like deforestation, soil erosion, and industrial pollution (Reed, 1996). Many of the more critical environmental and health problems described in the following chapters have, however, been largely ignored. This is unfortunate in light of the evident links between poverty, the environment and health, all of which have been individually identified as areas neglected in the pursuit of structural adjustment.

Structural adjustment has, to some degree, been the policy face of economic globalisation. In addition to bringing new economic

challenges, both structural adjustment programmes and global economic pressures have tended to divert attention not only from poverty issues, but from public problems which markets are ill-suited to solve. Environmental and health burdens often fall into this category. It is difficult, for example, to set up a market for pollution, ensuring that polluters negotiate with those affected, and pay an agreed price for the damage they cause. Moreover, the overall health impact of economic change depends critically on how it affects the most deprived sectors of society, rather than averages or aggregates.

Experience of structural adjustment and globalisation indicate that both international and local measures are needed to ensure ACP countries can respond to their environmental and health challenges. Many of these measures overlap with those which are needed to alleviate poverty. Local capacity building and good governance are particularly critical if negative environmental and health effects are to be avoided. They are needed in order to ensure that the concerns of ACP residents are well articulated in the international arena and in future adjustment programmes. They are also needed in order to respond to the new local challenges that globalisation is bringing. Markets may not be an efficient means of improving the environment and public health, but nor is it appropriate to rely on publicly financed environmental and health services.

1.3 The Diverse Forces Affecting Environmental and Health in the ACP

This section sets out, in very general terms, to describe the role of persistent poverty, uneven modernisation, and the often very high population growth rates in influencing environmental conditions, and hence health in the ACP. These themes, and especially the role of poverty, re-appear throughout the report, both in the chapters with a health focus (Chapter 2 and 3) and in those focusing on environmental trends (Chapter 4 - 6).

In discussing changing environments and health globally, the *World Resources Report 1998-99* considers such driving forces as population growth, economic growth and persistent inequalities, and then three main environmental trends: the intensification of agriculture, industrialisation and rising energy use. A similar approach is taken in this report, except that we have avoided the term 'driving' forces, for reasons that should become apparent, and selected somewhat different forces and trends.

The trends selected for this report are agricultural change, urbanisation and global environmental change (Chapters 4 - 6). Urbanisation trends are given precedence over industrialisation, since urbanisation has been rapid in most ACP countries in recent years, whilst industrialisation has reportedly been more notable for its absence. Global environmental change is separated out, since ACP countries are responsible for only a small share of the risks that global environmental changes pose. Hence while effects of climate change may seriously affect many ACP countries, their contribution to the build-up of greenhouse gases is negligible.

It has long been the case that as human interaction with the environment has changed, so have the health risks (Cohen, 1989; Mascie-Taylor, 1993). Most of the infamous infectious diseases, from measles to the plague, emerged on a significant scale only after some combination of agriculture, higher population densities and trade gave them the opportunity. Most non-communicable diseases, from coronary heart disease to various cancers, became significant with industrialisation, 'affluent' consumption and ageing populations. New diseases, including some infectious diseases such as HIV/AIDS, continue to emerge even as others decline in importance.

The overall global burden of disease has lessened in recent centuries. But the improvements have been uneven, and not without some major setbacks. For some sub-populations, often including groups far removed from the changes that provoked the new health risks, it is the setbacks that have been more decisive. Smallpox decimated the Native American populations, and contributed to their conquest (McNeill, 1989). The first introduction of measles into Fiji in 1875 killed about a third of the population in three months, with political consequences that still reverberate today (Mascie-Taylor, 1993, page 12). By way of contrast,

Europeans were the more obvious victims of infectious diseases during the colonial encounter with Sub-Saharan Africa (a fact that helped delay and limit colonial encroachment). But even in ACP-Africa, the colonial encounter clearly created a number of serious health problems (Feierman and Janzen, 1992).

The health profiles presented in Chapters 2 and 3 indicate that a large share of the ACP population continue to face a number of very serious threats to the environment and to their health. Poverty, economic development (both within and beyond the ACP) and population growth all influence the environmental problems that threaten health. As will be described in Chapter 7, better environmental management has great potential for improving health, particularly if it also contributes to poverty alleviation. Indeed, for most ACP countries, better health is a more compelling reason for pursuing environmental improvement than longer-term sustainability. The link between the environment and health is far more immediate than in many more affluent parts of the world, whilst contributions to global problems, such as greenhouse gas emissions, are far lower. In low-income regions, paying particular attention to the impact on health is not simply a means of justifying an environmental agenda, it is a means of helping to ensure that environmental concerns are grounded in local priorities.

There are also geographical factors that influence the disease burden, including some of the major infectious diseases of the region. The exceedingly high burden of malaria in ACP-Africa, for example, has environmental roots bound up with the ecology of *Anopheles* mosquitoes and disease transmission (Bradley, 1991). While geographically linked, the prevalence of these diseases is also influenced by poverty, modernisation and population dynamics. Not only does poverty make it more difficult to adopt protective measures, for example, but global modernisation and climate change are likely to change the geographical spread of many of these diseases, and population movements often expose susceptible groups to new (for them) diseases.

1.3.1 Poverty Related Environmental Health Problems

As indicated in section 1.2.3, the ACP countries contain a large and growing share of the world's poor. Poverty itself is a major factor in their morbidity and mortality profiles, leading to a greater disease burden and a higher share of morbidity and mortality directly attributable to environmental problems. Thus, while relatively obscure pollutants often capture the international headlines, faecal pollution remains far more important to human health globally, and especially in less affluent countries. Much the same applies to the more indirect threats to health arising from environmental change, and hence when agricultural systems are disrupted, it is the poor who are most likely to lose their food security, and suffer from malnutrition.

Food insecurity and malnutrition are common in a wide range of low-income settings. They can persist even where food production is technically more than sufficient to meet local needs. In rural areas in particular, the environmental dimensions of agricultural development are central to food security. Attempts to increase agricultural productivity, some of which are environmentally destructive, still tend to favour commercial farming, although subsistence farming is often more critical to food security. Land degradation and climatic change can easily undermine subsistence agriculture, and subsistence cultivators face many obstacles in their pursuit of sustainable agriculture. Moreover, and particularly during difficult seasons, years or periods of life, small cultivators often fall back on the 'alms of nature': foods and products that can be foraged from the surrounding countryside. The rural poor, who are most at risk from malnutrition, also tend to be most dependent upon these common property resources (Dasgupta, 1993). Ecological change, agricultural expansion, or institutional changes, some of which may be implemented in the name of environmental protection, can undermine access to such resources.

Many of the other health threats in low-income settlements are related to local environmental conditions, but the same sorts of problems arise in a wide range of geographical sites, both rural and urban.

Until recently, the environmental health burden of poverty was ascribed predominantly to inadequate water and sanitation, acting in concert with malnutrition, but it is increasingly recognised that a complex set of interconnected environmental and socio-economic conditions are usually involved. Thus, whilst diarrheal diseases tend to be blamed on the ingestion of contaminated water, the lack of water for washing is often more important (Cairncross and Feachem, 1993), and a wide range of environmental conditions in and around the home are implicated. Alternatively, whilst air pollution is often portrayed as an urban industrial hazard, the use of smoky cooking fuels is a far more significant hazard in most ACP countries, with women and small children particularly at risk (Smith, 1994; World Health Organization, 1997).

1.3.2 'Modernisation' and Global Environmental Threats to Health

The health threats from chemical pollutants, often associated with urbanisation, industrialisation, agricultural intensification and other aspects of modernisation, are very unevenly distributed across the ACP populations. With a few notable exceptions, such as South Africa, urbanisation and industrialisation levels are far lower in ACP countries than in most of the rest of the world, as is the use of chemical fertilisers and pesticides. Workers in particular occupations (see Box 4.5 on Pesticides and Workers' Health in Chapter 4), and residents of particular locations, face exceedingly high risks, but they are exceptions. Whether they remain exceptions will depend upon the pace and nature of economic development, and the speed with which countries are willing to adopt preventative measures.

In addition to the direct threats to health that environmental correlates of modernisation can pose, people's health is threatened when their life support systems and livelihoods are undermined. These threats are increasingly global in scale (McMichael, 1993), and affluent countries are typically the major contributors. The effects will be experienced locally, however. The fact that a relatively large share of the population in ACP countries is engaged in close-to-subsistence agriculture affects their vulnerability to climate change. As indicated above, malnutrition is a significant factor in ill health, and when environmental change undermines the subsistence strategies of small cultivators, the health implications can be devastating. Land degradation and local climate change, such as drought, are obvious examples. Their impacts in Sahelian Africa have been widely documented in the context of desertification (Raynaut, 1997).

Global climate change may also have a major impact on the spread of infectious diseases. The geographical boundaries of many of the vector-borne diseases, including malaria, are likely to change. The Small Island States are particularly vulnerable to changes in the sea level and extreme weather events.

Whilst these future threats to health need to be taken into account, it is the present day threats that are especially severe in ACP countries. Many of the future threats are, moreover, likely to exacerbate the poverty-related and geographically linked environmental and health problems noted above. Finding more resilient ways to address current environmental health problems is thus likely to be one of the best means of safeguarding against the dangers of global threats, including climate change.

And whilst ACP countries are particularly vulnerable to global environmental threats, the fact that they are not major contributors and face other environmental health problems changes the policy context. In affluent settings, increasing material consumption levels may satisfy people's desires, and still be both environmentally unsustainable and unhealthy. Things are quite different in more deprived settings, where increasing the extent to which people's material demands are met can bring about a direct result in the form of improved health. With sound environmental management, this same increase in affluence can be made both more sustainable and more healthy – but when trade-offs arise, they tend to be more acute. The health balance is, for

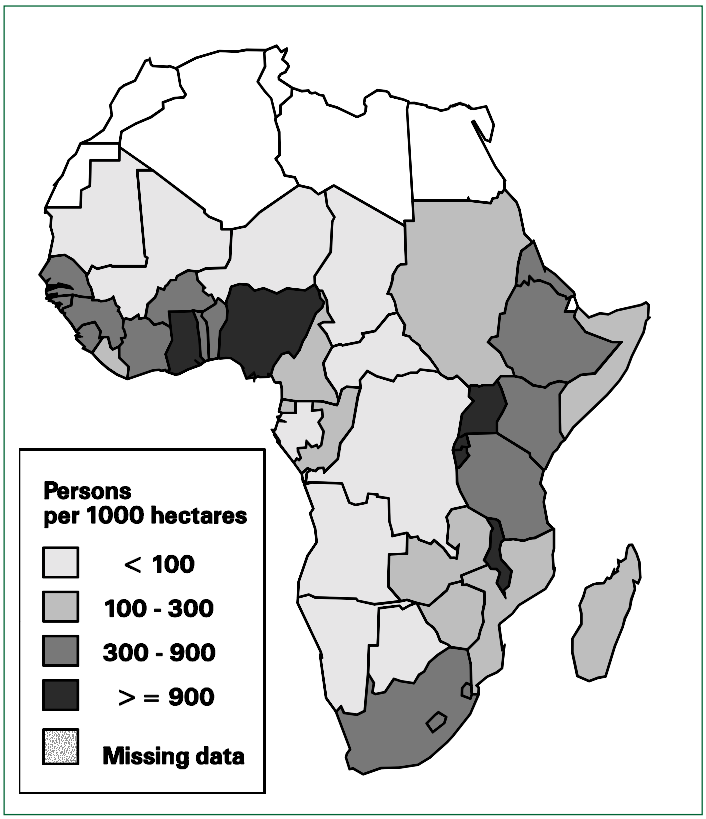

Figure 1.2 Population Density 1996 (persons per 1000) in ACP Africa

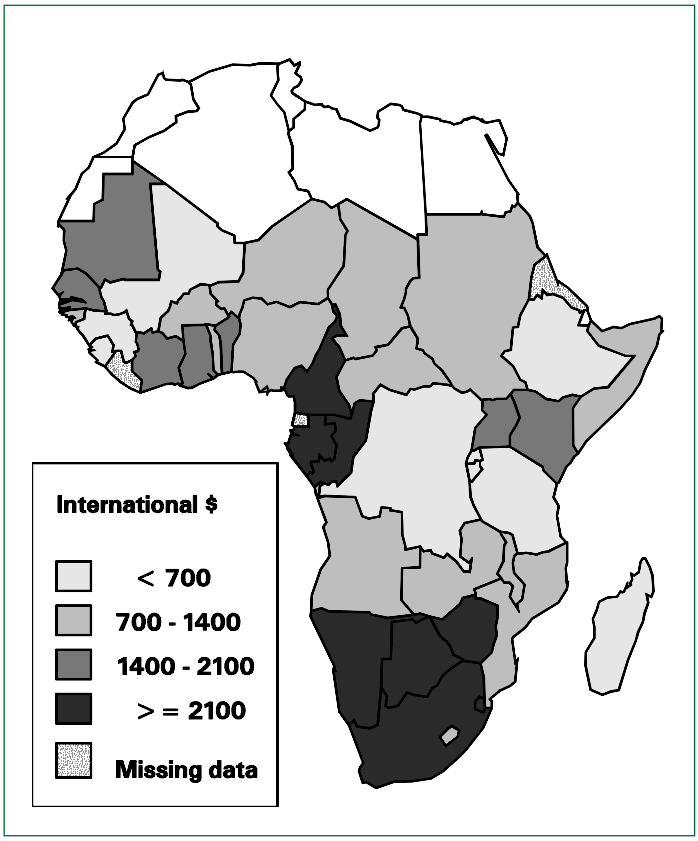

Figure 1.3 Gross Domestic Product per Capita in ACP Africa Purchasing Power Parity, 1995

example, quite different if a hazardous pesticide enables a malnourished child to be better fed than if it adds food to an already adequate diet, though in both cases the pesticide may pose a risk to health.

1.3.3 Population Growth

Population growth is better understood as part of a broad process of change that has many possible local manifestations, than as an underlying cause of environmental degradation and ill health. Reverend Thomas Malthus' well known claim, that population growth would inevitably erode any welfare gains on the part of Britain's poor majority, proved to be misguided. In many settings, welfare gains have been followed by declining population growth. In some settings, moreover, population growth has been accompanied by what most people would consider environmental improvement (see Box 1.4). Population growth is, nevertheless, a serious concern, and needs to be taken into account in any review of environmental and health issues in the ACP.

The ACP countries have almost 700 million inhabitants, or about 11% of the world's population. Around 19 out of every 20 of these people live in ACP-Africa, which, with a population growth rate of about 2.9%, is the most rapidly growing of the major regions of the world. The population growth rate in the Caribbean and Pacific countries (1.7%) is, by contrast, the same as the developing country average. As described in Chapter 2, there are indications that the average population growth rate in ACP countries is now on the decline, as is the case in most of the developing world, and most countries are now undergoing what has come to be termed the 'demographic transition'. As in most historic demographic transitions, the mortality decline has preceded the fertility decline, creating a period of extremely rapid population growth. Despite recent indications that population growth rates are set to decline, therefore, rapid population growth is likely to continue well into the next century.

The average population density in ACP countries is currently considerably lower than the world average (The World Bank, 1998). It varies widely across ACP-Africa, varies even more among the Caribbean and Pacific states,

and is generally a poor indicator of environmental health problems or degradation.[5] Similarly, as illustrated in Figure 1.2 and 1.3, while there is a relationship between population density and GDP per capita it is not very tight.

The two most densely populated countries in ACP-Africa are Mauritius, which has the highest Human Development Index ranking in the region, and Rwanda, which has one of the lowest (see Appendix 1). Among the Caribbean states, the two most densely populated countries are Trinidad and Tobago, one of the highest ranking, and Haiti, the lowest. Similar contrasts apply to the least densely populated countries, which range from Botswana to Mauritania. Quite clearly, population density alone implies very little about the environmental and health challenges faced by a country.

One of the conclusions of this report is that there are numerous ways of improving health through better environmental management. This conclusion would not hold if, in a neo-Malthusian manner, lower mortality rates increased population growth, which in turn created environmental problems and undermined the health gains. Several aspects of the complex manner in which population growth influences environmental and health issues are explored in other sections of this report. It is worth pointing out here, however, that health improvements, even when responsible for lowering mortality rates, do not necessarily contribute to long-term population growth. Indeed, lower infant and child mortality is not only an end in itself, and a good indicator of improving well being, but is often a prerequisite for reducing population growth.

1.4 Conclusion

Environmental and health problems contribute to the many daunting challenges governments and civil societies in the ACP face. Indeed, from a policy perspective, environment and health issues cannot be divorced from the economic and social context. If economic globalisation is allowed to affect the ACP adversely, for example, and poverty deepens, a number of the most critical environmental and health problems will be exacerbated. If on the other hand, the measures taken to improve the environment and health also alleviate poverty, the benefits will be compounded. Similarly, if new economic and social policies and programmes are also designed to yield environmental and health benefits, they are more likely to contribute to human development. Local governance and capacity building are, moreover, critical not only for implementing the right environmental and health policies, but for ensuring that they are based on local priorities. The remaining chapters of this report focus on environmental and health issues, but their relationships with poverty, demographic change, and governance are recurrent themes.

[5] The population density with respect to arable land is somewhat more revealing, but it remains a poor indicator (Aryeetey Attoh, 1997).

Box 1.4 Population Growth and Building Forests in Kissidougou, Republic of Guinea: Implications for Environment, Food Security and Health

Population growth and accompanying agricultural expansion is frequently associated with deforestation and land degradation, accentuating malnutrition, conflict over scarce resources and attendant health problems. The image is of small-scale cultivators creating their own demise, and that for their own good, interventions are needed to limit population growth and curtail agricultural expansion.

This is the image that policy-makers have held of Kissidougou prefecture in the West African Republic of Guinea, with agricultural and forestry interventions operating accordingly. Research reveals a very different trajectory, however, calling

into question the generalisations frequently made about links between population, environment and health. Here, in the northern margins of the West African forest belt, settlement and agricultural expansion have been associated with the conversion of open savannas to woodland and even high forest vegetation. How has this happened, and how has this landscape enrichment impacted on health?

Villagers value a woodland belt around their compounds for a variety of reasons, ranging from protection from dry season fires, to shade for tree crops and privacy for personal and social activities. Woodland is established through fire and grazing management, soil enrichment from gardening and disposal of household waste, and the planting of socially or economically valuable trees. These woodland belts grow over time into veritable islands of forest in a sea of savanna, and inasmuch as population growth has multiplied the number of villages and hamlets in the prefecture, more people have meant more forest islands. Islands have sometimes coalesced to cover fully the intervening savannas. Many of the farming practices used in savannas – especially the mounding, rotation and organic matter manipulation techniques used for groundnuts, cassava and other crops – also serve to enrich soils and encourage conversion to forest. Through these processes, forest and forest thicket cover in the prefecture have increased by as much as 40% during the last fifty years.

Tracing the consequences of this landscape enrichment for nutrition and health is certainly not straightforward, not least because over the same period so much else has changed in the broader economy and society. Nevertheless, villagers themselves trace a number of important and positive associations. Soils, elders argue, are able to support higher yields of rice, peanuts and other food crops than they used to. Women describe how their workloads in respect of weeding rain-fed rice farms and in collecting fuelwood have diminished. Fuelwood can now be gathered conveniently alongside farming tasks, from the trunks and branches left when woody fallows are cleared. Time thus saved tends, however, to be reallocated to other work, making overall improvements in workload hard to discern.

As vegetation has become more woody, so the oil palm (*Elaeis guineensis*) has multiplied in village territories, and is now available in northern localities where a few decades ago, palms could not be found. Palm fruit and kernel oils are valuable sources of fat and vitamins in the local diet, while income from the sale of palm products has become an important income generator for poorer families. Women process kernel oil to sell during the seasonal hunger period at the height of the rains, when both food, and the income to buy it, are scarce, and alternatives lead to indebtedness. The same story can be told for the many fruit trees which form part of village forests. Mangoes, avocados and oranges are traded from villages with reasonable road access, and when not traded certainly improved village diets – especially for children who collect them independently. Indeed throughout the region, parents complain that when the mango season arrives they lose control over their children, since discipline through leverage over food can no longer be upheld.

Many of the trees in forest islands are also valuable for timber. Given the current market conditions in Guinea, the sale of a large *Afzelia africana* or *Milicia excelsa* tree would dig a family out of crisis, or deal with the large social expenditures – such as funerals or medical costs – that can so easily precipitate them into it. Yet although responsible for the establishment of such trees, villagers can neither fell them nor benefit from their income under existing legislation. Since the early colonial period the state forest department has claimed ownership of these trees, on the grounds that they are 'natural' and the villagers are incapable of looking after them. Were forestry income to accrue to land managers who can enrich vegetation, they would probably invest more fully in valuable trees, bringing about a simultaneous improvement in the environment, and in people's income, food security and health. The fact that

farming can improve vegetation has similarly been ignored by policy-makers intent on ensuring that agriculture is concentrated in inland valley rice swamps. Not only is swamp farming itself associated with health hazards (e.g. Schistosomiasis, snake bite, and machete wounds), such policies have missed the opportunity to build on the sort of local skills found in rain-fed farming areas that can improve yields and enrich vegetation at the same time. Finally, the conviction that Kissidougou's environment is degraded and degrading, coupled with international aid donors' preoccupation with environmental issues, has had severe opportunity costs: external interventions have been directed towards misplaced efforts at reafforestation at the expense of far more pressing rural development concerns, including the need for improved health care and food security in a country which ranks among the bottom five in the world for its infant mortality levels.

Contributed by Melissa Leach, Institute of Development Studies, University of Sussex.

Based on

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Chapter 2

Demographic and Health Trends

Chapter 2 Demographic and Health Trends

Aims of the chapter

- To provide an overview of the health and demographic situation in the ACP countries, with particular emphasis on ACP-Africa.
- To review changes in health and demographic patterns in the region during the past two decades.
- To examine how these changes are different from the global pattern.
- To discuss projections for mortality, morbidity and burden of disease trends for the next two decades.
- To examine health differentials between and within ACP countries.

Main Points

- Demographic indicators for ACP countries, such as fertility rates and infant mortality rates, are some of the highest in the world. Although the demographic transition is under way (to varying degrees throughout the region), it is likely to take several decades before the ACP-Africa demographic profile begins to approximate that of other developing regions such as Latin America or Asia.
- Health conditions in the ACP countries have improved substantially during the past 50 years but are still amongst the worst in the world, particularly for children. There are worrying indications that the economic hardships of the 1980s and 1990s and the HIV/AIDS epidemic have adversely affected health conditions in some countries, particularly those in ACP-Africa. Further studies are needed in this area.
- ACP-Africa contains approximately 11% of the global population, but accounts for 21% of the global burden of disease. Most of this burden is borne by children of less than five years of age.
- The burden of disease within the ACP-Africa region is not equally distributed. There are large inequalities in health between and within countries. In general, the poor bear a disproportionate burden of disease.
- Whilst non-communicable diseases and injuries are increasing in importance, communicable diseases, most of which are environmentally related, still take the largest toll on human health. In 1990, two-thirds of the disease burden in ACP-Africa was attributable to communicable, maternal, perinatal and nutritional conditions. By 2020, this should drop considerably, but would still account for some 40% of the disease burden.
- Injuries account for 15% of the burden of disease in ACP-Africa, and this proportion continues to rise. Mental health problems are another neglected, but important, area for intervention.

2.1 Introduction

The twentieth century has witnessed substantial improvements in global health and well being. These improvements have not, however, been uniformly distributed. Most ACP countries still lag far behind both other developing countries and the established market economies of the West with regard to indicators of health status. Environmental factors, often linked to poverty, remain a major cause of sickness and death.

This Chapter provides an overview of the demographic and health situation in the ACP countries, with particular emphasis on ACP-Africa. It examines changes in health and demographic patterns in the region and discusses how these patterns are different from global developments. It then presents scenarios for changes in the burden of disease in ACP-Africa over the next two decades. In Chapter 3, we examine the relative importance of environmental factors in

determining this disease burden and discuss key health threats within an environmental context.

2.2 Demographic and Health Data: Availability and Reliability

Demographic and health data give insight into the relationships between population structure, and the burden of death, disease and disability. They also allow us to begin to analyse the relative importance of environmental factors in determining health status, and to examine future trends in health status. As the WHO has stated, however, '...this exercise is fraught with uncertainty. Not only is the state of death, sickness and disability reporting very incomplete and often arbitrary, but rarely is any effort made to report contributing factors, be those environmental, nutritional or otherwise' (World Health Organization, 1997, p 133). This is particularly true for some areas of ACP-Africa and certain Caribbean and Pacific states, where health and demographic reporting systems are weak and, in some cases, completely absent. (See Boxes 2.1 and 2.2 on data limitations and reliability.)

In writing this report, as much care as possible has been taken to point out deficiencies in the available data and to indicate where assumptions are being made.

Box 2.1 The Limitations of Health and Demographic Data in the ACP Countries

The problem of data reliability faced in compiling this report is not new. A 1957 UN report noted that 'Africa south of the Sahara remains to a large extent an unknown continent, as far as statistical information is concerned; there have been few systematic urban studies, and great difficulties have often been encountered, especially in conducting censuses and in obtaining accurate information from sufficiently representative cross-sections of the population.' (United Nations, 1957, p. 148). While the situation has improved substantially since that report was written forty years ago, there are still a number of problems with existing data which should be noted (Murray and Lopez, 1996; Phillips and Verhasselt, 1994):

- Because of the poor availability of reliable, quality data over a sufficiently long time period and with comprehensive geographical spread, it can be difficult to detect change and examine trends across the region.
- Data from wealthier ACP countries tends to be more complete, reliable and available and is therefore, out of necessity, given more emphasis in this review. Generalisation of trends from these country data to other countries in the region should be done with caution.
- For many countries only crude rather than age-adjusted mortality data are reported as population data by age group, needed to calculate age-adjusted rates is not available. As the age structures of populations across the region is very different, crude mortality rates may not allow for useful cross-country comparisons.
- There is very little reliable data on morbidity for much of the region. Most available data is cross-sectional (collected at one point in time) rather than longitudinal (sequentially collected over a period of time), focuses on particular groups such as women and children and is facility- rather than population-based. This makes any assessment of the extent of, and trends in, ill health at the population level difficult.
- The data available on child health is better than that available for adults (Feachem et al., 1992), due to the focus on child health by national and international agencies over the last two decades.
- Country level or regional data conceal large variations at the local level, for example between different socio-economic groups within a city.

- This report uses mainly population level data, based on averages across large numbers of people. It should not be assumed that these are applicable at the individual level.

In writing this report, as much care as possible has been taken to point out deficiencies in the available data and to indicate where assumptions are being made (also see Box 2.2).

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2.3 Demographic Trends

Most ACP countries are in the process of demographic transition. This means that their mortality and fertility rates are declining, while the population is ageing. The population age structure is consequently changing too. Changes in the levels and causes of illness are linked to this demographic transition. These changes are known as the epidemiological transition (see Table 2.1). Epidemiological transition involves a one-way movement in the population disease profile, from mainly infectious diseases to chronic diseases related to lifestyle changes, such as cardiovascular diseases and cancers. This may be followed by a stage in which the population's life expectancy increases, but health deteriorates owing to increases in chronic, non-fatal morbidity.

The speed of the epidemiological transition has varied greatly, both from one ACP country to another and within countries. The rate of change varies, for example, between socio-economic groups, leading to what has been termed 'epidemiological polarisation'. Some developing countries are experiencing

Table 2.1 Stages of Demographic Transistion.

Stage 1	- high mortality and high fertility: Life Expectancy at birth(LEB) under 45 yrs and Total fertility rate (TFR) over 6.5
Stage 2	- mortality and fertility begin to decline, with mortality decrease occurring first: LEB between 45-55 yrs and TFR between 5 and 6.5
Stage 3	- accelerated declines in mortality and fertility: LEB between 55 and 65 yrs and TFR between 3.5 and 5
Stage 4	- low mortality and low fertility rates: LEB between 65 and 75 yrs and TFR between 2 and 3.5
Stage 5	- very low mortality and fertility rates, below replacement level: LEB 75 yrs or over and TFR is under 2

Source: World Population at the Turn of the century. Population Studies (UN). 1989; (11).

Box 2.2 Routinely Collected Demographic Data in South Africa - Are They Reliable?

Vital statistics, i.e. statistics on births and deaths, are an important component of data used for health policy and planning, and feed into the calculation of crucial public health indicators such as the Infant Mortality Rate (IMR). In South Africa, vital registration, or the registration of births and deaths, is known to be underdeveloped for large sections of the population. A review of the number of registered births was undertaken to identify which of South Africa's nine new provinces experience the worst data problems and to explore ways of improving coverage. Estimates of the number of expected births for 1994 were made, based on age specific fertility rates from the 1991 census and on estimates of the female population of childbearing age in 1994. These were compared with the number of births registered by the Central Statistical Services (CSS) and with the number of
births recorded in the parallel recording systems operated by the health services (see Table below).

Table 2.2 Estimated Number of Births, Percentage of Births Registered, and Percentage of Births Recorded with Health Authorities in 1994, South Africa.

Province	Estimate (a)	Registered Births (CSS)	% Registered	Health Service	% Recorded in Health Service
Eastern Cape	218 733	19 035	8.7	115 328 (c)	52.7
Free State	91 149	18 071	19.8	97 740 (c)	107.2
Gauteng	195 006	76 933	39.5	72 269 (b)	37.1
KwaZulu/ Natal	279 576	34 251	12.3	181 317 (c)	64.9
Mpumalanga	96 869	11 138	11.5	67 552 (c)	69.2
North-West	113 230	7 242	6.4	52 714 (c)	46.6
Northern	178 004	6 931	3.9	97 290 (c)	54.7
Northern Cape	20 827	10 990	52.8	12 482 (b)	59.9
Western Cape	90 040	55 745	61.9	76 120 (b)	84.5
South Africa	1 283 434	240 336	18.7	772 812	60.2

(a) Estimated births, based on 1991 census age, specific fertility rates and estimates of the female population of childbearing age in 1994
(b) Local Authority
(c) 1994 Regional Health Management Information Systems (ReHMIS) data

The table shows that the completeness of birth registration is very poor, with only 19% of births registered by the CSS. It also demonstrates that provincial registration systems are not equally developed, resulting in substantial variance in coverage across the provinces. Comparison with the number of births recorded by the health services indicates that there would be an improvement in recording of over 300% if the births recorded through the health services were to be included in the registration system. Because vital registration data is incomplete, it is difficult to calculate indicators such as the IMR accurately.

How can these problems with routinely collected vital registration data be resolved? Survey data may provide a mechanism for estimating mortality levels. The first Demographic and Health Survey (DHS) has recently been conducted in South Africa and will provide reliable infant, childhood and adult mortality rates.

Until routinely available statistics are adequate, developing countries, many of which have even poorer births and deaths data than South Africa, will have to rely on surveys such as these. Concurrently, there is a need in the longer term to improve the accuracy and coverage of the existing vital registration system. This issue has been recognised within South Africa, and provincial technical committees are currently investigating improved mechanisms for births and deaths registration (Bradshaw et al 1998).

Contributed by Nadine Nannan and Debbie Bradshaw, Centre for Epidemiological Research in Southern Africa, Medical Research Council of South Africa.

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'delayed transition' in which life expectancy increases while infectious diseases remain significant (Phillips and Verhasselt, 1994). Epidemiological transition is, in turn, linked to changes in the types of risk present in the environment. Environmental changes which reduce the risk of infectious diseases of poverty, such as diarrhoeal disease and acute respiratory tract infections, but increase the risk of other diseases, such as cancers, contribute to the changes in the population disease profile described above.

As indicated in Chapter 1, whilst population growth in the ACP countries is higher than that in other regions, it is not necessarily increasing populations that pose a problem to providing adequate environmental and health services. Unequal resource distribution, including of income and land, is more important. For many ACP countries, income and land distributions are extremely inequitable. For countries in ACP-Africa for which data are available, the richest 20% of the population earn about 50% of the country's income while the poorest 20% of the population earn, on average, less than 10% of the country's income (World Resources Institute, 1998).

This maldistribution exacerbates the impacts of low average incomes and generally inadequate access to basic services, even where per capita GDP is commensurate with middle income countries. South Africa, for example, although classified as an upper middle income country, shows high levels of inequality, with 65% of wealth held by 20% of the population, whilst the remainder have poorer access to resources (World Bank, 1997; World Resources Institute, 1998).

Figure 2.1 a) Total Fertility Rate 1975-1980.

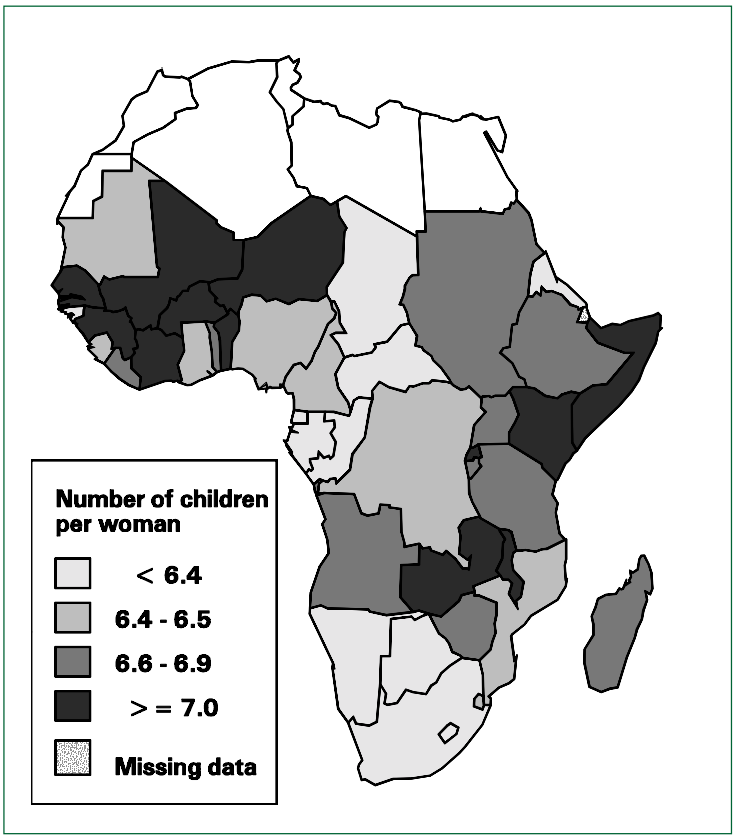
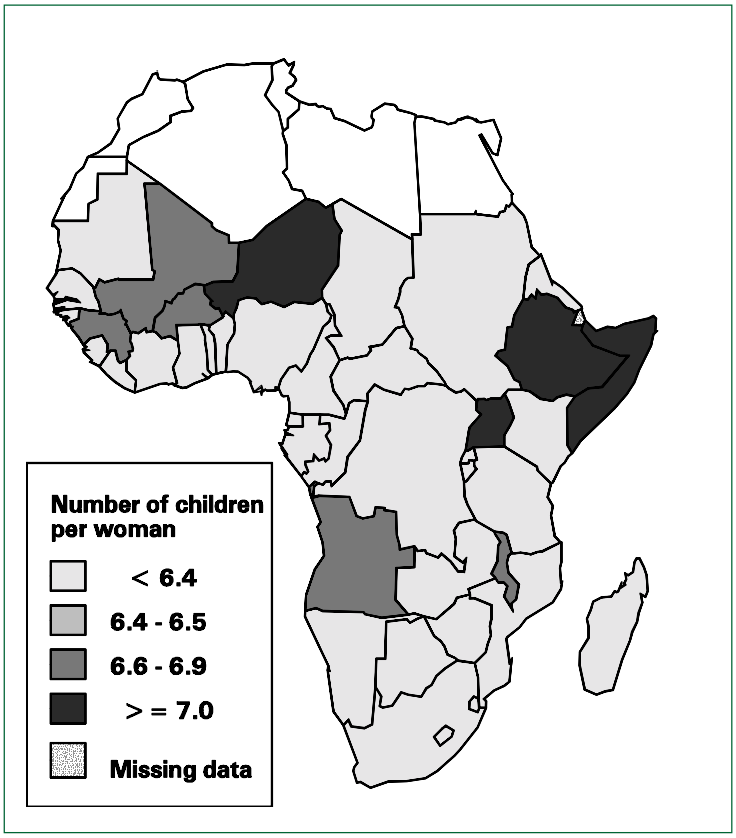


Figure 2.1 b)Total Fertility Rate 1995-2000.



Inequalities, together with population growth, urbanisation, dwindling resources, worsening terms of trade and increasing national debts are likely to have widespread negative impacts on the health of the most vulnerable. This is likely to be exacerbated in the future as populations age and dependency ratios (the number of dependants supported by the economically active aged population) increase.

The data used here to describe demographic patterns in the region are drawn largely from the United Nations Population Division and the Demographic and Health Surveys undertaken in numerous ACP-countries. Indirect demographic methods have shown, however, that existing data on fertility, infant mortality rates and other indicators are inaccurate, particularly for certain population groups (see Box 2.2). Some of the data therefore need to be viewed with caution.

2.3.1 Population Growth

The world's population growth rate is believed to have peaked between 1985 and 1990 and is now declining (World Resources Institute, 1998). In ACP-Africa, the ratio of births to deaths is predicted to continue rising until 2025, when it may begin to fall. Projections of population size for Africa to 2050 suggest that the population will continue to grow over this period. Africa's continued growth can be attributed, in part, to the region's fertility rate - the highest in the world.

The Caribbean and Pacific island states are generally further ahead in terms of demographic transitions than ACP-Africa. This means that Caribbean and Pacific states tend to have a more ageing population, with a longer life expectancy and a lower birth and infant mortality rates than ACP-Africa. The broad trends for each region are described below.

Africa

Data from Demographic and Health Surveys for the region suggest that, on average, during the 20 years after their first marriage, ACP-African women give birth to between five and six children, ranging from 4.1 in Botswana to 6.3 in Uganda (Muhuri

et al., 1994). This can be compared with the Asian, Latin American and Caribbean regions, where rates are mainly between three and four children per woman. Fertility rates are generally higher in rural than in urban areas of ACP-Africa.

The DHS data show, however, that two-thirds of the countries were found to have experienced fertility decline (particularly large in the case of Kenya and Zimbabwe) (Kirk and Pillet, 1998). As might be expected, fertility and family size decreased most in areas with more educated women and lower child mortality rates. Contraceptive use is believed to be a strong factor in this reduction in fertility, especially amongst younger women.

The maps in Figure 2.1 show actual (1975-1980) and predicted (1995-2000) total fertility rates for the region. The fertility transition is most clearly underway in Southern Africa where average total fertility rates are between four and five children per woman. East Africa is also beginning the transition, with Kenya, for example, experiencing one of the fastest decreases in fertility in the world, from a total fertility rate of 8.0 to 5.3 children per woman. In the Gulf area of West Africa, reductions in fertility are less dramatic. The fertility rates for Ghana and the Cote d'Ivoire, for example, are 5.5, and 5.7 children per woman, respectively. This compares with higher fertility rates in neighbouring West African countries, where levels of development and income are lower.

Economic downturns have also had an effect on demographic change. The economic reversal of the 1980s and worsening terms of trade have meant higher child mortality, especially in urban areas (see Box 1.3), and have also effected people's decisions on delaying or forgoing marriage and parenthood. Nigeria shows some of the most significant trends of increasing child mortality and decreasing fertility (Foote *et al.*, 1993). We return to this point in section 2.4.1.

In correlation, the crude birth rates for the region are also decreasing, as shown in the two maps in Figure 2.2 for the periods 1975-1980 and projections for 1995-2000.

Figure 2.2 a) Crude Birth Rate 1975-1980.

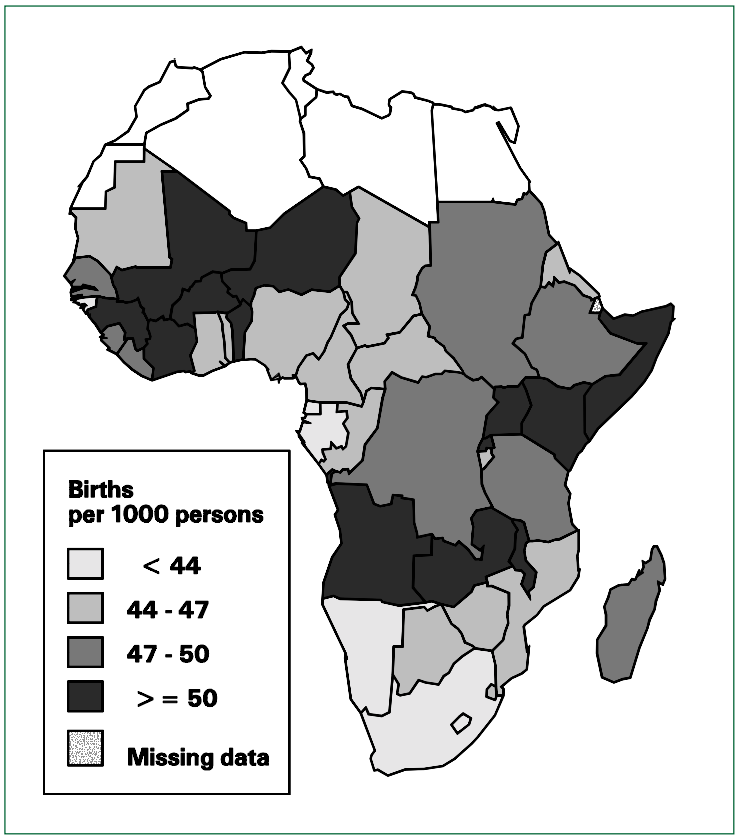
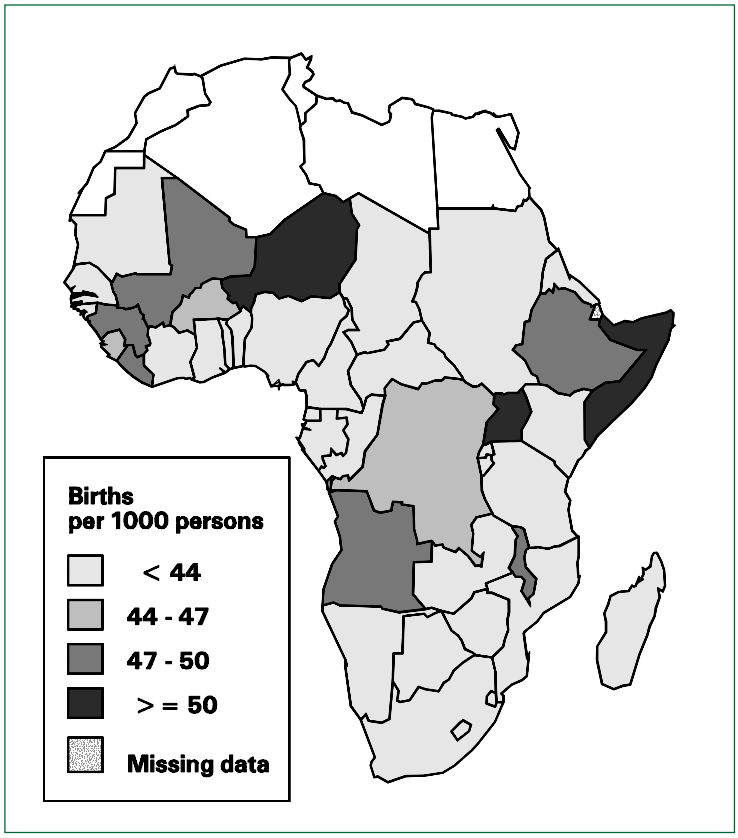


Figure 2.2 b) Crude Birth Rate 1995-2000.



The Pacific

Availability of demographic data varies between the different countries. States in Melanesia and Polynesia tend to have better data than countries in Micronesia. Much of the data used in this section are drawn from the Human Development Report (United Nations Development Programme, 1997) and the World Resources Report (World Resources Institute, 1998).

All of the island nations, with the exceptions of Fiji and Papua New Guinea, have populations of less than 0.5 million. Annual rates of population change in three of the six island states have gone down considerably, and they are now below the average developing countries' population growth rate. In Papua New Guinea, the Solomon Islands and Vanuatu, however, the population growth rates have not changed significantly since the 1960s. Fertility rates have remained consistently high, at between 5.3 and 7.2, over the past 40 years, despite family planning programmes. One reason is that contraceptives are used much less in the Pacific Islands than in many other developing countries (Ahlburg 1996). In the Solomon Islands and Papua New Guinea, for example, only 10-25% of women of childbearing age use contraception.

Projected population sizes from 1993 to 2030 suggest that four of the six island states will have an increase of more than 80%. The Solomon Islands is, in fact, projected to have an increase of 144%. Tonga, which is the most densely populated, will have the smallest increase at approximately 32%. The working-age population is also expected to increase by more than 100% in three island states. Because of the projected decrease in population growth, the number of people of less than 15 years of age is expected to fall, thus decreasing the dependency burden. Life expectancy is, however, also predicted to increase from 58-60 years to about 65-74 years, depending on the country, thereby increasing the burden again. The number of persons over the age of 60 has been steadily increasing, from only 4.9% of the total population in 1985to a projected figure in the region of 6.3% by the year 2000 and of 9.4% by 2025. Governments will need to examine the resource implications of this projected growth.

A considerable fertility transition seems to be obvious only for Fiji, although Tonga and Western Samoa can not be totally discounted since data is incomplete. In the 1950s, the average number children per woman in Fiji was six, but by 1993, this had decreased to 3.5. Papua New Guinea and Vanuatu have experienced modest decreases in fertility rates, but the rate for the Solomon Islands has remained very high. These changes in fertility may be related to education - Fiji has the highest adult literacy rate and the highest average number of years of schooling for both men and women amongst the four island states. Data on trends in fertility rates are not complete for Tonga and Western Samoa, but Tonga and Western Samoa nevertheless showed fertility rates of fewer than 5 children per women in 1993.

The Caribbean

Most countries in the region (excluding Jamaica, Trinidad and Tobago and the Latin Caribbean) have populations of less than a million and most Caribbean countries have much lower population growth rates than those seen in the Pacific island states. For most countries, except those in the Latin Caribbean, average population growth rates do not exceed 1.35%. Dominica and St Kitts and Nevis have negative growth rates of -0.13 and -0.30 (respectively). The Latin Caribbean countries, however, - Haiti and the Dominican Republic - have growth rates comparable to the average for developing countries.

Demographic transition in the Caribbean island states is well underway. Some countries, such as Barbados and Trinidad and Tobago, are well advanced, whilst others, such as Haiti and Guyana, are making the transition more slowly. Fertility rates for both the English-speaking and Latin Caribbean countries have shown a downward trend since the 1950s, although these decreases are more pronounced in the English-speaking Caribbean states. Projections into the next century would put all of the Caribbean island states into stages four or five of the demographic transition by the years 2020-2025. At present only Barbados, among all the Caribbean states, is in demographic transition stage five (see Table 2.1 page 43).

The dependency ratio (the ratio of the non-working age population to every 100 of those in the working-age population) is generally not as high as the Pacific Islands states, except, again, for the Latin Caribbean. For those countries where data is available, the dependency ratio was less than 70 persons for every 100 persons in the working-age population (1995 figures). This figure is projected to reach about 40-50 by 2025. Adult literacy rates are also quite high for all countries, except for Haiti, in comparison with the average for developing countries.

2.3.2 The Demographic Effects of Migration and Displacement

Migration, which includes population movement both between and within countries, often has profound and unpredictable effects on the demography of an area and may have profound impacts on the environment and on health. Not only do migrants carry diseases across wide areas, but in their new setting, they have been found to have less knowledge of how to access health services and to be less informed on local health problems. Morbidity and mortality statistics are, therefore, often higher for migrants than for local people in the ACP setting. The impact of migration also varies greatly across the three regions. ACP-Africa has the highest rates of migration in the world, with much of this population movement being due to conflict and political upheavals. In contrast, in the Caribbean and the Pacific, migration more often takes the form of the movement of the younger population to islands where economic opportunities are more extensive. This has economic implications, but its impacts on health and environment are generally less than those seen in ACP-Africa.

Africa

Although home to 10% of the world's population, Africa has more than 29% of its refugees with up to 16 million people in the region having been displaced. Sudan has the highest number of displaced people in the world, estimated at between 3.5 and 4 million people; fighting in the north of the country has destroyed grain stores and forced people off their land. In Malawi, one of the 12 poorest countries in the world, one in nine people are refugees (UNHCR, 1993). In Somalia, there are hundreds of thousands of refugees and an estimated one million people are displaced within the country.

In many cases environmental problems, such as drought and soil erosion, combine disastrously with armed conflict and famine. Resource depletion and famine have been used as a political weapon in conflicts in the region (Sanders, 1982). Dwindling resources have sparked conflict elsewhere, and in southern Ethiopia, for example, groups have impinged on the traditional grazing land of other clans, which has led to fighting. Population movements due to military conflicts and civil unrest have also contributed substantially to the burden of malaria in developing countries, as they have resulted in the movement of unprotected and non-immune populations into malarious areas. Some of the direct and indirect health impacts of these population movements are discussed in the next chapter.

The Pacific

High rates of population growth in the six island states may be offset by emigration, especially in Fiji, Tonga and Western Samoa, each of which loses between five and ten people per 1000 residents each year (Ahlburg, 1996). Since the motivation for emigration is economic improvement, most migrants are skilled workers and professionals. This phenomenon deters development in the island states. The usual destinations of emigrants are New Zealand, Australia and the United States or its territories. The result for some of those left behind, may, however, be positive. Money sent home by emigrants to their families has helped the beneficiaries improve their standard of living. Emigration is not a major problem in Papua New Guinea, the Solomon Islands and Vanuatu. This report could find no data on migration between the six island states, although this does not exclude the possibility that it happens. The growth in urban populations each year in the island states also suggests that urban migration is significant.

Figure 2.3 a) Life Expectancy at Birth 1975-1980.

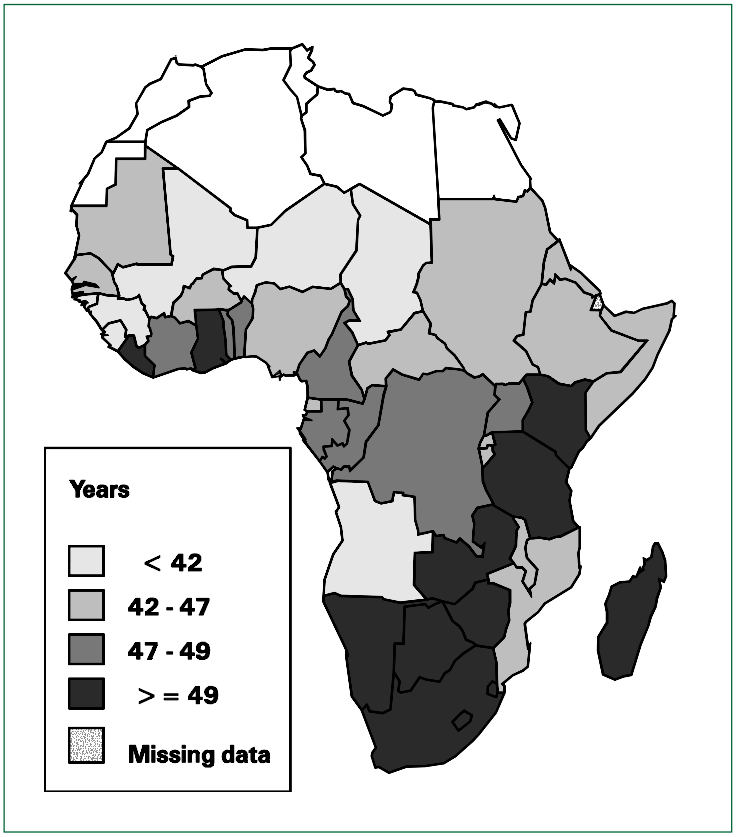
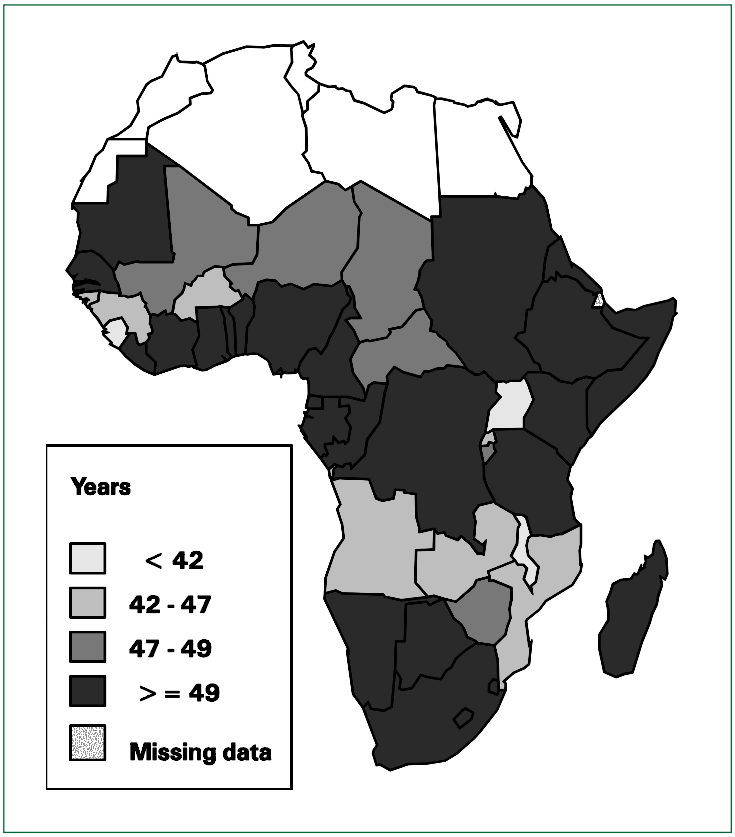


Figure 2.3 b) Life Expectancy at Birth 1995-2000.



The Caribbean

Emigration is a common phenomenon in the region. The PAHO Health Conditions Report (PAHO, 1997) suggests that countries with larger populations, such as the Dominican Republic, Haiti and Jamaica, are most affected by the socio-economic impacts of emigration. In most countries, however, a negative migration balance exists, i.e. a number of nationals born in the country live abroad. The countries which have a negative migration balance of more than 50% are: Dominica, St Kitts and Nevis, and St Vincent and Grenadines. Antigua and Barbuda, Barbados, Guyana, Jamaica, and St Lucia have a negative migration balance of between 30% and 50%. The most common destination for migrants is the United States.

2.4 Health Trends

2.4.1 The State of Health

The demographic transition has resulted in the rapid ageing of developing country populations and an increase in the number of adults relative to the number of children. These changes, described in more detail above, are expected to produce significant changes in patterns of deaths and in the global burden of disease for countries in Africa, the Caribbean and the Pacific. In the sections below, data on life expectancy and on deaths overall, and for specific age groups, are examined for the ACP countries.

Life Expectancy

Life expectancy at birth in one of the key measures that policy-makers use to assess human development. Based on life expectancy, it would appear that health conditions globally and in the ACP countries have improved substantially in the past 50 years. The maps in Figure 2.3 show how life expectancy varies across the region.

In ACP-Africa, life expectancy has increased from 36 to 52 years and there appear to have been large reductions in infant mortality rates — also see Figure 2.6 for infant mortality rate trends for selected ACP countries and Figure 2.4 for death rates for ACP-Africa from 1955-2025 (World

Health Organization, 1998; World Resources Institute, 1998). In the Caribbean and Pacific Islands, life expectancy at birth for males and females is comparable to that in developed countries and considerably higher than in most developing countries. Only Haiti and Papua New Guinea, where life expectancy is lower, are exceptions to this rule. The gains in life expectancy at birth during the past 30 years have been considerable- from about 50 years to on the order of 65-70 years in most Caribbean states. As expected, female life expectancy is much higher than male life expectancy in both the Caribbean and the Pacific.

While these trends in life expectancy are encouraging, there are now worrying signs that these gains are being eroded. There are two primary reasons for this: the economic reversals experienced by many ACP countries over the last decade and the spread of the HIV/AIDS epidemic. For countries in ACP-Africa which have experienced economic reversals, there are some indications of an acute deterioration in health status, such as increasing rates of wasting in children under five years of age and increasing maternal mortality rates (Bijlmakers *et al.*, 1996a; Bijlmakers *et al.*, 1996b; Stewart, 1995; Watkins, 1995) (see chapter 1). Evidence of deterioration in indicators that measure longer-term health impacts, such as life expectancy, however, is more difficult to establish, as the effects of economic reversals on health status may only become apparent several decades after the event. It is puzzling that these long term declines in mortality rates have been so resilient in the face of widespread erosion of socio-economic conditions in many developing countries. Many theories have been advanced for understanding these declines, and examined the importance of income, food and modern health technology, socio-cultural changes and the build-up or depletion of a society's health stocks and assets (Murray and Chen, 1993). Whilst the relative importance of these different factors is not yet clear, it is important to note these trends and their close relationship to the demographic trends described above (Lee and Bastemeijer, 1991).

The impacts of HIV/AIDS on life expectancy are now becoming evident and constitute a substantial threat to development (UNAIDS, 1998). Extra deaths from AIDS among children and young adults, is expected to lead to a fall in life expectancy in countries where HIV prevalence is high. The data from nine countries with an adult HIV prevalence of 10% or more (Botswana, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Africa, Zambia and Zimbabwe), indicate that HIV/AIDS will, on average, lead to a decrease in life expectancy of 17 years. By 2010-2015 life expectancy will regress to an average of 47 years, in comparison with the 64 years which would be expected in the absence of HIV/AIDS (UNAIDS, 1998). There are also indications that HIV/AIDS will contribute substantially to rising child mortality rates in many ACP-Africa countries, as discussed in Section 2.4.1.

Deaths

There are a number of different ways in which deaths can be classified. For this report, the classification of Murray and Lopez (1996a**)** has been used, as it is relatively simple, reflects the relationships between deaths and the epidemiological transition, and is widely used internationally. Under this system, classified deaths are broken down into three broad cause groups:

Group I:	Communicable, maternal, perinatal and nutritional conditions;
Group II:	Non-communicable diseases;
Group III:	Injuries.

It should be noted that this classification reflects the bio-medical model of disease. In Chapter 3 we attempt to place this classification within an environmental context by examining the importance of environmental risk factors in determining the burden of disease across these categories.

In ACP-African countries, Group I causes of death still account for 65% of deaths—the highest proportion of any region of the world. For the Caribbean,

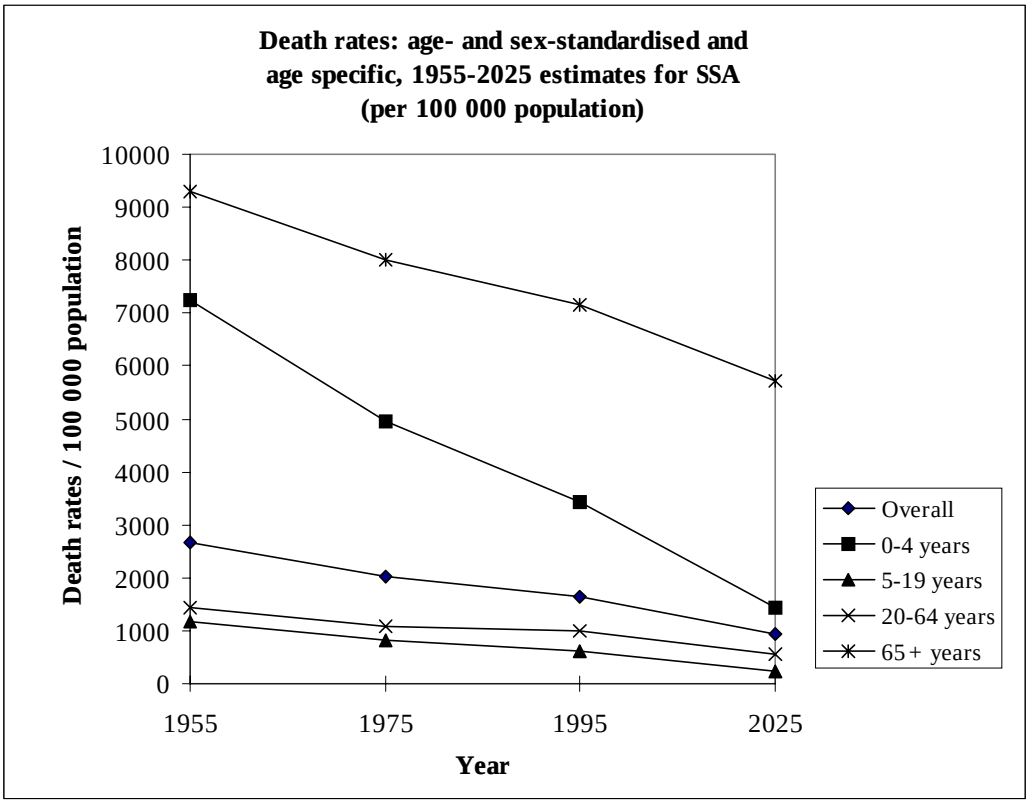
there are already four and a half times as many deaths from Group II causes as from Group I causes, reflecting the epidemiological transition in that region. Contrary to general opinion, premature mortality rates for Group II causes of death are higher in populations with high mortality and low income, such as those of many ACP countries, than in industrialised countries. This means that adults under 70 years of age in ACP-African countries are more likely to die from a non-communicable disease, such as diabetes or ischaemic heart disease, than adults of the same age in the established market economies. Non-communicable diseases are, therefore, not linked to affluence in itself. Rather, the ability to prevent and adequately treat and control these diseases appears to be linked to affluence.

The table (Table 2.3) shows the 10 leading causes of death for developed and developing regions for 1990 (Murray and Lopez, 1996a). These causes account for more than 50% of all deaths in these regions. The data indicate, first, that infectious diseases, such as tuberculosis and diarrhoeal disease, still constitute an 'unfinished agenda' in developing regions, accounting for five of the ten leading causes of death. Concurrently, deaths from non-communicable diseases are increasing in importance. This 'double burden' of communicable and non-communicable diseases experienced by many ACP countries is discussed in more detail below.

Infant Mortality Rates

The infant mortality rate (IMR) is regarded as a key indicator of the general health of a population. Figure 2.5 shows IMRs for the period 1975 to 1980, along with predicted rates for the years 1995-2000 and 2015-2020 for all ACP-Africa countries. Figure 2.6 graphs IMRs for selected ACP countries for 1960[1], 1975-80, 1995-2000 and projected

Figure 2.4 Death Rates: Age- and Sex-standardised and Age Specific, 1955-2025 Estimates for SSA (per 100, 000 population).



Source: WHO. 1998. p 168.

Table 2.3 The 10 Leading Causes of Death in 1990.

Developing Regions			Developed regions		
	Deaths ('000s)	Cumulative %		Deaths ('000s)	Cumulative %
All causes	39554		All causes	10 912	
Lower respiratory tract infections	3 915	9.9	Ischaemic heart disease	2 695	24.7
Ischaemic heart disease	3 565	18.9	Cerebrovascular disease	1 427	37.8
Cerebrovascular disease	2 954	26.4	Trachea, bronchus and lung cancer	523	42.6
Diarrhoeal disease	2 940	33.8	Lower respiratory tract infections	385	46.1
Conditions arising during the perinatal period	2 361	38.7	Chronic obstructive pulmonary disease	324	49.1
Tuberculosis	1 922	43.4	Colon and rectum cancers	277	51.6
Chronic obstructive pulmonary disease	1 887	46.1	Stomach cancer	241	53.8
Measles	1 058	48.7	Road traffic accidents	222	55.8
Malaria	856	50.9	Self-inflicted injuries	193	57.6
Road traffic accidents	777	52.8	Diabetes mellitus	176	59.2

estimates for 2015-2020. These have been selected to include higher income (Botswana; Trinidad and Tobago; Fiji), middle income (Namibia; Dominican Republic; Papua New Guinea) and lower income countries (Benin; Haiti; Solomon Islands). The picture from the 1960s is one of large and consistent improvements in IMRs across these countries of varying socio-economic status. Most of the improvements in infant mortality were seen in older infants (post-neonatal, i.e. 28 days after birth) (World Health Organization, 1988).

As can be seen from Figure 2.6, demographers predicted that the improvements in IMR would continue into

[1] Data for Fiji and Solomon Islands for 1960 were not available.

Figure 2.5 a) Infant Mortality Rate 1975-1980.

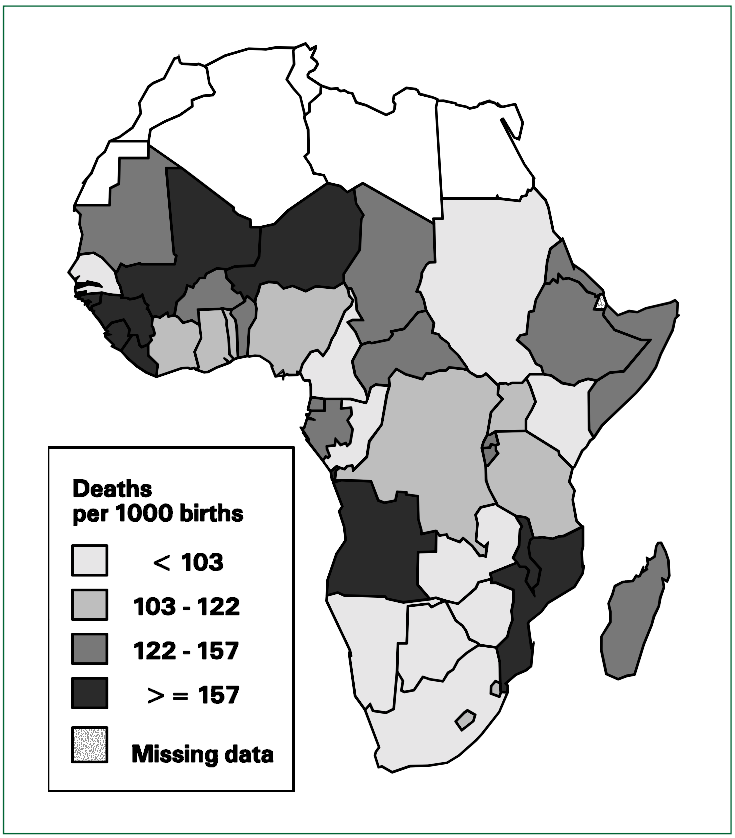
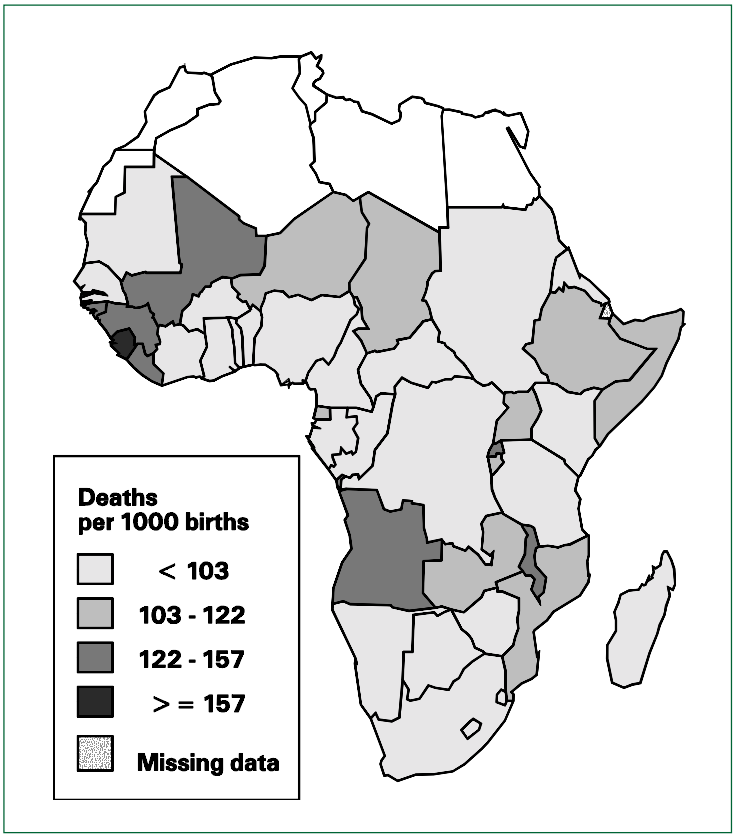


Figure 2.5 b) Infant Mortality Rate 1995-2000.



the new millennium. The spread of HIV/AIDS has, however, led to revisions in these estimates. A recent review by the Population Division of the UNDP (UNDP, 1998) examined the demographic impact of HIV/AIDS for 34 high prevalence countries, including 29 in Africa and one ACP-Caribbean state – Haiti. Taking into account the effects of HIV/AIDS, it is estimated that the IMR in the 29 African countries will decline from 103 per 1,000 live births in 1985-1990 to 78 in 2005-2010. In the absence of HIV/AIDS, however, the decline would have been much faster, from 102 per 1,000 live births to 70 during the same period (UNDP, 1998). In the nine highest seroprevalence African countries, HIV/AIDS has produced additional 10 infant deaths per 1,000 live births. Among these countries, Botswana has been the most affected: the IMR in 1995-2000 is estimated at 58 per thousand instead of 39 - 48% higher with HIV/AIDS than it otherwise would have been. By 2005-2010, IMR is expected to decrease to only 52 per thousand. In the absence of HIV/AIDS it would have been 27 per thousand - a 96% difference.

These figures indicate, firstly, the urgent need for basic preventive measures in the most affected countries (UNDP, 1998) and, secondly, the vulnerability of health gains to changes in disease patterns. Furthermore, it should be noted that even with the improvements in IMR to date, mortality rates in many of the ACP African countries are amongst the highest in the world. Many of the causes of infant mortality are closely linked to environmental conditions, as will be discussed in more detail in Chapter 3.

Infant mortality rates have decreased substantially in the past 30 years for all of the Pacific island states. Five of the six countries have lower infant mortality rates than the average for the developing countries (see Figure 2.6). The highest infant mortality rate is found in Papua New Guinea—at 68 per 1000 live births—which is also the largest and the least developed country in the region. Studies have shown that the infant mortality rate reductions in the Pacific Islands are due mainly to a decrease in mortality from diarrhoeal diseases and respiratory infections (Ahlburg,

1996). For most ACP Caribbean countries for which infant mortality data is available, the rates decreased over the period 1960 to 1994. Countries such as Antigua and Barbuda, Barbados, Bahamas and Trinidad and Tobago now have infant mortality rates lower than 15/1000 live births. These are substantially below the averages for the developing world and ACP-Africa, and are comparable to developed country rates. Haiti, where health indicators remain poor, is an exception. High rates of HIV infection in the country could be expected to contribute to worsening health indicators.

Child Mortality Rates

Child mortality rates are an important health indicator, firstly because child mortality after the first year of life in many ACP countries is high and, secondly, because it is a useful overall indicator of environmental and health service inputs. Under-five mortality rates have decreased for most ACP countries in the region between 1960 and 1995, although the reasons for this have not been fully elucidated

Figure 2.5 c) Infant Mortality Rate 2015-2020.

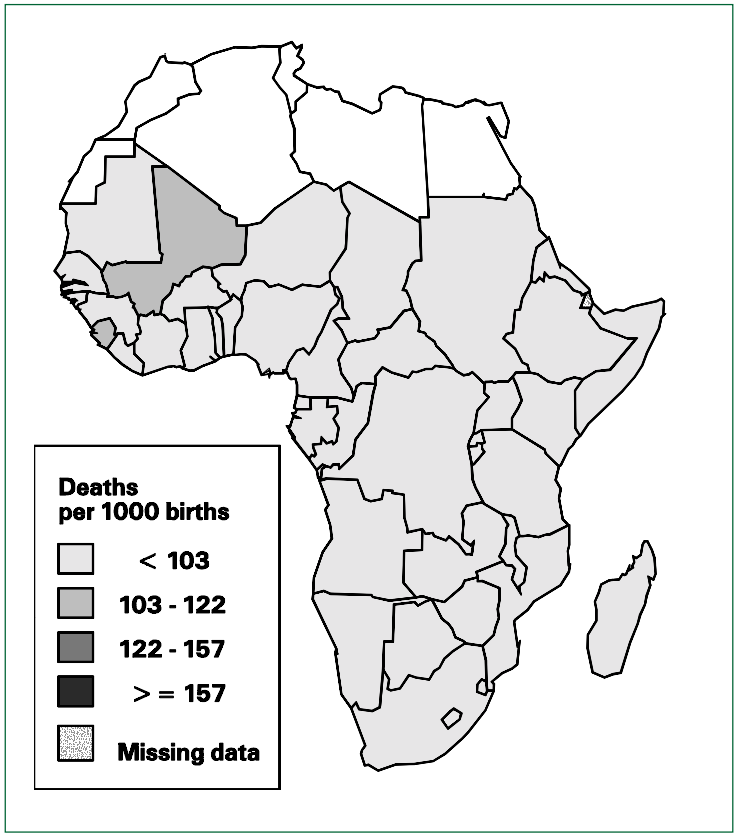


Figure 2.6 Infant Mortality Rates for Selected ACP Countries, 1960-2020.

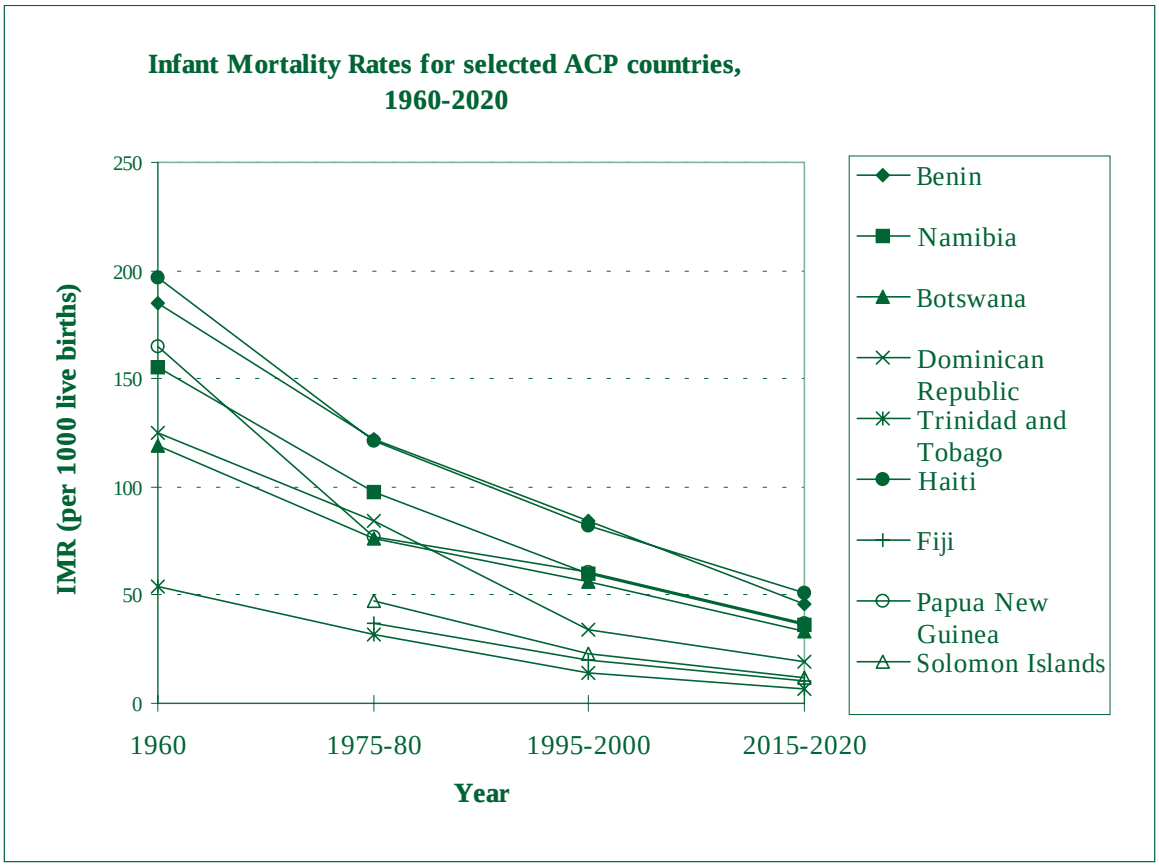


Table 2.4 Infant Mortality Rates (number of deaths/1000 live births) in Pacific Island States.

Island States			
Island State	**1970**	**1991**	**1995**
Fiji	50	26	22
Papua New Guinea	125	54-67	65
Solomon Islands	52	30	25
Vanuatu	100	30-45	43
Tonga	60	22-41	17
Western Samoa[2]	36	21-33	61
Developing countries, average (1994)*			64
Sub-Saharan Africa, average (1994)*			97

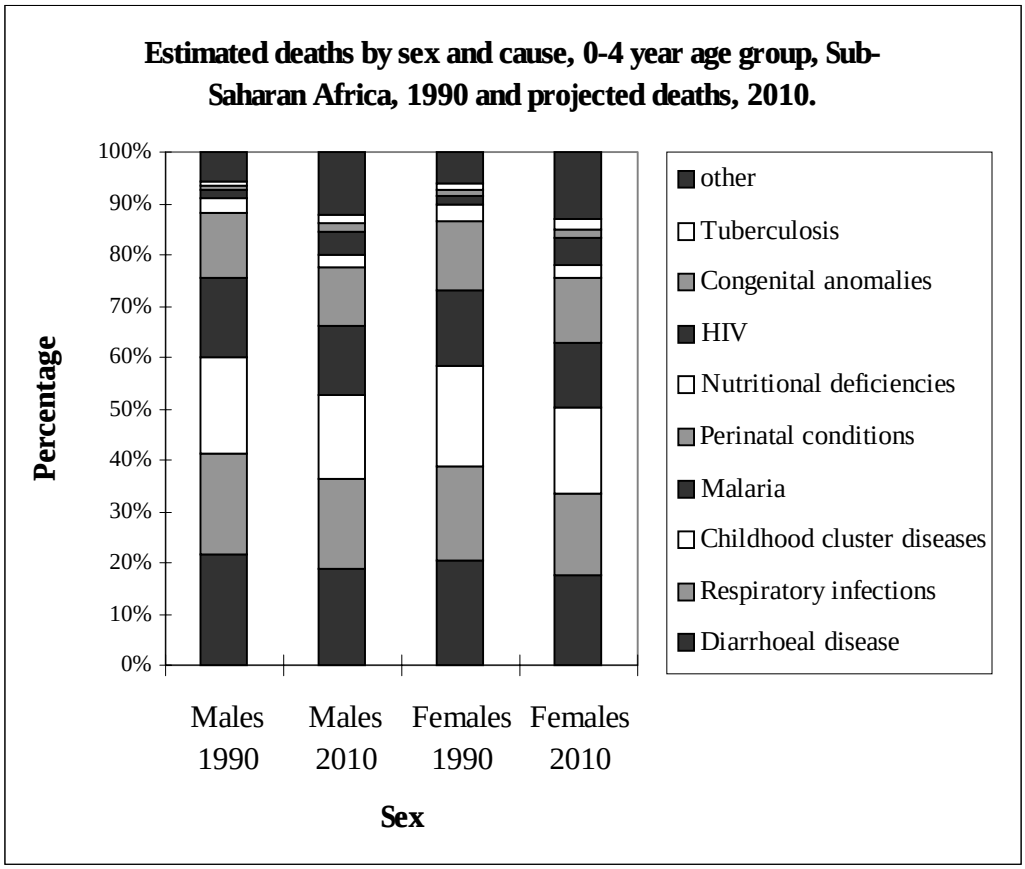
Sources: Ahlburg, 1996 and * United Nations Development Programme, 1997.

(World Resources Institute, 1998, Data Table 8.2). The overall fall in childhood mortality has been large. In many African countries, 30% to 40% of children died before reaching the age of five in the 1950s. By the mid-1970s, however, very few African countries lost more than 27% of their children before five years of age. These declines have not been uniform, however, and large variations in size, timing and pace have been noted (Hill, 1993). The major causes of death for children under five years in ACP-Africa in 1990, and child mortality estimates for 2010, are shown in Figure 2.7[3].

As can be seen, the major, largely preventable, infectious diseases still accounted for more than 70% of deaths in this age group for both males and females in ACP-Africa in 1990. There are large variations between and, indeed, within countries in the region with regard to the relative importance of childhood infectious diseases. There are few countries, however, in which these are not the most important cause of childhood death. Estimates for 2010 show that a decrease in deaths due to infectious diseases can be expected, but that these diseases will remain extremely important. Many of these infectious diseases are strongly related to environmental conditions at household and neighbourhood levels and, as will be discussed below, could be much reduced through environmental interventions. Perinatal conditions are also an important cause of death in this age group and are expected to remain so in the next decade.

[2] It is difficult to explain the variations in infant mortality rate (IMR) for Western Samoa, but they can probably be attributed to problems in data collection, such as underreporting of infant deaths in 1970 and 1991, rather than to real changes in IMR.
[3] In the Figure, perinatal conditions include low birth weight, birth asphyxia and trauma and other perinatal conditions. Childhood cluster diseases include pertussis, poliomyelitis, diphtheria, measles and tetanus.

Figure 2.7 Estimated Deaths by Sex and Cause, 0-4 year age group, Sub-Saharan Africa, 1990 and Estimated Deaths, 2010.



Source: Murray et al 1996. p 453.

HIV/AIDS accounted for only a small proportion of deaths in 1990, but the projections suggest, not surprisingly, that its importance is increasing. For many African countries, rising HIV rates have been seen as responsible for decelerations, and in some instances reversals, of the downward trends in child mortality of the late 1980s and 1990s (UNDP, 1998). The direct impact of HIV/AIDS on child mortality is mainly through vertical transmission of the disease from mother to child, either during pregnancy and childbirth or through breastfeeding. Zambia and Zimbabwe provide interesting examples of the different impacts of HIV/AIDS and other factors on child mortality rates. Table 2.5 shows changes in child mortality for the two countries during the past two decades (Hanmer and White, 1998).

Modelling of mortality rates for Zambia and Zimbabwe, using accepted figures for vertical transmission, has shown that 9% of rural and 26% of urban child mortality is due to HIV/AIDS in Zambia. In Zimbabwe, however, HIV/AIDS accounted for 40% of child deaths in rural areas and 66% in urban areas. Despite the much higher numbers of child deaths due to HIV/AIDS in Zimbabwe—largely a result of the country's higher seropositivity rate—child mortality has remained steady at around 26 per thousand. The underlying (non-HIV related) child mortality rate must, therefore, have continued to fall, offsetting the impact of HIV/AIDS. By contrast, the child mortality rate in Zambia has risen, partly owing to HIV/AIDS, but also due to a range of other socio-economic, demographic and health factors (Hanmer and White, 1998).

Table 2.5 Changes in Child Mortality in Zimbabwe and Zambia, 1970-1990s.

Child mortality (number of deaths of child less than 5 years of age per thousand population)				
Country	Late 70s - early 80s	Late 80s - early 90s	Early - mid 1990s	Maximum increase[4]
Zimbabwe	28-44	23-27	26	3
Zambia	78	82-93	98	20

Source: Hanmer, L. and White, H. 1998 p 12.

This example indicates, firstly, that not all ACP-African countries have continued to experience a decrease in key health indicators during the past two decades: where socio-economic conditions have worsened and deaths from other diseases, such as malaria, have increased, child mortality is also likely to have risen. Secondly, the data indicate that previous gains may well be reduced or reversed by HIV/AIDS. Finally, interventions which influence the demographic and socio-economic components of child survival can be important in minimising the impact of HIV/AIDS. This finding has important policy implications.

Infant and child mortality rates vary greatly both within and between ACP countries. Seven conditions have been suggested as essential for the observed improvements in infant mortality rate: female autonomy, education (particularly female education), the provision of accessible health services, a mechanism to guarantee the efficient operation of health services, an adequate minimal standard of nutrition, universal immunisation and the establishment of effective antenatal and obstetric services (Sandiford *et al.*, 1991). Much emphasis has been placed on the role of income and female education. Both are linked to nutritional status, effective use of health services and female autonomy. The pathways through which female education and income impact on infant, particularly postneonatal, and child mortality are, however, not yet clear (Sandiford *et al.*, 1997; Sandiford *et al.*, 1991; World Bank, 1993). It is also not clear why the observed decreases in infant and child mortality rates have, in many areas, successfully resisted economic and other setbacks. This may be related to the prolonged benefits of changes such as improved literacy, or may reflect the limitations of the available data.

This debate is relevant to policy makers concerned with identifying the elements to be included in a package of interventions designed to improve child health. There are likely to be both health and operational synergies between these interventions which suggest that a multifaceted approach would be appropriate. This is discussed further in Chapters 3 and 7.

Adult Health

In 1985, nearly half the population of ACP-Africa were between the ages of 15 and 59 years and this proportion is likely to increase to more than 50% by the year 2000 (Feachem *et al.*, 1992). Although this is lower than the average of 56% for all developing countries in 1985, it is still extremely significant and the health of this group therefore warrants attention. Current demographic trends will continue to increase the absolute and relative impact of adults and although adults consume a significant proportion of health sector resources in developing countries, policies designed to tackle their health problems are poorly developed.

[4] Calculated using the lowest past estimate and the highest most recent estimate.

Adult health has been neglected in many developing countries for a number of reasons (Timeaus, 1991). Firstly, the emphasis of primary healthcare services since the 1970s has been on child and maternal health. The probability that a person born in Africa will die between the ages of 15 and 60 years is, however, equivalent to the risk of death in childhood. The illness or death of an adult can, furthermore, have major repercussions for the household, particularly if the adult is the major breadwinner. Secondly, the health problems of adults are more diverse than those of children, and are, therefore, less easily prevented. Thirdly, it is difficult to obtain population-based estimates relevant to the health problems of adults, which limits analysis and planning.

Rapid reductions in the death rates of adults have been achieved in both richer and poorer ACP-Africa countries since 1945, although there is tremendous variation by region (Timeaus, 1991). As adult mortality declines in developing countries, mortality from communicable, non-communicable and reproductive diseases declines for males and females. Injuries, however, remain constant for females while declining for males (Murray *et al.*, 1992). These declines in non-communicable diseases are not well understood. This pattern notwithstanding, the burden of adult ill health will increase in the future, due to the ageing of the population (Phillips *et al.*, 1992). There are also considerable inequities in the distribution of the burden of adult ill health. As is the case in the developing world, groups with lower socio-economic status have both higher exposures to risks and higher mortality for both non-communicable and communicable diseases than groups with higher socio-economic status (Cavelaars *et al.*, 1997; Lynch and Kaplan, 1997; Montgomery *et al.*, 1996).

Adult ill health consumes a large proportion of healthcare resources in many developing countries. Households may spend as much on health-related care as the State**.** This may have a considerable impact on other essential household expenditure and, hence, on the health of the family. The illness of death of a child's main caregiver has particularly severe effects, and the mortality rates of infants whose mothers die can, for example, be as high as 90% (Phillips *et al.*, 1992). As described in Chapter 3, a substantial proportion of chronic diseases are associated with environmental exposures that have the potential to be minimised or mitigated, and a large proportion of adult deaths in developing countries are, therefore, avoidable. We will return to this point in Chapters 3 and 7.

2.4.2 Estimating the Burden of Disease

While mortality is a useful indicator of health status, it does not adequately capture the broader effects of ill health. Many illnesses may not result in death, but may produce considerable morbidity and substantially reduce quality of life. Most cases of childhood diarrhoeal disease, for example, do not result in death. Children who suffer repeated episodes of diarrhoea are, however, more likely to experience stunting and may be predisposed to other infectious diseases. Many other illnesses related to environmental conditions, such as worm infestations and respiratory infections, also result in considerable morbidity. In general, however, morbidity is studied far less and is seldom the focus of health policy debates, despite its obvious impact on quality of life and livelihoods. Quantifying the burden of disease and injury – including mortality and morbidity - at a global and regional level, using a common set of methods and common units is one method of providing information to inform international and regional health policy debates.

The global burden of disease study, co-ordinated by the WHO and the World Bank, has attempted to quantify the combined burden of fatal (mortality) and non-fatal (morbidity) health outcomes in a single measure, the Disability-Adjusted Life Year or DALY (Murray and Lopez, 1996a). This was done for 107 diseases and injuries by age group and by region. To calculate DALYs due to each disease or injury in a given year and population, the researchers added together: (a) the years of life lost through all deaths in that year, and (b) the years of life expected to be lived with a disability for all the cases beginning in that year summed and weighted

for the severity of the condition. One DALY is, therefore, one lost year of healthy life, and is a measure of the burden of the disease in question in the population concerned.

The approach is complex and involves a large number of estimations and assumptions, and it is beyond the scope of this report to discuss these in detail[5]. It is, however, important to bear in mind, firstly, that for many of the countries included in this report, the burden of disease study can only provide estimates of the disease burden. These may need to be refined or changed when better data become available. Secondly, the uncertainty inherent in the epidemiological data on disease is far more significant, in terms of its impact on the estimates derived, than the effects of changing any of the other assumptions incorporated into the calculations of the DALY (Murray and Lopez, 1996a). For Sub-Saharan Africa in particular, where the reliability of data for many diseases is poor and population estimates uncertain, these results need to be viewed with caution. Projections of the disease burden from the baseline year of 1990 into the future need to be viewed with caution for the same reasons. Thirdly, the methodology used in calculating the DALY has been challenged for being subjective, although a major strength of the approach is that the method is applied consistently (Paalman *et al.*, 1998).

Although the methodology underlying the DALY approach used in the BOD assessments is the subject of much debate, the data are presented here for three reasons. Firstly, because they are being used extensively by a number of UN and bilateral agencies, and increasingly at regional and national levels, in the development of health policies. A number of ACP countries, including Mauritius, South Africa and Tanzania, have already initiated BOD studies. Secondly, the data used for the global assessment has been extensively reviewed and is among the best data available for the ACP regions. Finally, the data allow us to begin to assess the proportion of the disease burden attributable to environmental factors (see Chapter 3).

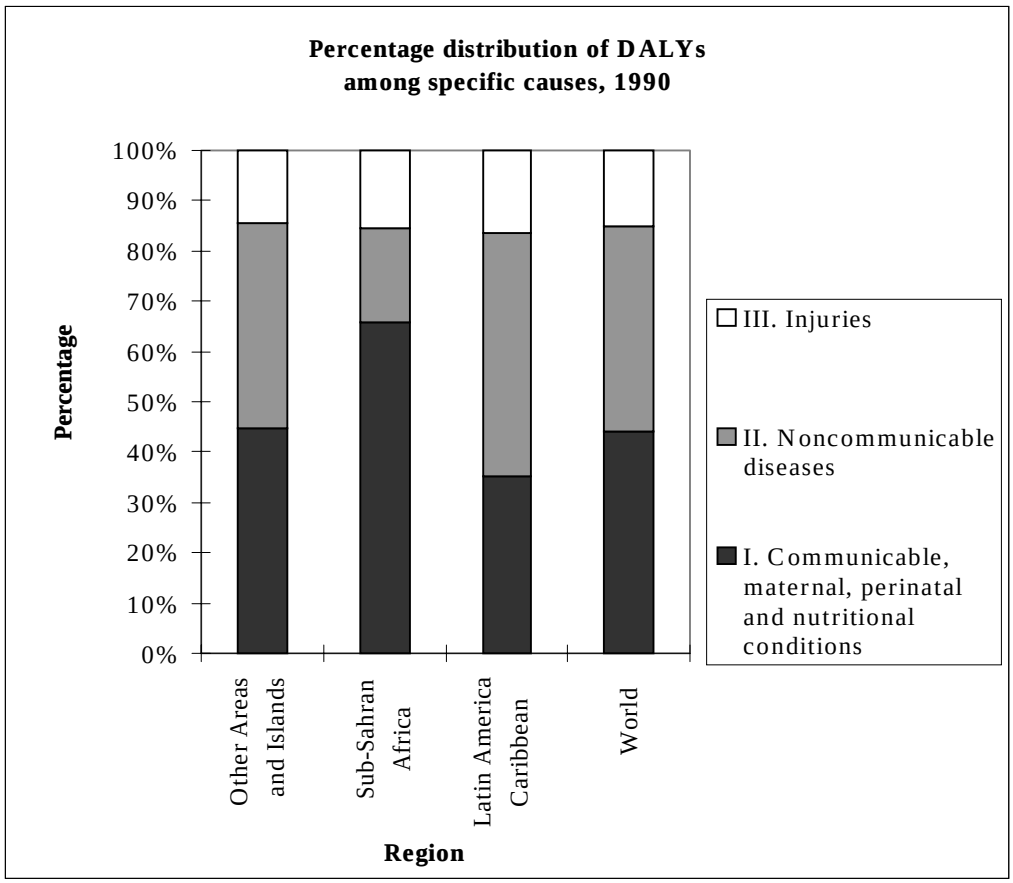
The three broad cause groups for the disaggregation of deaths and disability have already been described (see page 51). The diagram below shows the distribution of DALYs among these three cause groups, globally and for three regions: SSA, Latin America and the Caribbean and 'Other Asia and Islands'[6]. Only the SSA region of the burden of disease study coincides with the ACP region. Data on the island states of the Caribbean and Pacific is incorporated within the Latin America and the Caribbean and 'Other Asia and Islands' regions. These combined data should not be seen as representative of the small island states, as the populations of the islands are small, relative to the rest of the region in which they are included, and are shown here for comparative purposes only. More detailed data on the disease burden for these regions are shown in Appendix 2.[7]

The BOD study highlights the following key points with regard to the burden of disease for Sub-Saharan Africa in 1990 (Murray and Lopez, 1996a):

- With only 11.3% of the global population, Sub-Saharan Africa alone accounts for 21.4% of the global burden. 579 years of healthy life are lost in this region for every 1,000 of the population, compared with 124 years in the established market economies. More than 75% of this burden was due to premature mortality, the remainder being due to disability.
- The age distribution of DALYs appears to differ markedly between regions. 52% of the burden in SSA occurs in the age group 0-4 years, compared with only 6% in the established market economies. A further 31% of the burden in SSA occurs in

[5] See (Murray et al 1996a) for an in-depth discussion of the development of the DALY.
[6] 'Other Asia and Islands' includes all Asian countries except India and China and all South Pacific Islands, excluding New Zealand and Australia.
[7] Unfortunately, disaggregated burden of disease data for the Caribbean and Pacific islands were not available for this study.

Figure 2.8 Percentage Distribution of DALYs among Specific Causes.



Source: Murray, C. J. L. and Lopez, A. D. 1996a. *The Global Burden of Disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and Projected to 2020.*

adults aged 15-59 years. The effects of adult illness or death on family food supply and income are likely to be severe because of the high dependency burden per capita in developing countries (1.02 dependants per adult in SSA compared with 0.61 dependants per adult in developed countries (Feachem *et al.*, 1992)).

- The 'unfinished agenda' of infectious diseases is still the most important contributor to the disease burden for SSA. Two out of three years of healthy life lost is still due to these Group I conditions—for which effective interventions are available. For all developing regions, infectious diseases (lower respiratory tract infections, diarrhoeal diseases, tuberculosis, measles and malaria) still account for 5 of the 10 leading causes, and about 26%, of the disease burden. Conditions arising during the perinatal period (low birth weight[8] and birth asphyxia[9]/ trauma) also remain important.
- Tuberculosis, currently seen as a global emergency, accounts for 3.4% of the burden for SSA, with most of that burden falling on the age-group 15-44 years. Malaria, now the focus of a new WHO campaign, accounts for 9% of the burden but, unlike TB, the burden is experienced primarily by children under four years of age. The same is true for diarrhoeal diseases and other childhood cluster diseases.

[8] Low birth weight is defined as below 2,500g.
[9] Asphyxia is defined as interference with normal breathing, resulting in insufficient oxygen supply to the body.

- Group II conditions account for 18.8% of the disease burden in SSA. The main contributors are cardiovascular diseases, neuropsychiatric conditions, respiratory diseases and cancers. As discussed above, this burden falls largely on adults. The proportion of the burden attributable to Group II conditions is far lower for SSA than the global average or that of other developing regions. This indicates that the epidemiological transition in SSA is still at an early stage.
- Group III conditions (injuries) are an important, and often neglected, group across all regions, accounting for about 15% of the burden in SSA. Intentional injuries constituted 6% of DALYs in SSA in 1990. The burden of injuries in SSA is likely to increase in the next century up to 2020, due to a combination of the steep projected rise in road traffic accidents, war and violence, and the growth of the adult fraction of the population. Road traffic accidents are the second most important cause of DALYs among men aged 15-44 years.
- Another hidden burden is that of mental illness. Depression accounts for 3.4% of the disease burden in developing countries, but over 12% of the burden for women aged 15-44 years. When coupled with schizophrenia, bipolar disorder and obsessive-compulsive disorders, these diseases together account for approximately 19% of the disease burden within that age group.

2.4.3 Looking Ahead: Estimates for the Burden of Disease in 2020

Demographic and epidemiological transitions are already well under way in many of the countries included in this review (see maps), but most countries in SSA are at an earlier stage of the transition than countries in many other developing regions (Murray and Lopez, 1996b). Projections indicate that the demographic and epidemiological transitions in SSA are likely to continue, but with differing speed, across the region. These transitions, and related changes in socio-economic status, environmental conditions and lifestyle, will impact on the burden of disease in the region. These impacts have health and environment planning implications, and this section of the chapter examines estimates for the burden of disease in 2020.

The global burden of disease studies developed scenarios for future burdens of disease and injury, using the data for 1990 (described above) as a baseline (Murray and Lopez, 1996b). These projections are based on age-, sex- and cause-specific multivariate models, adjusted for changes over time in three socio-economic determinants: income per capita[10]; human capital[11] and smoking intensity[12]. Three scenarios, related to these socio-economic determinants, were developed: baseline, optimistic and pessimistic, all of which scenarios make different assumptions with regard to economic growth, mortality rates and birth rates across the regions. As with all projections, the authors note that 'The results of this exercise, however plausible they might appear and however correct (or incorrect) they might ultimately prove to be, are nothing more than the numerical consequences of the assumptions and method employed' (Murray and Lopez, 1996b, p 352). The findings should therefore be viewed with caution.

According to the baseline scenario (pessimistic and optimistic scenario projections indicated in brackets), by 2020, males born in SSA, whose life expectancy was below 50 years in 1990, can probably expect to reach 57 (53-58) years of age. Females can probably expect to reach 64 (58-61) years, corresponding to an improvement

[10] For the baseline scenario, GDP per capita is projected to increase in each region according to World Bank forecasts. For the optimistic scenario, a growth rate in per capita income 40% higher than the baseline was used. For the pessimistic scenario, growth rates only slightly higher than the lowest trend in income per capita over the last 3 decades for a given region were assumed (Murray and Lopez, 1996b. Page 340).
[11] Based on estimates for 98 countries for each five year period from 1950-90 (Murray and Lopez, 1996b. Page 341).
[12] Based on the assumption that the time course of the smoking epidemic observed in the United Kingdom will be repeated in each region.

of 13 (7.8-14.5) years since 1990 (Murray and Lopez, 1996a). Other estimates seem to suggest that life expectancy will stagnate in countries with high HIV prevalence. A recent review has shown that during the period 1995-2000, life expectancy in the 29 African countries with the highest HIV prevalence was estimated at around 47 years - 7 years less than it would have been in the absence of HIV/AIDS. By 2000-2005, life expectancy in these 29 African countries is expected to stay constant, whereas in the absence of HIV/AIDS, it would have been 56 years. Considerable variation does, however, exist between countries (UNDP, 1998). Large shifts in the patterns of death and disability are expected to accompany these demographic changes.

In Sub-Saharan Africa, Group 1 causes of death are projected to fall from 5.3 million in 1990 to 4 million in 2020. This is due to a relative contraction in the young population and to a continued decline in communicable disease deaths, due to increasing income and education and technical progress. These projections run counter to the belief that infectious diseases are making a 'comeback' worldwide. In 1990, 65.9% of the disease burden in Sub-Saharan Africa was attributed to communicable, maternal, perinatal and nutritional conditions. By 2020, this is expected to drop to about 39.8% (40.0-52.5) (Murray and Lopez, 1996a).

A 77% rise in the absolute number of deaths from non-communicable (Group II) diseases in 2020 is expected, in contrast to the decline in Group I causes, whilst the burden of non-communicable diseases is likely to increase from 18.8% to 32% (25.6-33.6). Mental illness is likely to increase to 15% of this burden, whilst tobacco will account for 9%—more than any other single cause. This 'double burden' of both communicable and non-communicable diseases is already being experienced in the ACP countries (Lewin *et al.*, 1998; Stephens *et al.*, 1994). SSA can also expect a sharp rise in the burden of injuries due to road traffic accidents and violence (Group 3).

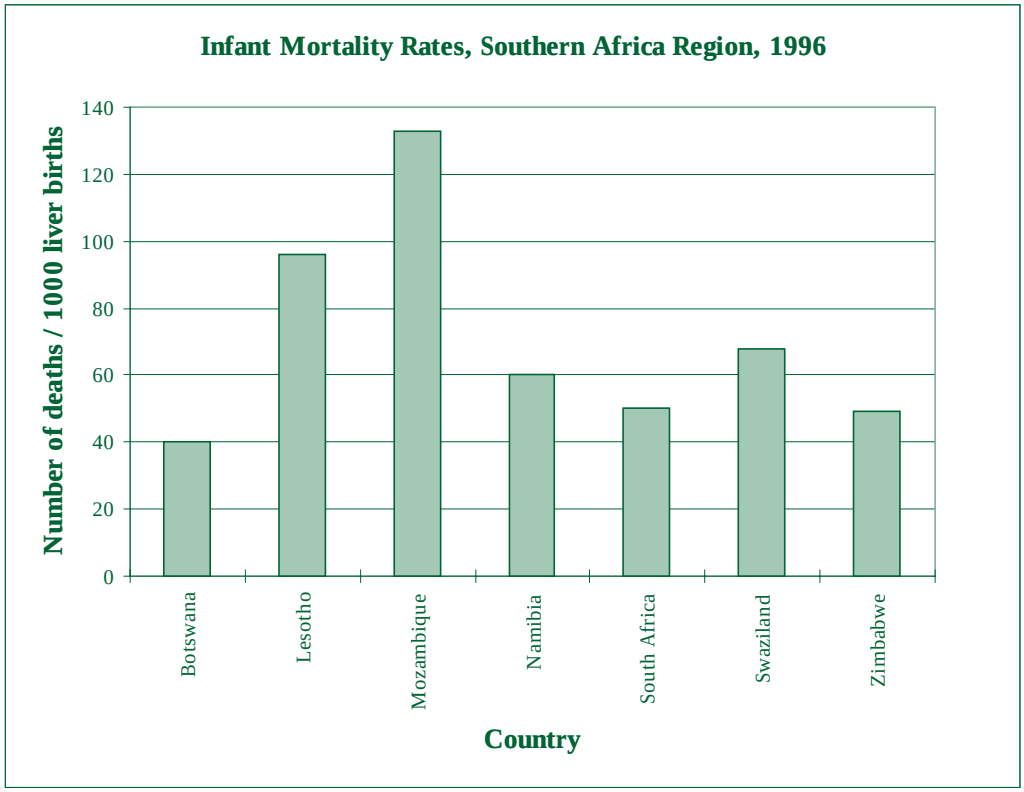
Most of the projected changes in the burden of disease for Group II and III conditions for SSA can be attributed primarily to changes in population growth and distribution, that is, demographic change. Changes in the burden of Group I diseases are due to a combination of epidemiological (risk factor) change and demographic change, the latter being more important. The ways in which environmental driving forces influence and interact with these changes, and the implications of these changes for policy making and service provision, are discussed later in this report.

2.5 Health, Wealth and Environment

The preceding sections of this chapter have described the health and demographic trends for the ACP countries. Despite the overall improvements in many health indices across these countries, disaggregation of the available data suggest that these gains are often not uniformly distributed across geographic and socio-economic groups. Substantial differentials in health status and in demographic indices continue to exist within and between countries, between the urban and rural setting; and by socio-economic status (see Figure 2.9, Infant mortality rates, Southern African Region, 1996). In general, health status indices and burdens of disease are positively related to access to basic services, levels of education, income and other proxies of socio-economic status. In other words, health status improves as socio-economic status improves – at both the individual and country level (Bloom and McIntyre, 1998; Murray and Lopez, 1996a; Stephens *et al.*, 1994; World Resources Institute, 1998). While these differentials have been observed since statistics have been available, there is evidence that they are widening in many regions. Widening inequalities in health and wellbeing by socio-economic status are of particular concern (Murray and Lopez, 1996a).

South Africa, as one of the world's most unequal societies, provides an interesting case study of differentials in health and wellbeing. The country's Gini coefficient—a measure of inequality calculated on the basis of income per adult equivalent—is 0.65, compared with 0.45 to 0.63 for countries with similar per capita GDP (Fallon and daSilva, 1994; Whiteford and McGrath, 1994), cited in (Bloom and

Figure 2.9 Infant Mortality Rates, Southern African Region, 1996.

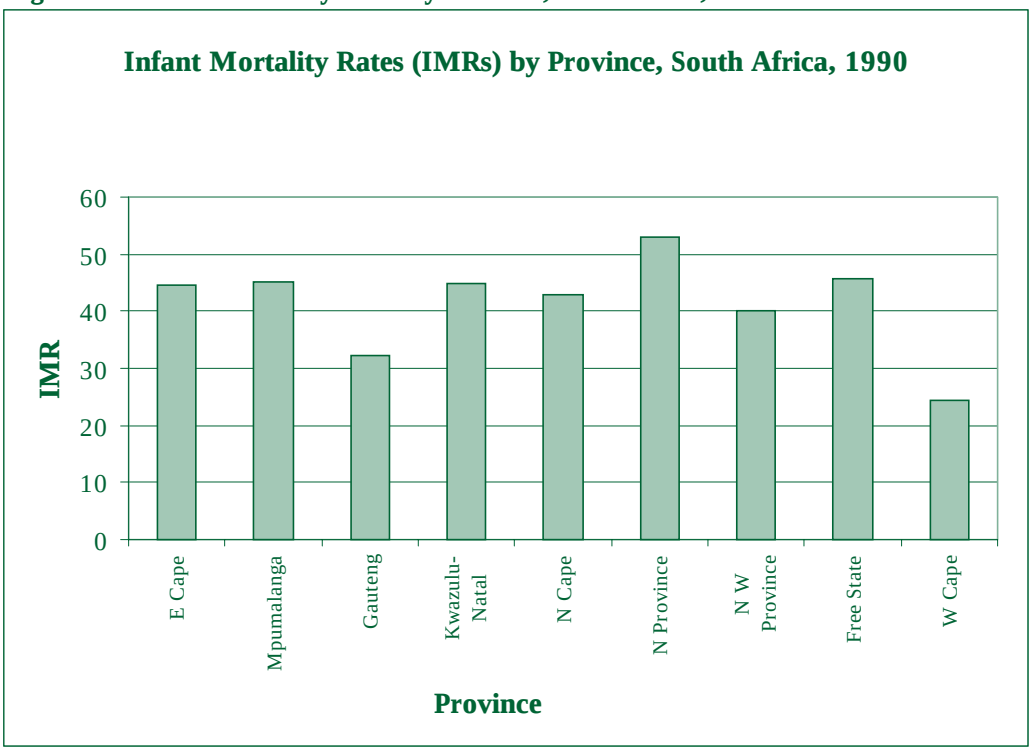


Source: Unicef 1998.

McIntyre, 1998). There are also large differences in access to social services, such as health care, by social group, largely as a result of apartheid policies. Figures 2.10 and 2.11 show differentials in infant mortality rate for South Africa by province and, for the country's second largest city of Cape Town, by residential area (as a proxy for socio-economic status). The infant mortality rate is a useful measure of the impacts of geographic and socio-economic variations in access to services. It acts as an indicator of the degree of poverty of mothers and children, including their access to basic environmental and health services.

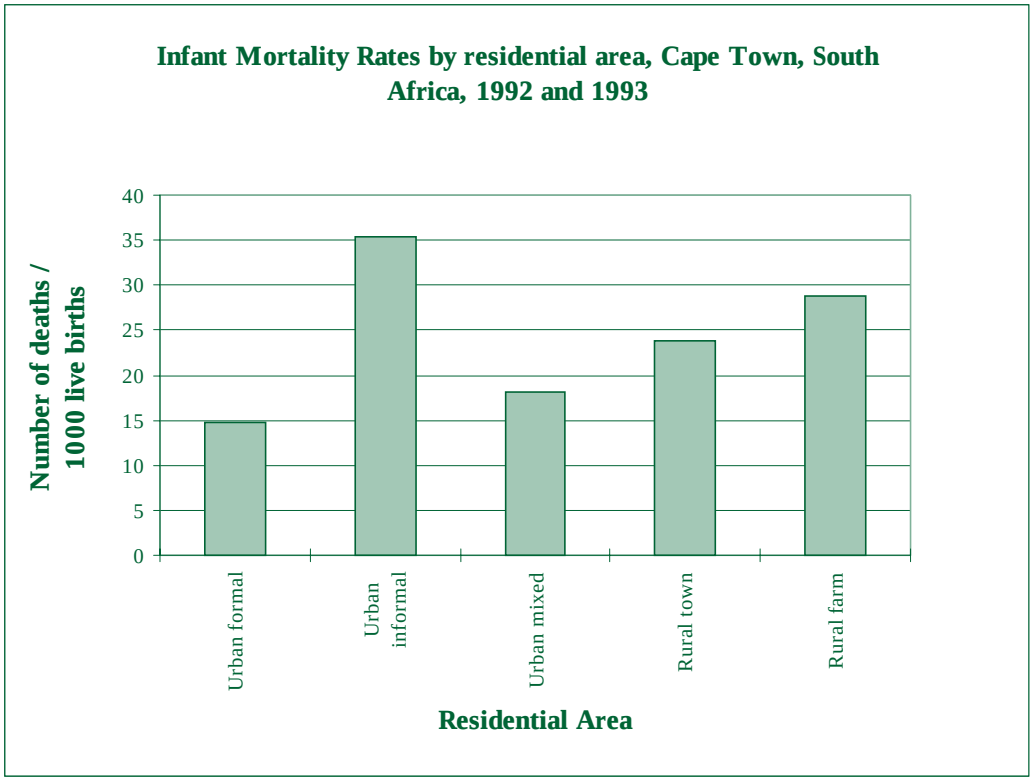
The data from Cape Town show that residents of informal settlements are relatively worse off than most other groups, as indicated by a high infant mortality rate. Further analysis of the main causes of death confirms the relationship between residence, poverty and ill health. While low birth weight seemed to be the leading cause of death across all levels, except in rural farming areas, four times as many infants in urban informal areas died of gastroenteritis as in urban formal areas (18.2 and 4.1% respectively). Furthermore, twice as many infants died of pneumonia on rural farms as in rural towns (14.4 and 6.7% respectively) (Bachmann *et al.*, 1996). Both gastroenteritis and pneumonia are treatable and partly preventable through environmental improvements, such as improved water supply, sanitation and crowding. Such differentials thus reflect access to a healthy household environment and to health services, as has been further demonstrated elsewhere (Arrossi, 1994; Garza, 1996; Songsore and McGranahan, 1993; Stephens *et al.*, 1994). Because the poor are unable to secure the facilities which support a healthy environment, they are vulnerable to a range of environment-related diseases. These, in turn, may be exacerbated by malnutrition, poor access to health services, lack of education and disempowerment.

Figure 2.10 Infant Mortality Rates by Province, South Africa, 1990.



Source: Bradshaw 1997.

Figure 2.11 Infant Mortality Rates by Residential Area, Cape Town, South Africa, 1992 and 1993.



Source: Bachmann, M., London, L. and Barron, P. 1996.

Disaggregated health and demographic data are not available in many developing country settings (Bradley *et al.*, 1991; Harpham *et al.*, 1988). This makes the assessment of differentials in health and wellbeing across socio-economic and geographical groups difficult. It is, nevertheless, important that policy makers address the problems of existing inequalities. The poor, whether in informal settlements or rural areas, continue to experience the drawbacks of unhealthy household environments and food insecurity, even as conditions improve for wealthier households, and policy options for reducing inequalities and achieving greater equity in health need to be further developed, as discussed in the final chapter of this report.

2.6 Conclusion

This chapter has provided an overview of demographic and health trends in the ACP countries, with particular emphasis on ACP-Africa. We have shown that whilst significant progress has been made in improving health, as demonstrated by a range of indicators, health conditions within many ACP countries are still poor. 39 of the 50 countries in the world with the highest estimated under-five mortality rates (U5MR) for 1996 are, for example, within the ACP group (UNICEF, 1998)[13]. Similarly, for infant mortality rates, the reduction experienced by the least developed countries between 1955 and 1995 was only 75% of that experienced by other developing countries (World Health Organization, 1998). There are worrying indications that the gains in health status over the last 50 years in many ACP countries are being eroded by adverse economic conditions and HIV/AIDS. HIV/AIDS, in conjunction with the concurrent problems of malnutrition and the high prevalence of communicable diseases such as tuberculosis, is of particular concern.

Although non-communicable diseases and injuries are increasing in importance, communicable diseases still take the largest toll of human health in the ACP regions. By 2020, the burden of communicable diseases is predicted to fall, but will still account for some 40% of the disease burden. In Chapter 3, we explore the importance of environmental risk factors in determining health and disease, and begin to examine the extent to which the burden of disease could be reduced through environmental interventions.

[13] The ten countries with the highest estimated under five mortality rates in 1996 are, in descending order: Niger, Angola, Sierra Leone, Afghanistan, Liberia, Guinea-Bissau, Mali, Malawi, Mozambique and Somalia. It should be noted that most of the countries have been wracked by wars over the past five years, with concomitant destruction of health, environmental and social services.

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Chapter 3

Health in an Environmental Context

Chapter 3 Health in an Environmental Context

Aims of the Chapter

- To explore the importance of environmental risk factors in determining health and disease
- To explore the extent to which the burden of disease could be reduced through environmental interventions
- To identify key health threats for the ACP countries within an environmental context.

Main Points

- About one-third of the total burden of disease in ACP Africa is associated with environmental factors, manifested in the high prevalence of environmentally related deaths and disabilities. Small children carry the weight of this burden. The poorer countries of ACP Caribbean and Pacific are likely to experience similar burdens.
- Water and sanitation related diseases are still extremely important in many of the countries included in this review. 10% of the disease burden in ACP Africa can be attributed to inadequate water, sanitation and hygiene, with children bearing most of this burden. Wealthier households and urban households are more likely to access water and sanitation services than poorer and rural households.
- Approximately 32% of the burden of disease in ACP Africa can be attributed to protein-energy malnutrition. Trends indicate that the number of underweight children in ACP Africa may be rising.
- Tuberculosis remains a major contributor to the burden of disease in the ACP countries. This burden is expected to rise by 2010, mainly due to rising HIV prevalence and demographic changes.
- Injuries are growing as a contributor to the burden of disease in the region, due to increases in road traffic accidents, wars and violence. The effects of armed conflicts in the region on health and the environment are very substantial. Urban violence is also growing as a public health threat. In both cases, the poor are at greatest risk. Compared with other regions, ACP-Africa has experienced the highest levels of population movement due to wars, famines and other environmental and political changes. This has had important demographic and health impacts.
- In all ACP countries, the poor continue to bear the largest proportion of the disease burden. Diseases such as tuberculosis, acute respiratory tract infections and diarrhoeal disease are closely linked to environmental conditions most often encountered in poor areas, and they are also compounded by other aspects of poverty. The unequal distribution of resources helps to ensure that these health inequalities are maintained. Low quality and insufficient food increases the risk of disease.
- The poor are often unable to protect themselves from the effects of natural and human-made disasters, which may further exacerbate poverty and disease. This is of particular concern in relation to the effects of global warming, and is further discussed in Chapter 6.

Policy Implications

- Because a substantial proportion of the burden of disease is associated with environmental factors, this burden could be mitigated by healthier living environments and improved food security.

- Key groups for intervention include women and children, who often experience the worst living conditions in both rural and urban societies. Improvements in food security for the poorest households, combined with attention to the status of women, to female education, and to increasing the income of poor household, have all been shown to contribute to reducing mal- and under-nutrition and reducing the burden of disease.
- While demographic changes are focusing attention on adult health, the 'unfinished agenda' of communicable diseases should not be neglected. Many of the most important communicable diseases in ACP countries - diarrhoeal disease, tuberculosis, malaria and acute respiratory infections - have strong environmental linkages. Improvements in environmental conditions are crucial to controlling these infections.
- The provision of adequate water and sanitation remains extremely important in improving health and reducing disease in many ACP countries. Integrated approaches to service provision, which include hygiene promotion, are likely to give the greatest health benefit and will also maximise operational synergies by ensuring that households have adequate water for the disposal of excreta. Improvements in water supply have also been shown to bring substantial economic benefits to households.
- Injuries, including those attributable to road traffic accidents, violence and wars, are an area of growing concern. More attention should be given to the development of intervention programmes.
- Some of the key health threats reviewed are linked to household level behaviours. Further research into the social and behavioural aspects of health and disease is required in order to develop programmes to change behaviours at the household level.

3.1 Health Conditions in an Environmental Context

The review of demographic and health trends (Chapter 2) showed that communicable diseases are still important contributors to ill health in the ACP countries. Many of these communicable diseases are closely related to environmental exposures, and indeed, this Chapter shows that around one-third of the total burden of disease in ACP African countries is associated with environmental factors. The majority of this burden is carried by children under the age of five years. Not all residents of ACP countries are equally affected- susceptibility, or the capacity to be affected, is an important factor in determining the impacts of environmental risks. Susceptibility may vary by age, nutritional status, immune status, genetic background etc. (World Resources Institute, 1998) Nutritional status and immune status are, in turn, linked with poverty and access to health care. This section examines the relative importance of environmental risk factors in determining the disease burden, based on recent studies (Smith *et al.*, 1998; World Health Organization, 1997), and begins to explore the poverty-environment-health nexus – a theme to which we will return later in this report.

One of the major difficulties of this task lies in defining what constitutes an 'environmental' risk in a health context. A recent review used the following approach in deciding what factors should be included (Smith *et al.*, 1998):

- behavioural factors related to personal and household hygiene;
- behavioural factors leading to community and larger-scale pollution;
- a proportion of the direct and indirect risks of malnutrition in order to account for degraded soils, floods and other human related impacts on the quantity, quality and distribution of food;
- a component of environmentally related injuries, based on the large variations

in injury rates between areas, and on the recognition that social stressors are, to some extent, environmental;

- the health impacts of the natural environment, such as dust exposure and natural disasters;
- a small component of environmental risk for each disease category (due to the environment's influence on disease outcome).

Genetic risk factors and the major risk factors of diet and active smoking (excluding passive smoking) were excluded.

The review then estimated the proportion of a particular disease category that would be eliminated if environmental risk factors were reduced to their lowest feasible values. These estimates were made on the basis of expert opinion, rather than through a systematic review of the literature for each disease (Smith *et al.*, 1998), and are, therefore, fairly subjective. The estimates also assume that if a disease has both significant environmental and non-environmental components, action against the environmental component will be taken first.

As with other data reported in this section, there are a number of uncertainties in these estimations as:

- data on morbidity and mortality are often incomplete and of poor quality;
- routine data on deaths and disease do not usually include contributing factors, such as environmental exposures;
- links between exposures and resulting health problems are multiple and complex (Smith *et al.*, 1998), as demonstrated in Table 3.1 below. Nutritional status, immune status and a host of other factors also

Table 3.1 Potential Relationships between Exposure Situations and Health Conditions.

Exposure situations / **Health conditions of concern**	Polluted air	Excreta and household wastes	Polluted water or deficiencies in water management	Polluted food	Unhealthy housing
Acute respiratory infections	*				*
Diarrhoeal diseases		*	*	*	
Other infections		*	*	*	*
Malaria and other vector-borne diseases		*	*		*
Injuries and poisonings	*		*	*	*
Mental health conditions					*
Cardiovascular diseases	*				
Cancer	*			*	
Chronic respiratory diseases	*				

Source: World Health Organization. 1997. *Health and Environment in Sustainable Development: Five years after the Earth Summit*. (World Health Organization, Geneva.), page 132.

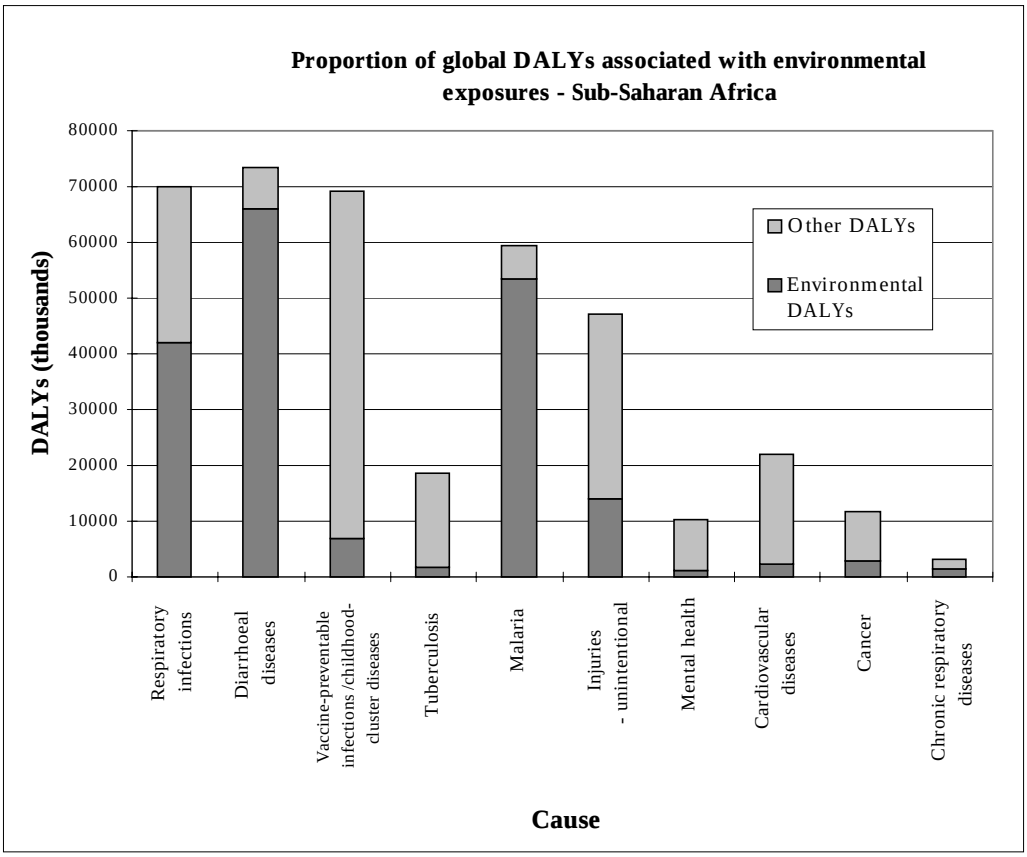
influence susceptibility to disease, as discussed above.

For this report, the data on the proportion of global burden of disease associated with environmental exposures (World Health Organization, 1997, p 173) was applied to the burden of disease estimates for Sub-Saharan Africa. This allowed estimates of the proportion of the burden attributable to environmental exposures in Sub-Saharan Africa to be calculated for a small range of diseases (Figure 3.1 Proportion of DALYs associated with Environmental Exposures – Sub-Saharan Africa).

The available data appear to indicate that 34% of the total burden of disease in ACP-Africa is associated with environmental factors. This is substantially higher than the global average of 23% and suggests that there is a high prevalence of environmentally related deaths and disability in the region. Such a finding is not surprising, as the mortality and morbidity data discussed in Chapter 2 clearly show the continued importance of infectious and other diseases related to poor household or neighbourhood environments. Environmentally related non-communicable diseases, such as cancers and chronic respiratory diseases, currently account for only a small proportion of the disease burden in the region. These diseases are, however, likely to grow in public health importance as the burden of communicable diseases declines and as environmental changes often associated with urbanisation, such as increasing levels of ambient air pollution, progress.

The data also reinforce the importance of household and neighbourhood level environmental improvements. Under optimal conditions, these environmental interventions appear to have the potential to reduce the burden of disease experienced in SSA by up

Figure 3.1 Proportion of DALYs Associated with Environmental Exposures – Sub-Saharan Africa.



Source: Murray, C. J. L. and Lopez, A. D. 1996b.

Box 3.1 The Increasing Importance of Non-communicable Diseases - Projections of the Disease Burden for Mauritius

The Republic of Mauritius, made up of the islands of Mauritius, Rodrigues and a number of other small islands in the south-west Indian Ocean, with a population of 1.1 million (1993), has developed rapidly over the past three decades. Per capita GNP has risen from US$ 280 in 1970 to US$ 2,980 in 1993 and the economy has diversified into industry, manufacturing and tourism. At the same time, the country has experienced a rapid demographic and epidemiological transition. The total fertility rate dropped from 3.6 in 1970 to 2.3 in 1993, whilst the IMR dropped from 60 per 1000 live births to 20 during the same period. These demographic changes, combined with lifestyle changes and changes in the incidence of and mortality from communicable diseases, have resulted in shifts in the disease burden for the country. Because Mauritius has a far higher per capita GNP, a small population and is substantially more developed than most other SSA countries, it should not be viewed as representative of the region. It is, however, the only SSA country for which a BOD assessment has been completed and it therefore provides insights into the impacts of epidemiological and demographic transitions on health.

The results of this study, which used estimates of the disease burden for 1993 for Mauritius to make projections to the year 2005, show that non-communicable diseases are becoming more important. If recent mortality and population growth trends are extrapolated to 2005, the country could expect the proportion of the disease burden attributable to Group I diseases to decrease from 14.8% to 8.6%; the proportion attributable to Group II diseases to increase from 74.8% to 80.6% and Group III causes to increase marginally from 10.4% to 10.7%. Within Group II causes, diabetes and alcohol-related diseases may increase dramatically. For females, the gains in reductions from communicable diseases (Group I) and most other non-communicable diseases offset the adverse trend for diabetes. For males, however, the per capita disease burden may rise, largely as a result of the adverse trends in alcohol-related diseases, diabetes, injuries and HIV infection, overwhelming reductions in Group I diseases. This increased burden will fall largely on adults aged 15-59 years.

Overall, the projection described suggests that the per capita disease burden could rise by 7% for women and 34% for men if current trends in non-communicable diseases, injuries and HIV continue. Efforts to promote the prevention and control of non-communicable diseases and injuries will need to receive high priority if these trends are to be stabilised or reversed. As discussed above, such projections need to be viewed with caution and are contingent upon the continuation of current mortality and populations trends and, in turn, on ongoing investment in services which impact on health. The projections may, nevertheless, provide valuable information on future trends in health and disease.

References

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to one-third. The synergistic effects of many of these interventions, such as improved water and sanitation facilities, across several diseases might mean that this is an underestimate of the overall benefits of environmental improvements. This is further discussed in the section on key health threats below.

In that almost all environmentally related DALYs are accounted for by the age group 0-14 years, the health of children under 15 years could benefit greatly from environmental improvements and the improved environmental regulation of pollutants, for example. Diarrhoeal diseases, malaria and respiratory infections are most closely linked with environmental factors and, respectively, constitute the top three environmentally related causes of death and disability for the region. They account for more than 28% of all DALYs. Of the DALYs associated with environmental factors, about 80% occur in the age group 0-4 years, indicating the particular vulnerability of young children to the multiple risks of inadequate environments.

While these figures can only be seen as broad estimates, they do begin to highlight the links between environmental factors and disease burden. Disaggregated burden of disease figures for the Caribbean and the Pacific small island states were, unfortunately, not available and so are not discussed here. It is, however, likely that the picture in these islands, particularly those with low per capita incomes and less developed infrastructure, is likely to be similar to that described above.

3.2 Key Health Threats In An Environmental Context

Because of the importance of environmentally related diseases in the ACP countries, it is useful to examine in more detail those making the largest contribution to the burden of disease. In the section that follows, the key health threats and their links to environmental conditions are discussed.

The key threats are classified using the scheme described in Chapter 2: communicable and nutritional diseases (Group I conditions), non-communicable diseases (Group II) and injuries (Group III). Grouping communicable and nutritional diseases helps to demonstrate the close relationship between malnutrition and many infectious diseases. Many of these diseases are also susceptible to improvements in household living conditions. Within these three broad groups, the health issues are presented in descending order of their contribution to the burden of disease attributable to environmental factors.

3.2.1 Communicable and Nutritional Diseases

Diarrhoeal Diseases

Faecal-oral diseases are the most important contributor to the environmental burden of disease in ACP-African countries and in certain Pacific and Caribbean countries. Murray and Lopez (1996) have attempted to assess the disease burden attributable to poor water supply, sanitation and personal and domestic hygiene practices, in order to indicate the proportion of the burden that could be prevented if the transmission of these diseases were interrupted through intervention. The authors suggest that 5.3% of all deaths worldwide are attributable to poor water supply, sanitation and hygiene and that these risk factors account for 6.8% of the disease burden. This is equivalent to the disease burden attributed to more well-publicised diseases such as malaria, measles and tuberculosis. This burden is not equally distributed across regions, however: in the developed world, these risk factors account for a negligible proportion of the disease burden (0.1%) while in ACP-Africa they account for approximately 10% of the burden of disease and injury. These inequalities reflect the inequalities in access to water and sanitation between the developed and the developing world.

Of the faecal-oral diseases, diarrhoeal diseases are the most important, particularly in children under five years of age. Diarrhoea is a complex of symptoms and signs and, while a number of definitions have been used in the literature, recent studies have considered more than three stools in 24 hours of observation as an indication of diarrhoea after the age of three months (Martines *et al.*, 1993).

The aetiology of diarrhoeal diseases is complex, and varies according to age and geographical setting. Rotavirus is a significant cause amongst children under two

Box 3.2 Classifying Water-Related Infectious Diseases

Bradley and Feachem (Feachem et al., 1977) divide water-related infectious diseases into categories which reflect their means of transmission, as shown in the table below.

Table 3.2 The Bradley-Feachem Classification of Water-Related Infectious Diseases.

Category of infection	Type of infection	Preventive strategy
Faecal-oral diseases (water-borne and water-washed)	Most diarrhoeas and dysenteries	- Improve quality of drinking water - Prevent casual use of unprotected sources
Strictly water-washed diseases	Infectious skin and eye diseases, louse-borne typhus	- Increase water quantity used - Improve accessibility and reliability of domestic water supply - Improve hygiene
Water-based (infections transmitted through an aquatic vertebrate host)	Schistosomiasis, guinea worm and so on	- Reduce need for contact with infected water and control snail populations[1] - Reduce contamination of surface waters
Water-related insect vector (infections spread by insects which depend on water)	Malaria, dengue fever and so on	- Improve surface water management - Destroy breeding sites of insects - Reduce need to visit breeding sites - Use mosquito netting

The Bradley-Feachem classification emphasises that faecal-oral diseases, such as diarrhoeal disease, can be transmitted by more than one route (from person to person or by way of contaminated water or food, for example), and also provides guidance for intervention, suggesting, for example, that if a disease is water-washed, then the quantity of water used by people must increase.

References

Feachem, R., McGarry, M. and Mara, D., (eds.) 1977. *Water, wastes and health in hot climates*. Chichester, John Wiley.

[1] Applies to schistosomiasis only.

years of age in developing countries, but other viruses and bacteria, such *as Escherichia coli, Salmonella, Shigella* and *Vibrio cholerae*, can also cause the disease. Diarrhoeal diseases are spread from the faeces of an infected person to fluids (stored water), fingers, flies or fields (neighbourhood contamination) and from there, either directly or via food, to a new host (Kolsky, 1993). The risk of diarrhoea morbidity and mortality is higher in poorer households, in conditions of poor personal and domestic hygiene, and amongst infants of low birth weight, those who are not breastfed and those who are malnourished (Chongsuvivatwong *et al.*, 1994; Daniels *et al.*, 1990; Martines *et al.*, 1993). Improvements in water supply, excreta disposal and hygiene behaviour are strongly linked to decreased diarrhoeal morbidity and mortality rates, as discussed below.

The burden of diarrhoeal diseases in developing countries remains extremely high. In ACP-African countries, approximately 950,000 people died of diarrhoeal diseases in 1990. Eighty-five per cent of these deaths were in the age group, 0-4 years (Murray and Lopez, 1996a). On average, children under five years of age in developing countries suffer 3.5 episodes of diarrhoea per year, with the rates in ACP-Africa even higher (Martines *et al.*, 1993). Whilst there is evidence of a reduction in diarrhoeal mortality during the past 15 years, there is little evidence of a reduction in incidence.

Interventions designed to improve water supply, sanitation and hygiene behaviour, and thereby reduce the incidence of diarrhoeal diseases, are a public health priority. Access to safe water and adequate sanitation is not only a prerequisite for health, but is also increasingly being seen as a social right.

Access to Water and Sanitation

Data on changes in access to safe water supplies over the past two decades for selected ACP countries are shown in the Figure 3.2 (further data are available in the appendices). Whilst some countries improved coverage dramatically (Botswana), others achieved more modest gains (Papua New Guinea; Benin), with some showing very little gain (Haiti). This does not necessarily mean that services have not expanded, but rather that expansion of access to water has not kept pace with population growth in these countries.

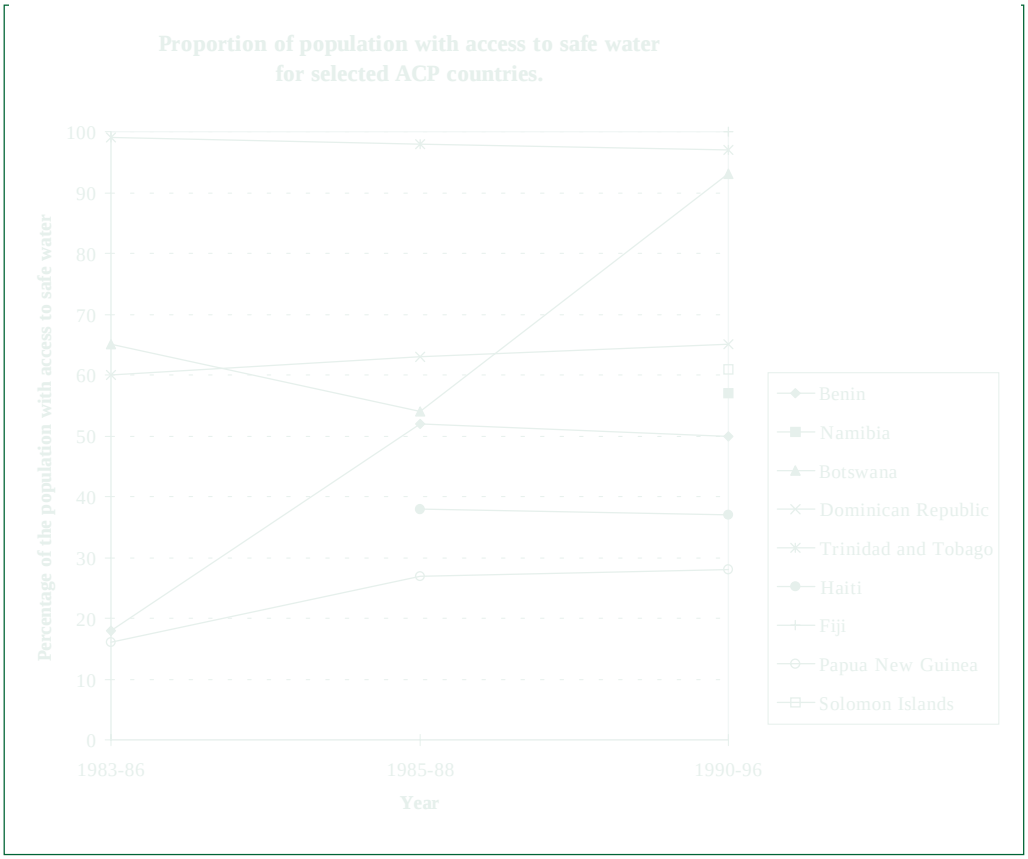
Despite what would seem to be obvious health, social and economic benefits, around 50% of people in ACP-Africa do not have access to safe water and adequate sanitation, with rural residents being twice as likely as urban dwellers to experience inadequate basic services (UNICEF, 1998).

In the Caribbean, most countries, apart from Haiti, have high levels of access to safe drinking water and adequate sanitation. Levels of access to these facilities have been maintained or increased since 1980. Unfortunately, access alone does not lead to a healthy environment. Contamination of water supplies and the indiscriminate disposal of waste and sewage are still serious public health problems, as indicated by the gastroenteritis rates seen across the region. This is especially true in Jamaica, St Vincent and the Grenadines, St Kitts and Nevis, and Trinidad and Tobago, where the incidences of gastroenteritis remain high. Furthermore, due to high levels of extraction from groundwater sources in many of the islands, saline intrusion has started to occur, making the water unpalatable and non-potable. Aside from saline intrusion, dangers from other toxins as a consequence of the improper disposal of sewage, domestic and industrial wastes also pose potential threats to human health in the region. The quality of surface water in the Caribbean has, for example, been affected by contamination with household chemicals and pesticide runoffs.

Figures on access to water and sanitation for the Pacific island states show that for several states, such as Papua New Guinea and the Solomon Islands, coverage is low compared with both the developing countries average and the ACP-African average. The incidence of waterborne and water related diseases in these areas are naturally high, as has been concluded in a number of studies. Data on other forms of water pollution in the region were not available.

There are also important differentials in water and sanitation coverage in cities and towns. In many ACP cities, subsidised public water and sanitation services are enjoyed by wealthier households, while poorer

Figure 3.2 Proportion of Population with Access to Safe Water.



Source: UNICEF. The state of The World's Children. 1988,1991 and 1998. Oxford University Press for UNICEF.

households are forced to purchase water at high prices and to use sanitation facilities that pose health risks. It is well known that the risk of diarrhoeal disease morbidity and mortality is greater in families of low socio-economic status (Martines *et al.*, 1993), and that this relationship is partly linked to their poor access to basic services.

The health effects of improvements in water supply and sanitation, and mechanisms for effecting these improvements, particularly in low income communities, are further discussed in Chapter 7.

Acute Respiratory Infections

Acute respiratory infections were the most common cause of death in developing regions in the 1990s (Murray and Lopez, 1996a). In ACP-Africa they affect mainly children and the elderly, and are responsible for 30% of the disease burden for children in the region (World Health Organization, 1997).

The term covers a range of conditions including the common cold, tonsillitis and bronchitis (caused by numerous bacterial and viral infections of the lungs and respiratory tract). Bacterial pneumonia is, however, the most important acute respiratory disease, accounting for many childhood deaths. The disease is spread by droplets from coughing, sneezing and from unwashed hands. Children are most susceptible during their first year of life (World Health Organization, 1997).

Acute respiratory infection is a disease of poverty, and is closely linked to poor environmental conditions. Estimates suggest that over 50% of respiratory infections are associated with environmental exposures (Smith *et al.*, 1998). These infections are aggravated by malnutrition, and most affect children already suffering from low birth weight, and other infections. Acute respiratory infection is linked to poor access to health care, poor housing conditions (such

as inadequate inhalation and dampness), overcrowding and poor hygiene. Relationships between acute respiratory infection and both indoor and outdoor air pollution are also being investigated. A link to the use of biomass fuels (such as wood, dung and coal) has been suggested.

Although most types of pneumonia cannot be prevented by vaccine, they can be treated by standard antibiotics. Efforts to reduce pneumonia mortality have centred around improved case management (including simplifying case detection) and increasing parental awareness of the need to seek medical attention (World Health Organization, 1998). This approach is being undermined by the increasing resistance to antibiotics of bacteria that cause pneumonia. Broader strategies are being sought, such as integrating prevention with measures to improve nutrition, including breast feeding and increase birth weights. Smoke reduction, both from cigarettes and cooking stoves, may also be an important focus for prevention, although more research is needed in this area (Kibel and Wagstaff, 1995). This is further discussed in Chapter 5.

Malaria And Other Vector Diseases

The environment plays a particularly important role in determining the distribution of vector-borne diseases, through factors such as water, temperature, humidity, vegetation density, patterns of agriculture and housing construction (see Box 3.3 and Table 5.2 Vector Related Diseases) (World Health Organization, 1998). All vector borne diseases, including malaria, lymphatic filariasis and schistosomiasis (bilharzia), are most serious in the poorest countries.

Ninety per cent of all malaria cases occur in tropical Africa (World Resources Institute, 1998). It is estimated that there are 100 million malaria cases every year in Africa and that 275 million people carry the parasite (Bradley *et al.*, 1991). In most cases this is *Plasmodium falciparum*, the more severe type of malaria. The three main mosquito vectors are resistant to one or more insecticides, and although urbanisation has been traditionally held to reduce malaria, other evidence suggests that in urban and peri-urban areas, transmission is often intense, but tends to be seasonal and for shorter periods than in rural areas.

Statistics increasingly suggest that there is higher incidence of malaria in older children and adults in the region, which is thought to be associated with urbanisation and personal protection from mosquito bites by various means (both of which reduce immunity), and which is seen to be worst in non-endemic areas where people reach adulthood without developing immunity. Malaria is also associated with population movements of non-immune people into endemic areas. The movement of highland populations in Uganda in the 1950s to colonise lowland areas, for example, led to a large epidemic.

Malaria is also an important cause of low birth rates in endemic areas as pregnant women are more susceptible to both malaria and anaemia. It is estimated that malaria accounts for between 20% and 30% of infant deaths in the region. Many of these child deaths are in more remote areas with poor access to health care services.

The type of rapid informal urbanisation seen in ACP-Africa has increased the number of breeding sites for the *Culex* mosquitoes which utilise pools of stagnant water. *Culex* are the vector for lymphatic filariasis, which causes the condition 'elephantiasis' and male genital damage (World Health Organization, 1998). In the urban context, breeding sites for *Culex* are often created when drains and other forms of sewerage disposal built to improve sanitary conditions become blocked due to inadequate maintenance or poor design, creating stagnant pools. Pit latrines are another important breeding site if waterlogged, as are cracked septic tanks (Curtis and Feachem, 1981). There is also evidence that *Culex* mosquitoes from one massive breeding site, such as a sewage farm, can infest a whole city (Curtis and Feachem, 1981). A study in India showed that the prevalence of filariasis decreased with distance from the centre of the city, implying that the city is the major breeding site for the mosquito vector and that the risk of disease increases with the growth of urban infrastructure (Overseas Development Administration, 1985). Increasing urban

populations with inadequate or poorly constructed or maintained sanitation and drainage can therefore produce an increased number of breeding sites for the *Culex* mosquito and lead to the increased transmission of filariasis within cities.

Some recent epidemics of vector borne diseases are being linked to climatic change (see Chapter 6), as well as to the opening up of non-endemic areas, changes in local environments (see Boxes 3.3 and Box 7.3 Current status of development of vaccines against malaria, schistosomiasis and filariasis), insecticide resistance and anti-malarial drug resistance. The distribution and prevalence of a number of other vector-borne diseases, including dengue (mosquito vector)[1], leishmaniasis (sandfly vector)[2], African trypanosomiasis (tsetse fly)[3], onchocerciasis (blackfly vector)[4] and schistosomiasis (aquatic snail vector)[5], are also closely linked to environmental conditions. Environmental improvements, coupled with adequate treatment and prophylaxis, hence have great potential to reduce the spread of these diseases.

Tuberculosis

Tuberculosis ranks seventh in the list of contributors to the global disease burden, causing an estimated 385,000 deaths in ACP-Africa and two million deaths worldwide in 1990 - probably more than any other single pathogen (Murray *et al.*, 1993; Murray and Lopez, 1996a; Raviglione *et al.*, 1995). It has been estimated for 1990 that about 1.7 billion people were infected with tuberculosis, mainly in developing countries. Whilst all age groups are affected, incidence and mortality is concentrated in adults aged 15-59 years. Tuberculosis is caused by the bacterium *Mycobacterium tuberculosis*, which usually infects the lungs. Infection is generally transmitted from people with pulmonary tuberculosis, particularly when coughing or sneezing. It is important to note that clinical disease may occur at any time from weeks to years after the initial infection, although most cases occur within two years of infection (Murray *et al.*, 1993). Disease at a later date may be 'activated' by weakening of the host's immune system, through malnutrition or HIV infection, for example.

Both the incidence of tuberculosis and the number of deaths attributable to the disease are likely to rise in ACP-Africa and other low income ACP countries during the next decade. Data shows that notification rates for ACP-Africa increased by 19% for the period 1989-91 when compared with 1984-86 (Raviglione *et al.*, 1995). Projections indicate that in ACP Africa, tuberculosis deaths may increase by 2010 in absolute terms and in relative terms from 4.7% to approximately 7% of all deaths - and from 3.3 to 5.8% of the disease burden (Murray and Lopez, 1996a). Tuberculosis in the Caribbean, while generally less common than that in most countries in Latin America and ACP-Africa, appears to be on the increase. The downward trend in the tuberculosis rate has reversed during the latter half of this decade, and whilst the reasons for the reversal are not clear, it does coincide with the deterioration of socio-economic conditions in a number of Caribbean countries (PAHO, 1997).

There are a number of likely reasons for this rise in incidence. Firstly, demographic shifts mean that the size of the most

continued on page 84

[1] Dengue is a viral disease causing fever, headache, tiredness, muscle pain, rashes and joint or bone pain. It is non-fatal, but those affected often experience a prolonged convalescence (Weatherall et al 1996).
[2] Leishmaniasis is caused by a parasite transmitted by sandflies, and is characterised by skin ulcers and nodules. These are not generally painful, but may disfigure or disable if scarring is severe or over a joint (Weatherall et al 1996).
[3] African trypanosomiasis, or sleeping sickness, is cause by a parasite transmitted by tsetse flies. The severity of the disease varies considerably, but initial fever, headache and malaise, later followed by meningoencephalitis and death over months or years (Weatherall et al 1996).
[4] Onchocerciasis is transmitted by blackflies which breed in fast-flowing watercourses. It may cause severe eye lesions, including blindness, and skin disease (Weatherall et al 1996).
[5] Schistosomiasis is caused by a parasite transmitted by aquatic snails. It may cause both acute disease, including fever, rigors and vomiting, and chronic disease of the urinary system and liver (Weatherall et al 1996).

Box 3.3 The Health Risks of Development Projects: Infectious Agents and Irrigation

Irrigation programmes, the construction of dams or water impoundments, and agricultural practices such as rice cultivation and coffee growing, are often undertaken in order to provide economic benefits for local people, to provide safer water, and to provide food. Whilst these goals are laudable, such interventions can adversely affect the health of local people by expanding the water sources used by vectors which transmit communicable diseases. This is particularly true in many countries in Africa, South East Asia and South America, where increased prevalence, incidence, and intensity have been reported for schistosomiasis, malaria, and filarial parasites.

Bilharzia

In Africa, the construction of water impoundments for irrigation and other projects have not only intensified community levels of infection but also created new areas of transmission. Slow moving water in irrigation canals and drainage ditches provides an ideal habitat for the snail which are the intermediate hosts to the organisms which transmit bilharzia (*Schistosoma mansoni* and *S. haematobium*).

There are a number of examples of this problem. In Senegal, as a result of the construction of a barrage to prevent sea water intrusion at Diama on the Senegal River, *S. mansoni* was introduced into the Lower and Middle Valleys of the Senegal River Basin and subsequently spread into the human population (Southgate, 1997). In Mali, a study of 225 villages compared areas with irrigation programmes, villages in the vicinity of small dams, settlements around a large artificial lake, communities along the Niger River, and places in savannah areas without any irrigation programmes. The risk of schistosomiasis infection in irrigated areas was six times higher than in savannah villages (Brinkmann et al. 1988). Interestingly, even in the vicinity of natural bodies of water, the prevalence of infection was three times less than near agricultural development projects. There are a number of similar examples from ACP-African countries (Bizuneh, Ethiop Med J 33:259, 1995; Hilali et al, 1995; Amankwa et al. 1994).

Malaria

The mosquito vectors of malaria, *Anopheles gambiae* and *An. funestus,* thrive in the quiet waters provided by dams built for drinking water, flood control, irrigation and water storage, and in rice paddies (Githeko et al, 1993; Lindsay et al. 1995). The epidemiological importance of rice fields varies from country to country (Lavanture et al. 1996). In West and Central Africa, where malaria is holoendemic, the rice fields support the breeding of mosquito vectors. A comparison of a rice irrigation scheme and a sugar-cane belt in Kenya showed that the number of infective bites per person per year was 416 in the irrigated area - some 4.5 times more than in the cane belt (Githeko et al, 1993).

Filariasis

There are two major types of filarial diseases. Lymphatic filariasis is transmitted by mosquitoes and afflicts about 90 million people in Africa, South America, the Indian subcontinent, south-east Asia, and China. The most dramatic manifestation of the disease is elephantiasis of the limbs, usually the legs. Onchocerciasis, on the other hand, is transmitted by simulium black flies and afflicts 18 million people in Africa, South and Central America, where it causes blindness in about 3 million people. The larvae of the black flies prefer fast running water and the term river blindness refers to the fact that the majority of infected people live along river valleys. Filariasis

transmission is also affected by man-made development projects, although the list of documented cases is not as long as for schistosomiasis and malaria.

Elephantiasis has been referred to as a disease of development. In north-eastern Ghana, high levels of lymphatic filariasis have been associated with two rice irrigation projects (Hunter, 1992), although this association is not always shown (Oemijati et al. 1978). A study in Liberia and Guinea showed that the black flies which transmit onchocerciasis bred in rivers and irrigation systems (Garms and Vajime, 1975).

Conclusions

It is clear that development projects can have an adverse effect on the health of the very people who are supposed to benefit from these projects. A multi-sectoral policy of prevention before development is strongly advocated (Hunter, 1992). Disease control efforts involving the spraying of vector breeding sites have been frustrated by the emergence of drug resistance. At present, immunoprophylaxis as a control measure is not yet practicable, although intense research efforts are ongoing in several laboratories to develop vaccines (see Box 6.1). Reasonable to moderate success has been achieved in developing vaccines against malaria and schistosomiasis, and several candidate vaccines are now at various stages of preclinical development (Bergquist and Colley, 1998). Little progress has, in contrast, been made towards the development of vaccines against filariasis. Prevention is, therefore, still the best strategy for managing the impacts of vector borne diseases associated with development projects.

Contributed by Thomas Egwang, Med Biotech Laboratories, Kampala, Uganda.

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continued from page 81

susceptible population group (15-59 years) is growing. Secondly, rapid increases in HIV infection rates will increase the proportion of the population susceptible to the disease - by the year 2000, an estimated 13.8% of tuberculosis cases may be associated with HIV (Dolin, 1994), cited in (Raviglione *et al.*, 1995). Thirdly, increased numbers of malnourished people living in overcrowded conditions caused by war, famine, natural disasters and economic marginalisation may also contribute to increased rates of disease.

A number of strategies have been adopted in an attempt to control the epidemic. Short-course chemotherapy for treatment and BCG immunisation to prevent tuberculosis are two of the most cost-effective interventions available (Murray *et al.*, 1993). The WHO has declared tuberculosis a global emergency and is promoting a policy of directly observed therapy, short course (DOTS), as a mechanism of achieving control of the epidemic. The emphasis on direct observation as a means of ensuring adherence to treatment is, however, not currently supported by evidence of effectiveness (Volmink and Garner, 1998; Zwarenstein *et al.*, 1998 Forthcoming). Further research is needed in this area. There is good evidence to suggest that preventive treatment of HIV-infected adults reduces the incidence of active tuberculosis (Wilkinson *et al.*, 1998), and this should be implemented where feasible.

The treatment of cases and contacts is only one strategy for reducing the incidence of tuberculosis. The relationship between socio-economic and environmental conditions and tuberculosis incidence is well known, and data from developed countries show that the most dramatic drops in deaths from respiratory tuberculosis occurred before the widespread availability of chemotherapy and vaccination (McKeown, 1988; Metcalf, 1991; World Resources Institute, 1998). During the first four decades of the 20th century, the annual risk of infection of tuberculosis fell by 3% to 5% per year in Europe (Murray *et al.*, 1993). This decrease is largely attributed to improvements in socio-environmental conditions such as housing and nutrition, to improvements in general health and, possibly, to the policy of isolating tuberculosis patients in sanatoria.

Tuberculosis rates in both developing and developed countries have been shown to vary inversely with socio-economic status (Coovadia and Benatar, 1991) and overcrowding (Elender *et al.*, 1998) - a fact which emphasises the link between poor living conditions and disease transmission. The extent to which individual improvements, such as those in housing, contributed to the reduction of tuberculosis rates is not clear, however, due to difficulties in disaggregating these impacts (Porter and Ogden, 1998). Overcrowding, poor ventilation, poor sanitation and under-nutrition or malnutrition are all closely linked to poverty and, as discussed earlier, there are synergies present in both the adverse effects of poverty on health and in the benefits of interventions which broadly address poverty. This point is crucial as, whilst anti-tuberculosis chemotherapy can decrease the annual risk of infection by 10 to 12%, it does not contribute to decreasing other poverty-related diseases such as childhood respiratory infections and diarrhoeal disease. Others have commented that, 'The consequences of a rigid biomedical focus is that the wider, more profound and long-lasting interventions, such as improved housing, reduction of gender discrimination and ways of building the capacity of communities to manage public health problems on their own terms, are not addressed' (Porter and Ogden, 1998, page 109). Recent studies have estimated that up to 10% of the tuberculosis burden could be prevented through environmental improvements (World Health Organization, 1997 and see Figure 2.11), but little attention has been paid by the health sector to strategies that address socio-environmental deprivation and social inequalities[6]. This is

[6] See chapter 2 for discussion of health differentials.

not to suggest that people with tuberculosis should not receive chemotherapy, but rather that equal attention needs to be paid to reducing poverty in areas where tuberculosis prevalence is high.

Acquired Immunodeficiency Syndrome AIDS /HIV

Two-thirds of all people with HIV live in ACP-Africa (World Resources Institute, 1998). In some areas, such as Botswana, up to 30% of the population have the virus (a figure that has doubled over the past five years). The large population movements to the cities of eastern and central Africa in the 1970s and early 1980s are thought to be a large factor in the spread of the disease, and urban rates are still the highest in the region. It was previously believed that the epidemic was levelling off, but current estimates indicate that 7.4% of the adult population in Africa, aged between 15 and 49, are HIV positive.

It is estimated that 80% of those with the virus in the region acquired it through heterosexual transmission (Feachem and Jamison, 1991). This is a very high proportion when compared with transmission modes in other regions of the world. It is believed that the high prevalence of other infectious diseases, such as malaria, may facilitate the virus, through their impact on the immune system. The clearest association with another disease is with tuberculosis. It has been estimated that one half of all adults in ACP-Africa have latent tuberculosis, which could be activated by HIV infection.

The rates of vertical transmission from mother to child are thought to be between 25% and 50%. A further 10 years will be needed before the true extent of child HIV morbidity and mortality are seen (because of the difficulties of diagnosis in children and increasing evidence that children infected before birth do not become ill until they are between seven and ten years of age).

The sex ratios of the disease vary by region. In Zaire and Uganda, for example, the ratio of male to female AIDS cases is less than one, whereas in Cote d'Ivoire and Senegal, the ratios are between two and four. Urban/rural differences are generally high throughout the region, with a much greater prevalence of the virus in urban areas. In Rwanda in 1990, the percentage of HIV-1 seroprevalence was 30.3 for those in urban environments and 1.7 for rural dwellers. Disproportionately high rates of infection are expected in future, amongst women and low income urban residents.

Whilst it is not clear why the rates of HIV infection have risen rapidly in some areas but not in others, there are several factors which influence the shape of the epidemic. Migrancy – either for work or in response to conflict or environmental disasters such as drought – is an important risk factor in many ACP countries. Refugees and those in conflict zones may have little control over exposure to HIV (UNAIDS, 1998), and poverty and deprivation are, therefore, important in understanding the spread of HIV in the ACP countries. Studies elsewhere, for example, have shown that where women do not have access to sanitation within the home, they may be forced to use communal facilities or open defaecation. This, in turn, places them at risk of rape and, therefore, for HIV infection (Cairncross *et al.*, 1998). In general, it is thought that people whose daily existence is stressful and dangerous may not care about the long-term risks posed by HIV. They may be more concerned with food security and ways of ensuring access to basic subsistence facilities, such as a supply of potable water.

Whilst the 'environmental' component of HIV/AIDS is probably smaller than that of many other diseases discussed in this Chapter, it is clearly a public health priority for the ACP countries. Its link to poverty and deprivation suggest that interventions to improve living environments and food security, and to improve the status of women may impact positively on the spread of the epidemic.

Nutritional Diseases

The term malnutrition is used to refer to the consequences of the combination of an inadequate intake of both protein-based energy and micronutrients to ensure optimal growth and function (UNICEF, 1998, page 14; World Health Organization, 1998, page

131)[7]. Malnutrition is not an environmental problem in itself, but it does work with environmental factors to increase susceptibility to disease (World Resources Institute, 1998) and may also be worsened by poor environmental conditions. Recent studies have estimated that 15% of deaths and 18% of the disease burden for children in developing regions are attributable to protein-energy malnutrition. For ACP-Africa, this rises to a staggering 32% of the disease burden (Murray and Lopez, 1996b)**.** Other studies have estimated that about 55% of all child deaths in developing countries are associated with malnutrition, including deaths from diarrhoea (19%), acute respiratory infections (19%), perinatal causes (18%), measles (7%), malaria (5%) and other causes (32%) (UNICEF, 1998). Much of this disease burden is attributable to under-consumption of protein and energy, although deficiencies in key micronutrients such as vitamin A, iron and iodine are increasingly been seen as important (World Resources Institute, 1998).

The causes of malnutrition are complex and interwoven, as illustrated in Figure 3.3. The immediate causes - inadequate dietary intake and illness - are influenced by household food security, access to a healthy living environment and health services, and child caring practices (Pinstrup-Anderson *et al.*, 1993). The issue of food security and its relationships to land access and tenure, agricultural productivity and food distribution, are discussed in chapter 4, and it is important to note that rising levels of food production per capita do not necessarily translate into improved household food security. Pricing and distribution mechanisms may, for example, reinforce inequalities in food availability and undermine the potential benefits of increasing production. The increased production of cash crops, whilst potentially lucrative, may undermine nutrition in poor seasons, as these crops are generally less resistant to drought and pests, and are subject to wide international fluctuations in commodity prices.

The importance of a healthy living environment is also increasingly being recognised. Studies suggest that children living in unsanitary environments may experience recurrent, low-level challenges to their immune systems that impair growth. This may be due to nutrients being diverted to the immune response at the expense of growth (UNICEF, 1998, page 26). Another study suggested that improvements in sanitation resulted in taller and heavier children for each of the levels of water supply studied - unimproved, improved and optimal[8] - and that incremental benefits in sanitation were associated with additional increases in the weights and heights of children. The study suggests that the health benefits from improved water supply are less pronounced than those for sanitation (Esrey, 1996). Although analyses of such cross-sectional data collected in different settings has its limitations (Cairncross and Kolsky, 1997), it highlights the links between sanitation conditions, nutrition and child growth that have been documented elsewhere (Pinstrup-Anderson *et al.*, 1993) (also see Chapter 2).

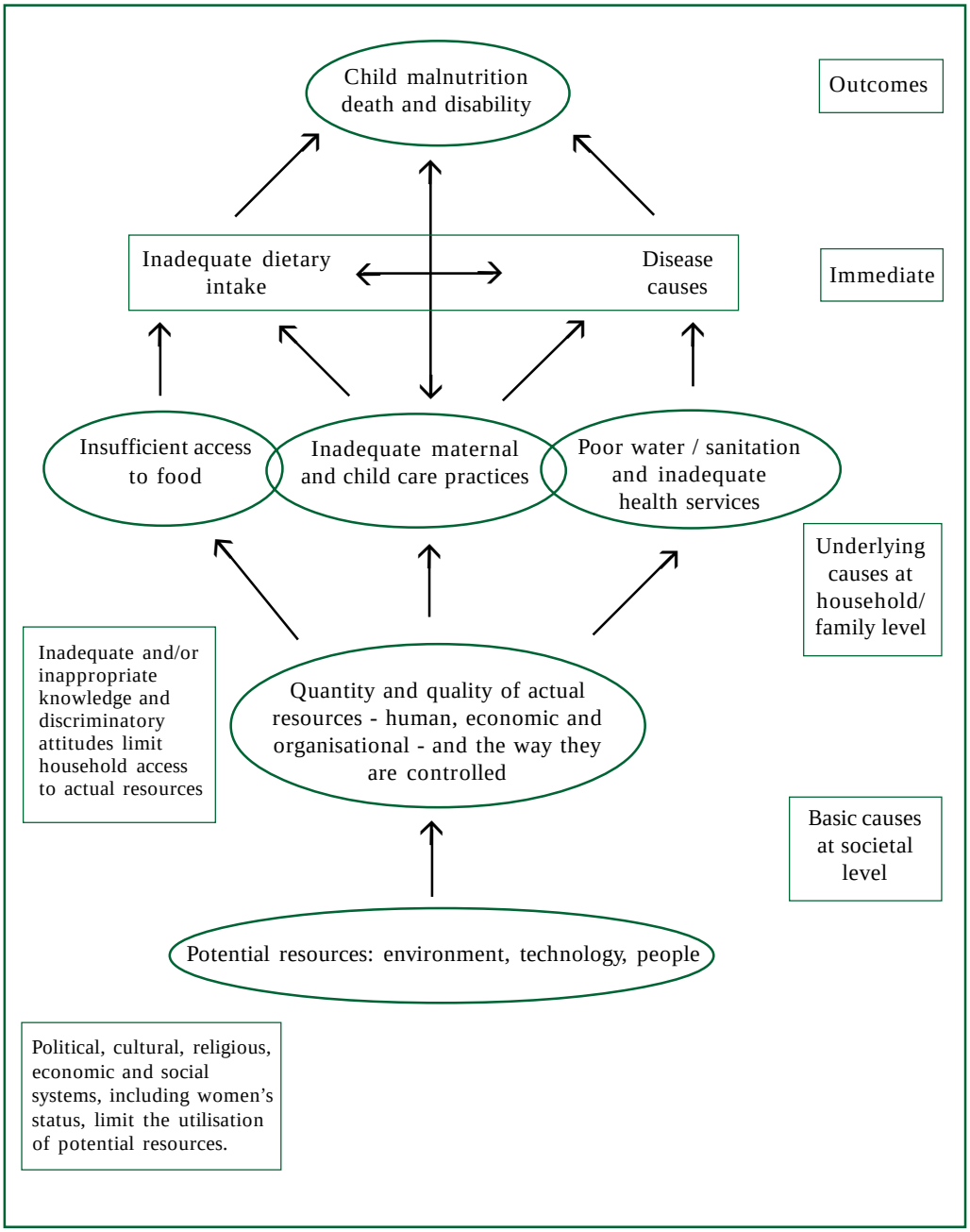
Poverty is at the root of the problem and acts as a proxy for interlinking factors of food, health and care. If a rural woman has to spend excessive time collecting water for household use, for example, her time and energy available for agricultural work, and for the preparation of meals, may be curtailed. The result may be a lack of or poor nutrition for her child. Her own nutrition may also be compromised, as carrying water may consume a substantial proportion of her daily calorie intake (Sims, 1994). This places her at greater risk for mortality during pregnancy and also increases the risk of a low birth

[7] The most commonly used indicator of malnutrition is the proportion of children for whom weight-for-age falls below an internationally agreed reference value (underweight for age) (World Health Organization, 1998, page 131). Low weight for a given height is referred to as wasting while low height for a given age is referred to as stunting. Micronutrient deficiencies include deficiencies in iron, zinc, magnesium and other trace elements and deficiencies of vitamins A, C and B complex.

[8] For the purposes of the study, the levels of water supply were defined as follows: optimal (on the premises) intermediate (improved public water) and unimproved. Levels of sanitation services were defined similarly: optimal (flush toilets or water-seal-latrines), intermediate (latrines) sanitation and unimproved (Esrey, 1996).

weight or micronutrient deficient infant who, in turn, is at greater risk of mortality, morbidity and impaired cognitive development (Pinstrup-Anderson *et al.*, 1993). In poor households, efforts to fulfil one precondition for adequate nutrition often compete with scarce resources required to fulfil another (UNICEF, 1998). Poverty at the household level may be a result of, or compounded by, poverty and under-development at a national level. Structural adjustment policies and poor terms of trade have both contributed to eroding the prices of commodities produced by rural farmers, and to the fragmentation of social safety nets in ACP-Africa (see Chapters 1 and 4). All of these broader or 'upstream' factors may, in turn, impact on nutrition (see Figure 3.3).

Figure 3.3 Causes of Child Malnutrition.

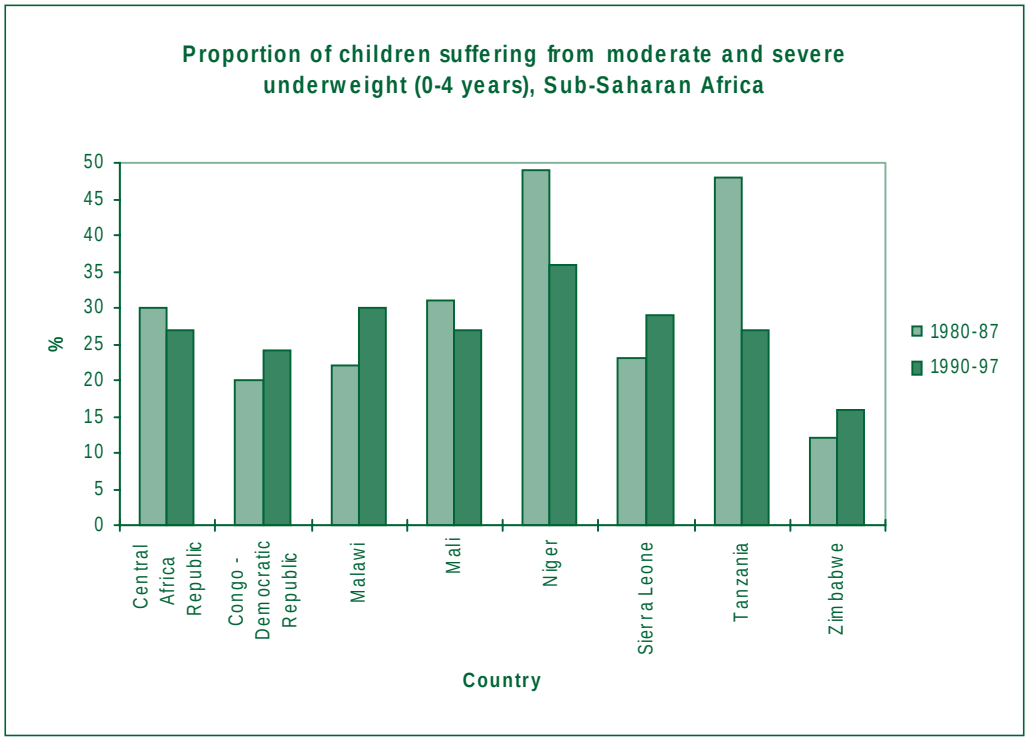


Source: UNICEF. 1998. The State of The World's Children 1998, page 24. Oxford University Press for UNICEF, Oxford.

Trends in child malnutrition for ACP-Africa are extremely worrying, with a number of countries showing increases in the proportion of children who are underweight (see Figure 3.4). There are a number of reasons for this. Economic poblems and structural adjustment programmes have resulted in low wages, underemployment and rapid changes in food prices in many countries (see Box 1.4 on structural adjustment and health in Zimbabwe). Natural disasters, climate change and land degradation continue to contribute to a lack of food security (see Chapter 4 for discussion of these environmental driving forces). War and civil strife are increasingly important, as food may be used as a weapon, or normal agricultural cycles disrupted (Sanders, 1982; Toole and Waldman, 1997). Surveys of acute malnutrition among children of less than five years of age in internally displaced populations and those afflicted by conflict, have shown that prevalence of malnutrition can range from 11% to 47%, and is often combined with micronutrient deficiencies (Toole and Waldman, 1997). Finally, whilst total food production in the region is increasing, per capita production has not risen during the past 10 years - a further cause for concern (World Resources Institute, 1998).

A recent report identified a number of strategies for improving nutrition (Gillespie *et al.*, 1996). Firstly, improvements in food security, particularly for the poorest groups, is essential and can be achieved through carefully planned food subsidy programmes. There is good evidence to suggest that universal subsidies on staple commodities are most effective in reaching the whole target population in very low income countries or in areas where many people are poor and malnourished. Where there are high levels of malnutrition among subsistence populations, additional strategies such as child-feeding programmes may be required (Cornia and Stewart, 1995). It is important to note that improved food security is not necessarily linked to economic growth, unless the benefits of that growth are equitably distributed across society.

Figure 3.4 Proportion of Children Suffering from Moderate and Severe Underweight.



Source: UNICEF. 1998. The State of The World's Children 1998, page 24. Oxford University Press for UNICEF, Oxford.

Secondly, attention needs to be paid to the status of women. There appears to be a relationship between nutritional improvement and efforts to reduce social discrimination against women. This is not surprising, in view of the synergies described above, but interventions are less easy to implement. As discussed earlier, female education is a key component of this process. Thirdly, investments in the social sector, including health, education, sanitation, welfare and other services, can contribute to improved nutrition through the promotion of breastfeeding, fortification of staple foods and improving access to water and safe sanitation, for example. Breastfeeding is one of the most effective interventions to prevent diarrhoeal disease, which is strongly linked to malnutrition.

Fourthly, more emphasis needs to be placed on achieving healthy living environments for the poor. This may impact on nutrition by reducing the incidence and severity of infections, such as diarrhoeal disease, which are strongly related to environmental conditions. As discussed in more detail in Chapter 7, ensuring healthy living environments needs to be placed on the agenda of agencies from municipal to international levels.

Finally, at a broader level, strategies to increase household income among the poor have been shown to contribute to higher protein and energy consumption, increased demand for education and health services, and improvements in living conditions. In that malnutrition is often a result of multiple, interacting factors, the effect of a single intervention may be limited, and integrated programmes, or those building on synergistic effects, are likely to be more successful (Pinstrup-Anderson *et al.*, 1993).

3.2.2 Non-communicable Diseases

Occupational and Industrial Diseases

Industrial disease in the region is thought to be extremely under-reported. Statistics are, for example, largely unavailable for the informal sector that makes up a sizeable proportion of economic activity. Within the formal sector, mining, forestry, agriculture, construction and transportation are seen as being responsible for the majority of industrial and occupational ill health (World Health Organization, 1998). Box 3.4 describes some of the health implications of industrialisation in the region.

3.2.3 Injuries

Injuries already account for 15% of the disease burden for ACP-Africa and projections indicate that this proportion will increase in the next century (see above) due to steep rises in the burden of road accidents, war and violence (Murray and Lopez, 1996a; Zwi *et al.*, 1996). They may also partially reverse the substantial gains made by primary health care initiatives in developing countries over the past two decades (Toole and Waldman, 1997). Despite the magnitude of the problem, however, it has received inadequate attention with regard to control programmes and research (Zwi *et al.*, 1996). Injuries are examined here in several groupings: those attributable to wars, urban violence, domestic violence, road traffic accidents and natural disasters.

War

Armed conflicts are estimated to have caused around 750 000 deaths in Africa between 1975 and 1989, mainly due to mass migrations and food shortages. Estimates suggest that war-related injuries may be responsible for 10% of the total injury burden and approximately 1.5% of the global burden of disease in 1990, and that this burden may double to 3% by the year 2020 (Murray and Lopez, 1996b). Children under five years of age are at the highest risk, and may account for the largest proportion of mortality and morbidity. This is due to indirect effects such as diarrhoeal disease, malaria, acute respiratory infection and meningitis - malnutrition contributes to deaths from all these causes. These effects are related to the disruption or destruction of essential environmental and health services, leading to increased rates of disease (World Health Organization, 1997).

War trauma and landmines also contribute to the burden, with the effects of the latter being spread over many decades and largely affecting civilian populations.

continued on page 92

Box 3.4 Occupational and Industrial Disease in the ACP Region

Although industrialisation has brought many benefits to ACP countries, it has also brought problems. In addition to creating ambient pollution, industrialisation can harm the health of those working in or living in the immediate vicinity of industrial establishments in three ways:

- direct physical injury from accidents
- acute poisonings at the workplace or in the surrounding neighbourhoods
- chronic poisonings (World Resources Institute, 1998)

Some ACP states are particularly vulnerable to the disbenefits of industrialisation in that a number of them have experienced very high rates of industrial growth in recent years - 15% for the Pacific countries between 1990 and 1995 compared with 2.6% for North America – whilst industrial and environmental regulations are simultaneously often poorly developed and implemented.

The problem of industrial and occupational diseases in ACP countries is an area in which only a limited amount of work has been published, but the health costs of industrialisation can be divided into three main groups: direct costs, indirect costs and politico-economic costs (Packard, 1989).

Direct Costs

The direct costs of industrialisation include the short-term or long-term physical and mental effects, and can be seen in many settings. A recent study of workers in the medium to small-scale sawmill industry in Nigeria (Fatusi and Erhabor, 1996) demonstrated that their respiratory functions were worse than similar workers outside the sawmill. Studies of paint workers (Haruna, 1988) suggest that those workers who are not protected from paint exposure are at higher risk of suffering from psychosomatic disorders.

These problems are not restricted to factory and agricultural workers. In a study of doctors and dentists in Nigeria (Olubuyide *et al.*, 1997), the health care workers were seen to have a higher rate of Hepatitis C antigen positivity than the control group, with particularly high rates among surgeons. This was attributed to a lack of resources for adequate protection through vaccination against the hepatitis B virus and provision of disposable gloves.

These costs may be due to a lack of awareness, to a lack of worker empowerment, or to a lack of resources for protective measures. In many cases, action is not necessarily due to a lack of information on the toxicity of substances. The mining of asbestos continues in many African countries, for example, with no statutory levels for regulating asbestos exposure, despite strong scientific evidence of an association between chronic exposure and cancers such as mesothelioma of the lungs (Packard, 1989). Attempts to protect workers are often seen by the state and by industry as a threat: in Swaziland, which depends on migrant workers from Mozambique, trade union activities have been banned and workers who protested sacked, whilst in Nigeria, although workers are allowed to form trade unions, protesting workers are intimidated and sometimes arrested.

Indirect Costs

This is a relatively unexplored area and involves the seemingly 'invisible' effects on workers, their families and the environment. Many of the workers who become ill due to the nature of their work (such as miners suffering from silicosis) leave their jobs due to their ill health. Since they are very rarely paid adequate compensation or

pensions, the burden of their care falls on their families. Households therefore have to cope, both with the burden of losing their breadwinner and with the costs of medical care.

In the agricultural sector, there are many examples of the unintended environmental impacts of large-scale farming, such as the introduction of previously unknown disease vectors into newly irrigated areas (see Box 3.3). In the manufacturing industry, there have been many cases of suspected environmental contamination, although there is little documentation from the region. An outbreak of lead poisoning in Trinidad and Tobago in 1991, resulting from the contamination of soil by the waste from lead recycling, is a good example.

Politico-economic Costs

The problem of occupational/industrial diseases in ACP countries can sometimes be due to a conscious decision by governments to promote industry. Improvements in the working conditions are seen as expensive and as an additional production cost. This has also come about, in part, as a result of globalisation in which transnational corporations play countries and localities against each other, bidding down wages and other labour standards in a global 'race to the bottom' (Chomsky, 1998). Such processes can undermine environmental and industrial standards (Stephens *et al.*, 1999). Asbestos, for example, although restricted or prohibited in many regions, is still being produced and used in countries such as Angola and Nigeria. This is mainly due to financial considerations, as it is considered cheaper, both in terms of labour and because of lax regulations governing the safety of workers and local populations.

Possible Solutions

The solutions to occupational and industrial health problems lie with governments and investors alike. There is a need to take the full costs of industrial processes into account and to consider all humans and other species that will be affected, both directly and indirectly (see Box on Health Impact Assessment – Chapter 7). Adequate arrangements to protect humans and other species from suffering the possible adverse effects of industrialisation need to be made for all stages of production.

Contributed by Ogonda Onwuchekwa MD, MSc. Environmental Epidemiology.

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continued from page 89

Estimates suggest that 30 million landmines have been laid in Africa. Approximately one-third of landmine victims are non-combatants, and approximately 20% are children of less than 15 years of age (Jeffrey, 1996). In several ACP-Africa countries, such as Angola, Mozambique and southern Sudan, the concentration of mines is sufficiently high that, in addition to causing numerous deaths and injuries annually, it also hinders development, farming, commerce, transport and recreation. Although data on these issues is scarce, studies from Afghanistan indicate that 20% of landmine victims were working in fields or collecting water when injured, that another 15% were travelling, and 8% were playing with a mine (Coupland, 1996).

Landmines may also seriously undermine food security in affected countries. Angola and southern Sudan, in particular, have suffered a massive loss of arable land, with wide social and economic ramifications (Andersson *et al.*, 1995; Toole and Waldman, 1997; World Health Organization, 1997). Normal points for collecting drinking water are, in addition, frequently mined, and landmines may also make it too dangerous to collect firewood in the forests (Coupland, 1996). The environmental impacts of wars, through the disruption of infrastructure, and, in particular, the effects of landmines, are, therefore, well demonstrated (World Health Organization, 1997). The role played by environmental and resource factors in fostering armed conflicts is only beginning to be researched, however, and remains largely conjectural (Homer-Dixon 1993, 1994).

Urban Violence

Worldwide, urban violence is estimated to have grown by between 3% and 5% per annum during the past two decades. Estimates for Africa suggest that, over a five-year period, more than two-thirds of the urban population are victims of some type of crime, and one-third are victims of assault and other crimes of personal contact[9] (Gilbert, 1996; United Nations Centre for Human Settlements (HABITAT), 1996). Research in Jamaica indicates that violence and crime is a serious problem in the poorer sections of the Kingston metropolitan area (KMA). These communities identified gang violence as the most serious problem, followed by rape (domestic) and drug-related violence. The impact of all types of violence on children was also recognised (Moser *et al.*, 1998). Much crime, particularly in low-income peri-urban areas, is, however, unreported and these figures therefore need to be viewed with caution.

It is important to note that 'It is not the city that generates violence: poverty, political and social exclusion, and economic deprivation are all working against the solidarity that would enable city inhabitants to live together peacefully despite their conflicts' (United Nations Centre for Human Settlements (HABITAT), 1996). Current research supports the view that urban violence needs to be understood in the wider societal context. It has been clearly demonstrated, for example, that cities with high socio-economic inequalities have higher reported crime rates than cities that are more egalitarian (Wilkinson, 1996), indicating the importance of social cohesion in minimising violent crime. Furthermore, and contrary to popular belief, much of the burden of violence is borne by the poor who cannot afford to protect themselves from crime and its associated injuries, and who now see safety as their first priority (Vanderschueren, 1998). In South Africa, for example, victimisation patterns are closely related to different parts of the city, as a result of the apartheid policies of separate development which have undermined security in the former township areas and poorer settlements, whilst fostering it in others. Recent surveys in both Johannesburg and Durban indicated that the majority of victims of violent crime lived in townships, informal settlements and the inner city (Shaw and Louw, 1998). There are also gender differentials in violent crime: murder

[9] Includes mugging, aggravated theft, grievous bodily harm, sexual assault.

rates are generally much higher for men than for women, with young men being at particular risk.

The urban environment both influences and is influenced by violence - crime brings major changes to the spatial form of cities and is, in turn, influenced by those designs. Crime may discourage people from using the streets, public spaces and public transport, and restrict them to their homes. Those who can afford to, may barricade themselves within 'fortified' suburbs or housing developments and fortified offices, leading to further social segregation within cities and resulting in the abandonment of neighbourhoods by traders and other services. For those who cannot afford to leave these areas or protect their assets (Shaw and Louw, 1998), the economic and social consequences may be severe (United Nations Centre for Human Settlements (HABITAT), 1996). Moser and colleagues have described how violence in Kingston, Jamaica, has impacted negatively on assets such as labour, human capital, household relations and social capital[10], thereby increasing the vulnerability of the poor. The mobility of the poor has, for example, been reduced, as bus lines no longer enter many drug and gang-ridden areas. This has clear implications for access to and choice of jobs, and access to other services, such as schooling and health care. Human capital may be eroded when children's access to education facilities is limited by violence, and social capital may be eroded as community organisations are undermined.

In summary, urban violence may threaten community cohesion and the capacity of societies to move towards better health and sustainable social development (World Health Organization, 1997). Environmental interventions also have an important role to play in reducing urban violence.

Domestic Violence

The extent of domestic violence is very difficult to estimate. Official statistics may be obtained from police reports, hospital data and crisis centres. This data shows that domestic violence is a significant cause of injury and death in the developing world, yet this is likely to give only a hint of a small fraction of the real extent of domestic violence.

It has been estimated that rape and domestic violence are responsible for between 5% and 16% of the healthy years lost to women of reproductive age (World Health Organization, 1996). Research based on more than 40 studies in 24 different countries has estimated that between 20% and 50% of all women have been assaulted by their intimate male partner (World Health Organization, 1997, page 154). The same source estimated that between 50% and 60% of women abused by their partners are also raped by them.

The characteristics that emerge from research are that the perpetrators of violence against women are almost exclusively men, that women are most at risk from men they know, that women and girls are the most frequent victims of violence within the family and between intimate partners, that physical abuse in intimate relationships is almost always accompanied by severe psychological and verbal abuse, and that the reaction of many professionals and social institutions has been to either blame or ignore the victims (World Health Organization, 1998).

In one study in Papua New Guinea (Heise *et al.*, 1994), 18% of the married women surveyed had received hospital treatment for the injuries inflicted by their husbands. Between 1979 and 1982, 73% of the adult women murdered in the country were killed by their husbands.

In a study in Cape Town, 59% of teenagers reported having been beaten by their male partners during an average of just over two years of sexual activity (Maforah *et al.*, 1993). Another study in South Africa found that 28% of urban adolescents had been 'forced to have sex against their will' (Richter, 1996). Other

[10] Social capital is defined as the networks, norms and trust that facilitate mutually beneficial cooperation in a community - both between households and community level social institutions which are horizontal and hierarchical in structure. Empirically it has been shown that the greater the collaboration of horizontally based social institutions at community level, the higher the 'stocks' of social capital (Putnam 1993 cited in Moser et al 1998).

studies in ACP-Africa, cited in Heise et al 1994, found that 46% of women in Uganda reported being physically abused, 42% of women in Kenya reported that they were regularly beaten, 60% of women surveyed in Tanzania reported being physically abused and 40% of women in a Zambian survey reported having been beaten.

Whilst rape and domestic violence are not primarily environmental issues, unsafe environments place women at greater risk (Cairncross *et al.*, 1998). A safe environment may head women's lists of environmental concerns in many areas and is therefore an important issue that must be addressed by policy makers.

Road Traffic Accidents

According to the *Global Burden of Disease* statistics, road traffic accidents are the most important cause of unintentional injury (Murray and Lopez, 1996a). ACP countries have only a fraction of the car ownership of the developed countries but at the same time carry a disproportionately high rate of road traffic death and injuries, and an increase in road traffic accidents is predicted in the future. Data for 1990 suggest that six African countries (Ethiopia, Ghana, Rwanda, Lesotho, Kenya and Cameroon) are the top six nations for road traffic death rates per 10,000 vehicles (Jacobs, 1997). Further research has suggested that between 1968 and 1985, eight selected African countries displayed the highest percentage increase in road traffic accidents worldwide.

Historical data suggest that 20 years ago, traffic accidents in ACP countries were already a growing problem. Data from Jamaica shows that as far back as the 1960s, road traffic death rates were increasing, whilst infectious, respiratory and intestinal death rates were all decreasing. Between 1958 and 1974 the road traffic death rate in Jamaica increased by more than 120%.

The situation is often compounded by the lack of adequate medical and paramedical facilities available, which increases the proportion of fatalities from injuries incurred. A disproportionately high number of the deaths and injuries are suffered by pedestrians and children under 16 (and in many cases involve public vehicles).

In Europe, during the 1950s and 1960s, car ownership increased and awareness of road safety was poor. From the 1960s onwards, however, safety was improved via the introduction of speed limits, car safety inspections, seat belts and improved car and road design, and accident rates improved greatly (World Health Organization, 1989). The lessons learnt from these settings need to be adapted for application in ACP countries.

Natural Disasters

It is estimated that almost one third of the global burden of unintentional injuries are associated with environmental factors (World Health Organization, 1998). The location of many low income settlements, for example, leads to flooding and landslides, whilst poor housing materials and designs exacerbate domestic injuries and building collapse. Poorly designed stoves can, furthermore, lead to burns, especially amongst children.

Most of the Small Island States are located in the tropics and many are low-lying, making them exceedingly vulnerable to climate change (as further discussed in Chapter 6), rising sea levels and natural disasters. Concomitant with climate change are temperature changes, higher rates of coastal land erosion and loss, fresh water shortage and changes in breeding areas of certain pathogens and vectors. Certain ecosystems, such as coral reefs, are sensitive to temperature changes, and their destruction could, in conjunction with coastal land erosion, prove to be detrimental to food security and tourism - the main source of income in most of these countries. Fresh water shortage is another serious consequence of climate change, since many of the island states depend primarily on rainwater as a source of water. With the lack of rainfall in the tropics exhibited by the El Nino phenomenon, drought could occur more frequently. This may reduce crop yields leading to malnutrition and health-related problems.

Small Island States are also especially susceptible to natural disasters because of the impacts of loss of property and more importantly, loss of lives, on their small

populations. Hurricanes and storms are common occurrences in the tropics - in the Caribbean, in 1995 alone, there were 19 hurricanes. Hurricanes, earthquakes and tsunamis also pose dangers in some Pacific island states, as is exemplified by the recent events in Papua New Guinea, where more than 3,000 people died as a result of a tsunami that swept the island following an undersea earthquake. All of the Small Island States' populations are thus exceedingly vulnerable to injuries, mortality and loss of property as a result of environmental disasters.

3.3 Conclusions

We have shown, in this chapter, that approximately one-third of the total burden of disease in ACP-Africa and some of the poorer countries of the Caribbean and Pacific is associated with environmental factors. Access to adequate water and sanitation is probably the most important aspect of the household and neighbourhood environments in relation to health, with ten percent of the disease burden in ACP Africa attributable to poor water, sanitation and hygiene, and children bearing most of this burden. Improving access to basic facilities, in conjunction with appropriate hygiene promotion, can play an important part in reducing the burden of water and sanitation related diseases. We will return to this point in Chapter 7.

Nutrition is another area of concern for two main reasons. Firstly, because malnutrition is a risk factor for many environmentally related diseases, such as diarrhoeal disease and acute respiratory infections. Secondly, because of the direct effects of protein-energy malnutrition on health. The immediate causes of malnutrition are influenced by household food security, access to a healthy living environment and health services, and child caring practices, and all of these factors are linked to poverty and deprivation.

Injuries are growing as a contributor to the burden of disease in the region, due to increases in road traffic accidents, wars and violence. The effects of armed conflicts in the region on health and environment are very substantial, but urban violence is also growing as a public health threat. In both cases, the poor are at greatest risk. Compared with other regions, ACP-Africa has experienced the highest levels of population movement owing to wars, famines and other environmental and political changes, and this has had an important impact on demographic and health matters.

In all ACP countries, therefore, the poor continue to bear the largest proportion of the disease burden. Whilst diseases such as tuberculosis, acute respiratory tract infections and diarrhoeal disease are closely linked to environmental conditions, they are also diseases of poverty, and the unequal distribution of resources helps to ensure that these health inequalities are maintained. The following Chapters explore the environmental context of the health and demographic trends outlined above, specifically focusing on agricultural change, rural livelihoods and health, urbanisation and healthy living environments, and global environment change. In the final Chapter we focus on ways to reduce the many environmental threats that undermine health, by exploring interventions designed to improve food security and create healthy living environments.

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Chapter 4

Agricultural Change, Rural Livelihoods and Health

Chapter 4 Agricultural Change, Rural Livelihoods and Health

Aims of the Chapter

- To identify the links between the socio-economic aspects of agricultural production, food entitlements and the health situation in ACP countries.
- To identify the links between agricultural development and food security.
- To explore the health effects of agricultural intensification in ACP countries.
- To explore the relevance of agricultural biotechnology to food security and health.

Main Points

- For ACP countries to improve the health of their growing populations it will become increasingly important to ensure that people have secure and sufficient access to food.
- Increasing food production does not guarantee food security.
- Secure and stable land tenure can contribute to environmental protection and food security, especially for weaker social groups. Indigenous land tenure systems have an important, positive role to play.
- The erosion of crop genetic diversity represents a threat to food security, especially for marginalised farmers.
- Low-cost sustainable agricultural systems have largely been ignored by agricultural development assistance schemes, yet are very important for food security.
- Mortality and illness due to pesticide exposure are common, relative to the amount of pesticides used, though they do not, as yet, constitute a major health burden. The health risks of increased fertiliser use are less significant.
- Land conversion and irrigation schemes can affect disease vectors and may increase disease transmission.
- Genetic engineering is changing the pace and direction of agricultural development, bringing benefits as well as risks, but its potential benefits for the rural poor are unlikely to be realised, given current trends.

Policy Implications

- Low-cost sustainable agriculture needs to be strengthened and assisted in order to improve the food security and health of large population groups in ACP countries. This will require giving support to small-scale farmers and rural women in particular.
- Policies and actions restricting the use of toxic pesticides, including the development of Integrated Pest Management (IPM) and Natural Pest Management, will be important in limiting the adverse impacts of agricultural modernisation.
- Increased attention needs to be paid to the health-related effects of land use changes. Health impact assessments of irrigation schemes and forest conversion should become part of project development.
- Research into the potential applications of biotechnology in small-scale farming is needed if genetic engineering is to contribute effectively to food security. More independent scientific and administrative capacity, and a new research and development paradigm, will be necessary to ensure that biotechnology contributes to, rather than detracts from, environmental and health-related improvements.

4.1 Introduction

From an ACP perspective, the environmental aspects of agriculture are of special relevance to health, because they are closely related to food security and malnutrition. As indicated in previous chapters, malnutrition is one of the most serious threats to health, and is a large contributor to ill health in ACP countries.

Lack of access to food is the major cause of malnutrition. Food security is often defined as access by all people to sufficient food requirements for a healthy and active life. Food insecurity is basically a problem of poverty, affecting those social groups with the weakest or most fragile food entitlements, both in terms of access to social networks and safety nets or to productive assets (capital, land agricultural inputs). Within such households, children and households headed by women tend to be most vulnerable (Delgado, 1997; Denninger *et al.*, 1996). Any intervention that improves access to food and better nutrition will have a large direct and indirect impact on human health in ACP countries (FAO, 1997).

Agriculture remains the predominant means of survival in most ACP countries and the majority of the population is still employed or active in the agricultural sector. Agricultural productivity in ACP-Africa has not, however, generally kept pace with population growth. Many of the ACP countries have experienced a stagnating or declining trend in food supply per capita, whilst most countries in Asia show an increasing food supply, relative to their population size. If ACP countries are to improve the health of their growing populations, therefore, it will become increasingly important to increase people's access to food through additional food production, agricultural intensification, and empowerment of the most vulnerable groups.

In reviewing the global situation, *World Resources 1998-99* (World Resources Institute, 1998) indicates that two of the main health concerns in relation to agricultural intensification are increased exposure to agrochemicals and infectious diseases associated with expansion of cultivated land and irrigation systems. Before reviewing the regional relevance of these arguments for ACP countries, we would like to give an overview of the agricultural prospects and problems in the region, focusing on ACP-Africa. As will be shown, the health situation in the region depends largely on the food entitlements of those most at risk. Understanding how these entitlements can be better secured is, therefore, just as important as understanding how more food can be produced. From a health perspective, this is how different agricultural systems should be judged, and we will, therefore, highlight the socio-economic aspect of agricultural production and food entitlements which we believe are of crucial importance for health in the region.

4.2 Overview of Trends and Future Challenges

Before discussing the relationship between health, food security and agricultural development, it important to expand briefly on the earlier discussion of trends in nutritional diseases in Chapter 3. Whilst East and South Asia have increased their per capita calorie supply, African ACP countries have seen a stagnating or declining trend in per capita calorie supply over the past 25 years. In contrast to most other regions in the world, both the absolute number and the percentage of chronically undernourished people in ACP African countries have also increased during the past 25 years (Table 4.1). In 1969/71, 35% of the total population of ACP-Africa suffered from undernutrition[1], corresponding to 94 million people. In 1994/96, the situation deteriorated and 39% of the population - or 210 million people - suffered from undernutrition (FAO, 1997). The average per capita calorie supply has also declined in ACP Small Island States, due to a 15% decrease in Haiti. Countries such as Fiji, Jamaica, Papua New Guinea and Suriname have, however, seen an increase in per capita calorie supply (See table 10.3 in Appendix 2).

[1] Persons who, on average during the course of a year, are estimated to have food consumption levels below those required to maintain body weight and support light activity. This threshold (ranging from an average of 1,760 Cals/person/day for Asia to 1,985 Cals/person/day for Latin America) is set equal to 1.54 times the Basal Metabolic rate.

Table 4.1 Estimates of Chronic Undernutrition in the 93 Developing Countries of the Study.

	Year	Total Population (million)	Population suffering from Under nutrition	
			% of Total Population	Million
Sub-Saharan Africa	1969/71	268	35	94
	1979/81	358	36	129
	1988/90	473	37	175
	1994/96	531	39	210
Near East and North Africa	1969/71	178	24	42
	1979/81	233	10	23
	1988/90	297	8	24
	1994/96	319	13	42
East Asia	1969/71	1120	44	497
	1979/81	1358	26	359
	1988/90	1558	16	252
	1994/96	1757	14	254
South Asia	1969/71	738	34	254
	1979/81	926	31	285
	1988/90	1144	24	271
	1994/96	1203	21	254
Latin America and Caribbean	1969/71	281	19	54
	1979/81	357	13	47
	1988/90	433	13	59
	1994/96	468	13	63
TOTAL	1969/71	2585	36	941
	1979/81	3232	26	843
	1988/90	3905	20	781
	1994/96	4278	19	828

Source: FAO, 1997. FAOSTAT, FAO, Rome 1998 (http://apps.fao.org/).

Based on existing trends, ACP-Africa's share of the world's food insecure population is estimated to be 39% in 2010. This implies that one in three people in ACP-Africa will be food insecure, compared with one in eight in South Asia and one in 20 person in East Asia (Pinstrup-Andersen *et al.*, 1997). An average availability of around 2,300 calories per person is predicted in the region — just barely above the minimum required for a healthy and productive life. Since food availability and accessibility vary throughout the region, this would leave a large number of people without enough food, and indeed, child malnutrition is expected to decline in all major developing regions except ACP-Africa. The International Food Policy Research Institute (IFPRI) predicts that by 2020, the number of malnourished children in ACP-Africa will have increased to nearly 50 million (Rosegrant *et al.*, 1995).

People's access to food depends both on the purchasing power of their income, and on their non-market entitlements, such as rights to land for subsistence farming and foraging purposes. The market economy is not expected to grow rapidly, and many non-market entitlements are in danger of decline. At the same time, it is projected that the population of ACP-Africa will almost double between now

and 2025 (see Table 9.1 in Appendix 2). Dramatic increases in cereal imports are unlikely, given the region's debt problems and the lack of purchasing power of the food-insecure populations, yet demand projections based upon food requirements suggest that, among the major developing regions, ACP-Africa will experience the largest percentage increase in demand for all major food commodities (albeit from low levels). The most recent models constructed to investigate agricultural production and food security changes over the next quarter to half century have, therefore, all concluded that food production will have to increase substantially (CGIAR, 1994; Crosson and Anderson, 1995; FAO, 1995; IFPRI, 1995; Leach, 1995; Pinstrup-Andersson *et al.*, 1997).

Comparisons of food supply and demand can, as noted in later sections of this chapter, be misleading. More food production does not necessarily mean more food for those who need it. Alternatively, low productivity can derive from a lack of effective demand rather than a lack of capacity to produce food. Projections of supply and demand do, nevertheless, help indicate the scale of the challenge.

In a projection to 2050 (Leach, 1995), it is estimated that Africa as a whole needs to increase its grain production by almost four times and its animal production by seven times (given a population of 2200 million in the year 2050). Ideas on how to meet this challenge vary enormously; some are optimistic, even complacent, others are darkly pessimistic. Some indicate that not much needs to change; others argue for fundamental reforms to agricultural and food systems. Some indicate that a significant growth in food production will only occur if new land is taken under the plough; others suggest that there are feasible social and technical solutions that would increase yields from existing farmland (see Box 4.1).

Most experts would agree that the largest part of the production increase has to come from yield increases. Current yield for cereals in ACP-Africa still average around or below 1 tonne per hectare - significantly lower than in South Asia and much lower that in Europe. Table 4.2 provide aggregated numbers - for country specific data, see Table 10.1 in Appendix 2. ACP-African countries like Zimbabwe and South Africa have higher average values, but this must be set against the very poor output in many other, potentially very productive countries, such as Zambia, Zaire and Mozambique.

Agricultural research has demonstrated impressive results on research stations in the region, but implementation on farms has not been successful. The lack of success is most

Table 4.2 Crop yields (tonne/hectare) 1994-1996.

Crop yields (tonne/hectare)	Roots and tubers	Cereals
ACP-Africa	5.5	1.2
ACP - Small Island States	7.6	2.8
ASIA	15.2	2.9
EU	30,4	5.0
Eastern Europe	15.0	3.4
North America	33.3	3.0
South America	12.3	2.6

Source: FAOSTAT, FAO, Rome 1998 (http://apps.fao.org/).

Box 4.1 Contrasting Approaches to Agricultural Development and Food Needs

There are five distinct schools of thought, each pushing international and national agricultural and food policies in a different direction.

Business-as-Usual Optimists
The business-as-usual optimists, who have a strong belief in the power of the market, say supply will meet increasing demand. World food production will grow, while population growth rates will decline (Mitchell and Ingco, 1993; Rosegrant and Agcaolli, 1994). As food prices are falling (down 50% in the past decade for most commodities), this implies that there is no imminent supplycrisis. Food production will increase as the fruits of biotechnology research ripen (so boosting plant and animal productivity) and as the area under cultivation expands by a suggested 20% to 40% by 2020 (with an extra 79 million hectares of uncultivated land converted to agriculture in ACP-Africa). Developing countries are also expected to substantially increase their food imports from industrialised countries (perhaps by as much as fivefold by 2050).

Environmental Pessimists
The environmental pessimists contend that ecological limits to growth are being approached, or have already been reached (Brown, 1994; Brown and Kane, 1994; Ehrlich, 1968; Kendall and Pimentel, 1994). Following a neo-Malthusian line, these pessimists claim that populations continue to grow too rapidly, whilst yield growth of the major cereals will slow down or even fall, due, in particular, to growing production constraints in the form of resource degradation - soil erosion, land degradation, forest loss, pesticide overuse, and over-exploitation by fisheries. Dietary shifts, particularly the increasing consumption of livestock products, are seen as an emerging threat, in that this results in the indirect consumption of an even greater amount of cereal. New technological breakthroughs are not expected to have a major impact, so population control is seen as the first priority.

Industrialised World to the Rescue
The 'industrialised world to the rescue' lobby believes that developing countries will never be able to feed themselves, for a wide range of ecological, institutional and infrastructural reasons, and the looming food gap will thus have to be filled by modernised agriculture in the industrialised countries (Avery, 1995; Carruthers, 1993; Knutson et al., 1990; Wirth, 1995). With increasing production in large, mechanised operations, smaller and more 'marginal' farmers will be forced to go out of business, so taking the pressure off natural resources. These can then be conserved in protected areas and wildernesses. The larger producers will then be able to trade their food with those who need it, or have it distributed by famine relief or food aid. It is also argued that any adverse health and environmental consequences of chemically-based agricultural systems are minor in comparison with those brought by the expansion of agriculture into new lands. External inputs (such as pesticides, fertilisers and genetically modified organisms, in particular) and free trade are said to represent a crucial part of any strategy for feeding the world (see Avery, 1995; Monsanto, 1998).

New Modernists
This group argues that biological yield increases are possible on existing lands, but that this food growth can only come from a concerted effort to promote 'modern' high-external-input farming (Borlaug, 1992; Borlaug, 1994a; Borlaug, 1994b; Sasakawa Africa Association, 1993-1995; Winrock International, 1994). Farmers simply use too little in the way of fertilisers and pesticides, which are said to be the only way to improve yields

and so keep the pressure off natural habitats. This repeat of the Green Revolution model is widely referred to as 'science-based' agriculture, the objective being to increase farmers' use of fertilisers and pesticides. It is also commonly argued that high-input agriculture is more environmentally sustainable than low-input agriculture, as the latter represents the intensive use of local resources which may be degraded in the process.

Sustainable Intensification

Another group is making the case for the benefits of 'sustainable intensification', on the grounds that substantial growth is possible in currently unimproved or degraded areas whilst simultaneously protecting or even regenerating natural resources (Hazell, 1995; Hewitt and Smith, 1995; McCalla, 1995; NAF, 1994; Pretty, 1998; Pretty, 1995a; Pretty, 1995b). They argue that regenerative and low-input (but not necessarily zero-input) agriculture can be highly productive, provided that farmers participate fully in all stages of technology development and extension. Evidence suggests that agricultural and pastoral land productivity is as much a function of human capacity and ingenuity as it is of biological and physical processes.

Based on Pretty, 1998.

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probably due to a mismatch between technologies developed and the socio-economic context, preventing small-scale and subsistence farmers from adopting research results. The big difference in productivity between farmers with the best practice and subsistence farmers, does, nevertheless, indicate enormous potential for an increase in crop productivity in ACP-Africa.

4.3 The Links Between Agricultural Development and Food Security

4.3.1 Links Between Food Production and Food Security

What are the links between food production predictions and food security for rural households? Many recent projections have examined aggregate data for cereals and concluded that food insecurity is set to grow massively (Brown and Kane, 1994; FAO, 1995).

Whilst the global production of cereals has been declining since 1985, however, this trend could be caused by changes in cereal demand rather than by emerging production constraints. The stabilisation of cereal production coincides with increasing production and consumption of high value foods such as fruit and vegetables, sugar and animal products (Leach, 1995). Recent falls in world cereal prices lend credence to this view, suggesting that declining production figures are more likely to be a response to reduced demand than to supply problems.

This emphasis on cereals tends to neglect other crops of equal, if not greater, importance for food security in ACP countries. These include root crops and tubers (such as yams, cassavas, sweet potatoes and arrowroot), which are mostly grown and traded by women, as well as various non-farmed tree products and other wild foods (Scoones *et al.*, 1992).

Furthermore, as argued by many economists (see, for example, (Sen, 1994)), current levels of agricultural productivity and production say little about potential levels, because they are simply a response to present levels of demand and price/market conditions. Sen, (1982) also argues that 'the most important thematic deficiency of traditional development economics is its concentration on national product, aggregate income and total supply of particular goods, rather than on "entitlements" of people and the "capabilities" these entitlements generate'. There is clearly much more to food security and sustainable livelihoods than food production alone.

4.3.2 Why Food Supply is Not the Same as Food Security

Attempts to tackle hunger through increasing food production alone will not solve the basic problem of access to food. It is also important to recognise social and political threats to rural livelihoods in many ACP countries. Images of famine transmitted by Western media are drawn repeatedly from a few countries ravaged by internal conflicts, such as Angola, Ethiopia, Somalia, Sudan and Mozambique. Instances when food shortages are handled effectively by ACP governments, by contrast receive almost no publicity (Drèze, 1995; Drèze and Sen, 1989).

Drèze and Sen (1991) also remind us that food production is not the same as food availability (production minus exports plus imports), and that aggregate availability and the ability to acquire food (food 'entitlements') are very different things. Whilst food production undoubtedly influences food entitlements, the connections are complex and there are also other matters involved. There are all too many examples of an ACP country maintaining per capita food production while its people starved (de Waal, 1989; Watts, 1983). One example is the so-called 'Zimbabwe Miracle'. During the early 1980s, activity was focused on smallholders' agriculture, and the production of maize and cotton more than doubled. By 1987, Zimbabwe was declared self-sufficient in food, with a surplus large enough to supply food deficit members of Southern African Development Community (SADC) (Scott, 1995). This surplus was not, however, a true indication of household food security and may have exacerbated food insecurity in the poorer areas. A large proportion of supplies were delivered to the food marketing board, rather than being retained to meet local food needs The aggregate figures had masked local disparities in production and consumption.

Food entitlements for urban dwellers are most often mediated through the market,

whereas for rural dwellers in general, and subsistence farmers in particular, these entitlements tend to depend more on the local production. Malnutrition can thus be a threat to urban and rural dwellers at different times and for different reasons. Urban-rural links are often created in the pursuit of food security, and hence urban dwellers will maintain rural contacts, or even land, to provide food security in case their purchasing power is disrupted, whilst rural dwellers will maintain urban contacts, in part to ensure against the loss of local food entitlements.

4.3.3 Changing Threats to Tenure

ACP-Africa is not, on the whole, characterised by the sort of land access problems confronting the rural poor in Latin America, parts of Asia or, for that matter, some of the ACP-Small Island States. The concentration of land ownership tends to be rather low, as is the percentage of landless people among the rural population. The problem of access to land in many parts of Africa involves questions of the form of tenure, and the loss of land rights in the transition from one form of tenure to another (Bruce, 1988; Cornia and Stewart, 1995).

In general, the prevailing form of land ownership in ACP-Africa has entailed various types of communal ownership, usually by clan or lineage, combined with user rights (of access) held by members of the clan or lineage. A common feature of many of Africa's tenure systems is that all eligible members of local lineage or kinship groups have been assured access to at least some land. At the same time, however, full ownership rights over land traditionally reside with the community, and individuals have a restricted set of use, exclusion, and transfer rights over the land they farm.

Historically, in the context of a high land-to-population ratio, these systems ensure adequate access to land for most people, but the stability of these systems is being threatened by two interrelated sets of pressures: rising population and changing resource uses, and changes in the form of tenure.

With regard to rising population and resource use, both arable and grazing land are becoming scarce in many areas. Losing the ability to use communal grazing land means poor farmers are further marginalised, because they are left with small areas which cannot maintain their few animals. Under these circumstances, weaker social groups are easily deprived of access to limited resources, in particular because economic and political changes have created a situation in which local leaders may not fulfil their traditional redistributive obligations.

With regard to the changes in the form of tenure, there has been a clear shift from local communal or lineage-based property towards a combination of private property and state property (Lane and Moorehead, 1994). This shift towards private property, in which claims to property are legitimated by the state, rather than by the community and/or communal group, holds further risks for the poor. This is especially true for women and pastoralists, who face the prospect of loss of all land rights as a consequence of having few resources to finance the costs of formal land registration. This change of tenure also affects the capacity of local groups to adapt to their particular environmental circumstances and technological options.

During the colonial era, many African governments took the view that only Western-style tenure systems and property rights could stimulate agricultural intensification and improve economic efficiency, as indigenous land tenure systems were inherently insecure and inefficient, and so acted as a brake on productivity. That thinking has been carried forward into the post-independence period, with proponents claiming that when private land ownership is clearly established, farmers are more likely to grow perennial crops, invest in land management practices that benefit the agroecosystem in the long-term, and improve their overall productivity.

Evidence increasingly suggests, however, that the extension of state property regimes has had a negative impact on both farmer incomes and natural resources. Maintaining poor farmers' access to these resources, and to their long-term productive value, will require some form of reassertion of community use and management rights (such as building on local rather than centralised systems of property). Ongoing attempts to formulate and implement indigenous resource

management practices and rural codes must, furthermore, be supported (Cornia, 1994; Lane and Moorehead, 1994).

With a few exceptions, formal land rights have not been found to be a significant factor in determining investments in land improvements, use of inputs, access to credit, or the productivity of the land in ACP-Africa. Rather, it is security of tenure that matters most.

It is also becoming clear, as indicated in Box 4.2, that indigenous land tenure in ACP-Africa can result in productive systems (Migot-Adholla *et al.*, 1991; Place and Hazell, 1993; Place *et al.*, 1990). Similar results have been found in studies of land tenure systems in Cameroon, Nigeria and Togo and Ghana - even under conditions of rapid population growth and increasing commercialisation, the shift from common

Box 4.2 Security of Tenure and Agricultural Productivity: Evidence from Ghana, Kenya and Rwanda

While it is widely accepted that indigenous tenure systems can help provide food security, it is sometimes argued that this security is accompanied by a lack of flexibility and lower productivity. Recent empirical studies have examined the productivity of indigenous land tenure systems in eight regions of Ghana, Kenya and Rwanda, representing a variety of combinations of scarcity and commercialisation of agriculture. The research asked, 'Are indigenous land rights systems a constraint on productivity?' Using household survey data and cross-sectional evidence, the investigators discovered that the rights which farmers hold over land vary widely and in many cases were private. Land improvements were positively correlated with tenure security, but not with formal land rights (private ownership); indeed, land improvements were the least likely in the case of parcels with short-term use rights and most likely for those with long-term tenure security.

Land rights were highly transferable, including in those cases in which the land had been acquired through non-market methods. With the exception of one of the eight areas surveyed, producers had complete rights to the land in between 45% and 81% of the cases. Preferential transfer rights (including the preferential right to bequeath the land) were found in 3% to 29% of the cases, whilst limited transfer rights prevailed in between 30% and 50% of the cases. With only two exceptions, the proportion of land parcels that could not be sold at all varied between as little as 17% and 31%. Finally, it should be noted that whilst land markets have emerged in tandem with an increase in land scarcity, the majority of transactions take place under the traditional system and are not sanctioned by formal legislation.

The research indicates that between 70% and 80% of the land parcels had been acquired through non-market methods (through inheritance, gifts, government allocation, clearing of forest lands), thus negating the hypothesis of spontaneous privatisation of land rights due to growing land shortage. Even in the most land-scarce areas, only 20% to 30% of the parcels had been acquired through the market. Based on these findings, the researchers concluded that privatisation of land rights is not a significant factor in determining investments in land improvements and agricultural intensification. Indigenous land tenure systems are thus not a constraint on productivity.

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property regimes to private regimes takes place very slowly. Indeed, traditional systems are often more flexible and adaptable to new conditions. The key point is that farmers are more likely to improve lands in which they have a long-term interest. This interest derives from use and transfer rights that farmers have over land, whether these rights are derived from private or common property systems. It is these 'bundles of rights' that must be protected if farmers are to be expected to invest in sustainable agriculture and improve their production in the long-term (Ostrom, 1990).

4.4 The Value of Wild Resources and Biodiversity for Food Security

4.4.1 Wild Foods and Food Security

It is widely recognised that hunter-gatherer communities, such as the Kung San in Botswana or groups in Papua New Guinea, depend on wild resources for secure livelihoods. What is less widely recognised is that farming households, regardless of whether their agricultural systems are predominantly pastoral, swidden or based on continuous cropping, also rely heavily on wild resources (see Box 4.3).

Many agricultural experts argue that the area of farmed land will have to expand substantially if the growing world population is to be fed. But if wild habitats are lost, they will no longer be available to rural households, and those who will suffer most are the poorest, who tend to rely on wild habitats as sources of food, fuel, medicines and fodder. Recently, the calls for expanding agricultural land have been toned down, as it is being increasingly recognised that expansion on this scale will incur significant costs for rural households and national economies alike.

Collecting, using, selling and managing wild resources, coupled with experiments involving their cultivation and domestication, are an inextricable part of many agricultural systems, and contribute to overall food security. The term, wild foods is used here to refer both to plants and animals. Some aspects of the value of wild resources in terms of sustainable rural livelihoods follow:

- Wild foods are particularly important for the health of women and children. In Tanzania, young unmarried and divorced women engage in the collection and sale or wild leaves (Fleuret, 1979), whilst in West Africa, women are extensively involved in the marketing of bush meat in both urban and rural areas. Children rely on wild foods in Sudan, Kenya and Zimbabwe, both as snack food and vital sources of protein (Scoones *et al.*, 1992).
- The appearance of many wild foods may coincide with the hunger season which precedes crop harvests. At these times, farmers depend on such wild foods to replace the absent nourishment from staples and to provide them with the necessary energy to harvest their fields (Chambers *et al.*, 1981).
- Wild foods provide insurance against crop failure, pest attack or drought because they can replace some of the lost crops (Saxena, 1986).
- Many wild foods have an advantage over cultivated crops in that their seeds can germinate and grow under drought conditions (Saxena, 1979). During such times, local people not only rely more heavily upon the usual forest resources, but also on those wild foods which require extensive processing before consumption.
- In many pastoral systems, a diet largely based on livestock products is complemented by the collection and consumption of wild foods, especially grains. The productivity of wild grain harvesting can be high, relative to alternative cultivation options. The collection of *Panicum laetum* (a wild millet), for example, yields 400-1100 kg/ha in the most productive, low-lying valleys of the Malian Gourma, which is higher than typical yields for cultivated millet (Maiga *et al.*, 1991).
- Wild resources are particularly important for the rural poor, women and children, especially at times of stress, such as drought, changing land availability or ecological change. These groups generally have less access to land, labour and capital, and thus need to draw more on the wild resources that are freely available. In Zimbabwe, for example, some poor households rely on wild fruit as an alternative to cultivated grain for a quarter of all dry season meals (Wilson, 1990).

Box 4.3 Use of Wild Plants for Food and Medicine by Farming Communities in ACP Countries

Location	Importance of Wild Resources
Botswana	Agro-pastoral Tswana use 126 plant species and 100 animal species as sources of food
Ghana	16-20% of food supply from wild animals and plants
Kenya, Bungoma	100 species wild plants collected; 47% of 49% households collected plants from the wild and maintained wild species within their farms to domesticate certain species
Kenya, Machakos	120 medicinal plants used, plus many wild foods
Nigeria, near Oban National Park	150 species of wild food plants
Papua New Guinea (Highlands)	Consumption of insects, fish, frogs, lizards, birds and small mammals provides twice as much protein as domesticated pigs
Papua New Guinea (Lowlands)	70 local wild foods eaten (ants and sago grubs, lotus and cycad seeds, leaves of joint-fir key source of protein)
South Africa, Natal/KwaZulu	400 indigenous medicinal plants are sold in the area
Sub-Saharan Africa	60 wild grass species in desert, savannah and swamp lands utilised as food
Swaziland	200 species collected for food
Vanuatu	Forest products vital for food, medicine and fuel
Zaire	20 tonnes chanterelle mushrooms collected and consumed by the people of Upper Shaba
Zimbabwe	20 wild vegetables, 42 wild fruits, 29 insects, 4 edible grasses and one wild finger millet; tree fruits in dry season provide 25% of poor people's diet

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- Wild resources with a market value represent ready sources of income for cash-poor households and may provide a significant proportion of total household income.

4.4.2 The Value of Biodiversity for Livelihood Resilience

Farmers of traditional and low-input agricultural systems have long favoured crop diversity, and even today, there are still a huge variety of crop combinations cultivated, including cereals, legumes, root crops, vegetables and tree crops. In Africa, more than 80% of all cereals are intercropped, producing, in some cases, highly complex patterns, with up to 20 species grown in close proximity.

In very variable conditions, farmers rarely standardise their practices. They maintain diversity, develop a variety of strategies and so spread risk. Mixtures of crops and varieties clearly provide farmers with a range of outputs, and also represent a logical approach to coping with variable environments. Mixed crops can also be less variable in time and space, and combined yields are often greater, particularly if differences in root and shoot geometry allow the crops to use light, nutrients and water more efficiently (Pretty, 1995). Intercropping can reduce weed problems, so influence labour requirements, returns to labour can be increased, and erosion and runoff may be reduced because of the greater ground cover given by the mixture.

It is only recently that fields restricted to single species and varieties have become common. The introduction of modern varieties and breeds has almost always displaced traditional varieties and breeds. The 20th century has seen the loss of some 75% of the genetic diversity of agricultural crops. Only about 150 plant species are now cultivated, of which just three supply almost 60% of calories derived from plants (Fowler and Mooney, 1990).

Such erosion of genetic diversity in agriculture represents a major threat to the food security of the majority of the world's producers. Modern, uniform crop varieties will only reach their potential if the environment is also uniform, which means high quality land where the fertility and water status have been evened out with the use of fertilisers and irrigation. In areas where monocropping is prevalent, diseases and pests can spread quickly and cause devastation. Whilst improved methods of controlling animal and crop diseases are now available, the costs of these services have become increasingly prohibitive for the farmer, through the introduction of structural adjustment programmes (Cooper *et al.*, 1992).

Crop genetic diversity provides security for the farmer against pests, disease and unexpected climatic conditions, and, in the highly variable environments of ACP-Africa, can help small-scale farmers obtain higher yields than they could with monocropping. Higher yields are obtained from using a mixture of crops and crop varieties, each one specifically adapted to the microenvironment in which it grows. Genetic diversity also provides farming communities with a range of products with multiple uses and values. Some varieties of a particular crop may be good for immediate consumption, for example, while others are better for long-term storage (Cooper *et al.*, 1992).

Small grains, such as sorghum and millet, are more likely to meet these needs than maize hybrids, because they are more drought-tolerant, their seeds can be stored for much longer, and they can be relied upon to germinate after several seasons of storage. They also require fewer pesticides and fertilisers for cultivation (Mushita, 1992).

In some contexts, however, farmers have become dependent on a few large corporations, which often dictate which crops should be grown where and when, simply by making available certain seeds at only certain seasons (FAO, 1993). Some countries have policies that make it illegal for farmers to plant unimproved seeds, but many improved seeds will only perform well if accompanied by the use of inorganic fertilisers and pesticides, and abundant supplies of water.

There is growing evidence to indicate that diversification reduces people's susceptibility to drought and other risks (Box 4.4).

Box 4.4 Diversity and Resilience in Farming Systems

Oruchinga Grazing Society, Uganda
The project promotes a sustainable approach through integrated crop and livestock management, and emphasises the full participation of local farmers. Milk production has increased to the extent that there is now enough for both sale and home consumption. Yields of maize, beans and soya beans have also increased. The integrated approach means that farmers are less vulnerable, not only to drought, but to market instability: if crop yields or prices fall, for example, they can fall back on animal products for income, and vice versa.

Relief Society of Tigray, Ethiopia
Low-cost soil conservation measures and the use of drought-tolerant crop varieties mean that the farmers' productivity is increasing. People's livelihoods have also been diversified considerably through access to credit schemes and a seed bank programme designed to support diversified food production and enable expansion into off-farm income-generating activities. This diversification has afforded these people a greater resilience to drought than those not involved in the project.

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4.5 The Health Costs of Past Approaches to Agricultural Development

The methods used to increase production determine the kinds of health-related impact seen. Using more land to grow crops, land and/or agricultural intensification, are often described as the main means of increasing production. In the *World Resources 1998-99* global discussion,(World Resources Institute, 1996) the following health risks were associated with agricultural intensification:

- Increased exposure to toxic substances such as pesticides;
- Excess use of fertiliser and manure, resulting in nitrate contamination of surface and groundwater, leading to human health risks;
- Infectious diseases associated with expansion of irrigation systems and the use of wastewater for irrigation;
- Increased exposure to infectious agents as tropical forest and other ecosystems are converted to agricultural land.

The following section reviews the extent to which these concerns are significant from an ACP perspective. In low-income ACP countries, in particular, such risks must be seen in the context of the food security issues noted above. Overall, the danger that agricultural intensification will fail to address food security issues, or will not occur, remains a more serious threat to health than this particular set of environmental hazards. Simply promoting pesticides, fertilisers, large scale irrigation and forest clearance is not necessarily the best way to improve food security.

4.5.1 Modern Agricultural Development

The process of agricultural modernisation has produced three types of agriculture: industrialised, Green Revolution, and all that remains - the low-external input, traditional and 'unimproved' systems. The first two types have been able to respond to the technological packages, producing high-input high-output systems of agriculture. For success, they require

conditions that are either like those where the technologies were generated, or else environments that can easily be changed and homogenised to suit the technologies. These tend to be endowed with most of the following attributes:

- Access to roads, urban markets, ports, coupled with ready access to inputs: machinery, marketing infrastructure, transport, agroprocessing facilities and credit;
- Good soils;
- Adequate supply of water, either through stable rainfall or irrigation systems;
- Access to modern crop varieties and livestock breeds; and
- Access to petroleum-based products and machinery.

Most agricultural systems in industrialised countries count as high-external input systems. In developing countries, high-external input systems are found in the large irrigated plains and deltas of South, South East and East Asia, and parts of Latin America and North Africa, but also in some ACP countries. They tend to be monocrop and/or monoanimal enterprises, geared for sale of produce, and so include lowland irrigated rice, wheat and cotton; plantations of bananas, pineapples, oil palm, sugar cane, market gardening near to urban centres, and intensive livestock rearing and ranching.

These are the lands of the Green Revolution, the success of which lay in its simplicity. Agricultural scientists bred new varieties of staple cereals that matured quickly, so permitting two or three crops to be grown each year; that were day-length insensitive, so could be grown by farmers at a wide range of latitudes; and that produced more grain than straw. They were also much more responsive to nitrogen than traditional varieties. These modern varieties were distributed to farmers, together with high-cost inputs, such as inorganic fertilisers, pesticides, machinery, credit, and water regulation. These technical innovations were then implemented in the most favoured agroclimatic regions, and for those classes of farmers with the best means of realising them, the potential yield increases. Now, some 50% of the total wheat, rice and maize acreage is planted with modern varieties, although the uptake varies considerably across continents. As a result, average cereal yields have roughly doubled in 30 years, and this has led to an improvement of about 7% in the total food produced per capita over the same period. This average does, however, hide significant regional differences: in South East Asia, food production per capita has increased by about 30%, but in Africa it has fallen by 20%.

The third type of agriculture comprises all the remaining agricultural and livelihood systems (Pretty, 1995), and represents a largely forgotten agriculture. These are the low-external input systems, located mainly in drylands, wetlands, uplands, savannas, swamps, near-deserts, mountains and hills, and forests. Farming systems in these areas are complex and diverse, and rural livelihoods often depend on wild resources, as well as agricultural produce. They are remote from markets and infrastructure, they are located on fragile or problem soils, and they are less likely to be visited by agricultural scientists and extension workers, or studied in research institutions.

These forms of agriculture often have low productivity, with cereal yields typically only 0.5 to 1 tonne per hectare. The poorest countries tend to have higher proportions of these agricultural systems, and indeed, most of the food production in Africa comes from these low-external input systems of agriculture. By the mid-1990s, some 30% to 35% of the world's population, about 1.9-2.1 billion people, were directly supported by this third and 'forgotten' agriculture (Pretty, 1995), yet these people are currently excluded from development assistance and agricultural policies that focus on the high potential lands. A 1988 US Office of Technology Assessment study of Africa said 'most agricultural development assistance ... has emphasised external resources' (OTA, 1988). But few farmers can afford to sustain the use of external resources: their only immediate alternative lies in low-external input systems, using technologies that conserve resources.

Although there has recently been some recognition of what can be achieved by a more sustainable form of agriculture, many institutions still believe in the modernisation

paradigm. The high external input systems and conventional cropland provide the bulk of the world's food, and they are thus assumed to be the only places where further improvements can be made. To some, this implies that activities should concentrate on high potential areas.

The remaining lands contribute small amounts in comparison, as yields are so low. The common assumption is that improvements elsewhere will encourage people to migrate from the 'marginal' areas to the `higher potential' ones, where they will have access to jobs and food. This will reduce the population pressure on marginal areas. The implied strategy is to create employment and income opportunities outside of agriculture in the marginal lands, and to 'boost productivity in the better endowed areas so that populations can move eventually from the marginal lands' (Morse, 1988). Such an approach ensured that existing low-input and traditional agricultural systems continued to be ignored.

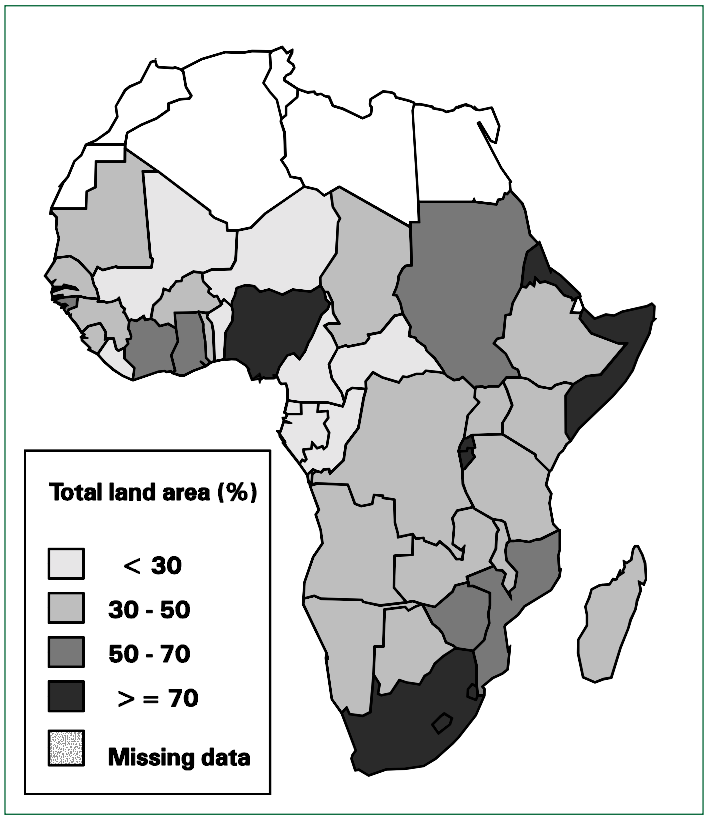
4.5.2 Environmental Impacts and Health Burdens of Modernist Systems

The agricultural production increases brought about by high-input packages have brought many benefits. Without them, many people would be worse off than they are now and many others might have died of starvation. But in order to assess the true net benefits of high input packages, it is also important to understand some of the external costs. This section is concerned with the environmental health hazards of high-input agriculture. It is also important to keep in mind that in some circumstances, modern agriculture undermines food security and health by putting the rural poor at a disadvantage, threatening their land tenure, and degrading wild resources and biodiversity - topics already discussed in preceding sections.

Many of the environmental problems associated with agriculture are a direct result of intensive and specialised farming. The mixed farm can be an almost closed system, making little impact on the outside world: crop residues are fed to livestock or incorporated in the soil; manure is returned to the land in amounts that can be absorbed and used; legumes fix nitrogen; trees and hedges bind the soil and provide valuable fodder and fuelwood, and habitats for predators of pests. The components of the farm are thus complementary in their functions, with little distinction between products and by-products. Both flow from one component to another, only passing off the farm when the household decides they should be marketed.

Intensification of agriculture has meant greater use of pesticides, fertilisers and water inputs, and a tendency to specialise operations. The inputs, though, are never used entirely efficiently by the receiving crops or livestock and, as a result, some are lost to the environment. Some 30% to 80% of applied nitrogen, and significant, but smaller, amounts of applied pesticides are lost to the environment where they contaminate water, food and fodder, and the atmosphere (Conway and Pretty, 1991). Water is often wasted or used inefficiently, leading to groundwater depletion, waterlogging and salinity problems. This is not only wasteful, but

Figure 4.1 Domesticated Land in ACP - Africa.



costly to those who want to use these resources and expect them to be uncontaminated.

Many environmental and health-related impacts have increased in recent years, whilst others have persisted, all efforts to reduce them notwithstanding (Conway and Pretty, 1991). Water systems have become increasingly contaminated. Nitrates in water can give rise to methaemoglobinaemia in infants, pesticide-contaminated water can harm wildlife and pollute drinking water, and nitrates and phosphates from fertilisers, together with organic wastes from livestock manures and silage, all contribute to algal growth in surface waters, deoxygenation, fish and coral deaths, and cause a general nuisance. Eroded soil also disrupts watercourses, and runoff from eroded land causes flooding and damage to housing, irrigation systems and natural resources.

Various pollutants also harm farms' and local areas' natural resources. Pesticides damage populations of the predators that help keep pest populations under control, as well as other wildlife, whilst inducing resistance in target pests. Nitrates from fertilisers and ammonia from livestock waste disrupt nutrient-poor wild plant communities, whilst metals from livestock wastes raise the metal content of soils, and pathogens in wastes can harm human and livestock health. The atmosphere is contaminated by ammonia (which plays a role in acid rain production) nitrous oxide derived from fertilisers (which plays a role in ozone layer depletion and global warming) and methane from livestock and paddy fields, (which also affects global warming).

The consumer is most likely to be directly affected by eating food contaminated by pesticide residues, nitrates and antibiotics. In industrialised countries, the levels of pesticides in foods have been falling steadily since the 1950s (Conway and Pretty, 1991), but there are, nonetheless, occasional public scares over particular products, and rare incidents of severe poisoning arising from the spraying of illegal products. In ACP countries, however, daily intakes are often very high. These may be in cereals or in fish, such as those from the lakes and rivers of Kenya, Nigeria and Tanzania (Atuma, 1985a; Atuma, 1985b).

The major hazard, however, lies in locally marketed food. Leafy vegetables are often sprayed twice a week and may come to market with a high degree of contamination, especially in the dry season. In Africa, vegetables have been found to contain organophosphates many times in excess of human tolerance limits (Atuma, 1985b). Leafy vegetables have also found to be contaminated with faecal material, although this is not confined to high intensity agriculture.

The costs of environmental damage are growing, and are dispersed throughout many environments and sectors of national economies (Conway and Pretty, 1991). Recent analyses, meanwhile, have been characterised by the recognition that farmers themselves are suffering declining incomes or health-related effects as a result of these modern approaches to agriculture.

4.5.3 Pesticides and Health

In the past 50 years, the use of pesticides in agriculture has increased dramatically, and the value of the global market is now about US $30 billion. Herbicides account for nearly half, insecticides a quarter, and fungicides less than a fifth. The largest individual consumer is the USA, followed by countries of the Far East. On a global scale, ACP-Africa is a relatively minor consumer of pesticides - about 4% of the total world consumption. The consumption is also quite variable, because of intermittent demand (locust eradication campaigns), a recent decline in government pesticide subsidies, and fluctuations in aid. Whilst application levels in many of the ACP-Small Island States are considerably higher, with only about 3% of the ACP cropland, their consumption levels are also globally insignificant.

Pesticides are intended to be hazardous - their value lies in their ability to kill unwanted organisms. But they are rarely selective. Most act by interfering with fundamental biochemical and physiological processes that are common to a wide range of organisms - not only to pests and weeds, but to humans, too. Pesticides affect workers engaged in their manufacture, transport and disposal, operators who apply them in the field, the general public, and wildlife. In the

first case, the hazard is common to all industries dealing with toxic chemicals. Of greater concern is the hazard to the field operators because of the high variability in field conditions and frequent lack of protective clothing. Also at risk, however, are the general public and the wider environment, both of which are difficult to protect directly.

At very high dosages, many pesticides are lethal both to laboratory animals and people, and can cause severe illness at sub-lethal levels, but the risks differ from pesticide to pesticide. Some are known to be carcinogenic, others are suspected but unproven, some are acutely toxic but produce no long-term effects, whilst others are of long-term concern. Much of the information on the health-related effects of pesticides is, however, still highly controversial and there is no clear picture of how much harm they do to farmworkers and those who eat the food produced.

In tropical countries, mortality and illness due to pesticide exposure are much more common, relative to the amount of pesticide used. Lack of legislation and widespread misunderstanding of the hazards involved greatly increase the dangers both to agricultural workers and to the general public. Many pesticides known to be highly hazardous and either banned or severely restricted in use in industrialised countries, such as DDT, parathion, mevinphos and endrin, are, moreover, still widely available in developing countries. In some cases, they may even end up being used for household spraying - a use which was found to correlate with respiratory problems among women in Accra (Benneh *et al.*, 1993).

One of the best studies to quantify the social costs of pesticide use was conducted by the International Rice Research Institute (IRRI) in the Philippines. Researchers investigated the health of Filipino rice farmers exposed to pesticides, and found statistically significant increased eye, skin, lung and neurological disorders. Two-thirds of farmers suffered from severe irritation of the conjunctivae; and about half had eczema, nail pitting, and various respiratory problems (Rola and Pingali, 1993).

According to the latest estimates by the World Health Organisation, at least three million, and perhaps as many as 25 million, agricultural workers are poisoned each year. Of these, some 20,000 die. The data paint a bleak and worsening picture[2]:

The future pesticide consumption of the ACP countries is difficult to predict, but it is likely to be influenced by a number of factors, such as profitability (which is determined by government subsidies, the price of alternative means of plant protection, opportunity cost of labour and so on), concern about environmental damage and direct damage to the health of people handling pesticides, and plant pest resistance. Judging by trends elsewhere, as a country develops, the type and amounts of pesticides used are likely to change from a small number of compounds used on a few crops to a wide range and larger total amount of insecticides, fungicides and herbicides on a large variety of crops. African pesticide consumption has been growing since the 1980s; between 1990 and 1995, sales rose from an estimated US$ 600 million to a US$ 1 billion, corresponding to an increase of 66%. Factors contributing to this growth include the increasing focus of multinational agrochemical companies on tropical markets (in the hope that growth in this market will help to offset a general world market slump in the 1990s), the opening up of the South African pesticide market and, in particular, the rapid growth of the African horticultural industry, including export commodities such as vegetables, flowers and fruits (Waage *et al.*, 1995)

Older and more toxic compounds (off-patent pesticides) still dominate the market in many ACP countries as they are far less costly than new ones. Strict regulations, bans and severe restrictions in developed

[2] For summaries, see: Pretty J N. 1995. *Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance*. Earthscan Publications Ltd., London, 320 pp; Dinham B. 1993. *The Pesticides Hazard.* The Pesticides Trust, London; Pesticides News 30 (1995), 10-11; Repetto R and Baliga S S. 1996. *Pesticides and the Immune System: The Public Health Risks*. WRI, Washington DC. Singh G S. 1996. Pesticides: a growing menace. Society for Participatory Research in Asia. New Delhi - reported in Pesticides News No 35, p10; *Pesticides News.* 1997. Pesticide facts in Thailand. No 35, p8

countries may be effective in gradually reducing their availability, but new (patented), less toxic and more environmentally friendly compounds may still remain too expensive for many applications, so more toxic pesticides remain in circulation.

In ACP-Africa, changes are visible in the politics of governments, international lending agencies and donors (Matteson and Meltzer, 1996). Many government policy reforms and initiatives supported by lenders and donors have the potential to affect pesticide use pattern, including the development of Integrated Pest Management (IPM) systems and their adoption by farmers. These new policies may have both direct and indirect impacts, but much depends on whether policies are actually implemented. Pesticide and environmental legislation is, furthermore, only valuable if it is followed up with implementation and the means of enforcing the regulations.

4.5.4. Health Effects of Increased Use of Fertiliser

In areas where soils are susceptible to nitrate leaching, over-fertilisation can result in high nitrate concentrations in surface and ground water. In very young babies, high nitrate exposure can lead to methaemoglobinaemia (blue baby syndrome). Will over-fertilisation be an issue in ACP-Africa in the foreseeable future? Perhaps locally, but not on a large scale. Even though the use of fertiliser increased significantly between 1960 and 1990, the region still accounts for less than 1% of global fertiliser use. The average use of fertiliser in ACP-Africa is about 12

Box 4.5 Pesticides and Workers' Health

Pesticides cause three million instances of severe poisoning and an estimated 20,000 deaths every yearl. 99% of these fatalities occur in developing countries, even though these countries use only 20% of the world's pesticides (WHO/UNEP, 1990). Pesticide use in ACP countries is largely restricted to large scale commercial farming, and agricultural workers in the horticultural and cash crop industries are often exposed to high pesticide levels (WHO/UNEP 1990). The use of toxic pesticides is probably one of the most important occupational hazards for these agricultural workers (Wesseling, McConnell et al, 1997), but the problems in this sector are many. The lack both of legislation and of sufficient knowledge of the hazards involved, coupled with poor labelling and the discomfort of wearing protective clothing in hot climates, all greatly increase the hazards. Many agricultural workers are, furthermore, unable read the labels correctly and extension systems in many countries are unable to ensure that products are used safely.

Many of the pesticides used in the ACP countries are old, highly toxic and banned or severely restricted in industrialised countries. These chemicals are cheaper because the proprietary rights of the original manufacturer have expired, but the use of these chemicals is also explained by the lack of restrictive legislation and the difficulty in obtaining alternatives.

Organochlorine insecticides (such as DDT and dieldrin) are still in use in many African countries. These compounds belong to the first generation of insecticides to be used on a large scale in agriculture after World War II. The acute effect of these compounds is a stimulation of the nervous system. Where poisoning occurs, the effects include dizziness, vomiting and convulsion. Organochlorine pesticides are, however, mainly associated with chronic effects, such as those on the central nervous, reproductive and immune systems, and with a risk of cancer. Dieldrin has also been reported to be associated with Parkinson's disease (Fleming, Mann et al, 1994). Many of the organochlorine compounds disrupt the hormone system. One of the best documented of these compounds is DDT, which acts on the female sex hormone, oestrogen.

Organochlorine pesticides can stay in the soil for years and are easily absorbed by certain root crops such as carrots (Hertzman and Akerblom, 1995). They are banned or highly restricted in most industrialised countries, mainly because of their persistence in the environment and their accumulation in fatty tissue, such as the brain and breast, and in breast milk, but are still in use in many ACP countries. Namibia, for example, uses up to 70,000 kilograms of DDT per annum to control malaria mosquitoes, along with dieldrin and alphametrin for tsetse fly control (Hines, 1995).

The pesticides associated with highest number of acute pesticide poisonings are the cholinesterase inhibitors, organophosphates and carbamates. Organophosphates and carbamates degrade much faster and do not accumulate in fatty tissue, but have been held responsible for the majority of acute poisonings (Wesseling, 1997). These pesticides inhibit the transmission of nerve impulses by inhibiting acetyl cholinesterase, a key enzyme in the nervous system. Early symptoms of poisoning include excessive sweating, headache, weakness, vomiting, abdominal cramps, diarrhoea, blurred vision and slurred speech (Dinham, 1997). Between 50% and 83% of pesticide fatalities in Zimbabwe 1980-84 were caused by organophosphates (Wesseling, McConnell et al, 1997). Paraquat is a widely used herbicide in many ACP countries, and one of the most frequently used of all herbicides in Zambia (Phiri, 1995). Workers who spray paraquat regularly are often affected in the skin, eyes, nose and fingernails (Dinham, 1993). There are several cases showing that dermal absorption in dangerous concentrations is possible (Hayes and Laws, 1991), with the kidneys, liver and lungs as the most frequently affected organs. Paraquat is, furthermore, often brought into fields in soft drink bottles, which are used as pesticide containers, and there have, as a result, been several fatalities where a mouthful of Paraquat concentrate was ingested by mistake (Wesseling, Hogstedt et al, 1997).

Contributed by Erica Toft, Erica Toft Konsult HB.

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kilograms per hectare (see Table **10.2** in Appendix 2) compared with about 200 kg per hectare in the European Union.

In large parts of ACP-Africa there is virtually no use of chemical fertiliser at all. Green manure is often used as fuel, and hence there is considerable scope for increasing the productivity of African land by using more fertiliser, including biological nitrification. ACP-Africa is projected to increase its use of fertiliser - the demand is expected to rise from 1.9 to 4.2 million tonnes NPK in the next 20 years (Bumb and Baanante, 1996). Inorganic fertilisers are, however, too costly or unavailable for the large majority of small-scale and subsistence farmers.

The main fertiliser-related problem is that of the inadequate replenishment of nutrients removed by agriculture and land degradation. The situation is serious in many ACP countries,

but most acute in Africa (both for major nutrients like nitrogen and phosphate, and for micronutrients like boron and manganese). In many countries in the region, nutrient removal exceeds nutrient replenishment by a factor of three to four. In the mid-1980s, all countries in the region were thought to be suffering from nutrient 'mining' to some degree (Bumb and Baanante, 1996), with the most serious problems occurring in semi-arid areas where livestock manure is in short supply and the use of mineral fertilisers is out of reach (and seldom economic) for the farmers. Traditionally, long fallows, 10-15 years in duration, were used to restore fertility, but increased population pressure has led to continuous cultivation. In many instances, this reduction in fallow periods has not been accompanied by alternative measures designed to restore fertility. As fertility declines and soil becomes barren, farmers with few other resources may be forced to clear more forests to meet food demand (though see Box 4.6).

In the light of this situation, increased fertiliser use in Africa may be a problem locally, near large commercial farms or cities, but would probably not be a significant health problem for major parts of ACP-Africa.

4.5.5 Infectious Agents, Land Conversion and Increased Irrigation

The conversion of land, whether from forests to agriculture, or rain-fed to irrigated land, can directly influence the prevalence of a wide range of infectious diseases. In both cases, ecosystems involving disease vectors are altered, and people move into new habitats. In the wrong circumstances, serious health problems emerge. Other changes in land use patterns and human settlement can also affect the ecology of disease. Deforestation and more extensive irrigation are of particular concern, however, since they are trends now unfolding in many ACP countries.

The scope for increasing the irrigated land area in Africa is quite restricted, since large areas are already experiencing water shortages. Some increase in irrigated cultivation may be possible, at reasonable cost, but by probably less than 15% of today's level (Leach, 1995). The health implications of such changes do, nevertheless, need to be taken seriously in that they can increase the prevalence of a wide range of water-related diseases, as indicated in Box 3.3. Water is central to the life cycle of many known disease vectors, and it is no longer defensible to introduce major changes to water systems without taking into account the potential health effects.

The conversion of forest to agricultural land is the main cause of tropical deforestation. Deforestation can have a number of environmental consequences, and health concerns are often ignored. As indicated in Box 4.6, deforestation does not simply add or subtract from the burden of disease, but alters disease ecology in ways that can be difficult to predict. As in the case of water systems, health concerns should inform policies which lead to changes to forest land use.

Most of the examples given in Boxes 4.6 and 3.4 involve relatively common diseases, affecting primarily those living in the areas subject to ecological change. There is also the risk, in rare circumstances, of ecological and demographic change creating opportunities for unfamiliar microbes to come into increasing contact with people, and then spread to the general population (Epstein, 1995; Le Guenno, 1995; Morse, 1995). Increasing contact with forest animals, for example, also increases human exposure to their viruses, creating more opportunities for viruses to jump species. More population movements in and out of these areas could then, hypothetically, give these viruses the opportunity to spread. It is possible that HIV/AIDS and other 'new' viruses first emerged in this fashion. Our understanding of how new diseases emerge, and the risks involved in particular ecological shifts, is, unfortunately, insufficient to draw clear policy conclusions. It does, however, provide a further indication that a precautionary approach is warranted.

4.6 The Problems and Opportunities of Biotechnology

Genetic engineering is changing the rate and character of the development of both agricultural and medical innovations, making it difficult to judge the future on the basis of

Box 4.6 Changing Forest Land Use and its Impact on Disease Vectors

Forests may be cleared, degraded to less dense forest cover, or replanted with a new mix of trees, any of which changes can affect disease vectors and disease transmission. Public health is not always threatened, but it can be, and predicting the health implications requires an understanding of the local vector and disease ecology.

The health outcome depends not only on the changes made to the forests, but on accompanying population movements, and the quality and uses of the surrounding land. Hence, settlements encroaching on forest land may simply come into increasing contact with pre-existing vectors, whilst the widespread conversion of forests to agricultural land may totally eliminate forest species from the area, encouraging savanna species instead. Some of these savanna species may carry more (or less) virulent strains of the same disease, or they may be vectors for different diseases.

In ACP-Africa, for example, the main malaria vectors are Anopheles gambiae and A. *funestus*, both of which can live in forest or savanna areas (Coluzzi, 1992). Members of the *A. gambiae* complex do, however, seem to prefer sites where humans have made changes, and deforestation will thus tend to favour this species. Malaria prevalencies are, however, only likely to increase appreciably when deforestation increases the availability of freshwater sites where mosquitoes can breed, as in a conversion of forest land to rice paddies.

Blackflies of the *Simulium damnosum* complex are the main vectors of human onchocerciasis in Africa, although *S. naevei* also act as vectors in some areas. The latter live in forests only, and deforestation has eliminated onchocerciasis in some areas. Deforestation can also affect *S. damnosum* if it changes the availability of water sites for the blackfly breeding, or if the loss of forest affects the efficiency of transmission between different members of the chain of vectors (Walsh, 1993). In Uganda, where deforestation led to disappearance of *S. neavei*, they were replaced by *S damnosum*.

Human loiasis, caused by the filarial worm *Loa loa*, is confined to rainforests in West and Equatorial Africa. Generally speaking, deforestation does appear to lead to a fall in prevalence, as breeding sites for the horsefly vector are drained. Developing rubber plantations can, however, lead to an increase in the vectors' breeding success, and hence in the subsequent rate of transmission of the disease, as was the case in Saele, Nigeria, (Walsh, 1993).

The impact of deforestation on sleeping sickness depends on the type of the tsetse fly vector present. One study in Ethiopia suggests that development is viable in areas that are home to *Glossina morsitans* only, since this particular species is easily disturbed by people and is likely to retreat in the face of deforestation (Hadis et al, 1995). Other species of tsetse are, however, more adaptable and so more able to continue transmitting sleeping sickness, despite changes in forest cover.

The habits of people living and working in the area are also significant, e.g. whether, their daily round takes them into the forest, and at what times of day. For this and other reasons, not all inhabitants of a given area are at equal risk. In south east Uganda, where *G. fuscipes fuscipes* is the main vector of sleeping sickness, a study found that people with the disease tended to have less economic power, come from families in which sleeping sickness had already appeared, and be more likely to collect firewood from the forest and to travel outside their own village - and were thus more likely to come into contact with the vector (Okia et al, 1994).

Inhabitants new to an area, with a low immunity to endemic diseases, also face especially high risks. Work in the Philippines suggested that, in an area where the malaria transmission levels were generally low, being a young (under 30 years of age) male migrant

into the area was a significant risk factor (Lansang et al, 1997). This finding has public health implications in ACP countries, particularly in relation to resettlement programmes, but also in more general terms.

Migrants can also bring a new disease vector into an area. Fears have been expressed that *Onchocerca volvulus* strains from the savanna, which are more likely to cause blindness in humans than other types of onchocerciasis, may be introduced into newly deforested areas by people migrating into these areas from the savanna (Walsh, 1993).

Contributed by Jane Seymour, Environmental Health Researcher, London, United Kingdom.

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past trends. The emphasis here is on agricultural applications, in line with the rest of this chapter, with particular reference to food security. It is important to keep in mind, however, that medical applications may also change the context of environmental and health issues.

On the technical front, biotechnology has considerable potential for addressing food security problems in ACP countries. Its possible applications extend beyond the high-input commercial farms, whose links to food security are sometimes tenuous. A number of the physical limitations of Green Revolution technologies, which tied them to high-input packages and a limited number of crops, have been overcome and it is now technically feasible to use genetic engineering to support low-input agriculture, and to target crops and animals of special relevance to small-scale cultivators and their particular needs. Provided that the potential side effects and external costs can be contained, it is easy to imagine a far more equitable 'Rainbow Revolution', helping to eliminate rural food insecurity in a wide range of settings.

As described in earlier sections, however, food insecurity is not primarily a technical problem, and institutionally, the new developments in biotechnology give far less reason for optimism. There is little financial pressure to serve the needs of people without food security, and biotechnology is led by commercial interests. The costs of developing applications is high, so whatever the technical potential, in reality the vast majority of biotechnology innovation is orientated towards large-scale commercial applications. There are also strong vested interests in maintaining high-input agriculture for genetically engineered food crops. Indeed, several of the companies that dominate food and farming applications of biotechnology, are also major exporters of chemical inputs. Moreover, the potential risks that accompany the use of genetically engineered species do not only, or even principally, threaten the users. Current trends thus suggest that the technological potential for serving low-input, small-scale farmers will not be realised in the foreseeable future, but that these farmers will bear some of burdens of external costs and increased competition.

The key question with regard to public health is whether the potential risks and institutional tendencies of new biotechnologies represent challenges that

must be overcome, or reasons to resist biotechnology-based approaches to food security. Biotechnology experts at present tend to be more optimistic than rural development specialists and environmentalists, and the debate is polarised and often confused. Institutions and policies lag far behind scientists' and industry's capacity to find new uses for the technologies. Ethical issues that require considered and extensive public consideration are in danger of being lost amid the technological push and pull.

4.6.1 What are Biotechnology and Genetic Engineering?

Biotechnology involves making molecular changes to living or almost-living things, such as proteins, and as such, it has a long history. The Egyptians and Sumerians had developed fermentation, bread-making, brewing and cheese-making by 2000 BC, and the Greeks had developed grafting techniques, enabling them to plant orchards and groves to produce fruit on a larger scale by 300 BC. The defining feature of modern biotechnology, also known as genetic engineering, is that it involves transfer of DNA from one organism to another, so allowing the recipient to express traits or characteristics normally associated with the donor. It goes well beyond conventional plant and animal breeding, involving such techniques as clonal propagation, embryo transfer, embryo rescue and mutant selection.

Modern biotechnology helps breeders to facilitate the targeted improvement of varieties adapted to particular agroecological niches. As breeders and agricultural scientists strive to increase the number and complexity of traits to be incorporated into new crop varieties, DNA marker-assisted breeding is becoming an increasingly important tool. The use of the DNA marker technology helps to identify genetic linkages to qualitative and quantitative traits, which simplifies and facilitates conventional breeding efforts.

Genetic modification, or development of transgenic organisms, is different from conventional breeding, since it involves the direct transfer of genetic material from one organism to another in order to change the characteristics of the recipient animal or plant. This permits genes to be transferred horizontally between organisms that do not normally breed. As these transfers or mixes do not occur in nature, the scope for genetic modification (these modified organisms are commonly called GMOs - genetically-modified organisms) is far greater than 'traditional' breeding, which recombines genetic material from the same species or genera, shifting only similar alleles.

Whilst biotechnology opens many new doors, concerns have emerged over its potential impact on the environment and health (Tiedje *et al.*, 1989). Some of the concerns relate to the effects of released GMOs on the structure and function of ecosystems - in particular, the creation of new weeds and the flow of 'unwanted genes' into the gene pools of wild relatives from the transformed crops. Others relate to the safety of consuming genetically modified (GM) crops or their products. Another hotly debated issue is the push, by biotechnology companies, for the extension of patent rights to living material, including genes. There is a growing concern in developing countries that foreign companies will gain rights to indigenous knowledge and genetic resources, without even providing proper compensation. All of these concerns are heightened by the fact that most ACP countries lack both biosafety information relevant to the region and the capacity to enforce biosafety regulations. When building up capacity in biotechnology in ACP countries, therefore, there is a concomitant need for training in biosafety risk assessment and discussions of ethical and legal implications (Virgin and Frederick, 1995).

4.6.2 Food and Farming Applications in the North

Biotechnology is now the fastest growing industry in both the health and the food and farming sectors of the North. There are some 1,500-2,000 biotechnology companies in the USA, and a further 700 in Europe. The vast majority of these companies are concerned with medical applications and the production of new drugs and pharmaceuticals. A relatively small number only are developing technologies for the food and farming sector.

Within this sector, however, biotechnology companies are playing an increasingly dominant role.

In the food and farming sector, there are six international conglomerates that currently dominate the market, namely Monsanto, Novartis, AgrEvo, Dupont, Zeneca and Dow, who are said to have already invested $8 billion collectively in technology development - Monsanto alone spent $730 million on biotechnology research in 1997. The growth in the farming sector started later than the medical boom and remains slower than that in the medical sector, but this situation is changing rapidly. In 1994, there were no GM crops grown commercially on farms anywhere in the world. In 1998, approximately 28 million hectares of GMO crops were cultivated world wide (more than 95 percent in USA, Argentina, Canada). In the USA, GMOs were sown on a quarter of all cotton-growing areas, and on 14% and 10% of soya and maize areas, respectively. The US Department of Agriculture believes that some 40% to 50% of all US crops will be GMOs by the year 2000 (James, 1998).

The first genetically engineered products eaten by humans were cheese and tomatoes. GMOs were first used to produce an alternative enzyme to calf rennet for making vegetarian cheese, namely chymosin, although labelling has only recently revealed this to consumers. Then in 1995, tomatoes with their softening gene 'switched-off' (allowing them to ripen on the vine without then rotting in transit) were introduced to the market in the form of tomato paste. They were quickly followed by a wide range of GM crops being given regulatory approval in the US, including potatoes, squash, oil seed rape, cotton and maize. Slow softening apples, raspberries and melon have also been produced.

The greatest growth area up to 1998 has been in two very high profile crops, namely soya beans developed by Monsanto to resist treatment with the herbicide glyphosate, or Roundup, and maize engineered by Novartis to contain the *Bacillus thuringiensis* gene that produces a compound toxic to the corn borer. The maize also contains an antibiotic-resistant marker, so that GM tissue can easily be identified in the laboratory. This maize was planted on 200,000 hectares in 1996, increasing to two million hectares in 1997. Both Monsanto and Novartis claim that these plants benefit farmers financially. They say fewer chemical inputs are needed overall, although the sales of their own herbicide products did increase.

Studies[3] from the USA and UK comparing GM with non-GM crops point to the following improvements:

- GM soya in the US required 9-39% less herbicide[4];
- GM cotton in Australia required 68% less insecticide;
- GM cotton in the US - 60% of the crop went a whole season without needing any insecticides;
- GM rape in the UK - production costs were cut by two-thirds from £75-80 to £25 per hectare;
- GM soya and canola yields were up 5% to 9% in the US in 1996 owing to better weed control and less injury to crops.

4.6.3 The Relevance of Agricultural Biotechnology to Health in ACP Countries

A number of GM crops will be making their way to ACP countries in the near future. Some will come directly from international seed companies, and some via national and international crop breeding programmes.

[3] Wilson M. 1997. Genetically-modified crops: are there significant risks or benefits? IEA Environment Unit Occasional Discussion, 30 October 1997. Institute of Economic Affairs, London.
Monsanto Crop Production. 1997. *Weed control on the farm: management of GM herbicide tolerant crops.* High Wycombe. From trials run by the ARC as part of the EU-funded Familiarisation with and Acceptance of Crops incorporating Transgenic Technology (FACTT) project.
[4] It is not entirely clear what exactly these data mean, in that reporting agencies do not distinguish between the number of applications of a product, and the amount in kg of active ingredient used.

International seed companies are likely to increase the number of field tests of transgenic plants in Africa, concentrating their marketing on countries that have already have a large market for elite crop varieties and a functional biosafety regulatory structure. These crops will, however, be expensive, and be more likely to compete with small-scale cultivators than be used by them.

At the same time, some ACP-African countries (such as South Africa, Kenya and Zimbabwe) are building significant plant biotechnology programmes within their National Agricultural Research Systems (NARS). These efforts focus on local crops and local problems. In East Africa, KARI in Kenya will soon test transgenic virus-resistant sweet potatoes developed in cooperation with Monsanto.

The research centres of the Consultative Group on International Agricultural Research (CG-centres) are also working intensively with the development of transgenic crops for African crop breeding programmes. The International Institute of Tropical Agriculture (IITA) is working on the production of transgenic yams, cowpeas and bananas that are resistant to disease and pests. Work on transgenic cassava is being carried out at the International Centre for Tropical Agriculture (CIAT) in Colombia, where the research is concentrating on transgenic cassava plants with increased insect resistance, modified starch quality and decrease of cyanoglucoside content. The French research organisation ORTSTROM and the International Laboratory for Tropical Agricultural Biotechnology (ILTAB) are collaborating on the production of genetically engineered cassava plants that are resistant to the African Cassava Mosaic Virus (ACMV). Finally, the Maize and Wheat Improvement Center (CIMMYT) is also working on the development of transgenic pest-resistant maize varieties suitable for Latin America and Africa.

In short, many transgenic crops (including maize, cowpeas, yams, cassava and bananas) will be ready to be incorporated into African breeding programmes in the near future (three to five years) and made available to a somewhat broader set of African farmers. Unfortunately, this does not imply that biotechnology will lead to a general improvement in human health, since it is not clear how those groups currently facing food insecurity will be affected.

If biotechnology does not benefit small-scale and subsistence farmers, its relevance to food security will be strictly limited. Whilst some transgenic varieties will be available through the NARS and the international research centres (IARCs), the majority of the varieties will be marketed by large agrobiotechnology corporations through their local subsidiaries at a premium price. Even the NARS will have considerable difficulty reaching the majority of farmers. Farmers without good access to new technology or financial resources will benefit last, if at all. Increasing food supply from high-input commercial farms can lower food prices, giving more purchasing power to wage labourers, but as long as a large proportion of people without food security are themselves small farmers who depend on their own agricultural sales and food production, an increase in the food supply will not ensure food security.

The overall health-related impact could also be negative if biotechnology hurts small cultivators. Even if the potential hazards of genetic engineering are ignored, there are still a number of ways in which biotechnology could harm small cultivators: it could make it more difficult for them to market their produce, by increasing supplies from competitors or shifting demand towards more standardised products, and it could divert public support from approaches more relevant to small-scale cultivators, such as those involving more traditional techniques and measures supporting local empowerment (Hobbelink, 1991; Rissler and Mellon, 1996). Even if they were to be adopted by small farmers, biotechnology innovations could reduce the diversity, flexibility and resilience of farming systems, and increase the risk of the sort of extreme events that can lead to famine. There is even the potential for workers in large-scale commercial farming to suffer if the demand for labour falls or production is shifted to other countries. Transgenic tropical crops such as sugar cane, coconut, vanilla and cocoa could be grown anywhere with appropriate genetic

modification, and whole industries in tropical countries could, as a result, be further destabilised or even disappear.

There are steps which could be taken to reduce the potentially negative impacts of biotechnology. More resources could be devoted to the innovations relevant to food security, such as introducing hybrid vigour into crop varieties without having to replenish seed stocks every year (Toenniessen, 1994). This would remove one of the inequitable aspects of conventional hybrids which need to be bought each year, favouring the more successful commercial farmers. Numerous complementary measures could also be taken. In short, for biotechnology to be able to address some of the key challenges facing poor farmers, suitable research paradigms will have to be developed by the National Agricultural Research Centres in the ACP countries. Simply embracing biotechnology on the grounds that it can increase food production could be a serious mistake.

The overall impact of biotechnology on health in ACP countries is uncertain, not only because its technical aspects remain poorly understood, but also because it is unclear how ACP governments and international actors will take up the challenges biotechnology brings. Biotechnology will not solve the problems of unsustainable agricultural practices and food insecurity. The question is whether it will become part of the solution, or another part of the problem. It is far more likely to become part of the solution if it can be integrated into a broad-based strategy for the environment and health, keeping the interests of the poor to the fore, than if it is treated as a technological fix for increasing food production.

4.7 Conclusion

In making generalisations about agriculture and health, it is tempting to fall back on aggregate measures of food production and malnutrition. In this chapter we have tried to show why it is of critical importance to keep the social and environmental aspects of the agricultural systems in view, and not to reduce food security to a question of food supply. As also indicated in *World Resources 1998-99* (World Resources Institute, 1998), agricultural intensification can threaten health by exposing people to harmful chemicals or creating new habitats for disease vectors, for example. More important for most ACP countries, those most at risk from malnutrition may not have secure access to commercially produced food, rely more heavily on the 'harvest' of nature and a more genetically diverse set of crops, and are generally more at risk from environmental disruptions. An approach to sustainable agriculture that takes health seriously must enhance the livelihoods of the most vulnerable rural and urban dwellers. Elements of such a strategy are presented in Chapter 7.

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Chapter 5

Urbanisation and Healthy Living Environments

Chapter 5 Urbanisation and Healthy Living Environments

Aims of the Chapter

- To identify the links between urbanisation, the quality of living environments and the health situation in ACP countries.
- To assess the most critical environmental health threats in the urban living environment, and their socio-economic context.
- To identify constraints on and opportunities for health-oriented environmental management in urban areas.

Main Points

- Rapid urban growth will continue to be a feature of most ACP countries for the coming decades. Urbanisation can be beneficial to human health, but this depends on good environmental management. The quality of urbanisation is more critical to health than the rate of urbanisation.
- The most severe environmental health problems are closely interrelated and found predominantly in low-income homes and neighbourhoods. They include poor access to water, bad sanitation, contaminated food, uncollected waste, smoky kitchens and a range of insect vectors (the *persistent poverty cluster*).
- Important environmental amenities, such as water and sanitation, are lagging behind population growth in many urban areas.
- Cooking with smoky fuels may be contributing significantly to respiratory problems, in particular for women and children. These problems are compounded by other factors such as poverty, poor housing, overcrowding, and air pollution from other sources.
- The relative lack of industrial development has meant a low average exposure to chemical pollution in the general population. This factor notwithstanding, where it occurs, exposure levels can be very high, posing a threat to industrial workers and nearby (often low-income) residents (the *conventional development cluster*).
- The rapidly growing *informal economy* of smaller and less regulated enterprises contributes appreciably to health by providing livelihoods, but can in some circumstances pose serious environmental health threats.

Policy Implications

- Governments cannot prevent rapid urbanisation with policies and legislation, but they can help ensure that urbanisation is a positive force. Unmanaged urban development creates very unhealthy living environments, whilst good local environmental management and service provision, in both urban and rural areas, can greatly reduce the burden of disease.
- The environmental deterioration and lack of services in low-income areas is an environmental and health priority. Conventional public service delivery cannot meet the challenge alone. Nor can private service delivery. Improvements that build on the strengths of both private and public sectors, and support the contribution of local residents and their organisations, are more likely to succeed. Strategies to address current deficiencies are also more likely to be successful if they:
  - develop local capacities and give priority to achieving good relationships between residents and service providers.
  - give priority to environmental improvements that people want, that have multiple benefits, and that alleviate poverty (which in turn increases the local capacity to manage the environment).

- draw upon and enhance both expert and local knowledge of environment and health.
- improve housing security.
- respond to the diverse needs of different groups, including, for example, men and women.

• Regulations and impact assessments can play an important role in controlling pollution, especially in the formal economy. Conventional regulations are, however, difficult to apply efficiently in the informal economy, and can easily become self-defeating. All stakeholders need a better understanding of environmental health risks, in order to support more participatory solutions.

5.1 Introduction

Urbanisation, like agricultural change, can be either beneficial or harmful to people's health. Much depends upon how the physical environmental changes that accompany urbanisation are handled. As indicated in Table 5.1, there are a wide range of city-related environmental problems that can adversely affect people's health, but if these problems are addressed effectively, urbanisation can lead to health improvements.

For many ACP countries, the problems that pose the greatest threat to health in the urban environment are those that low-income citizens face in and around their homes. Those threats include poor access to water, bad sanitation, contaminated food, uncollected waste, smoky kitchens, and a range of insect vectors (Hardoy *et al.*, 1992; McGranahan, 1993). Urban settlements not only concentrate people, they also concentrate potentially health-threatening activities. Many of the industrial threats to the environment and health, described in the *1998-99 World Resources Report* are concentrated in urban areas. Pollution from transport systems is typically more of a threat to health in cities than in the countryside, but in conditions of poverty, local threats to the home environment, as summarised in the first three rows of Table 5.1, in particular, are usually the most severe. Most of these problems can also arise in rural areas, although there, they may take a somewhat different form.

Table 5.1 Checklist for City-related Environmental Problems by Context and by the Nature of the Hazard or Problem.

Context	Nature of Hazard or Problem	Some Specific Examples
Within house and its plot	Biological pathogens	Waterborne, water-washed (or water-scarce),airborne, food-borne, vector-borne including some water-related vectors (such as *Aedes* mosquitoes breeding in water containers where households lack reliable piped supplied).
	Chemical pollutants	Indoor air pollution from fires, stoves or heaters. Accidental poisoning from household chemicals. Occupational exposure for home workers
	Physical hazards	Household accidents — burns and scalds, cuts, falls. Physical hazards from homebased economic activities. Inadequate protection from rain, extreme temperatures and so on

Context	Nature of Hazard or Problem	Some Specific Examples
Neighbour-hood	Biological pathogens	Pathogens in waste water, solid waste (if not removed from the site), local bodies of water. Disease vectors such as malaria-spreading *Anopheles* mosquitoes breeding in standing water or filariasis - spreading *Culex* mosquitoes breeding in blocked drains, pit latrines, or septic tanks.
	Chemical pollutants	Ambient air pollution from fires, stoves, and from burning garbage if there is no regular garbage collection service. Air pollution and wastes from 'cottage'-industries and from road vehicles.
	Physical hazards	Site-related hazards, such as housing on slopes with risks of landslides; sites regularly flooded, sites at risk from earthquakes. Traffic hazards. Noise. Health hazards to children if open sites are used as waste dumps because of no regular service to collect household wastes
Workplace	Biological pathogens	Overcrowding/poor ventilation aiding transmission of infectious diseases
	Chemical pollutants	Toxic chemicals, dust, indoor air pollution
	Physical hazards	Noise, dangerous machinery
City (or municipality within larger city)	Biological pathogens	The quality and extent of provision for piped water, sanitation, drainage, solid waste collection, disease control and health care at city or municipal level is a criti cal influence on extent of the problems
	Chemical pollutants	Ambient air pollution (mostly from industry and motor vehicles; general growth in the role of motor vehi cles); water pollution; hazardous wastes
	Physical hazards	Traffic hazards. Violence. 'Natural' disasters and their 'unnaturally large' impact because of inadequate attention to prevention and mitigation
	Citizens' access to land for housing	Important influence on housing quality directly and indirectly (e.g. through insecure tenure discouraging households from investing in improved housing and discouraging water, electricity and other utilities from serving them)
	Heat island effect and thermal inversion	Raised temperatures are a health risk, especially for vulnerable groups (such as the elderly and very young). Pollutants may become trapped increasing their concentration and the length of exposure

Context	Nature of Hazard or Problem	Some Specific Examples
City-region (or city periphery)	Resource degradation	Soil erosion from poor watershed management or land development/clearance; deforestation; water pollution; ecological damage from acid precipitation and ozone plumes
	Land or water pollution from waste dumping	Land pollution due to the dumping of conventional household, industrial and commercial solid wastes and toxic/hazardous wastes. Leaching of toxic chemicals from waste dumps into water. Contaminated industrial sites. Pollution of surface water and, possibly, groundwater from sewage and storm/surface runoff
Global	Pre-emption or loss of resources	Freshwater for city pre-empting its use for agriculture; expansion of paved area over good quality agricultural land
	Non-renewable resource use	Fossil fuel use; use of other mineral resources, loss of biodiversity
	Non-renewable sink use	Persistent chemicals, greenhouse gas emissions, stratospheric ozone depleting chemicals
	Overuse of 'finite' renewable resources	Scale of consumption that is incompatible with global limits for soil, forests, freshwater

Source: Satterhwaite, 1999.

5.2 The Urban Growth Phenomenon

ACP-Africa is the least urbanised region in the world, and simultaneously the most rapidly urbanising. Whereas most regions of the world have passed the peak of their rural-urban transition, as have most Caribbean ACP states, many countries in ACP-Africa are just reaching theirs. Their transitions have coincided with rapid population growth, leading to some of the most rapid urban growth ever experienced on such a scale. Occurring at a time of economic distress, this growth has helped create an enormous challenge for urban environments and health.

Whilst it is easy to fault the way in which this challenge is being met, it is worth bearing in mind that during the urban transition in 19th century Europe, and despite large-scale emigration to colonial settlements, urban environmental health nevertheless became a major problem. Urban mortality rates came to exceed those in rural areas by a large margin, and this gap was only eliminated after many decades

of sanitary reform[1] and economic development (Bairoch, 1988). In contrast, and despite the far more rapid urban growth, mortality rates in ACP-Africa are generally higher in rural than urban areas (Mosley *et al.*, 1993). The rural-urban disparity reflects the generally higher economic development in urban areas, including access to education and health services.

Given the demographic dominance of African countries in the ACP, most generalisations that apply to ACP-Africa also apply to the ACP overall, despite the higher urbanisation levels in several small island states, see Table 9.1 in Appendix 2. Between 1980 and 2000, according to UN Population Division estimates, the share of the ACP's population living in urban areas will have increased from 24% to 35%. Overall, urban growth rates are projected to decline from 4.7% per annum between 1980 and 1985, to 4.3% from 2000 to 2005, and then to 3.3% from 2020 to 2025. Such projections are inherently uncertain. Current estimates are also unreliable.[2] Projected urbanisation levels have, for example, been revised downwards in recent years (Satterthwaite, 1996). There are some indications that economic difficulties have stemmed urban growth, but in the absence of even more profound economic disruption or demographic shocks, rapid urbanisation is likely to continue.

Levels of urbanisation vary widely amongst ACP countries. Estimated urbanisation levels in ACP-Africa by the year 2000 vary from 6% in Rwanda to 74% in Botswana, whilst in the Caribbean and Pacific, they vary from 17% in Papua New Guinea to 74% in Trinidad and Tobago. Urbanisation levels are generally higher in the higher income countries, although urbanisation often proceeds even when economic growth falters, as has been the case in Zambia, for example.

Rural-urban migration still accounts for a large share of urban growth in most ACP countries. Most rural-urban migration can probably be explained by better economic opportunities in urban areas, although structural adjustment may have reduced this differential (Becker *et al.*, 1994). Some of the worst urban health problems arise when rural insurgency and famine are the driving forces. Maputo, Luanda, Addis Ababa and Monrovia all received large numbers of displaced people at times when urban conditions were already precarious. Alternatively, urban violence, such as recently experienced in Mogadishu and Kigali, can drive people out of the cities (Simon, 1997). As described in Chapter 2, such migrants are at particular risk from environmental health hazards.

5.2.1 The large cities

It is common in ACP countries for there to be what has been called a 'primate city' - a dominant urban centre with a population at least twice the size of the second largest city. This applies to both small countries like Burundi, Gambia and Togo, and to larger countries such as Angola, Congo, Senegal, Mozambique and Sierra Leone (Aryeeyey-Attoh, 1997). Such cities often dominate the political and economic landscape of the country, as well as providing the main link to the global economy. They typically contain both a large share of the country's wealthy minority and a significant share of the poor.

Despite this tendency towards primate cities, only the metropolitan region of Pretoria-Witwatersrand-Vereeniging, centred on Johannesburg in South Africa, and with a population of more than eight million (the

[1] The late 19th century sanitary movement was in many respects a precursor of the late 20th century environmental movement, but with an emphasis on local environments and health rather than on the global environment and sustainability (McGranahan *et al.*, 1996).

[2] International statistics on urban population are based upon each country's own definitions of what constitutes an urban settlement - and these definitions vary widely. Furthermore, the estimates are often based upon outdated and unreliable information, and hence when referring to the urbanisation estimates for African countries published in 1993 (United Nations, 1993), Rakodi notes that 'of the 53 countries included, only two-thirds had had a census since 1980; figures for 19 were based on censuses carried out in the 1970s and 3 in the 1960s' (Rakodi, 1997a; Rakodi, 1997b).

UN definition of a Megacity), clearly qualifies as a 'World City' within the global economy (Rakodi, 1997b). Lagos is the second largest ACP city, and whilst there is much dispute over its population, even the lowest estimates put it at more than five million.[3] Kinshasa contained more than two million people in 1984, and is often described as having reached four million by the mid-1990s, though here too, the population figures are disputed. Their role in the international arena is not, however, as large as these figures might imply.

South Africa also stands out by virtue of having a large number of major cities. As assessed in 1995, there were 38 cities with populations in excess of 750,000 in ACP countries, of which eight were in South Africa. Of the remainder, 27 were in ACP-Africa and three in ACP-Caribbean. Conversely, 24 African ACP countries, 13 Caribbean, and all eight Pacific ACP countries have no cities at all with a population of over 750,000 (United Nations, 1998).

Large cities, particularly in poor countries, often combine the environmental problems of poverty with those of uncontrolled urban expansion and industrialisation. As a result, their low-income residents often face both inadequate local sanitation and deteriorating ambient air and water quality. These cities do, on the other hand, also typically receive a disproportionate share of infrastructure investment, and their better-off residents often have access to environmental services that are unavailable in smaller settlements.

5.2.2 Smaller cities and towns

Smaller cities and towns are an important, and often neglected, part of the urban scene (Satterthwaite, 1996). There are, as described below, good reasons to believe that some of the worst urban environmental health problems are experienced in these smaller urban centres, although it is the environmental distress of the primate cities that attracts the most attention. These small cities can, moreover, play a critical role in the local economies. If information on the size and development of the larger cities is often inadequate and contradictory, information on the smaller urban settlements is often lacking altogether. A settlement of 5,000 people may or may not be considered urban; depending upon the definition a country employs. Similarly, peri-urban settlements beyond a city's boundary may or may not be considered urban, even if their income derives largely from urban jobs.

5.2.3 Urbanisation – a blessing or a curse?

Views on the costs and benefits of urbanisation have shifted back and forth over recent decades. In the 1950s and 1960s, rural-urban migration was typically portrayed in very positive terms, on the grounds that it increased agricultural productivity whilst simultaneously enabling the inherently more productive urban sector to expand. By the 1970s, the tables had turned and urban bias was increasingly being blamed for undermining rural potential, promoting over-urbanisation, and taking resources away from the predominantly rural poor (Lipton, 1989). In the 1990s, things have shifted yet again, and the dangers of neglecting urban potential, and the rapidly growing populations of poor urban dwellers, have been receiving more attention from both researchers (Becker *et al.*, 1994) and donors (Swedish International Development Cooperation Agency (Sida), 1995).

Irrespective of whether urbanisation is viewed as harmful or beneficial, controlling people's movements to and from urban centres is no solution. Even draconian measures, such as those applied through apartheid in South Africa, failed to control urbanisation directly. More indirect policies, with either an urban or a rural bias, also tend to cause more harm than good. Failing to give new urban residents the means to improve their local environment, for example, is an extremely damaging means of making urban migration less attractive. Alternatively, preventing small cultivators from charging market prices for their produce is an extremely damaging means

[3] Lagos is often cited in lists of the world's 20 largest cities as having a population of between 7-11 million, but the 1991 census suggested roughly five million. The state government considers this to be an under-enumeration, but the higher estimates are largely guesswork.

of keeping the urban cost of living down. Yet at times, both have been pursued simultaneously.

Overall, the quality of urbanisation is more important than its rate, and is more easily improved by better policies and better governance. This is certainly the case with regard to environmental and health concerns. As described in the following sections, there is no inherent tendency for urbanisation and industrialisation to create healthier or less healthy environments. Generally, they herald a change in the environmental and health challenges faced. There are, on the other hand, enormous differences in environmental and health conditions between different settlements, many of which relate to affluence. Even between settlements and neighbourhoods of similar wealth, however, there can be large differences in the environmental hazards to which residents are exposed, and the burdens displaced onto the surrounding environment.

5.3 Urban Environmental Change and Health

The archetypal urban environmental problems are smog, putrid rivers, garbage mountains and other city-wide environmental burdens, and the cities which thus epitomise environmental distress in many people's minds are the newly industrialising megacities. As indicated above, such cities are only found in a few ACP countries, but the urban environmental problems which have historically caused the most ill health are those which are prevalent in many low-income neighbourhoods, regardless of city-size, such as poor sanitation, inadequate water supplies, food contamination, smoky kitchens and insect vectors.

Box 5.1 summarises, in very simplified terms, the changing challenges that cities tend to face as they become wealthier.[4] Environmental problems generally tend to be more localised in poor urban centres and to threaten health in a more direct way. With increasing wealth, however, many of these problems are displaced. Water is transported into the city, serving the households' needs, but placing a greater burden on the regional water system. Human faeces and domestic waste are transported away, removing them from immediate human contact, but creating a large-scale disposal problem. Industrialisation and urban growth can, moreover, exacerbate a range of citywide and even global environmental problems, many of which have health repercussions. But where economic conditions are difficult, it is the local problems that are usually the greatest threat to health. This applies to a large share of the cities in ACP countries, and, in particular, to their low-income neighbourhoods.

The environmental evolution of cities depends upon more than just wealth, however, and whilst economic conditions help determine the environmental challenges a city is likely to face, health outcomes also reflect how well these challenges are met. Stylised curves such as those portrayed in Box 5.1 hide the enormous variation that can exist between cities of comparable wealth. The physical setting and economic functions of a city help determine its environmental qualities, but most importantly, government policies and local initiatives can make a huge difference.

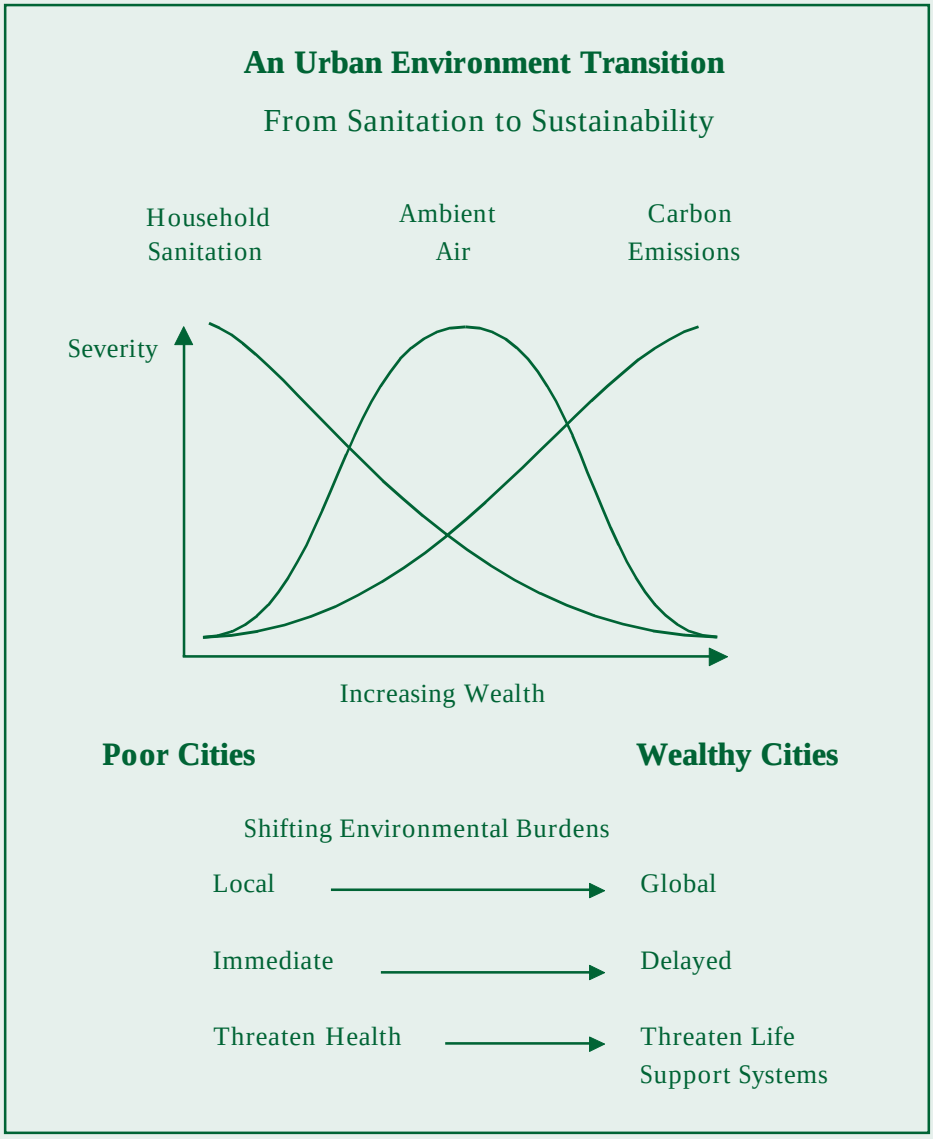
In ACP countries, as elsewhere, environmental management strategies have changed considerably in recent decades. For most of this century, the orthodox response to local environmental health problems has been to provide environmental services, primarily through the public sector. This was the approach that emerged from the sanitary reform of the 19th century, and from piped water to household refuse collection, such services and their accompanying infrastructure became a symbol of development. During the decades after World War II, urban development assistance often focused on infrastructure projects designed to improve urban service delivery. When the Water and Sanitation Decade was initiated in the 1980s, providing

[4] For a more comprehensive account of environmental transformations in cities as they get larger and wealthier, see Satterthwaite, 1997.

Box 5.1 A Stylised Account of Urban Environmental Change, Wealth and Health

Cross-country studies indicate that household sanitary conditions tend to improve with wealth, that concentrations of various outdoor air pollutants increase and then fall, and that contributions to carbon emissions increase. These relationships are summarised crudely in Figure 1. They reflect a more general urban environmental transition that helps to explain some of the large contrasts commonly observed between different cities. Whether one looks at the history of the more affluent cities, or at a cross-section of cities of increasing affluence, environmental burdens tend to become more diffuse, delayed and indirect.

Figure 5.1 Urban Environment Transition.



In contemporary low-income settlements, local environmental problems are a major cause of disease and death, whilst contributions to global environmental degradation remain small. Inadequate household water and sanitation, smoky cooking fuels, waste accumulating in the neighbourhood, pests carrying disease - all are major contributors to ill health and mortality, especially among children (World Bank, 1993). And all

involve closely interrelated local environmental processes. Virtually everyone living, working and socialising in the neighbourhood is at risk, but especially women and children. Low-income settlements may also come to be the worst affected by global environmental damage, but they have immediate concerns which are, and ought to be, the priority for local action.

In contemporary affluent settlements, the most serious local environmental hazards have been displaced or reduced, while existing lifestyles pose major, if often uncertain, delayed and diffuse threats to our life support systems. Waste, once a problem primarily in and around people's homes and workplaces, now interferes with a range of regional and even global processes. High levels of materials and energy consumption and waste generation, selective pressures on distant ecosystems, new hazards arising from technologies developed to meet the demands of the affluent; these are the stuff of the global sustainability challenge. And just as it is hard to live in a deprived neighbourhood in a Southern city and avoid the local environmental hazards, so it is hard to live in an affluent neighbourhood in the North and avoid contributing to global environmental burdens.

Between these two extremes are a range of citywide and regional problems that tend to be most severe in large, industrialising middle income cities. Pollution of ambient air and waterways are typical examples (Shafik, 1995). In cross-country studies, this class of problems has received the most attention, generating the notion of the environmental Kuznets' curve: an inverted U displaying the rise and then decline of environmental burdens with increasing wealth (Grossman and Krueger, 1995; Selden and Song, 1994; Selden and Song, 1995).

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all households with adequate environmental services was still seen as primarily the responsibility of public utilities, particularly in urban areas. More recently, however, the dominant role of the public sector in providing environmental services, and the dominant role of service delivery in improving local environments, have been called into question.

As former colonies, most ACP countries initially implemented restricted forms of environmental service delivery, targeting the colonial enclaves in particular. The early post-colonial period (the 1960s for many ACP countries) was characterised by economic optimism, rapid rural-urban migration, and ambitious attempts to extend planning and public service delivery. Economic setbacks, rapid urban population growth and public sector failures unfortunately undermined these improvement plans, which were probably overly ambitious in the first place. For the most part, and long before services reached all urban residents, it became clear that the local environmental problems could not simply be planned away, and during the 1980s and 1990s, many ACP countries experienced what amounted to a public

service crisis, as described in the *Global Report on Human Settlements 1996*:

> *'The deterioration in the built environment is sharply in evidence throughout most of urban Africa. As more of the urban population was forced into unplanned settlements on the outskirts of large cities, or into more crowded living space in an already deteriorating housing stock in the more established "high density" areas; as a lower proportion of the population had direct access to clean, piped water, regular garbage disposal and good health services, the quality of life for the vast majority of the population deteriorated during the 1980s and 1990s. This trend seems to have been accentuated by the effects of structural adjustment in many countries, according to which urban workers lost more than rural smallholders. Some demographers have even suggested that the decline in mortality rates that was clearly evident during the 1960s and 1970s may have slowed down during the 1980s.'*
>
> United Nations Centre for Human Settlements (HABITAT), 1996.

Whilst there are insufficient data to document the overall state of the local environments in ACP cities, conditions remain critical in most of the poorer settlements, and the goals of the Water and Sanitation Decade (1980s) are still far from realised. The gap between the expansion of service provision and population may even be increasing, in particular in urban areas and it is this coupled with the need for appropriate institutional responses, community involvement and good governance, that is discussed in section 5.4.2 below.

Economic difficulties have had repercussions for other urban pollution problems, such as ambient air and water quality, and which also affect health. The relatively low rate of industrialisation in most ACP countries has presumably meant less growth in a wide range of polluting activities. Less private wealth has also meant less traffic pollution, less urban water withdrawals, and less waste generation. Low-income residents are, on the other hand, particularly susceptible to ambient pollution, and pollution controls remain rudimentary in many urban areas. Where economic growth is the dominant priority and public sector resources are very scarce, there is a tendency to delay the implementation of environmental controls, or to relax enforcement. Whilst some environmental controls may indeed inhibit economic growth to the point where their net health effect is negative, and standards applied in more affluent settings may, therefore, not be appropriate, a general lack of environmental regulation can create some very serious environmental health problems, even where industrialisation rates are low.

The combination of rapid urbanisation, faltering economic growth and public sector retrenchment has also fostered the growth of what is sometimes called the informal economy. Urban residents have done their best to respond to the lack of investment-led economic development, often through small-scale informal activities, ranging from petty trading and household industries to small transport concerns and urban agriculture. Once considered marginal activities awaiting displacement by more formal economic enterprises, the informal economy has been expanding rapidly. (See section 5.6.) From an environmental and health perspective, the growth of the informal economy has important implications. Poorly monitored, and largely unregulated, the informal economy nevertheless plays a critical role in providing livelihoods, particularly for the more deprived urban dwellers, but the informal economy also brings environmental hazards, and a more difficult regulatory challenge than the formal economy. Traditional regulatory instruments are particularly ill-suited to the informal economy, and are more likely to curtail production than to promote more environmentally benign technologies. The health of those who engage in informal activities for their livelihoods is, moreover, easily compromised by economic disruptions. Alternative means of improving the environmental performance of the informal sector are still not well developed,

and this will become an even greater challenge if current urban trends continue. (See Box 5.5.)

Urbanisation is also associated with a range of health problems which, whilst not strictly speaking threats from the physical environment, nevertheless need to be taken into account in assessing urban change and environmental planning. Hence, for example, violence, traffic accidents and mental illness were all identified in Chapter 2 as growing health problems, and all are intimately related to the quality of urbanisation. The different aspects of urbanisation mentioned in the preceding paragraphs are examined in more detail below.

5.4 Environmental Health in the Home and Neighbourhood

As indicated in Chapters 2 and 3, two of the most serious health problems in the ACP are faecal-oral and respiratory diseases, which are especially prevalent in low-income settlements, urban and rural alike. The environmental conditions that facilitate the spread of these diseases tend to be associated with a number of other environmental health problems as well, and rapid urban growth, economic stagnation and public sector retrenchment are combining, in many ACP countries, to undermine traditional approaches to local environmental improvement.

One of the functions of conventional environmental services is to sever potentially hazardous environmental interconnections in and around the home. A conventional water system ensures that clean water is piped into homes, and wastewater is piped out. A conventional sanitation system ensures that faeces are immediately sealed off from air and from insects, and flushed away. A conventional solid waste system ensures that solid waste is bagged, placed in closed containers, and then carted away. And a conventional energy system ensures that wires carry electricity into every room, where it can be cleanly converted into heat, light or mechanical drive. Utilities and municipalities are left to manage the potentially polluting energy conversions, and the disposal of large quantities of liquid and solid waste, but the residential environmental health hazards are greatly reduced.

In poor urban neighbourhoods, where households are not provided with such environmental services, it can be hard to even distinguish between different problem areas. Bad sanitation may lead to contaminated groundwater and faeces finding their way into the solid waste, onto the open land, into the drainage ditches, and generally into contact with people. Flies may breed in the human and solid waste, and contaminate the food. Solid waste may find its way into the drains, causing accumulation of water in which mosquitoes breed. Microbial food contamination makes thorough cooking important, but cooking with smoky fuels may expose women and children to hazardous pollutants. The mosquito coils and pesticides used to combat mosquitoes may add to the air pollution and chemical hazards. Crowding and poor housing can exacerbate most of these problems.

Health problems also interact. In very unhealthy conditions, it can be misleading to attribute a death to a single disease or other cause. Typically, mortality is preceded by a series of health problems, often compounded by malnutrition. The disease which finally leads to death, could often have been overcome by an individual without the recent history of other health problems. Ill health can also have economic repercussions, further reducing people's ability to avoid or withstand environmental health hazards. Box 5.2 illustrates some of the complexities involved in determining the risk factors and the appropriate measures needed to reduce the incidence of childhood diarrhoea.

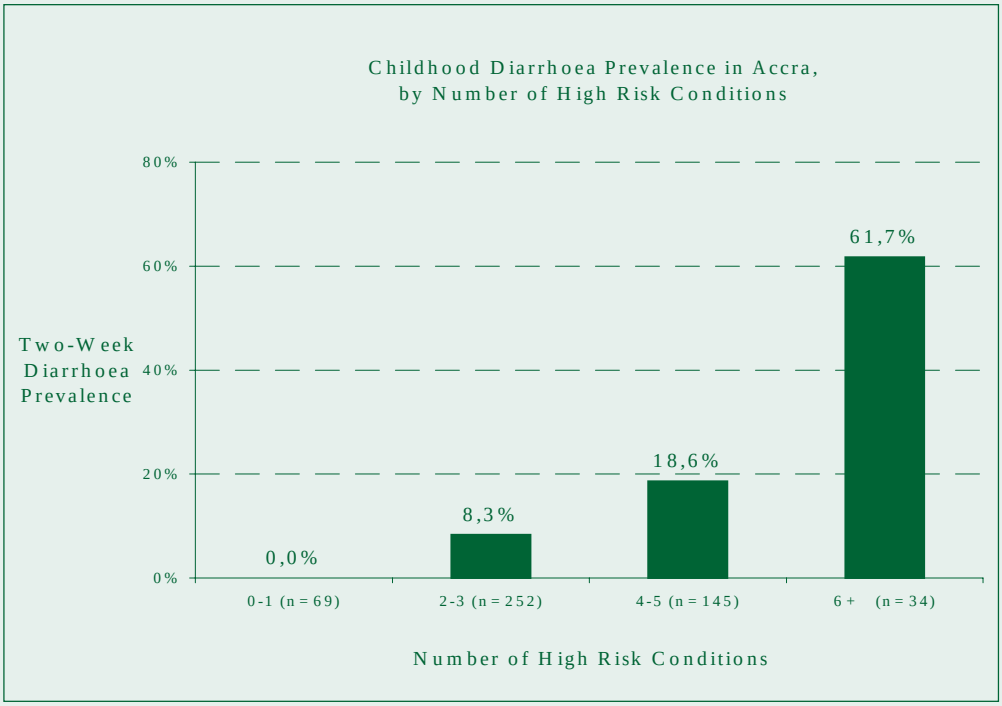
This multiplicity of interactions makes the environmental health problems of poor neighbourhoods very difficult to describe, let alone respond to in an effective manner. At the risk of suggesting that such entwined problems can actually be separated, the presentation below groups the issues around different type of environmental media (just as the presentations in previous chapters grouped by type of disease). Following the discussion of environmental conditions and hazards, there are further sections on some of the underlying institutional and organisational issues, covering obstacles to conventional environmental service delivery and the importance of local institutions and the social context.

Box 5.2 Compounding of Risk Factors

A household questionnaire survey in Accra (Benneh, *et al.*, 1993) provided information on diarrhoea prevalence, along with indications on the type of environmental and behavioural risks the people in the household faced in their daily lives. Overall, 13% of all households with children under six years of age had had at least one child with diarrhoea in the two weeks preceding the interview. Through one of the more common techniques employed by epidemiologists, logistic regression, a simultaneous analysis of diarrhoea prevalence and a number of possible explanatory factors can be made. This was used to identify a number of high-risk conditions:

- Sharing a toilet with more than five other households
- Outdoor defecation by neighbourhood children
- Experiencing water interruptions
- Storing water in open container
- Using a pot for storing water
- Many flies in the kitchen
- Not washing hands before preparing meals
- Buying prepared food from vendors

Figure 5.2 Childhood Diarrhoea Prevalence in Accra, by number of High Risk Conditions.



The risk conditions listed above relate to a number of infrastructural and behavioural conditions. The diagram below shows households grouped according to the number of high risk conditions they face. In the households facing fewer than two of the risks identified, none of their children had had diarrhoea, while most of the households facing more than five of the risks had had at least one child with diarrhoea.

This compounding of risk factors displays the importance of an holistic perspective towards improving health and living conditions in poor neighbourhoods. It may be futile to address only one isolated risk factor and expect an improvement in health. Some of the behavioural factors, however, such as failing to wash hands regularly, could often be substantially improved by, for example, a more reliable and convenient water supply. Educational campaigns, which are relevant to the local context, can also be instrumental in improving hygiene behaviour.

Reference:
Benneh, G., Songsore, J., Nabila, J. S., Amuzu, A. T., Tutu, K. A., Yangyuoru, Y. and McGranahan, G. 1993. *Environmental Problems and the Urban Household in the Greater Accra Metropolitan Area (GAMA) -Ghana*. Stockholm Environment Institute (Stockholm).

5.4.1 Health Threatening Environmental Problems

Water and Sanitation

As described in Chapter 3, various diarrhoeal and other diseases are spread via faecal-oral routes, and these routes are far more accessible when water supplies and sanitary conditions are inadequate. Water can carry many faecal-oral diseases, but is also critical for good hygiene. Washing, even with water that is not potable, can help curb faecal-oral diseases, as well as a variety of other health problems, ranging from scabies to louse-borne typhus. Better sanitation can lead to less contact with faecal material at defecation sites, and less indirect exposure via water, insects, food or human carriers.

Whilst many aspects of the transmission of faecal-oral diseases are well known, even within a given neighbourhood, it is usually difficult to identify the most important routes. The following conclusions, drawn from a recent epidemiological study of five African countries (Bateman *et al.*, 1993), do probably apply, however, to most low income settlements in the ACP, and conform to the results presented in Chapter 3:

- the association between improved sanitation and health is as strong or stronger than the association between water supplies and health;
- health benefits may not be seen with improved water supplies in areas; where the overall level of sanitation is low;
- water supplies should be as close as possible to the point of use to maximise the health benefit;
- health benefits of improved water supply and sanitation services can be seen only if improved services are used - and used properly by the whole family - and are properly maintained.

Where conventional services are lacking, urban water and sanitary facilities tend to be characterised by diversity as well as inadequacy. Households without indoor piping often have to obtain their water from a number of sources, such as overcrowded or distant communal standpipes, expensive private water vendors, heavily polluted wells or open waterways. Households without flush toilets may end up using one of a wide range of alternatives, including pit latrines, pan latrines, or latrines located over ponds, streams, drains or open sewers. Technical improvements are undoubtedly possible, and there has been some success with relatively simple but more hygienic latrines (Franceys *et al.*, 1992; Mara, 1996). Overcrowding, combined with poor maintenance, however, can and often does defeat design improvements. Public latrines are very difficult to manage, and when overused, can become public health hazards. These inadequacies can alter the relative importance of the domestic and public domains of disease, as described in Box 5.3.

Whilst water and sanitation problems give rise to particular problems in urban areas, conditions are often even worse in rural areas, and the growing urban water and sanitation challenge should not be allowed to distract attention from the persistent rural problems.

Box 5.3 The Public and Domestic Domains in the Transmission of Disease

One approach to classifying transmission routes for water-related infections, such as diarrhoeal disease and worm infestations, is to distinguish between transmission within the domestic domain, which includes the area normally occupied by and under control of a household, and the public domain, which includes public places of work, education, commerce and recreation as well as streets and fields. Transmission of infective agents in the public domain may be responsible for large epidemics, and has, therefore, often been the focus of research and intervention. Transmission in the domestic domain is, however, also important in that it may reduce the beneficial impact of water supplies and be the source of spread into the wider community. This classification is useful because different interventions may be necessary to control transmission in the different domains. Intervention in one domain only, such as the provision of latrines to control hookworm, may be insufficient to control the disease, in that it has little impact on transmission in the public domain, e.g. through open defecation. Multi-faceted interventions may, therefore, often be necessary.

A study in north-eastern Brazil demonstrated the significance of the different domains very clearly, showing that the transmission of intestinal worms decreased as community sanitation improved, but that the clustering of cases by households increased. The researchers concluded that in communities which lack sanitation, most of the transmission is unaffected by the characteristics of the household since it takes place in the contaminated public domain. As sanitation improves, thus decreasing contamination in the public domain, transmission within the domestic domain becomes more important. In other words, the specific characteristics of households may predispose their members to infection. The study also showed that environmental sanitation prevents transmission of diarrhoeal disease, mainly in children in excess of one year of age, as they are more likely to play in the contaminated public domain. For infants, most transmission occurs in the domestic domain, and is, therefore, less influenced by improvements in public domain sanitation. The relative importance of the two domains in the transmission of disease appears to vary from setting to setting and disease to disease. This may reflect both differences in hygiene behaviours and levels of contamination of these domains across different settings and the natural history of the diseases and their transmitting organisms.

There are political implications to the debate on the importance of the domestic and public domains in disease transmission. The public domain is a matter for public concern, and public regulation or interventions, such as drains and solid waste collection, can be used to reduce transmission that occurs there. The domestic domain, however, is private and transmission in that domain is largely the result of household behaviour, which is less amenable to public regulation. Health promotion interventions which aim to change household behaviour, and interventions which facilitate those changes, such as the provision of an adequate water supply within the household, are important in terms of controlling disease transmission in this domain. To achieve the greatest impact on disease transmission, however, interventions tailored to both domains must be developed and implemented.

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Food Contamination

Food, like water, can transmit infectious diseases and harmful chemicals. Infectious bacteria can multiply in food, and some of the bacteria and fungi that grow on food produce toxins. For viruses, protozoa and helminths, food acts primarily as a carrier. As with water and sanitation, the major health burden arising from food contamination is almost certainly its contribution to the diarrhoea and dysentery that figure so highly in the morbidity and mortality of children in the low-income countries. The extent to which food contamination is involved in the spread of these diseases is, however, poorly understood. Most faecal-oral diseases can be borne by food, but monitoring exposure to contaminated food is far more difficult than for water, and there are no clearly identifiable food practices or facilities through which one could expect to capture a major part of the variation in food quality. Epidemiological studies give little indication of the relative importance of food contamination, and one of the few attempts to estimate indirectly the incidence of diarrhoea involving food contamination gave a strikingly wide range: 15% to 70% (Esrey and Feachem, 1989).

Food contamination can occur within the home. Food handling and storage practices are critical, and the dangers of contamination are greater, given inadequate water and sanitation. Washing hands before food preparation and avoiding contact between food and flies are two obvious examples of preventive measures in the home. They are also practices that are easier, though less important, in homes with good water and sanitation facilities.

Food contamination is a problem in both urban and rural areas, but can take somewhat different forms. In rural areas, where subsistence agriculture is practised, the delay between food production and consumption evolves from the need to store food seasonally, and food handling is largely under the control of the consumer. In urban areas there is also a delay stemming from the need to transport, process and market food before it is obtained by the consumer. More importantly, in urban areas, it is difficult for the consumer to monitor food handling which takes place before the food is purchased. Finally, some urban consumption patterns can create food contamination problems. In a study of Monrovia (Molbak *et al.*, 1989), it was found that most urban (slum) households stored prepared food, and that 63% of the stored food samples were contaminated with enterobacteria (83% for baby foods). Rural households, on the other hand, were less inclined to store cooked food, and only 39% of their food samples were contaminated. These problems tend to be exacerbated when women, who carry out most of the domestic labour with relation to cooking, face severe time constraints, as they commonly also need to earn most or parts of the household's income.

Air Pollution from Domestic Sources

There are three major health risks which have been associated with the domestic use of polluting fuels (Chen *et al.*, 1990). Firstly, pollution from domestic fuels may facilitate the spread of acute respiratory infections by irritating the respiratory passages, and possibly in other ways too. Secondly, exposure may contribute to chronic obstructive lung disease, a significant health problem among adult women. Thirdly, long-term exposure is a risk factor for cancer. Studies of personal exposure and indoor air pollution levels indicate that, whilst considerable variation does exist, many users of smoky fuels are exposed to disturbingly high levels of particulates and other pollutants (Smith, 1993). Epidemiological evidence is slowly accumulating, and seems likely to confirm that domestic fires can contribute significantly to all three of these health problems.[5]

[5] Indoor air pollution can be particularly hazardous to health because it is released in close proximity to people. The 'rule of 1,000' states that a pollutant released indoors is 1,000 times more likely to reach people's lungs than a pollutant released outdoors (World Health Organization, 1997).

As with water and sanitation, the extent to which ill health is actually caused by exposure to domestic smoke is difficult to calculate. Cancer and chronic respiratory problems are likely to be the consequence of long-term or past exposure, which is hard to assess. There are many other risk factors for respiratory infection and they tend to be interrelated: crowding, poor ventilation, malnutrition, poor sanitation, lack of immunisation (Berman, 1991; Graham, 1990). There are also other sources of domestic air pollution that may relate to respiratory illness, such as mosquito coils, waste burning and smoking. Generally, the women and children who are more exposed to air pollution from domestic fires are also likely to be more exposed to other environmental hazards that also contribute to ill health.

Household fuel choice is often described as an energy ladder, with fuels such as crop residues and firewood at the bottom, followed by charcoal, kerosene, LPG and, finally, electricity (McGranahan and Kaijser, 1993; Smith *et al.*, 1994). Generally, the higher up the ladder, the less polluting the fuel. Since smoke can be unpleasant as well as unhealthy, and the less polluting fuels are more convenient for most purposes, they are usually favoured by wealthy households who can afford to switch. There is also a rural-urban dimension to the ladder, with crop residues and firewood being more readily available in rural areas. Also, fuelwood smoke is more likely to have beneficial side effects, such as controlling insects in thatched roofs, in rural areas.

Whilst wood is less common in cities, it is often used in peri-urban areas, and many ACP cities do have a fuelwood market. Charcoal has long been a characteristic urban household fuel in many ACP countries, and urban households in a number of countries also use coal. In terms of respirable particulates, which probably represent the major health risk, charcoal is considerably less polluting than wood, although carbon monoxide exposure may be higher, as indicated in a study of Lusaka (Ellegård and Egnéus, 1992). Coal emissions are closely related to the type of coal used, but research in South Africa indicates that they can be relatively high in terms both of particulates and carbon monoxide (Terblanche *et al.*, 1993b). Studies of coal use in China have produced some of the most convincing evidence of a link between domestic fuel use and cancer (Smith and Liu, 1993), and indeed, coal occupies a somewhat ambiguous place on the energy ladder, sometimes being viewed as a step up from charcoal, even though the associated health risks can be greater.

In many ACP countries, cooking with smoky fuels is primarily an outdoor activity, even in urban areas, presumably with the aim of lowering exposure levels. Poor households living in crowded conditions can create specifically urban problems, however, in that a large number of domestic users of smoky fuels can create a neighbourhood air pollution problem, and even contribute to citywide problems. Comparisons of particulate exposure amongst children in South Africa indicate that the electrification, or otherwise of the neighbourhood, and perhaps even whether their school is in an electrified neighbourhood, can make a significant difference (Terblanche *et al.*, 1993a).[6] This implies that, as with water and sanitation problems, it can be difficult for households in crowded areas to protect themselves individually from exposure to pollution from domestic fires.

Pests

Most pests are more common in rural areas, where there are also far greater variety of habitats and species. (See Box 3.3 Infectious Agents and Irrigation, and Box 4.6 Changing forest land use and its impact on disease vectors.) The opportunities for controlling insect vectors are generally greater in urban areas, but this fact notwithstanding, there are

[6] It should be noted, however, that where the unit cost of electricity, or electric appliances, is high, most households will continue to cook with smoky fuels, even if electricity is available in the neighbourhood.

mosquitoes and flies which have adapted well to particular urban habitats, and find themselves relatively free of competition (Lines *et al.*, 1994). Some of them are disease vectors. As indicated in Table 5.2, several pests play a role in transmitting a range of diseases, and this is particularly true where sanitary conditions are already problematic.

Mosquitoes breed in standing water. Water in towns tends to be either polluted or in containers, rendering it a less suitable breeding site for most mosquito species, including those that spread malaria. As species adapt and migrate, however, the urban advantage can be lost. In African cities, the most important breeding sites are a by-product of urban cultivation, though there is some evidence of malarial mosquitoes breeding in urban household water containers (Chinery, 1990). Moreover, other species, such as those

Table 5.2 Selected Vectors and Related Diseases.

Vector	Breeding Environment/Primary Means of Transmission	Disease
Cockroach	Requires a source of moisture for survival. Feeds particularly on refuse and human food. Spreads potentially pathogenic material adhered to its feet and body, as well as through its faeces and fluids regurgitated whilst feeding.	Mechanical carrier of enteric infections (food poisoning)
Housefly	Larval stages associated with decomposing organic matter of all types. Feeds on human food, faeces and refuse. Spreads potentially pathogenic material adhered to its bristles, body surface and taken up by the tiny hairs on its foot pads. Deposits particles from its body while it preens, or from its feet as it walks over food, and from indiscriminate defaecation.	Mechanical carrier of enteric infections (food poisoning)
Mosquito: *Anopheles*	Breeds in fairly clean, slow-moving brackish/fresh water, such as irrigation water, ponds, and marshes. Feeds at night.	Malaria, Filariasis
Mosquito: *Aedes*	Breeds in clean fresh/salt standing water, such as water pots, cisterns, small containers, and temporary pools. Feeds day and night.	Yellow fever, Dengue, Filariasis
Mosquito: *Culex*	Breeds in fresh or salt water polluted with organic matter, such as pit latrines, clogged storm drains, open sewers, waste stabilisation ponds or soakage pits. Feeds day and night.	Filariasis
Snail	Breeds along river/lake banks or irrigation/drainage canals. Worm eggs in excreta develop into larvae (miracidia) and infect snails; snail eggs hatch into larvae (cercariae) that penetrate skin; larvae need to find host within 6-48 hrs.	Schistosomiasis (Bilharzia)
Rodents (rats)	Breeds and feeds in uncollected solid waste and in waste disposal sites; urine and faeces can spread disease, through direct contact or ingestion	Leptospirosis (Weil's disease) (Plague via rat fleas)
Water flea (Cyclops)	Breeds in small freshwater ponds; causes ulcers on leg/foot, from which worm sheds eggs that develop into water fleas (copepods) that people drink	Guinea worm (Dracunculiasis)

Source: Based on (1) Burgess, 1990 and (2) Listorti, 1996.

responsible for the spread of dengue fever (primarily an urban disease), are already well adapted to urban water containers.

Just as urban mosquito problems are intimately linked to water, urban fly problems are linked to waste. Various families of flies have adapted to the urban environment. The most obvious health risk they pose is that they provide possible short cuts on faecal-oral routes. The housefly, along with several other species, is a filth feeder and breeder. Given poor sanitation, some flies are likely to be in contact with human faeces and will later land on human food, drink or skin. Open, uncollected piles of garbage increase the fly populations by providing breeding sites, whilst open food preparation areas, and especially food stored in the open, provide opportunities for flies to land on food. Where the risks are already high, flies are particularly likely to increase the prevalence of the diarrhoea and dysentery often associated with bad water and sanitation (Levine and Levine, 1991).

Some of the measures taken to control insects and other pests create their own environmental health problems: mosquito coils, and other substances burned to repel insects, cause air pollution, whilst indoor spraying with aerosols and pump sprays exposes residents to potentially damaging pesticides. The health risks of such measures can outweigh their sometimes minimal effect on the spread of vector borne disease. Mosquitoes and other disease vectors are, furthermore, developing resistance to insecticides, including those applied in many government programmes. All this points to the importance of controlling breeding sites - a form of environmental management that should be far easier in urban rather than rural areas.

Solid Waste

Solid waste is a more intractable problem for urban than rural dwellers, at least where removal services are lacking. Most domestic solid waste is not a direct threat to health, but local accumulations can quickly become unpleasant, a nuisance and a threat - at least indirectly - to health although it contains few hazardous chemicals in comparison with industrial waste. Faecal matter is, however, often mixed with domestic waste, especially where disposable diapers are used or sanitary facilities are scarce, although if kept in closed containers and removed regularly, the health risks and unpleasantness to local residents are minimal. Even within and around the home, the more serious solid waste problems involve inadequate disposal, and accumulation of waste, which attracts pests, blocks the drains or otherwise degrades the local environment.[7] The two groups most directly exposed to solid waste and its health hazards are children and waste pickers.

Both the quantity and composition of waste varies with wealth. Not surprisingly, wealthy households tend to produce more waste, and much of the additional waste comprises non-compostable materials such as paper, glass, metal and plastics (Cointreau, 1986). It is in low-income areas, however, that problems of removing waste are most severe. Door-to-door waste collection is too expensive for many households or municipalities to afford, and the streets of many poor neighbourhoods are, in any case, too narrow for vehicles. Collection points can easily become small garbage dumps, especially when collection is intermittent. Public budgets have been under great pressure in many ACP countries, and waste collection is often among the services to suffer most (Stren and White, 1989). Indeed, solid waste often creates one of the most visible environmental challenges in low-income communities.

Other Household and Neighbourhood Environmental Problems

There are a number of environmental problems that people encounter in and around their homes in addition to those described above.

[7] Accumulation of decaying waste provides a breeding ground for flies and other insects. *Aedes* mosquitoes, the vectors of dengue fever, can breed in rainwater that collects in empty containers. Rats can feed on the refuse, and this may increase the risk of rat-related diseases such as plague. And in tropical cities, when the rains come, the waste can block the drains leading to flooding and accumulation of water where other mosquitoes can breed.

Some, such as ambient air pollution from non-domestic sources, are better classified as city-wide problems, see section 5.5.3. Cooking and lighting may also pose a fire hazard – exacerbated by dense housing. Furthermore, many environmental problems arise because low-income residential areas are situated in unsuitable areas. The land in these areas is often inexpensive for good reasons, some relating to environmental conditions. The location of many disadvantaged settlements is, moreover, determined not through planning or market forces, but through a lack of planning or efficient markets. People settle where there are no well-articulated plans or ownership patterns. Such land may be located on steep, unstable slopes or in flood prone areas, thereby creating various health risks. Polluting industries are, moreover, less likely to encounter resistance from already disadvantaged residents.

A number of very serious local environmental problems also arise from inadequate housing itself. One of the roles of housing is to protect inhabitants from natural environmental hazards, such as rain and excessive heat or cold. At times, inadequate housing not only fails to fulfil this role, but also creates new environmental problems through excessive crowding, indoor damp, and concentrations of pollutants. Such problems can be greatly exacerbated when, as is common in many low-income settlements, the home is also a commercial workplace. Women are often forced to combine childcare with economic activities in the home, ranging from commercial cooking to cottage industries. The risks depend upon the nature of the activity, and remain poorly documented. It is likely, however, that there are many locations where the juxtaposition of small-scale industry and housing create extremely hazardous conditions.

The materials of which the house is built may also constitute a danger for its residents. Asbestos has, for example, been used in developing countries for several decades, often as roofing material for low-cost housing and schools. Asbestos dust may be produced during inadequately controlled repair or demolition activities. The impact on health in developing countries is, however, poorly documented (World Health Organization, 1997). Results emerging from a recent study in Soweto, South Africa, however, showed 43% of the studied population living in houses with asbestos roofs. The majority of these houses were over 20 years old and most of them had no ceilings. Many of them were, furthermore, in a state of disrepair. A small proportion of the people had undertaken repairs themselves, most probably without protective gear. The majority was unaware of any harm having been caused to their health.[8]

Policies to improve situations like these need to be carefully designed in order to actually improve housing conditions. Straight-forward prohibitions, without any provision of alternatives for better (or cheaper) materials can be counterproductive. Regulations in combination with alternatives and increased awareness of the risks can help people make better-informed choices and undertake protective behaviour. The possibilities for improving health through better housing is explored in Chapter 7.

5.4.2 Institutional Aspects of Environmental Health Problems in Low-Income Neighbourhoods

A review of actual and anticipated progress in water and sanitation provision indicates that even the provision of 'safe' service levels is falling behind. Official statistics collected from 39 ACP governments indicate that, in the early 1990s, eight ACP countries, namely Benin, Chad, Guinea, Guinea-Bissau, Lesotho, Mali, Niger, Zambia and Haiti, reported that half or more of their urban dwellers did not have 'convenient' access to safe water supplies. Similarly, 10 ACP countries reported that more than half of their urban residents were without 'adequate' sanitation, namely Angola, Burkina Faso, Guinea-Bissau, Lesotho, Madagascar, Malawi, Mauritania, Sierra Leone, Somalia and Haiti (See Table 7.4 in Appendix 2). Moreover, in all but five of the countries, at

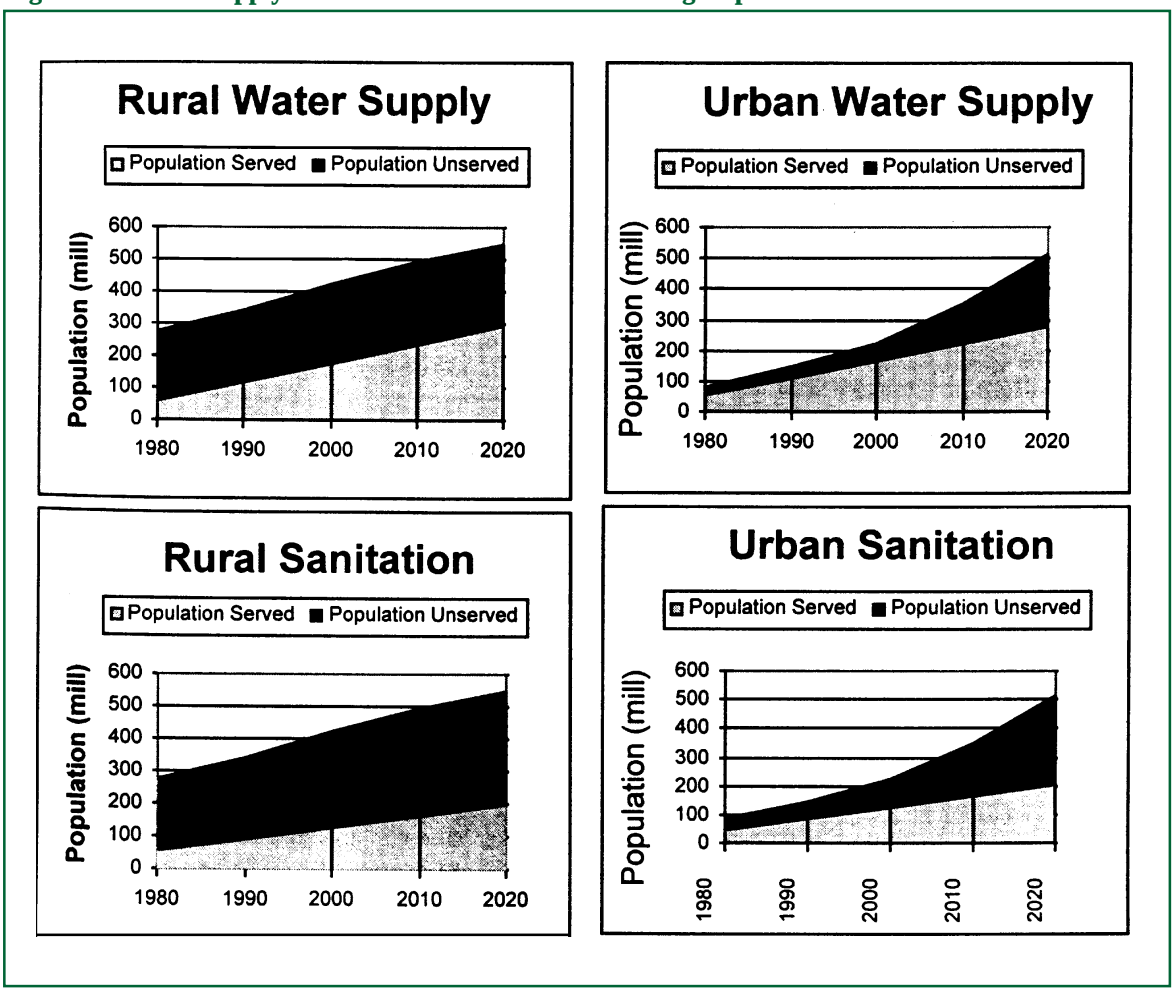
[8] Personal communication, Angela Mathee, South African Medical Research Council, May 1999.

least 10% of urban dwellers were identified as without either adequate water or sanitation. And such statistics probably underestimate the severity of the problems (Satterthwaite, 1995). Figure 5.3 projects the water and sanitation coverage in urban Africa into the future, assuming that the rate of service expansion reported during the Water and Sanitation Decade (1980s) continues into the future. A similar picture would almost certainly emerge for the ACP countries, taken as a whole. Whilst such assessments of water and sanitation coverage are inherently uncertain, and hide considerable variation, they clearly illustrate the difficulty in relying on public sector service provision, particularly where economic difficulties and public austerity persists. There is a serious danger that a growing gap is emerging between the need for urban water and sanitation and its provision. Much the same picture would also be likely to emerge from an analysis of other services. Indeed, solid waste removal is often one of the first services to suffer when public funding is cut, and while comparable statistics are not available, they would probably indicate an even larger gap.

Obstacles to Conventional Environmental Service Delivery

It is common to attribute most of the local environmental problems described above to a lack of infrastructure and services. It is also often argued that whilst the provision of these services has traditionally been considered the responsibility of the public sector, progress is now best achieved through the private sector. Both of these views are, however, somewhat at odds with the local environmental challenge developing in many

Figure 5.3 Water Supply and Sanitation Services – a Growing Gap.



Source: Sharma, N. P. 1996. *African Water Resources.* World Bank Technical Paper No. 331. p.19.

ACP cities. Whilst better service provision is undoubtedly needed, given the level of coverage that can realistically be achieved in the foreseeable future, additional means of improving conditions in unserviced settlements clearly need to be found. Moreover, whilst public services are in crisis in many countries, the private sector is not able to adequately fill the gap.

Some of the main service categories are listed below, along with three examples for each type, in descending order of capital cost.

- **Piped water systems**: providing safe (quality) drinking water and sufficient (quantity) water for washing.
  - Household connections;
  - Yard taps;
  - Public standpipes.
- **Sanitation systems**: ensuring human faeces are removed from the living environment.
  - Flush toilets;
  - Ventilated improved pit latrines;
  - Bucket toilets.
- **Clean fuels**: preventing smoky fuel combustion in the home.[9]
  - Electricity;
  - Kerosene;
  - Charcoal.
- **Garbage collection**: preventing the accumulation of waste in residential areas.
  - Daily door-to-door collection;
  - Weekly door-to-door collection;
  - Local collection points**.**

Typically, the more capital-intensive options transfer most of the responsibility for the service provision to the utility. Users merely have to turn a tap to get water in their home, turn a lever to flush faeces away, turn a switch to get heat for cooking and space heating, and fill a container outside the door to dispose of solid waste. Drains and cleaning services ensure that water and waste do not accumulate on public land.

The less capital-intensive services typically involve a far higher level of resident involvement. Effective use also requires a far greater understanding of the environmental health risks involved. Even if water is uncontaminated at the source, it is difficult to maintain this quality if it is drawn from a public source, transported home, and stored in containers designed for other purposes. Washing hygienically with a few litres of water requires far more care than with running water. Maintaining, and even using, a pit or bucket latrine hygienically is far more difficult than with a flush toilet, especially when water is not available at the site. Much the same applies to the other services.

Capital intensive service provision can bring new environmental challenges. Urban piped water systems increasingly place a burden on already strained water supply systems: sewage is often released untreated into waterways, electricity generation often leads to a range of environmental problems, depending upon the resources and technologies employed, and in many cities, landfills are little more than open dumps. As discussed in Chapters 3 and 7, however, the health benefits of providing reliable services can be substantial, and in any case, environmental constraints are rarely the reason for the lack of services. With respect to water, for example, provision is frequently inadequate in cities with extensive water resources, and even where resources are scarce, providing low income households with sufficient water to meet their health needs is unlikely to make a large difference to overall demand. The quantities of water required to achieve health are small in comparison with typical water demands for other purposes (World Resources Institute, 1998).

The past two decades have witnessed numerous attempts to privatise service delivery, in ACP countries as elsewhere. This is partly an aspect of a more general shift towards market-based economic management, and partly a response to specific failures in public service provision. The failure of the public sector has often

[9] Notwithstanding, 'cleaner' fuels provide no protection against accidents.

been taken as a justification for shifting responsibility to the private sector. In particular, it is often claimed the failure of public and other price-controlled utilities to expand the water system has created a situation where people who would be willing to pay the full cost for a better service end up having to rely on distance sources or expensive vendors (Serageldin, 1994). Evidence for this phenomenon, which appears to be common in many ACP countries as well as large parts of Asia and Latin America, comes principally from two sources:

1. The high prices that low-income urban dwellers often pay to obtain water from informal vendors who have emerged to fill the service gap, but do not have the capital or legal basis to extend the piped system.

2. The results of 'contingent valuation' surveys, which indicate both urban and rural dwellers' willingness to pay for better water and sanitation services, even if they are on a low income.

As indicated in Box 5.4, however, the private sector is also prone to failure, and a private utility will also tend to under-provide environmental services in low income areas, unless it is well regulated. It is thus generally accepted, even by strong advocates of privatisation, that there is still an important role for the public sector in ensuring that public health goals are pursued, that monopoly pricing does not result, and that environmental burdens are not merely displaced.

The practice of privatisation has, in any case, not conformed to any simple model of private sector involvement. A recent review of the privatisation of services in East Africa found that numerous players have, in addition to private companies, been playing a growing part in service provision (Semboja and Therkildsen, 1995). Non-governmental organisations (NGOs), community-based organisations (CBOs) and various levels of government have also helped to create some of the more successful attempts to meet local service needs. There is, furthermore, a critical need for community involvement,

Box 5.4 Institutional Failures in Environmental Service Delivery

To some degree, the health hazards so prevalent in low-income settlements, in the ACP as elsewhere, are simply the environmental face of unacceptable economic poverty. People who cannot afford adequate food, clothing and other basic necessities, cannot be expected to afford a safe living environment. Environmental health is not an easily marketed good, however. Services such as piped water, garbage collection, and sanitary systems can, up to a point, be packaged and sold. Such services, however, only go part of the way towards resolving local environmental inadequacies, and in some cases displace environmental burdens onto the broader environment. Equally importantly, the public sector, the private sector, and the local communities themselves, are all prone to their own particular failures if they are relied on to provide environmental services. A recognition of these weaknesses can help in the pursuit of sound partnerships that build on the strengths of the different sectors. Whilst many problems are specific to a particular settlement, there are some common failures that arise.

Public Failures

The conventional public sector response to environmental health hazards in deprived settlements has been to try to provide affordable environmental services. Contradictory political pressures and bureaucratic inefficiencies often prevent effective service delivery, however. A public utility will often be required to keep prices low, but not be given sufficient funds to cover the costs of extending the services. A typical outcome is subsidised (but often poorly maintained) services for wealthier residents, and a

utility so financially constrained that it cannot extend services to low income areas. A perverse, but not uncommon, result is for poor households to end up paying higher prices for sub-standard services. Moreover, public utilities generally adopt standard operating procedures appropriate to conventional service delivery, and find it difficult to adopt to lower cost, locally adapted solutions.

Private Failures

Whilst public failures have helped motivate attempts to shift responsibility for environmental service delivery to the private sector, the market, too, suffers serious problems as a mechanism for meeting local environmental needs. Environmentally sound sanitation, waste removal, pest control and even clean water provide public benefits to the neighbourhood, and even beyond, but it is not possible for a household to protect itself effectively from local health hazards by purchasing environmental services unless other households do likewise. According to conventional market economics, therefore, the private provision of environmental services will tend to be inadequate. These inadequacies are compounded when monopolies develop (due to increasing returns to scale, for example), or the inadequacies are difficult to perceive (such as the imperceptibility of pathogen transmission).

Failures of Local Collective Action

Local communities, especially in low-income areas, are increasingly called upon to take a lead in solving their own local environmental problems. Most low-income neighbourhoods are clearly not in the position to organise conventional environmental service delivery, but even in terms of their local extension and management, they have a number of common failings. Local communities are rarely homogenous or particularly harmonious, and conflicting interests often arise. Even if they can reach verbal agreement on what needs to be done, they rarely have the right to enforce this agreement should some residents decide to opt out. Moreover, the boundaries of the environmental health burdens rarely correspond to those of any well-defined community, and whilst local residents may have a far better understanding of many aspects of their local environmental problems than outside experts, they are typically in a weak position in relation to external suppliers and some of the more technical environment and health issues.

particularly where services are not provided to individual households. Among the relevant services, water and clean energy provision come closest to providing a private good, and even water in isolation provides public health benefits to the communities on the receiving end. The benefits of good sanitation, drainage and waste removal benefit the community at large to an even more obvious extent.

There are several reasons why sanitation and drainage often lag behind water developments (Kolsky, 1992). The boundaries of responsibilities of different institutions and organisations are related to the issues of public and private benefits - Box 5.5 provides an example of on instance where a successful doubling of water consumption levels created problems because the institution legally responsible for draining away the additional wastewaters was not involved. Over and above this type of boundary problem, there is also the issue of capacity within the responsible institutions, and the fact that the capacity to act in a coordinated manner can also be problematic for social institutions, such as the family. Local institutions, in relation to gender and housing security, are described in the following section.

Box 5.5 Water and Waste: the Need for Integrated Programmes at the Local Level - A Case Study from Djenné, Mali

Djenné is a small Sahelian town in Mali, located on a tributary of the Niger River, upstream from Timbuktu. The two settlements have strong historical ties: in the past, camel caravans ensured a vibrant trade between them and both share the same Sahelian architecture – square adobe structures plastered with mud in colours from ochre brown to light grey – that warranted the designation of Djenné as a UNESCO world heritage site.

Though surrounded by water, Djenné's 15,000 inhabitants recognised the need for improved access to a potable water supply, especially in times of cholera. They were eager to take part in a programme initiated by National Water Directorate with the help of a bilateral support agency. Ageing pipes, pumps and generators were replaced and a larger water tower was designed to blend with the local architectural style. Under the new system, management responsibilities are shared between volunteers of the Water User Association and professional managers based in the capital city of Bamako. The arrangement has yielded encouraging results. In the four years since the initiation of the programme, for example, daily per capita water consumption in the town has doubled to 12 litres. After operating costs, the total savings are enough to eventually replace ageing parts and renew equipment.

Problems have, however, also arisen. An improved water supply, coupled with higher consumption, and in the absence of adequate and concomitant provision of wastewater disposal, have lead to increased environmental pollution. Water is not drained away from the public standpipes, and the surrounding areas consequently become muddy and provide breeding grounds for flies and mosquitoes. The same stagnant pools of water are also undermining the foundations of the old adobe buildings of the town that are a major tourist attraction and an important source of revenue. Clearly, improvements in water supply need to go hand-in-hand with improvements in wastewater disposal, in order to minimise public health risks and protect the cultural heritage of Djenné. But what local processes exist to ensure this occurs?

Local government bodies, called *communes*, bear the legal responsibility for co-ordinating, contacting and controlling the actions of the water user association, local health association and tourist authorities. Communes could engage stakeholders in a broad-based planning exercise and follow through on a *local environmental action plan*, but to orchestrate such a concerted effort requires skills such as mediation, communication, planning and monitoring that most often do not exist at the local level. By building this kind of capacity at local level, governments and external agencies could support and enable the local governance processes needed to ensure that essential environmental interventions do not have unexpected, and sometimes harmful, spin-offs.

Contributed by Marc Vézina, International Water and Sanitation Reference Centre (IRC) The Hague, The Netherlands.

Local institutions: their role in environmental management

Local institutions are far more critical to environmental management where services are lacking than is the case in areas where there is comprehensive coverage. As noted above, the less capital-intensive technologies demand a far more sophisticated understanding of environmental processes and health risks on the part of the users. Far more cooperation and informal regulation is also required when, as is often the case, the

services (such as water taps, toilets, waste collection) are provided collectively rather than to individual households. More generally, in the absence of environmental services, the problem is not so much one of technology management as of managing without any well-defined technologies.

The relevant institutions extend from comparatively formal community-based organisations to informal arrangements. The household itself is a critical institution which is often at the centre of much local environmental management. Land tenure institutions or, more generally, housing security, can make a large difference to the incentives for local environmental improvement. Institutional relations also develop between residents and the governmental or non-governmental players who provide the services that do exist. These and other local institutions can either help or hinder people in pursuing their environmental and health needs. Capacity building within the different institutions is important, but it is also important to improve collaboration and understanding between institutions at different levels.

If it is difficult to document the changing trends of environmental service delivery, it is far harder to document the changing institutions in under-served areas. Their evolution is, nevertheless, critical to local environmental and health conditions in cities. When 'top-down' approaches to local environmental management were the prevailing orthodoxy, local institutions could be ignored, even if, in practice, they played an important role in determining whether the approaches succeeded. If local residents are meant to become leading partners in improvement efforts, however, it is obviously critical to take these local institutions into account. Three particularly important aspects of the local institutional context are gender, housing security and the relationships with service providers.

Gender

Internationally, there is a great deal of discussion of how to empower women to enable them to meet their own needs and to achieve broader development goals. In the urban context, local environmental management is central to any such endeavour. Women typically play a far more active role in environmental management in and around the home than men. They also tend to be more exposed to environmental health hazards. Men, on the other hand, tend to dominate environmental service organisations and, in many cases, the local organisations that become involved in environmental management. Men may also have a disproportionate influence over the household budget, including expenditure on clean fuels, sanitary facilities and other protective devices. Gender relations thus influence local environmental management, and changes that give women greater influence should yield environmental benefits. Gender conflict can, on the other hand, easily undermine attempts to improve environmental and health issues, and unsuccessful attempts to give women more influence can be detrimental on all fronts.

Gender-related conflicts over local environmental management arise in and around the home on a daily basis, and the health of the residents depends to a very considerable degree on the way in which they are resolved. A study of gender, local environmental management and health in Accra, where compound housing is common, found that environmental inadequacies in and around the home posed a serious threat to health, primarily for children (both male and female), but that they primarily constituted a labour burden for adult women. It was almost exclusively women who managed the compound housing environment, but changing gender relations were beginning to be perceived as a threat by men (Songsore and McGranahan, 1998). Women were more inclined to resent this labour burden when the men were not fulfilling their traditional economic roles.

As mentioned above, women tend to be more exposed to environmental health hazards in and around the home. This is partly a consequence of the fact that women, as well as children and the elderly, tend to spend many more hours in and around the home area (Benneh *et al.*, 1993). Women's higher exposure is also a consequence of their disproportionately larger responsibilities for cleaning, cooking and

caring for the sick. For example, women often clean shared toilets, which potentially exposes them to pathogens contained in faeces. Cooking with smoky fuels also heightens the risk of respiratory infections, both for the women and for the small children who are often together with their mothers while cooking (Songsore and McGranahan, 1998).

Despite the attention that has been devoted to gender issues in recent years (particularly by development assistance agencies), a great deal remains to be learned about how to take gender into account when designing policies. Conventional service delivery often fails to take women's views into account, and these views are particularly important when service levels are low. Perhaps more importantly, however, there is a need to empower women who manage the local environments, especially when adequate services are not going to be made available.

Housing Security

It is often observed that residents are more inclined to invest in a better home environment if they can be confident that they will benefit from their investments, and will not be displaced, without compensation, after the improvements have been made. And just as residents in insecure housing often want to avoid investing in environmental infrastructure and management, governments often want to avoid providing environmental services to settlements considered illegal. Since much of the rapid urban growth in ACP cities is taking place in an unplanned fashion on unsurveyed land, housing insecurity is a common problem. It is often complicated by the simultaneous application of different tenure rules in different spheres of society. Whilst freehold and leasehold tenure are favoured by many governments, in practice, a wide range of tenure systems operate, often including traditional systems developed in rural settings, but nonetheless applied in urban areas.

Housing security is important to the environmental management of the neighbourhood, as well as to more individualised improvements, and can be an important issue, even where private tenure is regularised, in that a good neighbourhood environment raises the value of the housing. Owner-occupiers typically have housing security and benefit directly. Tenants, on the other hand, may have to pay the price in the form of higher rents, or may even face eviction. Owner-occupiers thus have a more immediate incentive than tenants to join in collective efforts to improve local conditions. Other mechanisms are needed if tenants are to achieve housing security and a stake in their neighbourhood. In most ACP cities, the complexity of the tenure arrangements is far greater than the distinction between owner-occupiers and tenants implies, but the majority of urban dwellers are probably tenants of one sort or other (World Bank, 1993).

Recent decades have seen a shift in attitudes towards informal settlements, and it is increasingly recognised that, in addition to creating a number of problems, they have an important role to play. Similarly, there have been a number of attempts to introduce new tenure systems or adapt traditional systems to counteract some of the inadequacies of housing markets based exclusively on private ownership rights (Payne, 1997). Botswana, for example, introduced 'Certificates of Rights' and Zambia introduced 'occupancy licences', in order to provide more security for people who do not own the land they live on. Papua New Guinea and Ghana, on the other hand, are countries where traditional tenure systems have continued to play an important role in urban housing. Rent controls have also been common, but although these can enhance housing security, they simultaneously remove any incentives the owners might have had to improve housing quality, and have thus tended to be counterproductive.

From an environmental perspective, the goal must be to give residents a stake in their community and the assurance that if they contribute to local environmental improvement, others will do likewise. Most successful attempts to improve housing security have been carefully adapted to local circumstances, and NGOs and local associations can play an important supportive role in this process. Given the rapid urban growth most ACP countries are experiencing, however, housing security will remain a critical issue for the foreseeable future.

Relationships with Service Providers

Historically, the traditional public sector response to environmental problems has entailed regulatory measures, at least when the environmental management function cannot be transferred to a public entity such as a utility. Sanitary inspectors, for example, were once a common means of attempting to minimise public health hazards (see Box 5.6). Such regulatory approaches tend, however, to reinforce conflict between the government and the residents of deprived areas. Conflict can also easily arise between service providers and local residents when the quality of service is low. In a recent study of Port Elizabeth, South Africa, for example, bucket latrines were found to be the source of numerous complaints on the part of residents, who felt that the bucket collectors did not come on schedule and were insufficiently respectful when they did come (Thomas *et al.*, 1999).

More local participation is often invoked as a means of improving relationships between residents and service providers, and, more generally, of promoting local environmental improvement. Donor-funded projects servicing low-income areas now typically require some form of local participation. As noted above, there is also considerably more involvement on the part of NGOs and CBOs in environmental service provision, particularly in low-income areas. Securing good relationships between service providers and local residents remains a priority, however.

Box 5.6 The Colonial Heritage: the Case of Public Health Legislation in Accra

Accra was made the capital of the then Gold Coast (now Ghana) by the colonial authorities in 1877. It is now estimated that Accra is home to 30% of the urban population of Ghana and over 10% of the total population of Ghana (Min. of Local Government, 1992).

Most of the legislation and by-laws which guide environmental health in the capital date back to the colonial era. Many are outdated, ineffectual and have lost their significance. Others have become impracticable, given the developmental trend that is seeing Accra develop the status of a metropolis.

Control of sanitation during the pre-independence era achieved successes within its own limited remits, and also failed afterwards for a number of reasons:

- It was based on an autocratic system, efficient at punishing offenders, but not in terms of developing an understanding of the health risks among the public, or of securing popular legitimacy.
- A Sanitary Inspection Department was set up under the then Town Council as a policing unit, with sweeping powers to find and prosecute sanitary offenders. This department came to be seen by many as an oppressive wing of the local authority, rather than as an organ of change or development.
- Laws and by-laws were specific to the residential environment only, e.g. The Accra Town Council Ordinance of 1943 (Gazette Notice No. 912). This led to the exclusion of adequate inspection of the working environment - a problem that continues to this day.

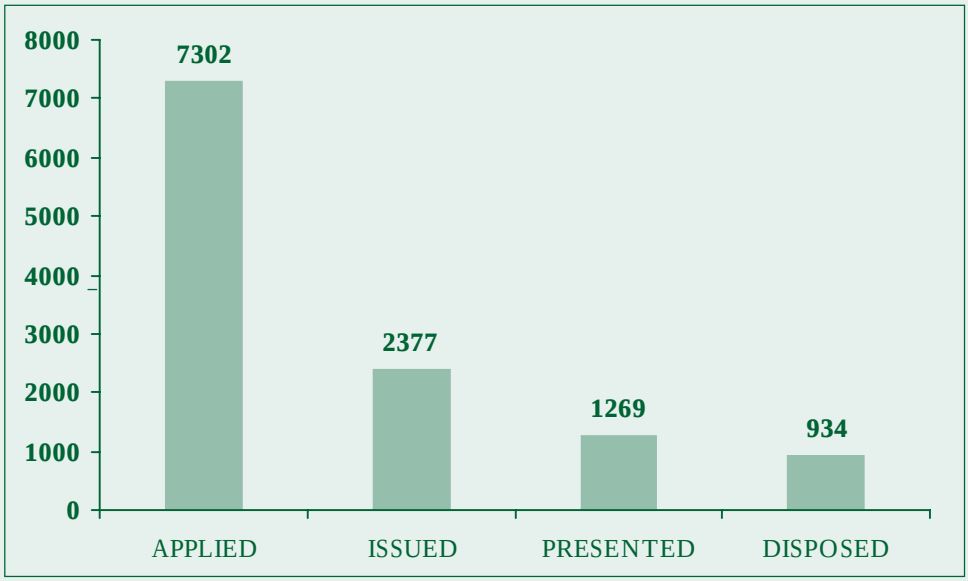
With the attainment of independence, many aspects of sanitation policy were relaxed rather than redesigned:

- The government and, for that matter, the local authorities failed to provide adequate sanitation infrastructure and deliver adequate sanitation services.
- The Judicial Service's handling of sanitation cases weakened to the extent that only around 10% of sanitation offence cases brought for prosecution are disposed of after a frustrating long period of adjournments (Annual Reports of the Director of Public Health, Accra Metropolitan Authority. 1996 and 1997).

- Given the current level of development, some of these laws have become unenforceable. The Criminal Code of 1960, Act 29, for example, makes the owner or occupier of any land or building responsible for keeping the surroundings clean up to the middle of the street(s) or road(s) abutting it, including the drains, gutters or channels. This is neither practicable nor fair when most of the filth originates elsewhere, and failures in public service delivery are compounding the problems.

The combination of the factors listed above explains the poor outcome of prosecutions, as depicted graphically below.

Figure 5.4 Application of Public Health by-law on Enforcement of Sanitation Laws in the Accra Metropolitan Area, 1996.



Source: Annual Report of the Director of Public Health, Accra Metropolitan Assembly. 1996.

Key:
(1) Applied: Number of applications for a writ for the prosecution of sanitary offenders.
(2) Issues: Number of writs of summons issued to the department to be served on sanitary offenders.
(3) Presented: Number of cases presented at the courts for various sanitation offences.
(4) Disposed: Number of cases disposed of.

The current thinking is that a sustainable impact on the management of the environment will only be made through partnership between all stakeholders in the environment and health, including the public. This should be guided by a review of public health legislation that takes present realities into consideration and ensures that it prioritises the needs of vulnerable groups and protects them from undue pollution and environmental degradation.

Contributed by Dr Dela Attipoe, Public Health Department, Accra Metropolitan Assembly, Ghana.

5.5 Environmental Risks from Heavy Industry and Vehicular Transport

Industrialisation is one of the three main trends examined in *World Resources 1998-99*. As indicated above, the dangers of rapid industrialisation are less relevant in most ACP countries than in many other parts of the globe, and this is one reason why industrialisation has been included under urbanisation in this report, rather than the reverse. A second reason is that, given the low level of industrial activity, the health risks from industrial pollution tend to be more concentrated in selected areas, typically in cities or towns. The risk, for example, of persistent organic pollutants (POPs) and heavy metals being widely dispersed, creating low-level concentrations to which large sectors of the population become exposed, is lower here in comparative terms than elsewhere.

5.5.1 Industrial Pollution in ACP Countries

Whilst industrial pollution is not treated as a major issue in this report, this should not be taken as implicit grounds for ignoring industrial pollution where it does occur. Low averages hide hot spots where action is clearly warranted. Moreover, some of the environmental health risks of industrial activity arise not from exposure to pollutants from multiple sources, but from concentrated exposures to pollutants from single sources. Such health risks (see Box 3.4), which include most occupational hazards and many hazardous wastes, deserve the same level of stringency, regardless of the overall level of industrial activity. More generally, it is the health burden per unit of production (and the costs of mitigation), not the aggregate health burden, that should be decisive in determining whether the health risks of environmentally hazardous production processes are acceptable.

In ACP countries, the average industrial contribution to the Gross Domestic Product was about $170 per capita in 1995, compared to a world average of about $1,600 (see Table 6.1 in Appendix 2). If Nigeria and South Africa are removed from the equation, the industrial contribution falls to below $90 per capita. In comparison, the industrial contribution in a heavily industrialised country such as South Korea was over $4,000 per capita, and it reached a high of more than $15,000 in Japan—almost 100 times the ACP average.

The limited industrialisation that has taken place in ACP countries has, nonetheless, brought many of the hazards described in *World Resources 1998-99*. Those affected are primarily the comparatively small number of industrial workers, and those living in the vicinity of industrial establishments. For these minorities, industrial pollution can be a major health hazard. Effective regulation is often lacking, and public awareness is often low, partly because industrial pollution is not a widespread hazard. As a result, it is safe to assume that a larger share of the industrial health risks in ACP countries come from high levels of exposure on the part of a few people, and that a smaller share involves low levels of exposure on the part of the general population. One might also expect a disproportionate share of accidents relative to routine pollution, although of the 44 serious industrial accidents world-wide (1970-92) listed by the WHO (World Health Organization, 1997), only one was in an ACP country (an ammonia tank explosion in Dakar in 1992).

Major industrial polluters include mines, thermal power plants (especially coal-fired), fertiliser factories, textile mills, cement factories, chemical manufacturing plants, pulp-and-paper plants, slaughterhouses and tanneries. These establishments tend to be located near cities, or, in the case of mines and pulp-and-paper plants, in towns near their resource base. They create water and air pollution problems, as well as various forms of solid waste, but most of the pollutants giving rise to concern are chemicals. A notable exception is the medical establishments, whose waste can contain pathogens in sufficient quantities to spread infectious diseases.

In 1995, South Africa alone accounted for an estimated 40% of the industrial value added in the ACP. Not surprisingly then, South Africa is where a large share of the industrial pollution problems arise. South Africa has a long history of industrialisation, but as one of the more affluent ACP countries, it also has relatively well developed environmental regulations. With its history of apartheid, however, concern for the wellbeing of the majority of the population has been a low priority (McDonald, 1998).

Whilst industrial pollution is less closely linked to poverty than the problems described in the previous section, when industrial pollution does occur in low-income settings the consequences tend to be more severe. The industrial pollution affecting townships such as Soweto are fairly well documented. The dangers of poorly controlled industrial waste in low-income settings are also well illustrated by the town of Mafefe, South Africa (Booth *et al.*, 1994). Mafefe is located alongside an asbestos mine, and a survey in 1987 found that one third of the homes were built with materials containing asbestos, which can cause scarring of the lung tissue leading to lung disease (asbestosis) and various cancers.

Some industrial pollution problems are more democratic in their impacts. South Africa's Mpumalanga Highveld has one of the highest concentrations of coal-burning industries in the world, along with some of worst industrial air pollution. Even the health of affluent residents is put at risk from such pollution.

Not all industrial waste comes from local industry, however. Trade in hazardous waste can create health risks in receiving countries, and not all such trade is official (almost all official trade originates in the OECD and is between developed countries). In one of the best known illegal attempts to export hazardous waste, a German ship with 2,100 tonnes of Italian hazardous waste sailed to Nigeria in contravention of an EC directive and had to return the waste to Europe (Cortinas de Nava, 1996). Following this incident, the ACP countries proposed a new provision in the Lomé convention, banning any export of hazardous wastes to any ACP country. The risks associated with illegal trade remain, however, and, as free trade expands, control is becoming more difficult.

There is also a danger that as environmental controls tighten in affluent countries, countries with lax controls will attract polluting industries and technologies. The guidelines of the European Chemical Industry Council say that the environmental and health safety aspects of transferred technology should be 'equivalent to that achieved in the home facilities of the technology supplier' (Castleman, 1995). ACP countries have a clear interest in following the way in which such guidelines are developed and enforced, as well as in continuing to develop their own standards.

5.5.2 Road Traffic Accidents

The health risks of transportation systems also receive comparatively little attention in this report – for similar reasons and with similar qualifications as with industrialisation. The average level of vehicle ownership in ACP countries is very low, and whilst the numbers of vehicles are rapidly increasing in absolute terms, the transport system is currently not a major contributor to ill health. These problems can be expected to change with time, particularly if preventative measures are not taken. The insufficient number of vehicles in relation to the demand for transport also leads to vehicle overuse, which increases the risk for breakdowns and accidents, and also reduces engine efficiency. This is compounded by the fact that many vehicles are very old, and that the low quality of the roads further aggravate the problems of ageing vehicles. Poor traffic management and low levels of compliance with traffic rules also increase the risk of accidents. Further concerns with regard to the disproportionately high incidence of motor vehicle accidents in comparison with the low number of vehicles were noted in Chapter 3.

5.5.3 Air Pollution from Non-Domestic Sources

Air pollution and accidents are the main health burdens imposed by the transport system. Emissions of hazardous pollutants per vehicle are almost certainly higher than the global average, although not nearly high enough to offset the low numbers. Most exposure to vehicular emissions occurs in urban areas, where ambient concentrations tend to be far higher than in rural areas. The major contributor to urban air pollution, in addition to vehicles, is usually industrial activity, although, as described in section 5.4, waste burning and household fuel use can also be important.

A list of air pollutants, with their principal sources, health and environmental effects, is provided in Table 5.3. Whilst the health effects of air pollution have long been studied,

recent epidemiological findings have raised new concerns, particularly in relation to particulates of less than 10 µm in effective diameter (PM10). These studies have demonstrated relationships between particulate levels and respiratory ailments in comparatively affluent cities, and at comparatively low concentrations, and have provoked world-wide revisions in air quality standards and guidelines (Murray, 1998; Dockery and Pope III, 1994; Dockery *et al.*, 1993; Pope III *et al.*, 1995). Given the importance of acute respiratory infections in most ACP countries (see Chapter 3), these results suggest that even if it is not already a major health problem, ambient air pollution needs to be taken seriously.

Air pollution monitoring is rare in most ACP countries, and the air pollution data that are collected are not generally compiled in a form that allows international comparisons. The most severe problems are likely to be encountered in the few large industrial cities, especially those with adverse meteorological and topographical features. Perhaps even more than the large cities of South Africa, Lagos provides a telling example of the potential risks of air pollution when coupled with inadequately controlled urban development (Baumbach *et al.*, 1995). In addition to the ambient air pollution in large cities, 'hot spots,' such as bus terminals and market places, can create locally elevated concentrations, posing a particularly severe hazard to local workers. These 'hot spots' do not depend so much on city size and overall industrial development, and deserve particular attention.

For some health hazards, most notably childhood lead poisoning, air pollution adds to exposures that can also come from numerous other sources. Lead can lead to a range of health and developmental effects, including lower IQ levels among children. In recent studies of environment and health in Bangkok and Cairo, exposure to lead was identified as a critical and avoidable environmental health problem (Abt Associates and Sobotka & Co., 1990; Sessions *et al.*, 1994). With a few exceptions, cities in ACP countries are unlikely to have such severe problems, but there are a number of reasons for concern. Among the reasons summarised in a recent review of childhood lead poisoning in Africa (Nriagu *et al.*, 1996), most of which are relevant to several of the Small Island States, are:

- While gasoline consumption is low, the lead contents are among the highest in the world (see Table 8.6 in Appendix 2);
- Numerous detailed studies have indicated high levels of lead in particular groups of children in high risk settings (such as living near mining centres or lead polluting industries, or working or schooling near traffic);
- Various socio-ecological factors predispose low-income children in particular to lead exposure when it is present in the ambient environment;
- Children can be more susceptible to environmental lead poisoning when they have iron deficiency, and lead poisoning can aggravate communicable diseases.

5.6 The Urban Informal Economy, Livelihoods and the Environment

The economic survival of many urban dwellers in ACP countries, particularly during periods of stress, depends upon what has come to be termed the informal economy. Informal economic enterprises include a very diverse range of 'small-scale, mostly family operated or individual activities that are not legally registered and usually do not provide their workers with social security or legal protection' (Rogerson, 1997). It has been estimated that 63% of Sub-Saharan Africa's labour force is already engaged in the informal economy (Rogerson, 1997, citing ILO-JASPA), and that in the 1990s it will account for 93% of all new jobs in urban Africa (Rogerson, 1997).

Being informal, these activities are very poorly documented, and international estimates should be treated with scepticism. There are, however, a number of more detailed studies demonstrating that, at least in some cities, informal activities have been growing extremely rapidly, partly in compensation for the poor performance of the formal economy (Rakodi, 1997b). For women in particular, going to work in informal activities, where pay differentials are high but access is easy, is a common

response to increasing poverty and vulnerability (Moser, 1996).

Since informal sector activities do not generally abide by environmental regulations, the rapid growth of the informal economy might seem to pose a serious threat to health — for the workers, the consumers, and the local residents affected by their pollution. Most informal activities evolve around trade, however, and whilst such activities are sometimes suppressed on environmental grounds (unsightliness), they rarely pose a significant risk to health. Urban agriculture, for example, is often seen by

Table 5.3 Principal Sources and Impacts of Selected Air Pollutants.

Pollutant	Source	Health and environment impact
Particulate Matter	Incomplete combustion of fuels and industrial additives. Diesel vehicles. Soil dust.	Respirable particulates affect the lungs. Small particles are likely to be most damaging (penetrate deep into lungs and tend to be more chemically active). Particulates from diesel engines are potentially carcinogenic. Can cause allergies, asthma and chronic bronchitis.
Carbon Monoxide (CO)	Combustion – primarily from motor vehicles and industrial processes. (Also, burning of refuse, cooking, heating and tobacco smoke.)	Weakens the blood's capacity to transport oxygen to cells. Affects the cardiovascular, nervous and pulmonary systems. Contributes to (ground level) ozone formation.
Sulphur Oxides (SO_x, SO_2)	Burning of fossil fuel (coal and petroleum) (Also, wood and tobacco smoke)	Aggravates respiratory diseases. Increases risk of cardiovascular disease. Contributes to acidification of water and soils.
Nitrogen Oxides (NO, NOx, NO_2)	Burning of fossil fuel (coal, oil, natural gas) (Also, tobacco smoke.)	Damages human lungs, certain sensible plants, as well as physical structures. Can increase susceptibility to contracting viral diseases. Contributes to acidification.
Lead	Vehicle emissions (leaded gasoline), smelters	Can cause impairments in intellectual functioning, kidney damage, infertility, miscarriage and hypertension. Especially hazardous for young children.
Ozone (O_3) (at ground level)	Secondary pollutant resulting from the chemical reaction between nitrogen oxides and organic compounds in the presence of solar radiation.	Irritates eyes, nasal congestion, and reduction of lung function. Can also decrease resistance to infections. Harms vegetation. The principal component of dense smog.

Sources: Based on: (1) (Jacobi et al., 1999),(2) (Listorti, 1996) and (3) (World Resources Institute, 1998).

planners as a contradiction of the image of the city. It is, nonetheless, quite common, see Box 5.7.

A number of informal enterprises can, nonetheless, pose serious health risks. Food provisioning is a very common informal sector activity, and food contamination is a very real threat to health. Alternatively, a number of informal industry activities also involve hazardous waste or air pollution. In both Trinidad and Jamaica, for example, cottage lead smelting and 'backyard' battery

Box 5.7 Urban Agriculture, Food Security and Environmental Health

Urban agriculture has many of the characteristic features of the informal economy of which it is often a part. Even more than most informal activities, urban agriculture is closely tied to health, since it can enhance food security directly but can also create a range of serious health hazards. The hazards, which are often the responsibility of environmental health officials, tend to dominate the health discussions, but in most circumstances, the health benefits of greater food security are likely to outweigh the hazards, especially if appropriate measures are taken.

In many ACP cities, urban farming is technically illegal, but has nevertheless become an increasingly important activity over the past two decades (Rogerson, 1997; United Nations Development Programme, 1996). Urban farming has long been common, particularly in small urban centres and peri-urban areas. As indicated in Table 5.4, however, it has also become significant, even in the largest ACP metropolitan areas, including those of South Africa (Rogerson, 1996).

Table 5.4 Urban Agriculture in selected ACP Countries.

City, Country	Farming Reported by Urban Agricultural Network
Ouagadougou, **Burkina Faso**	36% of families are engaged in horticultural cultivation or livestock
Yaounde, **Cameroon**	35% of urban residents farm
Libreville, **Gabon**	80% of families are engaged in horticulture
Suva, **Fiji**	40% of households engaged in horticulture
Nairobi, **Kenya**	20% of residents grow food in urban area
Maputo, **Mozambique**	37% of surveyed households produced food, 29% raised livestock
Port Moresby, **Papua New Guinea**	80% of households take part in food production
Kampala, **Uganda**	70% of poultry needs are produced in the city
Lusaka, **Zambia**	45% of 250 low income households surveyed grow horticultural crops or raise livestock around the home or in the city periphery

Source: United Nations Development Programme. 1996.

Most studies of urban agriculture note that the primary motive for urban farming is obtaining food for household consumption, and that the cultivators are mostly women (Maxwell, 1995; United Nations Development Programme, 1996). This, combined with the observation that urban agriculture has expanded in response to the crisis in the formal economy, suggests that it is has become an important element of urban food security. Urban agriculture can add important micronutrients to the urban diet (Atkinson, 1992), but more importantly, it can often provide food when income falters. A study of urban farming in Kampala thus found that urban farming was often used by women 'as a strategic reserve for times when there is no money for buying food, either because of erratic household income or because, in conjugal households, the wife who is responsible for food is not allocated a sufficient amount of money by her husband' (Maxwell, 1995). Moreover, recently abandoned or widowed women fell back on urban farming when they had no other means of acquiring food.

Access to land, as well as social norms and law enforcement, can radically alter the opportunities for urban agriculture in different cities, however. Many urban farmers do not own the land they cultivate, and in some cases the very lack of tenural clarity that prevents the efficient use of land by the formal sector provides important opportunities for the socially excluded. It should not, on the other hand, be assumed that all, or even most, urban cultivators in a city are poor. Indeed, there is evidence in some urban areas that the poorest groups are excluded from access to land, and there are indications that the more affluent are increasingly dominating urban agriculture. Such tendencies will tend to reduce the role of urban agriculture in providing food security. From a health perspective, it is important to ensure that low-income residents have access to the urban 'farmland' if urban agriculture is to be promoted in the name of food security.

The health risks of urban agriculture range from malaria to food contamination; the level of risk depends very much on how and where the agriculture is practised. Malarial mosquitoes generally favour rural settings, where there is open and unpolluted water for breeding. Urban farming, and especially irrigated agriculture, can introduce breeding sites into densely populated urban settings. Malarial and nuisance mosquitoes can be difficult to distinguish, however, and urban agriculture is sometimes unfairly blamed for promoting malaria. It is thus often wrongly believed, for example, that malaria mosquitoes breed in maize plants (Birley and Lock, 1998). A well-informed health perspective on urban agriculture can hence not only identify measures to prevent the urban agriculture from creating malaria risks, but in some cases, also correct misconceptions about these risks.

The possibilities for food contamination are heightened in urban agriculture because of potential exposure to urban pollutants, such as heavy metals and human waste. Lead particles from air pollution can fall on crops this is a particular risk near roads used by vehicles powered by leaded fuel, but can be substantially reduced by washing (Birley and Lock, 1998). Also, when the soil or water is contaminated by heavy metals, plant uptake can lead to food contamination, although the importance of this exposure route is not well documented. The risks associated with exposure to human waste are particularly pronounced when urban wastewater is used for irrigation, or, more generally, faecal material is used as a fertiliser. Here too, there are many steps that can be taken to reduce such risks, and although informal urban agriculture may be difficult to regulate, targeted measures designed to reduce some of the more serious risks are still possible. New more ecological approaches to urban sanitation are, moreover, being developed, many of which could directly benefit urban agriculture (Drangert et al., 1997; Esrey et al., 1998). Their success is far more likely to be assured if health and environmental sectors can combine to take an integrated approach.

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recycling have been shown to pose a considerable risk to children's health (Matte *et al.*, 1991). Urban informal mining and the processing of building materials, such as sand and stone, is very important for the burgeoning building industry, and constitutes a major source of income for the poorest urban dwellers. As virtually no protective gear is available, however, these people also inhale dust, and flying pieces of rocks can get into their eyes. Other injuries include the smashing of hands and fingers (Jambiya *et al.*, 1997).

If informal activities were truly undertaken with no concern for their health consequences, the impacts of these enterprises could be devastating. The informal sector is not unregulated, however: rather, it is informally regulated. With food provision, for example, there are two common institutional responses to preventing contamination, one more relevant to formal enterprises and the other to informal enterprises. Firstly, certain practices on the part of food handlers can be proscribed by the government, and additives restricted. Secondly, the economic lure of future sales and the psychology of personal contact can help ensure that a food vendor will not sell food known to be contaminated, at least to regular customers. This inducement is multiplied when the vendor works in a neighbourhood where reputations, and hence sales, rise or fall with the quality of the food sold. Similar links of patronage and reputation can work back through the food system, mitigating at least the worst excesses that would arise in an anonymous, and unregulated, free market. The more serious problems arise when customers, local residents and in some cases the operators are unaware of the health risks involved.

The informal sector can also, under the right circumstances, contribute to better environmental management and, indirectly, better health. Where piped water is not provided to people's homes, informal enterprises can transport it at a comparatively low cost. Waste disposal and recycling are traditional informal activities which can have environmental benefits. Romanos and Chifos argue that informal urban enterprises are already making a significant contribution to environmental management, and could do more (Romanos and Chifos, 1996). Their examples are primarily taken from Asia, where such informal enterprises are more active in the water and waste sectors, but given the growth of the informal sector in many ACP countries, there are perhaps many important lessons to be learnt from the Asian experience.

Overall, the informal economy's contribution to health by providing livelihoods for vulnerable populations undoubtedly outweighs the risks it poses to health through hazardous practices. From a health perspective, it is critical to distinguish between the largely aesthetic environmental impacts of most

informal sector activities, and the health hazards of a few. It is also important to recognise that those most at risk are likely to be the informal sector workers themselves. Since these workers are often also local residents, their awareness of the environmental risks can make a considerable difference.

5.7 Conclusions

Urbanisation in ACP countries has coincided with rapid population growth, creating some of the most rapid urban growth ever experienced on such a scale. Occurring at a time of economic distress, this growth constitutes an enormous challenge for urban governance. Measures designed to restrict urban growth are likely to be counterproductive, however, and the priority should be to improve the quality of urbanisation, and to help ensure that cities contribute to sustainable and healthy development.

The major environmental health challenge is to improve conditions in low-income homes and neighbourhoods, where poor access to water, bad sanitation, contaminated food, uncollected waste, smoky kitchens and a range of insect vectors combine to form a complex of health threatening conditions. Poverty is at the heart of this challenge, but better environmental management can be an important part of the solution. Conventional public and capital-intensive approaches are increasingly seen as inadequate and unaffordable routes for improvement, but leaving local environmental management to the private sector is even worse. It is necessary to combine the strengths of government, markets and community action, and to build on both scientific and local knowledge. Capacity building, education and awareness raising at all levels are crucial, as is the need to take the views of local residents more seriously. This is further developed in Chapter 7.

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Chapter 6

Global Environmental Change

Chapter 6 Global Environmental Change

Aims of the Chapter

- To identify and describe the potential effects on health of global climate change and ozone depletion, and their importance to ACP countries.

Main Points

- The activities contributing to global climatic change and ozone depletion originate largely outside of the ACP country region – only about 2% of global carbon emissions originate within the ACP, for example.
- The projected effects of climate change are world-wide, with uncertain regional and local implications. Major effects are likely to be increased temperatures and frequency of extreme weather events, along with a rise in sea levels.
- The health threats of climate change include malnutrition arising from agricultural disruption, infectious diseases spread by insects and other vectors advantaged by climate change, as well as the direct loss of lives and livelihoods from rises in sea levels and extreme weather events.
- The ACP is likely to suffer disproportionately from global climate change, due to its geography (small islands and semi-arid regions are particularly exposed), the presence of already food-insecure populations, and a lack of capacity for adaptation.
- The health risks of stratospheric ozone depletion include skin cancer, which is less of a risk for the dark-skinned majority of ACP residents, but also extend to eye diseases, immune system damage and ecological and climatic effects that may potentially undermine food security.

Policy Implications

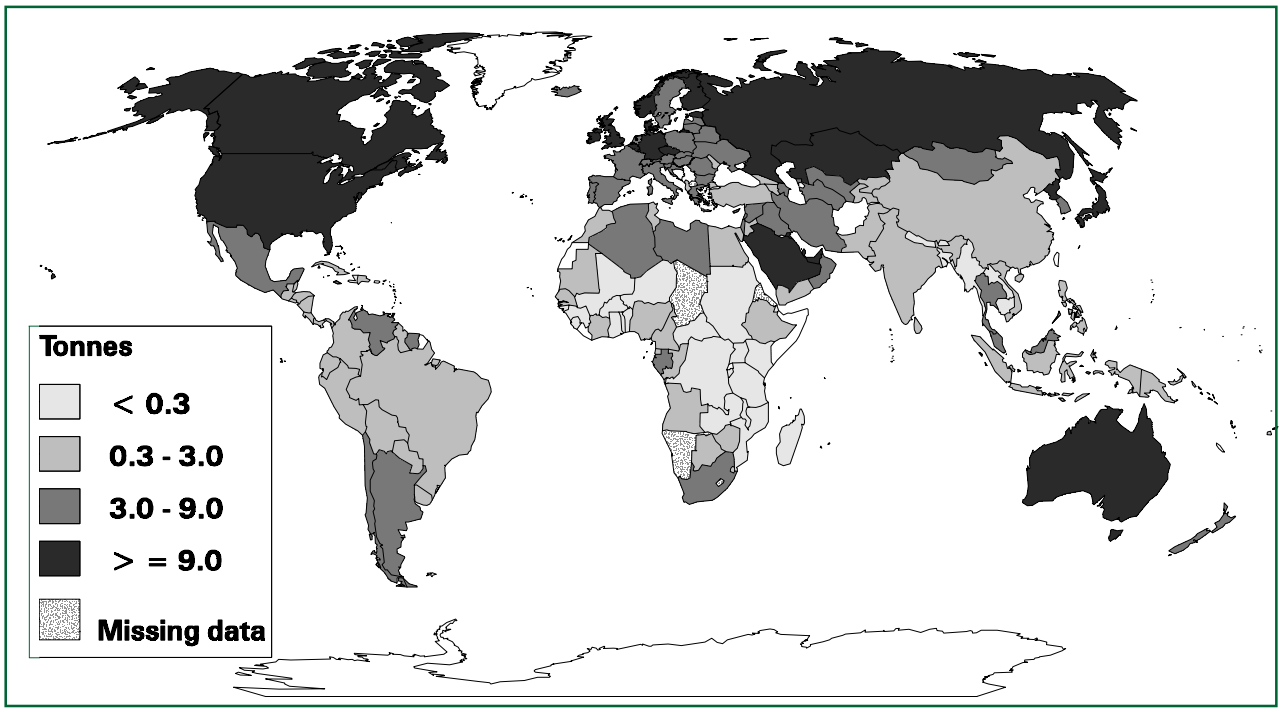
- As ACP countries may suffer disproportionately from climatic change, they have a particularly high stake in limiting the global emissions of greenhouse gases, which may also extend to ozone depleting substances.
- As ACP countries do not contribute appreciably to the emissions of greenhouse gases or ozone-destroying chemicals, their main concerns should be to ensure that international agreements are equitable as well as strict, and that vulnerability in the ACP is reduced.

6.1 Introduction

The preceding chapters discuss the effects on human health of environmental changes at local and regional levels. No overview of environment and health issues would be complete, however, without a discussion of global environmental changes and the threats they pose to health. Unlike the environmental problems described in previous sections, global environmental changes are largely the result of activity outside of the ACP countries. Human-induced climate change is, for example, primarily a result of carbon dioxide (CO_2) emissions, the vast majority of which originate in non-ACP countries (Figure 6.1). As this chapter illustrates, however, ACP countries are vulnerable to the effects of global environmental changes and to climate changes in particular. Food security, the prevalence of infectious diseases, and UV-induced conditions may all be altered as a result of climate changes.

While this chapter focuses on climate change and, to a lesser extent, ozone depletion, global environmental changes can also be taken to include the depletion of global resources and sinks, as well as pollutants that affect health far from their source (e.g. persistent organic pollutants or POPs). These may also have health

Figure 6.1 Carbon Dioxide Emissions per Capita (metric tons) 1995.



Source: United Nations Development Programmme. 1998. Human Development Report 1998. Oxford University Press (New York).

consequences for ACP countries, but are not covered in this chapter. Hazards from persistent organic pollutants are already described in considerable detail in *1998-99 World Resources* report (World Resources Institute, 1998). The principal health-related impacts of the loss of global resources and sinks are likely to come through economic repercussions, which are beyond the scope of this report. Similarly, the health-related impacts of climate change and ozone depletion considered in this chapter do not extend to the indirect effects that may derive from economic and political disruptions.

The Earth's climate is moderated by the greenhouse effect. Atmospheric gases such as CO_2 and CH_4 (methane) re-radiate heat back to the Earth's surface that would otherwise escape into space. Although the magnitude of the greenhouse effect has fluctuated throughout history, human activity has increased greenhouse gas emissions since the start of the Industrial Revolution. Measurements from Hawaii indicate that atmospheric CO_2 has increased from 310 ppm (parts per million) in 1958 to a current level of almost 360 ppm. Since the 1970s, the global temperature has increased by about 0.2°C per decade. The Intergovernmental Panel on Climate Change (IPCC) predicts that, barring major shifts in anthropogenic emissions, the mean global temperature will increase by 1°C to 3°C by the year 2100, relative to 1990 temperatures (Houghton *et al.*, 1996). Precipitation and other weather patterns would also change, and the combination is likely to affect agriculture, infectious disease distribution and coastal zone communities.

Climate change is a gradual process, and climate models generally predict climatic characteristics under a 'double- CO_2' scenario, which will occur in about a century's time if present trends continue. The potential human vulnerability to change during this time must, therefore, be borne in mind in any discussion of the impact of climate change on human health. As socio-economic factors and physical systems also need to be taken into account, any long-term predictions for human health are made that much more difficult. The development of

an effective and affordable vaccine for malaria, for example, or of a successful planned retreat from coasts in preparation for sea level rise, would drastically reduce the importance of these aspects of the global change threat. On the other hand, continuing population growth and the mounting international debts of many ACP countries limit their ability to adapt to a changing climate and ensure that in some ways, their populations will be even more vulnerable a century from now.

6.2 Climate Change and Food Security

As explained in Chapter 4, food security is critical to health, and is closely linked to the evolution of agricultural systems. Two factors make agriculture in ACP countries particularly vulnerable to climate change. Firstly, these countries are located in the geographic regions likely to suffer the most adverse effects of climate change, such as drought, and to gain the least from potential benefits such as CO_2 fertilisation (see section 6.2.1 below). The overall impacts of climate change on agriculture do, of course, depend on the complex interactions of physical, biological and socio-economic systems. Temperature, precipitation, CO_2 fertilisation and the increasing frequency of extreme weather events will directly influence crop plants and livestock, and these same factors will also affect agriculture indirectly by altering the distribution of weeds, pests and crop diseases.

Second, given their socio-economic characteristics, ACP countries are poorly equipped to adapt their agricultural systems to climate change. ACP countries depend appreciably on food produced by small-scale farmers, who generally lack access to irrigation and other factors that buffer larger-scale agriculture against climate change. 60% of the Sub-Saharan African population, for example, depends directly on agriculture; likewise, small island states depend heavily on local production, due to the high cost of transporting food to remote islands. Much of this food is produced on a subsistence scale. In contrast to those countries or regions whose food supply is imported from industrial farms, most people in ACP countries are not well connected to an external food supply. This limits their ability to supplement their diets with imported food, should climate change reduce local food production. Those living in conditions of poverty are generally most vulnerable.

6.2.1 Direct Effects on Crops

Temperature and precipitation are key determinants of cropland suitability and crop yield. Physiologically, most crop species have an optimum temperature range of about 5°C, from 15°C to 20°C or from 25°C to 30°C. Above these temperatures, sterility, loss of pollen viability, or other reproductive damages may result. In addition to favourable temperatures, consistent moisture is critical during crop growth.

While mean temperature and precipitation are major determinants of yield, the frequency and severity of extreme weather events are often equally important. A drought or storm, for example, may alter the annual mean temperature and precipitation only slightly, but could completely destroy a season's crops. And whilst changes in extreme events as a result of climate change still comprise an area of major uncertainty, several climate models suggest the possibility of increasing droughts and heavy rainfall events (Kattenberg *et al.*, 1996).

In many parts of Africa, the main constraints on agriculture are water availability and the length of the growing season. Temperature extremes and solar radiation are also important factors in the highlands (Watson *et al.*, 1996). The mean temperature in Sub-Saharan Africa is expected to increase over the next century, which would make the highlands in eastern Africa, Lesotho and parts of South Africa suitable for annual cropping (due to decreased risk of frost). In the lowlands, that same trend would accelerate crop growth, shorten the growing season and, if growth accelerates while the grain is developing, decrease yields. Higher temperatures also increase the atmospheric demand for moisture (potential evapotranspiration) - in semi-arid Africa, potential evapotranspiration could increase

by up to 100 mm per degree of warming (Hulme, 1996). Precipitation patterns will also be altered, with the effects varying by region, so whilst monsoon rains may hit higher in the Sahel, alleviating drought but damaging cropland with erosion and flooding, in tropical and mid-continental regions, precipitation is expected to decrease (McMichael *et al.*, 1996).

ACP countries in the Pacific may experience decreased yields as a result of increased cloudiness (decreasing solar radiation), rising temperatures (shrinking the duration of growth and increasing sterility), and more frequent and severe droughts, floods and seawater intrusion (Singh, 1994).

The increased atmospheric CO_2 responsible for climate change may alter not only temperature and precipitation, but the distribution and abundance of plant communities as well, including crop species, by 'fertilising' them. Plants capture CO_2 through openings called stomata, and photosynthesise it to build carbohydrates. While the stomata are open, water vapour diffuses out of the cells as CO_2 diffuses in (transpiration). A higher- CO_2 environment could reduce water loss by allowing plants to reduce their stomatal openings while maintaining the necessary CO_2 intake. In the arid environments of ACP-Africa, this could be especially important.

Some research has been done to predict the combined effect of temperature, precipitation and CO_2 on crops in Sub-Saharan Africa. Hulme *et al* (1996) describe their application of the CERES-Maize model to southern Africa to evaluate the response of maize crops to different climate change scenarios. Their model indicates high potential yields under increased CO_2 scenarios, mainly because they expect climate to change relatively little compared with the higher levels of CO_2. The authors acknowledge, however, that the CERES-Maize model underestimates water and nutrient stress, so it treats each season as an independent event without accounting for water and nutrient depletion over time. In addition, the model estimates potential, not actual yields, and Sub-Saharan Africa is characterised by a wide gap between the two. Other studies predict declines in maize yields throughout Sub-Saharan Africa, ranging from –5% to –40% (Downing, 1992; Muchena, 1994).

6.2.2 Indirect Impacts of Climate Change on Crops

Temperature, precipitation and CO_2 fertilisation have direct effects on crop plants, but their impact may not end there. Weeds, pests and crop diseases are also likely to be affected, via the same mechanisms that affect the crops themselves. These factors are seldom included in models, due to the indirect nature of their influence, but are worth considering.

Weeds cause crop production losses of about 25% in traditional production systems, so their distribution is important to crop output (Parker and Fryer, 1975). Most weeds respond to very slight changes in temperature (Flint and Patterson, 1983; Flint *et al.*, 1984; Patterson, 1993) and, like crop plants, weeds will be affected by CO_2 fertilisation. Whilst most crop plants (with the important exception of maize) use C_3 photosynthesis, however, 14 of the world's 18 worst weeds use the less-responsive C_4 variety (Holm *et al.*, 1977). CO_2 fertilisation alone is, therefore, unlikely to favour weeds. In addition to affecting weeds directly, climate change may influence the effectiveness of the mechanisms used to fight them, and in C_3 weeds, in particular, herbicides may be hampered by the high leaf starch concentrations typical of C_3 plants in high- CO_2 environments, or by their increased growth of rhizomes and tubers (Watson *et al.*, 1996). Weeds' faster metabolic activity under warmer conditions would, on the other hand, increase the uptake and effectiveness of herbicides.

Several studies have attempted to predict insect pests' responses to climate change. Very little work has, unfortunately, been done that pertains directly to ACP countries, although a few principles apply generally. Firstly, insect pests are relatively mobile, and are, therefore, capable of adapting quickly to climate change by migrating (McMichael *et al.*, 1996). Secondly, pest outbreaks often

Table 6.1 Predicted Relationships between Climate Change and Crop Disease.

Climate Conditions	Disease Response Source	Reference cited in Watson *et al*, 1996
Milder winters	Increase in powdery mildew, brown leaf rust of of barley, and strip rust cereals	Meier, 1985
Milder winters combined with warmer weather	Increase in Cercosporea leaf spot disease, powdery mildew and rhizomania disease	Treharne, 1989
Dryer and hotter summers septoria leaf spot	Decrease in Rhyncosporium leaf blotch and	Royle *et al.*, 1986
Increased summer precipitation	Increase in Rhyncosporium leaf blotch and septoria leaf spot	Royle *et al.*, 1986
Warmer temperatures	All diseases move into previously cooler regions	Treharne, 1989

occur following extreme weather events, so predicting agricultural pest activity in ACP countries depends in part on our ability to predict this climatic factor. Thirdly, a general warming trend will encourage pests to over-winter in areas from which they now migrate seasonally. Table 6.1 lists a few of the relationships between climate and crop disease.

The distribution of fungal and bacterial plant diseases is a function of temperature, precipitation, humidity, radiation and dew, and again, it appears that little work has been done to address this issue in ACP countries.

6.2.3 Climate Change and Livestock

Livestock play a special role in small-scale agriculture in developing countries. They are better able to withstand extreme weather events such as drought than crops, and thus constitute a good 'insurance' against disaster when more formal means are not available. Despite this, most research on the effects of climate change on livestock relates to large-scale industrial agriculture in developed countries. Whilst it is important to note that such livestock are raised under very different conditions than those of primary concern to subsistence farmers and herders in ACP countries, some general principles can still be delineated. The predicted effects of climate change on livestock include impacts on pastures and forage crops, changes in feed grain prices and availability, effects of weather and extreme events on animal health, as well as changes in livestock disease distribution (Watson *et al.*, 1996). In ACP countries, where feed grain is not usually purchased, its price changes would be less important. The other effects, however, would still be relevant.

6.3 Climate Change and Infectious Disease

Climate influences the infectious diseases discussed in this section because its parameters help determine where parasites, vectors and other organisms associated with disease spread are able to thrive. As temperature and precipitation change, for example, so do mosquito habitats. But climate also has a less direct influence. It affects human migration, living conditions and urbanisation, which factors in turn create disease habitats in some cases, destroy it in others, and determine how often humans come into contact with diseases. (See also section 3.2.1 and Box 3.3 of Chapter 3 and Box 4.6 of Chapter 4.) Climate also influences humans' access to water for washing and drinking, which is important

for the control of faecal-oral diseases, as explained in Chapter 3.

It should always be remembered that disease is a function of many different factors, including individual exposure and vulnerability, the community's health behaviour, the home environment and physical infrastructure, as well as institutional capacity to treat ill health. These are all in addition to the climatic factors discussed in this chapter, and some of them have a much more direct relationship with the health outcome. Many of these relationships are dealt with in the preceding chapters. The effects of climate change are also all projections of our future, but many other events may change the significance of a modified climate or disease vector distribution. Advances in vaccinations or other preventative measures could, for example, tip the scale in favour of health in the next century or even sooner. (The current status of research and development of vaccine for certain parasitic diseases is reviewed in Box 6.1.) Conversely, environmental trends, such as crowding and water scarcity, could do just the opposite.

6.3.1 Malaria

Malaria is the world's most important vector-transmitted disease. Around 270 million people are infected at any given time, and a total of two billion people are at risk. Between 1 and 2 million people die from malaria each year, most of them in Africa. Four species of parasites are responsible for causing malaria in humans: *Plasmodium falciparum, P. vivax, P. ovale* and *P. malariae*. These parasites are transmitted to humans through any of the 50 to 60 species of *Anopheles* mosquito that serve as vectors for malaria. Infected individuals typically experience fever as their primary symptom.

The distribution of the malarial parasite and its anopheline vectors is limited in latitude and altitude by climatic factors. Whilst malaria is most prevalent in Africa, it also afflicts almost every ACP country, as well as South-East Asia, Central and South America, and to a limited extent, parts of Europe. Malaria's effects vary in severity within these zones. In areas where malaria is perennial (transmitted 8-12 months out of the year), indigenous populations build up immunity to it, and most deaths in these zones occur in infants and young children who are not yet immune. Where climatic conditions allow malaria and its vectors to build up for fewer than eight months per year, malaria is seasonal. In these zones, epidemics are common and affect all age groups (Bradley *et al.*, 1991).

Most research into the effect of climate change on malaria has focused on the role of temperature. Researchers have suggested that recent malarial epidemics in Ethiopia and Madagascar may have been a result of temperature effects of the El Niño-Southern Oscillation (ENSO) weather phenomenon (Bouma *et al.*, 1996). In Rwanda, record high temperatures in 1987 were associated with increased malarial incidence, particularly at high altitudes (Loevinsohn, 1994). Temperature affects malarial incidence in a number of ways. The direct effect of temperature on the malaria parasite occurs while it resides within the *Anopheles* vector. All *Plasmodium* species spend several days developing inside the mosquito before the mosquito becomes infective. This period is called the extrinsic cycle, and it is shortest around 27-31°C (Martin and Lefebvre, 1995). Climate projections imply that more areas will move up into this temperature range than will move out of it (Bradley, 1993; Martin and Lefebvre, 1995), and if the current climate projections are thus realised, malaria transmission rates can be expected to increase.

The feeding behaviour of mosquitoes also responds to temperature. Small changes in temperature can have a substantial effect on biting frequency, increasing at higher temperatures before reaching a plateau around 27°C (Lindsay and Birley, 1996). Egg-laying rates also increase and larval stages are shortened at higher temperatures (Bradley, 1993). These influences all serve to increase the reproduction rate of mosquitoes, and, indirectly, of malaria transmission. Bradley (1993) cautions, however, that high temperatures could have counter-effects: the life-expectancy of mosquitoes might fall at higher temperatures unless relative humidity increases correspondingly. Lindsay and Birley (1996) also point out that the risk of mortality

Box 6.1 The Development of Vaccines against Malaria, Schistosomiasis, and Filariasis

Disease control efforts involving the spraying of vector breeding sites are constrained by the emergence of drug resistance and other undesirable side effects. Although intense research efforts are being undertaken in several laboratories to develop vaccines, this alternative control measure against parasitic diseases is not yet practicable. It is, however, reasonable to hope that vaccines against parasitic diseases be incorporated into immunisation programmes during the next decade. A great deal of effort is, however, needed before this dream becomes reality. Research is required to discover efficacious vaccines, development is required to bring these vaccines into clinical trials, after which the production of the vaccines in sufficient quantities to provide coverage to the hundreds of millions of people at risk in tropical countries is also required. The infusion of substantial funds is a *sine qua non* if parasitic disease vaccines are to become incorporated into immunisation programmes.

This short review finds that moderate success has been achieved in developing vaccines against malaria and schistosomiasis, but that very little progress has been made towards the development of vaccines against filarial diseases.

Schistosomiasis (bilharzia)

Medical treatment remains the cornerstone of intervention in schistosomiasis. Rapid re-infection demands frequent treatments, but drug delivery requires an adequate transport infrastructure to cover all parts of an endemic area on a regular basis, and the prospect of drug resistance is never far away.

Vaccination hence remains an important complementary control strategy. The fact that partial protective immunity does exist in infected people has been the motive force behind current research efforts to develop schistosomiasis vaccines. Six schistosomiasis vaccine candidate molecules have undergone various stages of preclinical development (Bergquist and Colley, 1998). These include target enzymes which are involved in key metabolic processes, muscle proteins and fatty acid binding proteins. Three of these candidate vaccines are patented and three are in the public domain. Four of these vaccines have been developed in the USA, one in France, and one, significantly, in Brazil. Protection in inbred mice has ranged from 30% to 70%. A meeting held in Cairo in 1997 entitled *Progress in Schistosomiasis Vaccinology*, recognised that all of the candidate vaccines still require significant process development. Scaled-up production of antigen preparations, followed by clinical trials was, however, endorsed for some of the candidates; for others, research aimed at DNA vaccination was recommended.

Malaria

Malaria control programs are currently heavily dependent on chemotherapy treatment of infected individuals, since the mosquito vectors have become resistant to insecticides. Anti-malarial drug resistance has, however, also become a serious problem in many countries in Africa and Asia, as the parasites have become resistant to chloroquine, sulfadoxine/pyrimethamine, quinine, and other anti-malarials. It is, therefore, imperative that malaria vaccines be developed as a complementary tool of disease control. Reasonable progress has been made in this respect and a dozen vaccines or formulations are currently in various stages of preclinical development (Engers and Godal, 1998).

There are technical constraints on the production of malaria vaccines. Several 100 litre-volumes of bacterial cultures are required to produce a few milligrams of recombinant[1] proteins. The emergence of DNA vaccine technology[2] might, however,

provide the solution (Simmonds *et al.*, 1997). DNA vaccines are relatively cheap and easy to produce, and, most importantly, they do not require cold storage. This is an important attribute for field use in tropical countries. DNA vaccinology in malaria has advanced fairly rapidly to the point where several malaria vaccines have already been incorporated into DNA constructs ready for clinical trials (Gramzinski *et al.*, 1997; Hoffman *et al.*, 1997; Leitner *et al.*, 1997).

Peptide vaccine development, where parts of malaria proteins are artificially constructed to produce an antigenic response,[3] may be another way of circumventing the technical problems of producing recombinant malaria vaccines and indeed, the first malaria vaccine to enter into clinical trials, the SPf66 vaccine, is a peptide-based vaccine (Patarroyo *et al.*, 1988). One outstanding issue is the fact that the mode of action of SPf66 remains unclear, but important strides in malaria vaccinology and immunology can only be made when based on an understanding of immunological mechanisms. In conclusion, current scientific opinion on SPf66 is divided, with one school of thought advocating more research into SPf66 (Graves *et al.*, 1998) and another advocating abandoning field trials of the vaccine altogether (Gilbert and Hill, 1997).

Filariasis.

If several vaccine candidates are on the horizon for schistosomiasis and malaria, there are few, if any at all, for filariasis. At present, the only filarial vaccine candidate molecule characterised at the laboratory level is a potential transmission blocking vaccine (Wang *et al.*, 1997). It will probably require another 5 to 10 years of intense research efforts before filariasis vaccines reach the preclinical stage of development, and to compound this problem still further, there are very few funding agencies which currently support work on filariasis vaccines.

Vaccine Production in ACP Countries

The development of SPf66 vaccine in Colombia, in South America, demonstrates that with political will and adequate funding, Third World countries can produce vaccines locally. The caveat is, however, that the production of vaccines requires investment in production facilities with good manufacturing practices and quality control. Whilst recombinant vaccines could, in principle, be produced in ACP countries, the enormous costs involved in setting up manufacturing facilities that meet regulatory requirements constitute a serious bottleneck. These financial and technical considerations notwithstanding, it would be appropriate for ACP countries to begin to manufacture their own vaccines locally, rather than to continue receiving them from major multinationals through aid programmes. There is, therefore, an urgent need for capacity building in this important domain.

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[1] Recombinant vaccine centres on the discovery that specific antibodies may be synthesised in response not only to the whole viral or microbe particle, but also to isolated components of the virus or microbe. Hence genetic coding for antigenic parts of a microbe or a virus could be 'included' into other organisms which then reproduce and produce the desired antigen in large amounts.

[2] This involves the use of live vaccines which are recombinant harmless viruses carrying parts of a specific pathogen. One example of this might be a gene coding for the hepatitis B major antigen which is transferred to a harmless human virus. After injection of the virus into the bloodstream, the replication of the virus will not only create new virus particles, but will also create significant quantities of the major hepatitis surface antigens. The sufficient number of antigens are thus created in the human body, rather than in the laboratory.

[3] The difference between recombinant and peptide vaccines is that the latter use chemically synthesised parts of antigens, whereas recombinant vaccines use biologically synthesised parts.

Contributed by Thomas Egwang, Med Biotech Laboratories, Kampala, Uganda.

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for mosquitoes should be highest when it is seeking a blood meal or laying eggs. The prospects for changes in relative humidity in a changing climate are less well understood than are those for temperature, so it is difficult to say with certainty which effect will win out.

The uncertainty with regard to humidity applies to precipitation as well, and there is little agreement on regional precipitation amongst global climate models. This lack of unity notwithstanding, increased rainfall generally increases both the probability of a mosquito vector surviving through a given day, and the number of female mosquitoes per person (both of which influence malaria transmission). Increased precipitation is thus commonly presumed to increase malaria incidence. This is not, however, always the case. It has been suggested that the failure of the south-west monsoons, which decreased precipitation during a recent ENSO year, increased malaria incidence in Sri Lanka by creating standing pools of water where water would normally have been running. These pools provided excellent breeding sites for *Anopheles* mosquitoes (Bouma *et al.*, 1994). If climate change decreases precipitation in other currently humid tropical regions, it is plausible that the same effect could be seen.

Several models attempt to predict changes in malaria distribution as a result of climate change (Jetten *et al.*, 1996; Lindsay and Birley, 1996; Martens *et al.*, 1997; Martin and Lefebvre, 1995). Whilst the models differ in approach, they all point to general trends in the pattern we can expect for malaria in response to future climate change. Specifically, latitudes just outside the current malarial zones are at risk under global warming. These regions are typically already home to the *Anopheles* vector, but the *Plasmodium* parasites are held at bay by low temperatures. The same is true for high altitude zones within malarial bands - specifically, mountainous areas in eastern Africa may be at risk. Since these newly infiltrated zones would not be accustomed to coping with the disease, malaria may initially pose a greater threat there than it does in its present locations. In many areas where malaria currently exists, control measures such as insecticide-

impregnated bednets and chloroquine are widespread. Whilst they are controversial, these measures effectively reduce the short-term prevalence of malaria, although they take time to put in place in newly infected regions.

In addition to latitudinal and altitudinal spread, seasonal malarial zones are likely to increase in number at the expense of perennial zones (Martin and Lefebvre, 1995), thus increasing the number of epidemics and the average age of malaria morbidity and mortality.

6.3.2 Schistosomiasis

Schistosomiasis, also known as bilharzia, is a water-based disease caused by certain species of trematode worms (schistosomes).[1] It is expected to respond in a similar fashion as malaria to changes in climate, as temperature influences snail reproduction and growth, schistosome mortality, infectivity, and human-water contact (Martens *et al.*, 1995). Schistosomiasis presently afflicts most of Sub-Saharan Africa and parts of the Caribbean. A predictive model currently under development indicates that schistosomiasis is likely to spread beyond its current distribution limits as a result of climate change. It will also decrease in some areas, however, as temperatures exceed the upper limit for the snail and the trematode.

6.3.3 Dengue

A severe influenza-like viral infection, dengue currently infects 10-30 million people per year. It is common throughout the tropics, and spread by mosquitoes, mainly the *Aedes aegypti*. Like malaria, dengue and its vectors are limited in range by climatic conditions. Dengue provides a good example of a primarily urban disease, that is spread through different species than malaria. As with most parasitic diseases, however, its spread is influenced by many factors other than climate. For dengue, the institutional capacity to provide water supply and solid waste disposal in cities is crucial, and disease distribution may, therefore, only partially be linked to climate change.

Climatic factors could, nonetheless, influence dengue transmission. Potential expansion of dengue transmission under +2°C and +4°C scenarios has been analysed by Jetten and Focks (1997), and although their model is based on temperature alone, excluding rainfall and other variables, they were able to validate it by comparing model projections to current dengue distribution in five cities. Their results indicate that potential transmission intensity could increase by a factor of one to five throughout all ACP regions and elsewhere in the +2°C scenario, and by considerably more for the +4°C scenario. In both cases, the increase would be highest at the northern and southern limits of its current distribution. Intensity would only drop in very few locations in northern Africa. In addition to the latitudinal expansion demonstrated, this model also indicates altitudinal expansion, together with a general lengthening of the transmission season in most susceptible areas.[2]

The potential for increased transmission intensity is dangerous, not only because of the likely additional cases, but also as a result of the increasing hazard posed to individuals by multiple dengue infections. Infection with one dengue serotype renders an individual immune to that strain, but not to subsequent infections by other strains. Sequential infections by different serotypes are increasingly likely to result in more severe conditions, particularly in adolescents.

Malaria, schistosomiasis and dengue are just a few examples of the important diseases whose distributions are likely to respond to a changing climate, and whilst less research has been done into the relationship between climate and other vector-borne diseases, onchocerciasis (river blindness), yellow fever, and, potentially, trypanosomiasis (sleeping sickness) are also amongst those that may be redistributed by climate change.

[1] Infected persons excrete schistosome eggs. As the eggs find water, they develop into tiny swimming organisms that infect certain water snails. Some time after infection, the snail will shed a new form of swimming schistosome, which will infect their next human host through the skin, most commonly when bathing (Cairncross and Feachem, 1993). See also Box 3.3 Infectious Agents and Irrigation.

[2] It should be noted that actual dengue risk, apart from transmission intensity, also involves local conditions such as health services, local immunity and infrastructure. These factors were not included in this model.

6.4 Climate Change and Coastal Zones

In a warmer world, the sea level will rise as a result of the thermal expansion of ocean water, coupled with the melting of glaciers, ice caps and ice sheets. IPCC estimates that by the year 2100, sea level will be 38-55 cm higher than it is today (Houghton *et al.*, 1996). The consequences of this rise depend not only on its global magnitude, however, but on the local physical and ecological responses. The extent of flooding cannot, for example, be predicted simply by estimating the land area, less than a set distance above sea level, since erosion, tidal flows and a variety of other factors are involved. It is impossible to say whether the intensity, frequency or locations of cyclone occurrence would change in a warmer world (Kattenberg *et al.*, 1996), but several climate models suggest that heavy rainfall events are likely to increase in a warmer environment (McMichael *et al.*, 1996).

Taken together or individually, a rise in sea levels, coupled with extreme weather events, pose health risks to people living in coastal areas. These include Caribbean and Pacific island residents, as well as deltal and coastal populations of ACP-Africa. In fact, in a vulnerability index (equal to coastline multiplied by population density divided by land area) calculated for hundreds of countries, ACP countries weighed in on the high end (Gommes and du Guerny, 1998). Tuvalu, Seychelles, Kiribati and Barbados were considered to be at particularly high risk.

More directly, the resulting flooding, storm surges and inundation have the potential to drown and/or displace large numbers of individuals, leading to injury, over-crowding and unsanitary conditions as people retreat from the coasts. There is also great potential for natural disasters to damage health-related and other infrastructure (Finau *et al.*, 1986). In addition to these direct impacts, agricultural land, fisheries, freshwater supplies and disease vectors could also be affected by a rise in sea level, flooding and tropical storms.

In the short run, flooding as sea levels rise could decrease the quality and quantity of fresh water. In the longer term, rising sea levels could lead to saltwater intruding into aquifers. As already observed in Israel, northern China and the southern United States, the geography and hydrology of coastal cities such as Dakar in Senegal, and of small islands, render them susceptible, too - and it is quite difficult to restore aquifers that have been contaminated by saltwater in this manner. In addition to reducing freshwater quantity, intrusion could also reduce water quality by raising the water table, flushing viral and bacterial contaminants from sewer systems out into waterways. This contamination could harm coastal fisheries and areas of mariculture, which provide an important source of income and animal protein in most coastal communities.

Any reduction in water supply could affect health in two ways. Firstly, reducing the water supply makes it difficult to maintain basic levels of hygiene, as washing is made more difficult, and the spread of faecal-oral diseases, such as cholera, typhoid, hepatitis A and diarrhoeal diseases may result. Additionally, as water supplies dwindle, people may turn to poorer quality freshwater sources, such as contaminated rivers.

6.5 Ozone Depletion and Human Health

Stratospheric ozone (O_3) is concentrated between 15 and 25 km altitude. Its most important function to life on Earth is to absorb harmful ultraviolet (UV) radiation before it penetrates the lower atmosphere.

Ozone depletion was first evident in the 1970s. By the early 1990s stratospheric ozone was being lost at a rate of 0.4% per year between the latitudes of 30°N and 60°N. The 1987 Montreal Protocol was designed to curb ozone depletion by strictly limiting the use of CFCs, (chloroflourocarbons), the long-lasting chlorine substances responsible for ozone loss. If its guidelines are followed, stratospheric ozone damage should peak in the next decade, at a total loss (relative to the ozone of the 1960s) of 12-13% in the north mid-latitudes during the winter and spring, 6-7% at the same latitude during the summer and fall, and 11% at the south mid-latitudes. This is expected to increase UV radiation exposure by 15%, 8% and 13%, respectively (WMO *et al.*, 1994). The intensity of UV radiation exposure is a function of the angle of the radiation, that is, of the time of day, season and latitude, and is thought to increase exponentially, rather than

linearly, as a function of ozone depletion (Booth and Madronich, 1994).

6.5.1 Skin Cancer

The correlation between UVR exposure and skin cancer is perhaps the best understood and most commonly acknowledged health effect of ozone depletion. Although the mechanisms involved are complex, UVR has been implicated as a cause of both melanomic and non-melanomic skin cancers. Cancer, however, will probably be less of a concern in ACP countries than elsewhere, at least in the foreseeable future. Skin cancer primarily afflicts fair-skinned individuals, while ACP countries are generally populated by people with darker skin. Additionally, problems described elsewhere in this section pose immediate threats to people in ACP countries, whereas cancer often has a latency period of 30-40 years (McMichael *et al.*, 1996).

6.5.2 Eye Damage

Ultraviolet radiation exposure has been implicated in a number of eye problems, most notably cataracts, which account for half of the world's 25-35 million cases of blindness (Harding, 1991; McMichael *et al.*, 1996; Thylefors, 1995). In poor countries, their prevalence is probably much higher than the 5-10% of the over-65 population of Western countries. The higher incidence is due to micronutrient deficiencies and diarrhoea. Melanin does not act as a defence against UV-caused eye damage, and eye exposure to certain UV radiation is thought to damage protein molecules, causing cataracts (Dahlback *et al.*, 1989; Dolin, 1994; Taylor *et al.*, 1988; World Health Organization, 1994; World Health Organization, 1997).

6.5.3 Immune System Suppression

The role of ultraviolet radiation in interfering with immunity is poorly understood, but could be of grave consequence to ACP countries, which, often face a narrow margin between health and infectious disease. Several researchers have found some indication that low-level ultraviolet exposure causes both local and systemic immunosuppression (Jeevan and Kripke, 1993; Kripke, 1990; Morison, 1989; Noonan and DeFabo, 1992). Some evidence indicates that UV exposure inhibits antigen-presenting cells in the skin, impairing local immunity, and certain UV radiation exposure has been shown to dampen systemic immunity for days to weeks (McMichael *et al.*, 1996). It is not yet clear whether dark-skinned individuals respond to the same level of exposure as light-skinned individuals (Oberhelman *et al.*, 1994; Vermeer *et al.*, 1991); nonetheless, any such effect has implications for infectious diseases, response to vaccination, and the progression of cancers (Armstrong, 1994; Chapman *et al.*, 1995).

6.5.4 Indirect Impacts on Health

Ultra-violet radiation can also affect terrestrial and aquatic ecosystems, and interfere with biogeochemical cycles relating to climate change. Whilst these indirect health effects are poorly understood, they could be of even greater significance than the direct effects (Lisorti, 1997).

6.6 Conclusions

The health effects of climate change and ozone depletion will only be felt after several years, partly because the effects of the driving forces behind these global changes are delayed, and partly because the health implications are often indirect and/or take time to develop. If current projections are correct, when they occur, their causes will already be history. To address these global environment changes, one has to be able to deal with high levels of uncertainty.

Given their geography, ACP countries may be the more vulnerable with relation to rising sea levels, extreme weather events and more erratic rainfall. In addition, the economic resources of ACP countries put them at a disadvantage in terms of mitigating climate change effects through improved physical infrastructure, for example. Finally, the actions required to reduce emissions of harmful substances into the global environment need to be taken by the wealthier countries in the 'North' and in newly industrialised countries. ACP countries are not, therefore, in a good position to determine their own future with relation to global environment change.

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Chapter 7

Environment and Health - the Shared Agenda

Chapter 7 Environment and Health – the Shared Agenda

Aims of the Chapter

- To present the case for a shared health and environmental agenda, addressing the large burden of environmental health problems in ACP countries.
- To identify and describe measures to improve environmental care and food security, and thereby reduce malnutrition.
- To identify and describe measures to help achieve healthier living environments, thereby reducing the burden of (especially infectious) disease.
- To identify priority actions for preventing environmental health burdens which might otherwise arise from conventional development initiatives and global environmental change.

Main Points and Policy Conclusions

- For most ACP countries, poverty lies at the heart of the environmental challenge, reinforcing the links between environmental degradation and ill health. The affluent can often afford to delay or displace environmental impacts, whilst the poor more typically have to bear the consequences in the form of ill health.
- In these conditions, it is especially critical that environmental and health sectors develop a shared agenda, grounding environmental improvements in health concerns, and taking advantage of environmental means of improving health.
- Two of the principal ways in which environmental burdens threaten health in the ACP are by undermining food security and creating unhealthy living environments. These are particularly important for the large cluster of environmental health problems associated with poverty, including a large share of infectious diseases and malnutrition.
- Conventional supply-side approaches (which focus on the quantities of food produced or the quantities of water and other environmental services supplied) often fail to address the underlying causes of food insecurity and unhealthy living environments, and consequently fail to reach those most in need.
- Key principles that can help guide attempts both to improve food security and to establish healthier living environments are listed below. These principles derive from the fact that the people now facing food insecurity and unhealthy living environments are the most important resource for mobilising and implementing improvements, but need greater capacity to do so effectively.

  - Environmental improvements that *enhance the livelihoods* of the poorest will also increase their capacity to achieve food security and create healthy living environments.
  - People with *secure access to housing and land* are more likely to invest in healthy living environments and sustainable agriculture.
  - *Education and supportive public sector programmes* can increase the capacity of local groups to pursue food security and healthy living environments.
  - *Women are central* to food security and the management of the living environment. Measures that favour men are likely to be inefficient as well as inequitable.

- Key actions that can be taken to improve environmental health prospects include.

  - *improving food security*: support and promote a sustainable agriculture, building on successes that have been achieved in areas where external inputs and incomes are currently low.

- *improving living environments*: develop and support coherent multi-sectoral strategies, including, but not limited to, improved service delivery systems.
- *preventing health-threatening development initiatives*: institute environmental and health impact assessments in a systematic fashion.
- *reducing the health burdens of global environmental change*: create an effective international platform through which ACP countries can represent and promote their environmental and health concerns.

7.1 The Shared Agenda

As seen in Chapter 3, the environmental health burden in the ACP countries is especially large for children. The dual impacts of food insecurity and unhealthy living environments combine to produce some of the worst levels of child morbidity and mortality in the world. As seen in Chapter 2, the absolute number of children in the region (and, therefore, the numbers at risk) will continue to increase for several more decades. In addition, new environmental health challenges are also emerging.

A shared health and environmental agenda is necessary to address this massive health burden. As mentioned at the beginning of this report, if health-related and environmental assistance efforts are implemented independently, the health agenda is likely to over-emphasise curative measures, whilst the environmental agenda is likely to over-emphasise long-term sustainability, at the expense of poor people's needs today. These divergent priorities relate to the way in which players in the different sectors are credited for achievements, together with the way in which they can access funds for furthering the developments of their own organisations. It must be recognised that many important factors affecting both health and the environment are outside of the control of environment and health professionals, and that is precisely why activities need both to be put into the larger context, and integrated into related development initiatives.

The necessity to co-ordinate health and environmental concerns and activities has, therefore, been emphasised throughout this report. The advantages should be clear: health and environmental goals overlap, but actions pursued independently may conflict. Box 7.1 points to some of the benefits of the 'combined agenda'. Additionally, in many settings, there are organisational gains to be made from combining forces. For example, environment ministries (along with women's, or gender ministries) have been formed during recent years in many developing countries. Still in their infancy, these ministries often lack the resources and political power to achieve environmental goals. Health (and agriculture) ministries tend, in comparison, to have longer histories, and are comparatively well represented at regional or even district levels. For governments to have environmental issues dealt with by both health and agricultural extension workers, would, therefore, probably mean a more efficient use of existing personnel, and could also improve co-ordination.

Better co-ordination can, in the long run, both reduce costs and increase health benefits, though this is not always apparent when a narrow sector perspective is taken, since the rewards and responsibilities are often divided. These divisions occur in urban as well as rural areas. In Port Elizabeth, South Africa, for example, numerous players, ranging from households to city departments, are involved in combating pests. Households spend on average close to 13 Rand per month on insecticides. The municipality's Environmental Health Sub-Directorate has also been implementing a vermin eradication programme, focusing on cockroaches, fleas, rodents and mosquitoes, using disinfection and removal operations (Thomas *et al.*, 1999). But the combined expenditure of private households on insect control amounts to far more than the

municipality spends, and indeed is roughly equal to the municipality's overall monthly health budget. All of these players are, moreover, working in the areas where they have some degree of control, regardless of whether their actions are the most effective. A more 'integrated pest management strategy' would extend to hygiene, food storage and, in particular, waste disposal, rather than relying on toxins for killing pests. A prevention initiative, rather than control, would thus involve many more players, education and awareness raising, as well as the sharing of funds and responsibility.

Whilst health, environment and other agencies are often very well aware of the need to collaborate, it may still be difficult to realise in practice (Lewin, 1998). The sharing of power, finance and information is often problematic, as it requires mutual trust and a commitment to goals that are beyond those of each individual organisation. Co-ordination of activities is a problem amongst donors and governmental departments alike. Box 7.2 illustrates how expensive infrastructure projects can easily ignore agencies not directly involved, such as health departments. Donor co-ordination is sometimes achieved when funds are scarce. In such circumstances, donors tend to team up around common pursuits. But whilst the increased emphasis given to 'catalytic' or 'seed' funding may help co-ordination better water and sanitation

Box 7.1 The Case for Combining Health and Environmental Agendas

- Environmental and health problems overlap, especially in low-income ACP countries. Compared to most other parts of the world:
  - a larger share of (physical) environmental burdens affect people's health, rather than, for example, depleting the global resource base;
  - a larger share of the burden of disease arises from (physical) environmental threats, rather than, for example, from lifestyle choices.

- Good health and environmental quality both require multidisciplinary research and multi-sectoral action. Specifically:
  - the actions which degrade the environment and threaten health are taken largely by players outside of the health and environment sectors, narrowly defined;
  - when conceived and implemented sectorally, environmental initiatives overemphasise regulative measures, and health initiatives overemphasise curative measures.

- Pursued independently, there is a danger that health and environmental agendas will work at cross-purposes:
  - local environmental health problems will be treated by means of displacement, thereby displacing or delaying (rather than removing) environmental burdens;
  - environmental capital will be protected by denying the most vulnerable groups access to the resources and environmental services they need to protect their health.

- Pursued together, health and environmental agendas can be made complementary:
  - health prevention can move 'upstream' and take advantage of the multi-sectoral approach to environmental improvement;
  - environmental improvement can become grounded in issues of local concern, and take advantage of the local presence of health professionals.

Box 7.2 Co-ordination of Donor Projects in Accra, Ghana

Prevention of ill health in Accra depends on the co-ordination of diverse departments and multiple donor initiatives, targeting the various risks faced by the population. The Accra Metropolitan Authority (AMA) benefits from a number of donor-led projects that address environmental health problems. They are, however, poorly co-ordinated. Projects result in vertical programmes involving only one government department, and whilst this approach fulfils the goals of the donors and achieves the strengthening of individual departments and institutions, it invariably fails both to achieve the stated project goals and the needs of the AMA. Examples of this include:

- GTZ support to the AMA (1985-1998) was designed to bring about improved waste management in the metropolis. This support was run as a vertical programme by the Waste Management Department of AMA, which has responsibility for collection and disposal of solid and liquid wastes only. Despite the presence of a Technical Adviser to the department, it failed to recognise the potential roles that other departments such as the Public Health Department, Roads Department, Engineering Department etc. can play in improving waste management and public health in the metropolis.

- The World Bank-sponsored Urban Environmental Sanitation Project (Urban IV) has a component aimed at improving the metropolis' drainage. This project failed to take into account other proposed projects, e.g. the Kuwaiti Development Fund supported by the Ministry of Works and Housing, until the implementation phase. The sanitation component of the World Bank project also failed to take into account the '5-Year Development Plan' of the AMA which seeks to ban the use of pan latrines by providing those communities with underground nightsoil holding tanks. It also omitted to recognise the role of the Public Health Department in the education of the beneficiary communities.

- DFID support of the ATP-Accra Waste Project for the storage and treatment of liquid waste and the provision of trucks for solid waste collection originally failed to recognise the institutional weaknesses of the AMA and the needs of the communities who should have benefited from the project. A later realisation of this shortcoming has led to the development of the DFID-sponsored Accra Environmental Health Initiative (AMEHI), whose key principles are as follows:

  - Community Participation
  - Intersectoral Collaboration
  - Institutional Capacity Building
  - Good Information For Good Management.

In summary, even though most of the initiatives are intended to contribute to improved environmental health conditions in Accra, the potential contribution of the Public Health Department is almost always over-looked. This omission should become a thing of the past and there should be adequate consultation at the design stages of such projects. New links must be forged between the Health Department and all donor-led environmental health initiatives, in order to bring about real improvements in the health and well being of all of Accra's citizens.

Contributed by Dr Dela Attipoe, Public Health Department, Accra Metropolitan Assembly, Ghana.

among donors, it still often falls short of enabling co-ordination amongst the local players involved.

A more positive example of donor co-ordination is provided in Box 7.3. The donor activities surrounding tuberculosis in Malawi have been successfully co-ordinated to develop a responsive, harmonised approach to tuberculosis control. This type of approach is often adopted in development initiatives to help co-ordinate different sectoral contributions. One of the important conditions for its success is strong political support and a strategically well situated co-ordinating body.

Most of the remainder of this chapter focuses on topics of particular relevance to the shared environmental and health agenda. Food security and healthy living environments are priority areas which deserve more attention and funding. Simply doing more of the same in these areas is unlikely to be effective, however. Implementing a shared agenda will require changes in procedures, as well as changes in priorities. Detailing specific actions that need to be taken is difficult, since local conditions vary considerably, and adapting to local specificities is one of the keys to success. There are, however, common principles that can help guide local action, some of which are summarised in the following section.

7.2 Key Principles for Successful Interventions

Environmental and health improvement programmes can both benefit from and contribute to the pursuit of other development goals. If progress can be made in reducing social conflict and inequality while improving local governance and international relations, the task of achieving food security and healthy living environments will be far easier to realise. Simultaneously, more targeted actions, aimed at improving food security and achieving healthier environments, can contribute to broader economic, political and environmental goals. If the more targeted actions further these broader goals, the net effect on health will be enhanced.

Adequate livelihoods, local participation, education, equitable access to resources and gender equality are goals in and of themselves - they are seen by many as social rights. They also provide the basis for principles that can help guide efforts to improve food security, achieve healthier living environments, and a range of other environmental and health goals.

Enhancing the livelihoods of the poorest

Poverty and inequality account for a large share of the environmental health problems in the ACP regions. Individuals and households with secure and sufficient livelihoods are able to achieve much higher environmental health status than those without (see Chapter 3). This has implications when choosing measures to improve food security and achieve healthier living environments. Two measures may have the same costs, and produce the same direct environmental health benefits. But if one constrains people's livelihoods, whilst the other contributes to them and assists in reducing inequalities, the overall health impact of the latter will be greater, and in some cases far greater.

Increasing participation

People want both food security and healthy living environments, and will work hard to achieve them. External assistance may be needed to help people achieve these goals, but to be successful, this assistance must have the support of those it is intended to help. Local knowledge and local initiative can, moreover, contribute substantively to better programmes and policies, and participation in one dimension of environmental health improvement can help enable more participation in other dimensions.

Improving education

Whilst existing local knowledge is a valuable resource, education can provide significant benefits to environmental health. The positive impact of female education upon household health status is consistently found by researchers and practitioners alike (World Bank, 1993). More specifically, a better knowledge of hygiene promotion is seen to

Box 7.3 Donor Co-ordination in Tuberculosis Control in Malawi

Since 1984, the Malawi National Tuberculosis Control Programme (NTP) has been supported by the Royal Netherlands TB Association (KNCV) and the Norwegian National Health Association (NNHA). Both these donors have provided the NTP with technical assistance and channel funds for drugs and training through the International Union against Tuberculosis and Lung Disease (IUATLD). The World Health Organization (WHO) has supported TB operational research since 1994, and in 1996, another donor, namely the Department for International Development (DFID), UK, began to support the NTP in the form of a resident technical adviser and of funds for training, operational research and equipment. This support may continue for another 5-8 years.

Prior to 1986, the NTP was run from the Central Unit, with authority and lines of communication passing down to 3 Regional Units and from there, down to 25 District units. In 1987 the Central Unit re-organised itself as a Programme Management Group (PMG). The PMG is under the chairmanship of the TB Programme Manager and has a membership which includes a Malawian National TB Officer, the DFID Resident Technical Adviser, a consultant from the Malawi College of Medicine, and a District Health Officer with an interest in TB, thus ensuring broad representation which extends outside the NTP. The PMG is an executive body with clear terms of reference that meets every 4 to 6 weeks. Full minutes of these meetings are circulated to senior Ministry of Health officials and other interested parties. The main functions of the PMG are to i) develop annual costed workplans which include operational research, ii) ensure the smooth implementation and evaluation of all programme activities in accordance with the annual workplan, iii) to attend the NTP Finance Committee looking at all budgets and expenditures on a three monthly-basis and iv) to report to the TB Programme Steering Group (PSG) on a 6-monthly basis.

The NTP's performance is overseen by the Ministry of Health and Population (MOHP) - Donor Co-ordinating body. The PSG was set up in 1987 at the same time as the PMG. All the main donors to the TB Programme (KNCV, NNHA, WHO and DFID) sit on this Steering Group, along with 3 senior MOHP officials, including the Controller of Preventive Services, who is the MOHP official with responsibility for public health programmes in Malawi. The PSG meets every six months, and has terms of reference which include: i) the review and approval of an annual costed workplan produced by the PMG, ii) review implementation, status reports and monitoring the progress of achievements against purpose, outputs and activities as defined in the NTP workplan, iii) reviewing reports on NTP finances and iv) providing an active lead for the PMG on issues of policy, strategy and ideas which will help to promote the achievement of the programme's goals, purpose and outputs.

The organisational structure of the NTP, with the PMG and the PSG, has led to a co-ordinated approach to TB control and TB research in the country. It has also facilitated a system whereby research carried out by the NTP is in response to the needs of the programme. Several examples now exist in the country of research findings being used to bring about constructive changes to practice and policy, hopefully for the better.

Contributed by Professor A. D. Harries, Technical Adviser, British High Commission, Lilongwe, Malawi.

services. Agricultural education can play a similar role for food security.

Gender equality

Women are not only the primary providers of households' health and environmental care and management, they also take the lead in meeting nutritional and livelihood needs. Participation of women in the planning and implementation of any environmental health intervention is, therefore, a vital goal. Without it, environmental health improvements at household level are difficult, if not impossible, to achieve. Furthermore, initiatives which help improve women's status in households tend to have positive effects on environmental care.

Giving local residents a stake in environmental improvement

People who stand to benefit from investments in environmental improvement are more likely to support them. Thus people with secure access to their housing are more likely to invest in improvements to their living environments, whilst people with secure access to the future produce of the land are more likely to invest in its sustainability.

These principles, and others, are returned to later in the chapter in the discussions of food security and ways of achieving healthy living environments. All have very practical implications for action, but the implications vary, depending upon local circumstances.

7.3 Environmental Care and Food Security

This section examines methods of and approaches to improving food security in the ACP countries. It will discuss ways of shifting to sustainable agriculture, providing appropriate support for the pastoralist and livestock sector, protecting nature whilst simultaneously ensuring food security, empowering rural women, improving food security in urban areas, and redirecting biotechnology.

7.3.1 Shifting to Sustainable Agriculture

The basic health challenge for sustainable agriculture is to improve the food security of vulnerable rural and urban dwellers by making better use of available resources. Agricultural and rural development policies over the past 50 years have emphasised external inputs as the way to increase food production. This has produced remarkable growth in food production, but a concomitant and even greater growth in the global consumption of pesticides, inorganic fertilisers, animal feeds, and machinery. Pesticides have replaced biological and mechanical methods of controlling pests, weeds and diseases, inorganic fertilisers have been substituted for livestock manures, composts, nitrogen-fixing crops and fertile soils, information for management decisions comes from input suppliers, researchers and extension workers, rather than from local sources, and fossil fuels have been substituted for locally-generated energy sources. What were once valued local resources have often now become waste products.

Sustainability can be achieved by reducing and balancing the use of external inputs, by regenerating internal resources more effectively, or by combinations of both approaches. Used appropriately, technologies and practices that conserve resources can be hugely beneficial for both farmers and rural environments. They make a positive contribution to natural capital, either returning it to pre-degraded levels or improving it yet more. A more sustainable agriculture, that can also serve to reduce malnutrition, systematically pursues the following goals:

- A thorough integration of natural processes (such as nutrient cycling, nitrogen fixation, and pest-predator relationships) into agricultural production processes, thereby ensuring profitable and efficient food production;
- A minimisation of the use of those external and non-renewable inputs with the potential to damage the environment or harm the health of farmers and consumers, and a targeted use of the remaining inputs, used with a view to minimising costs;
- The full participation of farmers and other rural people in all processes of problem analysis, and technology development, adaptation and extension, leading to an increase in self-reliance amongst farmers and rural communities;

- A greater use of local knowledge and practices, including innovative approaches not yet fully understood by scientists or widely adopted by farmers;
- The enhancement of nature's goods and services, and other public goods of the countryside.

The best evidence of the widespread redesign of farming systems in favour of sustainability comes from areas where farming has been largely untouched by modern packages of externally-supplied technologies, where agricultural yields are low and food insecurity high (Pretty, 1998; Pretty, 1995). In these lands, farming communities adopting regenerative technologies have substantially improved agricultural yields, often using few or no external inputs. Most of these successes are community-based activities that have involved the complete redesign of farming and other economic activities at local level, with the full participation of farmers and local people in the process.

A recent survey of 74 rural initiatives in East and Southern Africa found dramatic improvements in food production, with improvements in both natural and social capital (Hinchcliffe *et al.*, 1996). These initiatives share important common characteristics. They made use of resource-conserving technologies in conjunction with group or collective approaches to agricultural improvement and natural resource management. They have put participatory approaches and farmer-centred activities at the core of their agenda, which means these activities are occurring on local people's own terms. They have supported the active involvement of women as key producers and facilitators of change. And they have emphasised 'adding value' to agricultural products through agro-processing, marketing, and other off-farm activities, thus creating employment and income-generating opportunities, whilst retaining the surplus in the rural economy.

Despite the increasing number of successful sustainable agriculture initiatives in different parts of the world, including ACP countries, it is clear that most of these are still only 'islands of success'. Finding ways to spread or 'scale up' the processes which have brought about these transitions remains a huge challenge.

A recent analysis of 95 agricultural project evaluations recorded on the OECD Development Assistance Committee database shows a disturbing rate of failure (Pretty and Thompson, 1996). The cited reasons for failure included an emphasis on external technologies only, no participation by local people, ineffective training of professionals, and institutions working with no orientation towards the diversity of local conditions and needs of local people. This evidence from completed agricultural development projects suggests four important principles for sustainability:

- *imposed technologies are not sustainable:* if coercion or financial incentives are used to encourage people to adopt sustainable agriculture technologies (such as soil conservation, alley cropping, integrated pest management), then they are not likely to be sustainable;
- *imposed institutions are not sustainable:* if new institutional structures are imposed, such as co-operatives or other groups at local level, or Project Management Units and other institutions at project level, then these were rarely sustained beyond the project;
- *expensive technologies are not sustainable*: if expensive external inputs, including subsidised inputs, machinery or high technology hardware are introduced with no thought to how they will be paid for, they too will not be sustained beyond the project;
- *sustainability does not equal fossilisation or continuation of a thing or practice forever:* rather it implies an enhanced capacity to adapt in the face of unexpected changes and emerging uncertainties.

A more sustainable agriculture can lead to both health and environmental improvements. It does, however, need co-ordinated action on the part of national governments, to encourage and nurture the transition towards more sustainable alternatives. Without appropriate policy support, it will remain at best, localised in extent, and at worst, wither away. Whilst

investing further resources may be appropriate in some areas, there is much that governments can do within existing resources (Pretty, 1995).

7.3.2 Providing Appropriate Support for the Pastoralist and Livestock Sector

Over the past 30 years, the millions of dollars that have been spent on projects in pastoral areas in Africa have brought remarkably few benefits (Scoones, 1995). Many development agencies have now abandoned dryland pastoral areas, deeming them to be 'no hope' zones, in favour of so-called 'high potential' areas. National policies to 'modernise' the livestock sector have, moreover, tended to try and force the creation of private ranches and a move away from common property systems (Lane and Scoones, 1993). There are, however, several good reasons not to abandon traditional pastoral areas.

Firstly, the social and natural resource costs are very high. Many pastoral areas in Africa are characterised by conflict or civil strife, with great human cost borne by pastoral people. Nomadic pastoralists are now considered to be amongst the most vulnerable of the world's rural poor, and national governments and the international community bear the monetary costs of this insecurity and famine (ITDG, 1995; Scoones, 1995).

Secondly, livestock make a significant contribution to national economies in dryland Africa. In 1988, the total value of livestock products was estimated to be 25% of the total agricultural output in Africa, equivalent to US$ 12 billion (USDA, 1990). If livestock benefits of manure and draught power are also included, this figure may increase to 35% of total agricultural GDP (Winrock International, 1992).

Thirdly, much of the land in ACP-Africa is not suitable for arable production and so is best used as rangeland. For example, some 87% of South Africa's land falls into this category. In these areas, communally managed livestock systems are the most productive form of land use and should thus be supported in the interests of food security.

Pastoralists are often better off than settled farmers during normal times. If their flexible strategies are supported, they can move their animals to follow the rains or take them to established seasonal grazing areas. They do, however, need extra help during prolonged periods of environmental stress. For these reasons, a sustainable approach to agriculture and livestock development emphasises reducing vulnerability and strengthening local control, which can be achieved by providing support to traditional pastoralist activities and enhancing productivity through improvements to traditional structures.

7.3.3 Protecting Nature Whilst Ensuring Food Security

Reinstating legal access and increasing the economic value of wild resources can promote resource conservation by making sustainable use a viable option. Experience has shown that for the economic returns from common property resources to reach their users, effective institutions and incentives for the management of common property are essential (Murphree, 1994). Approaches that support and enhance local management capacity are vital.

In highly industrialised or post-industrial countries, protecting nature is often associated with keeping people out. Since only a small share of the population lives off the land, and virtually none depend upon harvesting natural products, the sacrifice is comparatively small. It is clearly inappropriate, however, to simply transfer such an approach to ACP countries, where the majority of the population live off the land and many of the most vulnerable depend on natural produce. Exclusionary policies are, in such conditions, less likely to protect the natural resources, and indeed, as indicated in Box 1.4 (chapter 1), population expansion is not always bad for the environment – in the right circumstances it can be beneficial. Exclusionary policies are, moreover, far more likely to have negative health consequences.

The need to involve neighbouring communities in forest management has long been recognised (Westoby, 1989), though developing practical strategies has proved difficult. On the one hand, there are sometimes very real trade-offs involved, and finding appropriate local solutions is often

difficult. On the other hand, forest ministries have long principally seen their role as protecting the forests from people, and this goal was often built into their institutional structure. The need to solicit the participation of local inhabitants is now recognised in most efforts to protect or improve natural ecosystems. However, as indicated in Box 7.4, practice often remains far from ideal, and the result can be an increase in health burdens.

7.3.4 Enhancing Participation by Rural Women

Women in ACP-Africa currently play a crucial role in meeting the food and nutrition needs of their families in three main areas related to food security: food production, economic access to food and nutritional security. Women account for 70%-80% of household food production, and do some 95% of the work related to feeding and caring for the family (IFPRI, 1995). African women also perform about 90% of the work of processing food crops and providing household water and fuelwood, and 80% of the work of food storage and transport from farm to village. They achieve this, despite unequal access to land, inputs and information: they receive, on average, for example, only 4%-6% of all agricultural extension visits. They are also generally excluded from an active role in research, such as seed development and selection.

Women also have valuable knowledge of wild diversity. In some areas of ACP-Africa, women cultivate or collect an extremely wide variety of species of plants on land fragments between fields and in the areas surrounding communities. In times of famine or drought, this knowledge can be especially important. During the 1984-1985 famine in the Sudan, for example, female-headed households were found to be better off nutritionally than those headed by men, because women were more knowledgeable in the collection and use of wild plants that sustained their families through the crisis (de Waal, 1989).

An important means of gaining this access, other than through food production and the collection of non-domesticated plants, is through income. Women are more likely to spend their income on household food than men. Ensuring the nutritional security of the household, through the combination of food and other resources, is the almost exclusive domain of women. If the constraints confronting women farmers were removed and women were granted access to the resources available to male farmers, they could make a more significant contribution to combating food insecurity.

7.3.5 Improving Food Security in Urban Areas

Increasing the supply of food from large-scale commercial agriculture or imports and lowering food prices are more likely to improve food security among urban than rural dwellers, and this is one of a number of issues around which urban and rural interests can come into conflict (Sah and Stiglitz, 1992). Interventions that depress urban food prices are not, however, likely to prove an efficient means of improving urban food security. Moreover, some of the most vulnerable urban dwellers rely on rural links or urban agriculture to ensure their food supply.

In many ACP cities, assisting low-income households with urban agriculture could be an effective means of improving urban food security. As indicated in Chapter 5, there are indications that in some urban areas it is becoming increasingly difficult for low-income households to access agricultural land, and measures that both improve the food safety of urban agriculture and improve access for low-income residents, especially women, could thus make an appreciable difference.

More generally, of course, urban food security depends upon wages, employment and informal sector opportunities, and the importance of a health perspective is less evident here. It is, nevertheless, important to keep in mind that measures designed to improve urban food security which undermine the economic opportunities of the more vulnerable urban residents are likely to be counterproductive.

7.3.6 Redirecting Biotechnology

Opinion is sharply divided on whether biotechnology and genetic engineering are creating opportunities to be seized or a danger to be avoided. These divisions extend to the role of biotechnology in addressing food

Box 7.4 Forest-Adjacent Communities in the Amani Nature Reserve, Tanzania: Bearing the Costs and Missing the Benefits

The pursuit of conservation aims often results in communities around conservation areas being denied access to the natural resources from which they obtained a livelihood, and as a result, forest-adjacent communities increasingly find themselves experiencing excessive socio-economic stress and uncertainty. This approach falls far short of ensuring the successful conservation of resources. One example of this type of contention can be found in the biodiversity rich forests of the East Usambara mountains of Eastern Tanzania, where the Amani Nature Reserve (ANR) has been established. The Amani Nature Reserve (ANR) covers 8,380 ha, comprising about 20% of the forest cover of the East Usambaras.

The forest benefits accrue to global, regional and local stakeholders, with the global benefits including, among other things, carbon sequestration functions and a very important gene pool. The climatic conditions make the area suitable for large-scale agriculture – especially tea growing, the catchment functions are important for water supply downstream and the forests are very important for the livelihood of the over 36,000 people of the East Usambaras (1996 pop.) Agriculture includes cultivation of high value crops such a black pepper and cardamom, but a wide range of tangible and non-tangible items, including woodfuel, charcoal, hunting, wild foods, grass, medicines, poles, fibres, honey, clay, sacred shrines and even aesthetics are also provided by way of the forests.

The forests of the East Usambaras are currently managed by the East Usambara Catchment Forest Project (EUCFP). The EUCFP was established in 1991 to remedy the ecological damage done to the natural forests by FINNIDA (Finnish International Development Agency) when they supported extractive forest operations. The buffer zone approach was utilised, in order to extent the ANR's surface area, which meant extending current protected areas rather than reclassifying land within the areas. Existing land laws and tenure systems in Tanzania mean that the occupants of adjacent land have access in order to use the land, but have no security of tenure, resulting in uncertainty for the forest-adjacent communities when boundary extensions have to be made. Adjacent communities were involved in consultation with regard to this process of border extension, and compensation was a key issue. Partial compensation came too late and was inadequate, coercion, bureaucratic bungling and lack of transparency fuelled distrust and indignation against the forest authorities, and some of those who were obliged to give up their land now had no alternative land to cultivate. Many local benefits were now suddenly out of reach of forest-adjacent communities, with dire consequences for many households. In desperation some still attempt to access these resources, knowing that they are breaking the law in the process.

It appears that the full implications of extending the ANR to the communities were never fully appreciated by both sides. The forest authorities got their enlarged forest, but at the expense of lost livelihoods on the part of local communities. The forest-adjacent communities are not all "angels" - they too have their problems, such as misreporting, poaching and encroachment, but the role of the bureaucracy that was involved in implementing the expansion of the ANR is also questionable. Bureaucracy may not be the ideal tool for encouraging popular participation, and indeed, accusations of bureaucratic inefficiency, a lack of appropriate skills, corruption, and inertia have all constituted major hindrances to the effective management of natural resources, to the populations affecting and affected by natural resources, and to the workability of the system as a whole.

Some experts note that, internationally, there are few buffer zone initiatives which can truly claim to have succeeded in establishing stable and compatible land use systems around a protected area in such a way that local people are genuinely reconciled to the conservation function of the area. This failure is apparently often due to the fact that buffer zones have been imposed on people by external agencies oblivious to local needs and sensitivities.

In this example, field observations clearly show a healthy regeneration of flora and fauna in the new areas. Several forest-adjacent communities have noted positive changes to the microclimate and increased availability of wild animals and water supply. From the ecological point of view, something is being done right. The question that now arises, however, is how can the communities adjacent to protected areas be brought into the joint management approach so that benefits and costs are shared more equitably between the global and regional stakeholders and the forest-adjacent communities?

One expert notes that the attitudes of local people towards protected area managers are strongly influenced not only by contacts with protected area employees but also by the services and benefits they personally receive. This suggests that extension programs should be designed in a way that not only establish permanent lines of dialogue with ANR managers, but that also provide direct tangible benefits for local people. Whilst the former is in operation, there is little evidence of the latter in some of the affected areas around the ANR.

The promotion of land-use practices that maintain low human density on adjacent lands is probably the most desirable long-term strategy. While this is desirable, however, the main problem lies in how this can be done. Some people around the ANR have been suggesting that they be relocated to other areas that have more land, but most of these areas are in the lowlands, and the highland communities are especially susceptible to prevailing lowland diseases. Their current levels of poverty would, moreover, necessitate a well-worked out program of assisted re-settlement. Given Tanzania's poor record of resettlement, such a move is likely to be unpopular both with government and donor agencies. In the past, there have been a few successful initiatives that could be emulated, e.g. Operation Ukara, where people were moved from the ultra-high density area of the island of Ukara to Sengerema District, but were such an exercise to be conducted again, it must be done properly and not through coercion.

The core challenge for the ANR is to find ingenious ways of putting people back into conservation. It is important that participation should be viewed as a means to an end. The interests of the global, regional and local stakeholders do not necessarily converge, but the goal should be 'to promote local sustainable livelihood' whilst simultaneously - rather than, as opposed to - 'preserving the integrity of ecological values'. The project approach to participation concentrates on the mechanisms involved, but overlooks critical issues such as who is responsible for, and has rights to, the land, its products and its services.

Contributed by George Jambiya, University of Dar es Salaam, Tanzania.

security problems. Proponents of biotechnology tend to be pessimistic about the alternative means of improving food security, and optimistic about all aspects of biotechnology, including its ability to solve the world food problems. Opponents tend to be optimistic about alternative means of improving food security, and pessimistic about both the dangers biotechnology brings and the likelihood that it will actually get more food to those in need. The pro-lobby hopes that protesters will go away, or will be persuaded that biotechnology can benefit us all. The anti-lobby hopes policy-makers and the public can be persuaded to prevent genetically modified organisms from entering the food chain.

This report is not the place to debate the technical potential of biotechnology, or to pass judgement on the risks it will bring, or the ethical questions it posses, though it should be clear that whilst the potential is considerable, so are the risks. It is, however, important to note that biotechnology does represent a challenge to ACP countries. How this challenge is met could have important implications for both environmental and health issues.

Opponents of biotechnology are surely correct in that there are alternative means of improving food security. Emerging empirical data on sustainable agriculture suggest that current and future populations can be fed with low-cost (to both farmers and the environment) and regenerative technologies. Also, to the extent that biotechnology is limited to large-scale commercial farming, it can at best address one side of the food security problem. Increasing food production is not, for the reasons outlined in Chapter 4, the same as providing food security, especially for the rural poor. Clearly, biotechnology should not be pursued as the solution to food insecurity.

Proponents may, however, be right to say that biotechnology has the potential to overcome many of the barriers which currently prevent modern technologies from benefiting small cultivators. Whether this potential can be realised, efficiently or safely, is open to debate. This debate needs to take place within ACP countries, and there needs to be the local capacity to ensure that informed decisions can be taken. In most industrialised countries substantial efforts have been devoted to developing regulatory structures, policies and procedures and to biosafety mechanisms, in order to ensure environmentally safe applications of biotechnology (Doyle and Persley, 1996; Tzotzos, 1995). A major problem facing most ACP countries is the insufficient capacity for enforcement of biosafety regulations and lack of biosafety information relevant for the region, and there is a hence a need for training and biosafety research to address shortage of human resources and fill important information gaps (Virgin and Frederick, 1995).

7.4 Achieving Healthy Living Environments

This section examines methods of and approaches to achieving healthy living environments, building upon Chapter 5. It will discuss how to enhance local capacities for achieving healthy living environments, as well as more targeted attempts to improve environmental services and housing conditions.

Most people living in ACP countries are exposed to a high share of environmental health hazards in and around their homes and work places. It is through better living conditions that environmental improvements can have the greatest direct impact on health. This applies to rural as well as urban areas, and an overly sharp distinction between urban and rural living be misleading. Indeed, some of the settings where the living environments are least healthy are peri-urban settlements that combine urban and rural lifestyles and livelihoods.

Traditional tools of pollution abatement can only go a small way towards achieving improved living environments. A recent set of reports on Bridging Environmental Health Gaps concluded that 'a focus on pollution control can give a false sense of achievement in environmental health improvement', and argues cogently for paying more attention to the role of infrastructure (Listorti, 1996). Much also depends upon the capacity of local residents to meet their own environmental health needs, and to represent their collective needs to the government and in the political

arena. Centrally mandated regulations, designed to ensure that living environments are 'up to standard' and to punish offenders, cannot be expected to come to terms with the variety of conditions that prevail in low income settlements.

7.4.1 Building Local Capacities for Environmental Management

Building a stronger local capacity for environmental management is important in its own right, and can also improve the success of external interventions and services. Most of the labour and investment for improving living environments comes from the residents themselves, in that outside experts are rarely in good position to identify priorities: the environmental health threats in deprived settlements are closely interconnected, complex, and often specific to the particular settlement. Externally designed interventions are rarely accepted uncritically and relations between low-income residents and governmental agencies are often strained. As described in sections 7.4.2 and 7.4.3, environmental service and better housing programmes can help address these problems, but it is also important to take action to ensure that local residents have the capacity and opportunity to improve their own living environments, and influence external interventions.

In the right conditions, people have a very strong incentive to act to improve their local environments. Better health is not the only motivation, and indeed, many environmental health experts have found that other reasons are often far more important to the adoption of better hygiene practices and technologies (Cairncross and Feachem, 1993). Cleanliness, convenience, privacy, propriety, status and religious codes are often the factors which motivate people to improve their living environment. Health often reinforces such concerns, however, and better health can be a very positive outcome.

Poverty alleviation is itself one of the most important ways of building local capacities to manage the environment. This report cannot do justice to the strategies needed to improve livelihoods in both urban and rural areas. But in any attempt to improve environmental health, it is necessary to take into account that measures which also alleviate poverty will be doubly beneficial to health, whilst those which impose a significant economic burden on the poor are likely to be counterproductive. In addition, it is typically among the poorest households that improving living environments yields the largest health benefits.

Improving housing security is also important if residents are to have a sufficient incentive to improve their local environment. Expanding land registration and formalising land tenure are tools, which, in the right context, can improve housing security. Slum clearance and evictions, on the other hand, undermine housing security, even beyond the bounds of the targeted areas. Although making environmental improvement a condition for land titling can be an effective tool of environmental management, overly strict conditions can undermine housing security and become counterproductive. In some contexts, rent control will enhance housing security, but in others it will give owners less reason to improve or maintain the quality of their living environments. It is, therefore, vital that the local context is taken into account in the pursuit of housing security. If this is done, the benefits for people's living environments can be substantial.

Giving women greater control over the local environment, either through better technologies, more knowledge or, perhaps most important, more influence over collective initiatives (such as public services), can also increase local capacities. In most settlements, women are already central to environmental management in and around the home. These management tasks are time consuming, onerous, and at times hazardous, particularly where services are lacking. They are also critical to achieving healthy living environments. Measures that simply add new tasks, or create new constraints for women, are unlikely to be beneficial, even if they are environmentally motivated. Whilst women's own priorities may not always be well informed or public-spirited, they will generally be preferable to centrally designed prescriptions.

Environmental education, focusing on local processes and health hazards, also has a potentially important role to play. As

described above, far more knowledge of the underlying environmental processes is needed to live healthily in a settlement where services are lacking. Formal schooling, as well as more tailored educational initiatives and awareness programmes, rarely take local environmental management seriously. Considerable verbal support is given to hygiene education, but many practitioners still feel that the level of professionalism is woefully low (Quarry, 1994). There are also indications that a prescriptive approach to hygiene education often fails to provide residents with the capacity to respond to their specific challenges. Given the local variability in environmental conditions, it is clear that neither standard prescriptions nor formal schooling, based on standardised curricula, can ensure that locally relevant information is made available. This gap could potentially be filled by techniques drawn from Participatory Learning and Action (Pretty *et al.*, 1995) and other locally adaptive education.

Improving the quality of local governance, and its ability to respond to the environmental concerns of residents in a constructive fashion, is also critical. Many of the most critical environmental health problems arise in the public domain, and a responsive local government can work with residents to find solutions. The importance of local government, as well as non-governmental organisations, has become increasingly crucial with the decline of central planning. In order to fill its new responsibilities, however, greater capacity is needed. Increasing capacity in the areas of environmental health and communication with residents is particularly important. Many improvements in living environments are the joint outcome of public and private initiatives, and better relations, especially with local residents, can lead to greater success.

Providing micro-finance for low-income households can allow them to improve their housing and water and sanitation. This can take the form of enabling them to afford connection charges, of better provision within their home (such as installing a well-designed latrine) or of allowing them to buy or build a better quality home. There are many examples of successful community-based savings and loans schemes that have done this with high levels of cost recovery. Utilities can play a similar role, for example collecting repayments for connection costs in the monthly bills. Sound financial management is, moreover, critical to both private and public initiatives, and is especially important when subsidies are involved.

Many of the principles mentioned above tend to be incorporated into community-based approaches. A community-based approach is, however, not a solution in itself, but rather one way of trying to come to grips with all these issues. That collaboration with communities does not automatically solve all problems is spelled out in Box 7.5. To work effectively with communities it is necessary to address all these challenges.

7.4.2 Improving Water, Sanitation and other Environmental Service Provision[1]

Improving environmental service provision remains one of the most important means of bettering health in many ACP countries, even if it is only a partial solution. Providing good water, sanitation and drainage can reduce a wide range of 'water-related' infectious diseases (see Chapter 3). Cleaner energy services can reduce respiratory infections and conditions, and waste removal can help avoid a range of environmental hazards prevalent in many low-income settlements (see chapter 5). From the evidence provided, it should be clear that if everyone in the ACP group of states had ready access to even the most basic services, the health benefits could be enormous.

There is still a great deal to be done, not only in terms of investing in improved infrastructure, but in developing institutional approaches and technologies better adapted to the needs of low-income settlements.

[1] This and the following section draw heavily on materials prepared by David Satterthwaite in support of an OECD-DAC initiative on Shaping the Urban Environment in the 21st Century.

Box 7.5 Community-Based Approaches to Development - What are the Obstacles?

Community approaches have been shown to be useful in resolving health and other problems arising from urban development. Certain obstacles can, however, reduce the effectiveness of community interventions. Some of these obstacles are described below, and are based on the experience of a large NGO (Non-governmental organisation) in Dakar, Senegal:

Constraints of collaboration with communities:

- Lack of resources: in some communities, inadequate human and financial resources, illiteracy and migration limit the capacity of community members to invest in projects.
- The play of political interests at community level: it would be naive to believe that community leaders are concerned only with improving the living conditions of the populations which they represent. These leaders have their own objectives and strategies and their own stake in the social resources of they area. These may be different from the objectives of the project and may prevent its implementation. In certain cases, government decentralisation creates a client-patron relationship between community leaders and local governments, which may also lead to a shift in the objectives of the project.

Institutional constraints - governments:

- The quality of governance: the lack of definition regarding the roles of the State and civil society may mean that governments do not recognise local institutions. Traditional institutions of social organisation are, therefore, weakened, whilst modern public institutions continue to evolve, often with deleterious effects on the manner in which health problems are managed.
- Modes of interaction: the fact that governments do not recognise local institutions, a system of regulation which does not support community organisations, and the difficulties in establishing durable working relationships with government administrations are all important factors.

Institutional constraints - community organisations:

- Turnover of personnel: it is difficult for NGOs, for example, which are themselves unstable, to attract and retain qualified personnel.
- Financial challenges: mobilising ongoing financing for communities, providing regular budgetary support for their activities, and setting up transparent and efficient financial systems within the associations, institutions and organisations of the community are all important challenges.

Constraints on participation:

- Limited internal resources: Representatives of the African community are still, in most cases, young people who are, themselves, still developing socially. Many have limited social support and financial resources.
- Indifference or external hostility:
  - the lack of financial backers, and the insistence that organisations undergo rigid financial assessments, may hamper success in these initiatives.
  - the relevant governments and services sometimes react as though local organisations are competitors in fields previously reserved for them. The integrated management of the city, which is currently a promising path for sustainable urban development, faces the inflexibility of the public authorities

who are confined to traditional management styles, and do not attempt to solve problems at a grass-roots level.

Constraints on 'scaling-up' of the initiatives:

- High demands on resources: the extension of the pilot activities initiated at the local level requires enormous human and financial resources, which NGOs often lack.
- Government services, unaccustomed to collaboration with NGOs, do not recognise their role in urban management and may, therefore, hinder progress.
- Local diversity: the diversity of local initiatives may hamper expansion.

Contributed by Cirre Fall, Enda – Relais pour le developpement Urbain Participe Dakar, Senegal.

Progress has, however, been slow, despite long-standing recognition of the health benefits. The slow pace can be partially but not fully explained by the lack of political will and finance, and the failure of centrally planned solutions. Among the problems which persist are:

- skewed subsidies, favouring the better-off, and harming the most deprived;
- poor relations between service providers and low-income residents;
- under-financed utilities;
- too great a reliance on capital intensive, often imported, technologies;
- poor maintenance of existing infrastructure.

Improving environmental service provision is a critical task, but not an easy one. It deserves the best that science and governance can provide. The appropriate approach, given limited budgets, will inevitably vary considerably from place to place and in line with technical, environmental, demand-related and institutional differences. Technical issues may be related to the cost of supply, e.g. urban versus rural location, distance from existing water supplies, sewers, drains or electric grid, topography, soil structure, settlement layout and opportunities for waste composting. Environmental issues may be related to the vulnerability of local and regional ecosystems, such as excessive abstraction from aquifers, overloading of renewable or non-renewable sinks, or deforestation due to fuelwood use. Demand issues may be related to the needs and priorities of local residents, such as socio-economic status, health status, waste composition and cooking practices. Institutional issues may be related to the organisational capacity to improve service delivery, such as local government structures, land tenure or the strength of community based organisations, and the rules which guide the actions of these players.

Different approaches are, of course, also required for the different services. There are, for example, far more opportunities for cost recovery through user fees for water and electricity, than for sanitation and waste collection. Even for water and electricity, however, it is not possible to rely on market mechanisms to ensure supply.

Prioritising various environmental service interventions can be difficult to achieve on the grounds of health improvement alone. Box 7.6 presents a brief overview of the difficulties involved.

There are a wide range of well-documented technological options for water and sanitation (Cairncross and Feachem, 1993; Mara, 1996), along with an even greater number of locally developed

alternatives. There is a growing recognition that companies or agencies responsible for water and sanitation need to be more aware of and responsive to users' needs and local realities.

Responsible organisations, for example, need a more detailed understanding of existing (formal and informal) systems and businesses that are already providing water and sanitation to those they do not serve. They also require information on different inhabitants' own needs, priorities and willingness to pay. Secondly, they need to develop a range of responses to meet the diversity of needs, priorities and financial capacities. For many of the lowest income settlements or within the weakest local authorities, this will often include support for community provision and management. Community provision may take the form of the agency providing piped water and sewer or drain connections to the site, and the inhabitants organising the systems within their settlement. Community management may take the form of day to day responsibility for water points and shared sanitation and washing facilities, for example, resting with certain members of the community.

Responsible agencies also need to be more active in providing and maintaining both sanitation and water supply. This is because improved sanitation is needed to reduce diarrhoeal and other water-related diseases. The safe disposal of households' wastewaters (sullage) is also important because this contains certain disease-causing agents, and if not removed, can provide a breeding ground for disease-carrying insects or facilitate the development of soil-based parasitic worms, such as hookworm.

Responsible agencies could also draw on a considerable range of methods of safe, good quality sanitation. When providing sewers, for example, costs can be cut by using smaller

Box 7.6 Using Scientific Evidence in Environmental Health Decision-Making: the case of Water and Sanitation

Many development and government agencies would like environmental health specialists to provide clear scientific evidence to guide them in their choice of interventions. A number of studies have attempted to estimate the separate and joint health effects of improvements in water supply and sanitation in developing countries. Clear answers are difficult to find, however, due to a variety of factors.

For example:

- we still lack knowledge, of the way in which faecal-oral diseases are transmitted and of the relative effectiveness of public health interventions in reducing this transmission;
- the health-related impacts of interventions such as an improved water supply or sanitation depend on many additional factors, such as household hygiene practices (Cairncross and Kochar, 1994);
- relationships between environmental and health issues are strongly confounded by households' socio-economic status. Latrine owners, for example, tend to be better off than non-owners, to be more likely to use improved water sources and larger quantities of water, and to be more likely to report good hygiene practices (Daniels *et al.*, 1990);
- the interactions between the interventions (such as water supply and sanitation measures) may vary from setting to setting, and are difficult to measure.

Bearing these factors in mind, analyses of existing and rigorous studies have produced the following findings;

Table 7.1 Median Reductions in Diarrhoeal Disease Morbidity from Improvements in one or more Components of Water and Sanitation.

Intervention	All studies		Rigorous studies[1]	
	No.	Reduction (%)	No.	Reduction (%)
Water quality & quantity	22	16	2	17
Water quality	7	17	4	15
Water quantity	7	27	5	20
Sanitation	11	22	5	36
Water and sanitation	7	20	2	30
Hygiene	6	33	6	33
ALL STUDIES	49	22	19	26

Source: Esrey, S. A., Potash, J. B., Roberts, L. and Shiff, C. 1991.

The above table indicates that larger reductions in diarrhoeal disease morbidity were noted following sanitation improvements and hygiene interventions, such as hand washing, than following improvements in water quality or quantity. Studies examining the combined effects of water and sanitation showed reductions similar to those for sanitation and hygiene alone, possibly because of interactions between interventions, as discussed above.

From this table, one might conclude that improved water quality alone has a substantially lower impact on diarrhoeal disease than improved sanitation. There are two possible reasons for this. Firstly, there is good evidence that improving water quality at source may not ensure a reduction in the transmission of water-related diseases. A number of studies (Genthe *et al.*, 1997; Lindskog and Lindskog, 1988; Mertens *et al.*, 1990; Verweij *et al.*, 1991)) have shown significant deterioration in water quality between the source and the point of use, indicating contamination of water during collection and storage. This contamination appears to be more severe where the water source is outside the home (i.e. private outdoor and communal taps). This perhaps indicates that contamination of household water from a source outside of the household poses a greater risk of diarrhoea than any household contamination (VanDerslice and Briscoe, 1993). Improvements in water quality alone would, therefore, be expected to have little impact on diarrhoea in highly contaminated neighbourhoods.

Secondly, water quality may be less important than the quantity available to the household. The availability of larger volumes of water is associated with child health benefits and can lead to increased domestic water consumption for hygiene purposes (Aziz *et al.*, 1990; Cairncross, 1987). Household water consumption remains largely the same, however, until the source is within the compound or home, when it rises exponentially, often to more than four times previous volumes (Cairncross and Cliff,).

[1] Studies were excluded from the rigorous category if they had a single major, or several minor, flaws that may have led to bias in the results (Esrey *et al.*, 1991). Criteria for this process are reported in (Esrey and Habicht, 1986).

This evidence suggests that water quality receives too much attention relative to the role of water in 'washing away' pathogens.

Finally, it should be remembered that environmental interventions are not without risk and can, if badly designed or maintained, *increase* health risks. Drainage interventions may, for example, in the absence of adequate maintenance, increase the number of sites for vector breeding, encouraging the transmission of diseases such dengue, yellow fever and filariasis, or may increase exposure to contaminated floodwaters (Curtis and Feachem, 1981; World Health Organization, 1997). This risk can be minimised if interventions are designed with careful attention to local conditions, including local risk perceptions (Stephens *et al.*, 1994).

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pipes and shallower trenches, shallower gradients and interceptor tanks. But where support for improved sanitation is within settlements where sewers cannot be provided, too little attention is often paid to ensuring that there is an effective service for the collection and disposal of excreta from bucket and pit latrines and septic tanks. Projects involving the construction of latrines often fail to develop adequate programmes to ensure they can be regularly emptied. Households with latrines need an efficient and affordable service, in that the manual emptying of pit latrines is a very unpleasant and hazardous job.

'On-site' sanitation options that do not need sewers tend to be lower cost. These include options such as 'ventilated improved

pit' (VIP) latrines and pour-flush toilets, linked to double vaults or community septic tanks. Local conditions, such as soil conditions, the ease with which pits can be dug, and groundwater levels will help determine which is most appropriate in each circumstance. Provision for sanitation must also make provision for the safe disposal of wastewater. In large and high-density residential areas, unit costs for sewer systems may, in fact, be comparable to 'on-site' systems, and be much preferred by the inhabitants because these also remove wastewater and do not need emptying.

These examples represent technological innovations that may be beneficial in the provision of water and sanitation. There are other types of innovation which can also improve provision and cut costs. Institutional innovations, in settlements where it is too expensive or too difficult to provide household piped water connections, can, for example, create a range of measures to improve provision (many of which can also recover costs). Where people rely on communal water points and water vendors, for example, well-managed water kiosks (including those managed by community organisations) may improve service levels, reduce the distance that water has to be carried and reduce prices, whilst simultaneously recovering costs. Water connections to each house or plot do, however, remain the ideal, because these provide health benefits that more distant sources do not. There are often ways in which water agencies can support such connections, rather than providing them themselves, e.g. for urban settlements where the inhabitants lack the income to afford connection charges, the water agency can provide connections to water mains and trunk sewers at the settlement's boundary with the inhabitants organising the systems within their settlements. For water agencies seeking to reach low-income households with affordable piped supplies, selling the water or equipment 'wholesale' to an organisation (such as a co-operative), with the community collecting payments from households can reduce costs. Such innovations can make a large difference, but inevitably require close cooperation with the residents themselves.

7.4.3 Improving Housing Conditions

In the past, many housing programmes 'for low-income groups' produced few units, usually with high unit costs and often in locations that are too far from income-earning opportunities. There is, however, a new generation of shelter programmes that support low-income urban households with regard to the building, purchase or extension of their homes, and to obtaining improved infrastructure and services (either by negotiating provision from outside agencies or by building it themselves). These can bring multiple benefits, all of which contribute to better health.

Improved housing can bring about direct improvements in health. The infectious disease burden can be considerably reduced by improving housing quality and relieving overcrowding, and by improving the provision for water, sanitation, drainage and garbage management. Improved housing can also reduce accidents such as burns, scalds and fires that are related to the combination of overcrowding, the use of open fires or kerosene stoves, and flammable buildings. Improved ventilation and the nature of cooking facilities can greatly improve respiratory health. Health burdens are further reduced if the land on which housing stands is safe and not for instance, on flood plains or steep slopes.

Increasing home ownership is increasingly seen as a positive step for low-income groups. Acquiring a legal home may bring substantial cost-savings. Better quality homes mean less ill health and reduced costs, as noted above. For many low-income groups, acquiring their own shelter also means not having to pay rent. This can be a great saving as many tenant-households spend more than a third of their income on rent. Households who rent rooms or live in illegal settlements may also be paying high prices for other services.

For low-income urban dwellers who acquire their own shelter (usually within illegal or informal developments), their homes are their most valuable asset. If they can obtain secure tenure of the land plot, they can improve and extend their homes, when resources are available. This combines improvements in their living conditions with increases in their asset base or increased incomes (e.g. through

extending their house to allow a small business to operate there, or building rooms which can be rented out). Acquiring legal tenure also means a better chance of obtaining loans (with the house providing the collateral) and connections to piped water, sewers and electricity (since official utilities often refuse or are not allowed to serve 'illegal' settlements).

Community-led housing programmes, whether they involve upgrading or new developments, can bring many other benefits. These include increased demand for labour and services and also for building materials, fixtures, fittings or components made locally. They also include considerable time-saving, especially for women and girls (for instance time saved when water no longer needs to be collected by hand and when garbage no longer needs carrying to distant dumps or buried). Extended housing can, in addition, permit income generation, e.g. by giving food producers increased space for food preparation and improved ventilation, ensuring garment producers have the space needed for private fittings, storage and product design, and enabling traders and shop-owners to enlarge windows for trading. When housing and neighbourhood conditions improve, more local businesses tend to develop.

A further benefit of improved housing conditions may come in the form of better community organisation. Low-income groups who work together to address their housing problems often develop the capacity to negotiate more resources, services, and legal tenure from government agencies. Many small community initiatives in squatter settlements aimed at addressing some specific need (e.g. improved water or garbage collection) develop into more ambitious programmes. Many communities that organise to improve housing and basic services also develop the capacity to work together to address other development needs.

As Chapter 3 has shown, child health and development is a crucial area of concern in the ACP countries, with a very high environmental health burden falling on children. Safe, secure and healthy housing brings tremendous benefits for children. When low-income groups acquire such housing, it brings dramatic falls in infant and child mortality and morbidity. But children's physical, mental and social development are also much enhanced by safe and secure places to live, study and play, and by homes that allow them to avoid the constant movement and forced evictions that are so common for low-income families. The time-savings brought by good quality housing also reduces work burdens for children (especially girls) and may permit parents to spend more time with their children.

From the above paragraphs, it is obvious that safe, secure and healthy housing can greatly reduce the vulnerability of low-income households. Serious illnesses and the costs of medicine or other treatment costs are among the most common causes of impoverishment, and improved housing also means much reduced health risks. Better quality homes on sites with drainage reduce risks from floods and storms.

In terms of affordability, there are many examples of good - and inexpensive - projects supporting improved housing for low-income groups. Indeed, when projects seek to keep down costs and use loan-finance when appropriate, full cost-recovery is often possible, with funds recovered available to further extend the project.

7.5 Addressing Other Environmental and Health Burdens

There are numerous other environmental and health issues that must be addressed, not just in the ACP region, but internationally. Many of these fall into what we have labelled the 'conventional development cluster' - environmental problems which environmentally unmindful development tends to bring about.

Some, such as most of the vector borne diseases, are long-standing health threats whose overall incidence is declining. Many vector-borne diseases still represent a major burden, however, and their decline has been uneven. Certain developmental interventions, such as dams and other water-related interventions, can increase a number of water-related diseases, such as schistosomiasis and malaria.

A number of environmental health hazards typically associated with urbanisation and industrialisation, such as air and groundwater pollution, are already becoming serious in some ACP countries. Every opportunity should be taken to ensure that ACP countries benefit from recent improvements in environmental

technology and management. Otherwise, not only will there be a tendency to repeat some of the same environmental mistakes committed in more developed economies, but environmentally hazardous technologies will be transferred to ACP countries to avoid increasing restrictions in more affluent countries. Generally speaking, chemical pollutants in the ambient environment do not represent an appreciable health burden, except in selected locations. However, in these locations, where, for example, industrial pollutants, agricultural chemicals, or mining wastes create acute hazards, action is needed.

More dispersed toxic environmental hazards, such as lead exposure, also deserve attention, although more research is required both to identify the scale of the problems and the most appropriate interventions. Such threats tend to be less immediate, but are likely to increase in importance over time. Developing the means of addressing these problems could help avoid future additional burdens.

Since many of these 'other' environmental health burdens arise because of poorly chosen or designed development initiatives within the ACP, environmental monitoring (to help detect emerging problems) and environmental and health impact assessment (to help ensure that health-threatening developments are avoided) are important tools for prevention. For such tools to be effective, however, they need to be accompanied by appropriate regulations and enforcement.[2] More representative governments may also be better able to take residents' needs into account. Given the political will, enhanced project appraisal methodologies (see Box 7.7) may greatly enhance investments' contributions to better health.

Problems such as climate change, originating almost entirely from Northern activities, could also have a major impact on health in the ACP, by further undermining food security and increasing the burden of vector borne diseases, especially in Africa. For the Caribbean and Pacific islands, climate change could exacerbate water-related health problems, and the threat of extreme weather events. The main preventative actions need to be taken elsewhere, but adaptive measures need to be explored and developed. It is thus important that ACP countries represent their interests effectively in international negotiations on treaties to limit green house gas emissions, for example. ACP countries have a collective interest in helping to ensure that action is taken internationally to reduce the risks, but they also have an interest in ensuring that their currently low contributions do not translate into reduced rights to the global commons.[3] Where possible, actions aimed at adapting to the effects of climate change also need to be considered. It is in this latter context that a health and environment perspective is particularly important. Local impacts of global warming are likely to involve many of the same environmental and health risks that are already extant.

7.6 Conclusion

Working towards a shared health and environmental agenda is a powerful and proven means of improving conditions and prospects for people in ACP countries. This report has identified two key areas of particular concern to the environmental health status of the ACP countries, namely food security and healthy living environments. These two areas, through complex interactions of environmental, political, poverty and other factors, create a considerable burden on the most vulnerable. Children in the regions are particularly at risk from malnutrition and the various diseases associated with inadequate services,

[2] While enforcement of regulations is a typical problem in developing countries, this difficulty by no means forfeits the usefulness of regulations. Hettige *et.al.* (1996) show that informal regulation through pressure from people living around industries has been very effective in South and South East Asia. This process is greatly helped by the existence of formal regulation, despite the lack of enforcement on behalf of the authorities. Existing regulations will, in addition, serve as guidelines for industries that are in the process of investing in new equipment.

[3] ACP countries may have obligations arising from international agreements, or may engage in preventive measures through, for example, the Global Environment Facility or the Clean Development Mechanism (Goldemberg, 1998).

housing and livelihoods. These two areas have also been selected as areas for potential action. Considerable research has been undertaken in recent years into investigating ways of improving living conditions and food security. This report has attempted to draw upon these experiences and recommend areas of action.

In the case of food security, the adoption of sustainable agricultural procedures can promote both human health and the 'health' of the environment. In the case of healthy living environments, inter-sectoral approaches to improving housing quality and environmental services can help to reduce a significant health burden. In undertaking such actions, key processes, such as promoting the participation of women, enhancing livelihoods and improving education and governance, are fundamental in achieving meaningful change.

In addition to these specific recommendations for action, environmental health assessment and safeguarding need to take a more prominent position within ACP countries. On a global scale, processes such as global environmental climate change, the origins of which come from more industrialised countries, are already impacting upon the environment and health of the ACP region. There is, therefore, a need for an effective platform for ACP nations to voice these inequities and lobby for accountability and change.

Box 7.7 Health Impact Assessment

Less than 5% of government budgets are spent on developments in the health sector, albeit the development spending in the other sectors, representing 95% of the budget, has a major impact on health. This spending affects the physical, social and economic environment and creates many of the health benefits and disbenefits described in the report. Shared actions are required at the design, implementation and operational stages of projects, programmes and policies, to ensure that positive health impacts are maximised and negative ones minimised. One appropriate tool is prospective health impact assessment (see Birley et al. 1997; Birley 1995 for details on conducting health impact assessments). Health impact assessment seeks to determine the change in health risk that may be reasonably attributed to an intervention, and to use this information to prevent health-threatening developments.

Political Commitments

The Treaty of Maastricht obliges European member states to consider the health implications of their policies (Article 129, 1993). This obligation has not yet been fully implemented, however, with regard either to internal or external policies. There is little or no recognition of the fact that lending and aid to third countries can have major health-related impacts. The Organisation of African Unity issued a policy statement on malaria control in 1997 recognising the need for all future development activity in Africa to be subject to health and environmental impact assessments. At present, however, there is little or no evidence that this policy is being adopted by governments, donor agencies or UN organisations.

Procedures

Health impact assessment can be seen as a component of Environmental Impact Assessment (EIA), but although EIA procedures are established in many countries, they typically ignore health issues. One primary difference between EIAs and HIAs lies in the relative importance accorded to the human community.

Regulation
Impact assessments can be applied to a variety of development initiatives, whether they be projects, programmes or policies. The procedure requires a proponent to submit a plan to an authorising authority, in order to receive permission to proceed. The authority can require an impact statement to be included with the plans and permission withheld until there are plans to ensure that all major impacts are mitigated. Consistent enforcement is a critical part of the process.

Screening
There is always a large stream of new development initiatives under preparation in every country. There is also, however, a lack of the time and other resources to carry out a detailed health impact assessment for them all. Screening provides a system of prioritisation, and a rapid health impact assessment will sometimes be required to decide whether or not to devote resources to a detailed impact assessment.

Commissioning
A steering committee can be established, comprising representatives from both the proponent and other affected sectors - including the health and environment sectors. This steering committee needs the skills required to engage in intersectoral dialogue, in that its task is to obtain a health impact assessment report for the development initiative, to accept or reject the report and to use the report during any negotiations on any adjustments needed to safeguard health. The steering committee will usually consist of civil servants who have been trained to commission health impact assessments, but they do not necessarily have to be trained to undertake assessments themselves, as assessments are usually undertaken by trained consultants from universities or private companies.

Quality control
The quality of the health impact assessment can be assured by setting appropriate terms of reference (TOR) for the assessor, choosing an assessor (or team of assessors) with appropriate skills, and appraising the completed report. Prospective impact assessment involves a great deal of uncertainty and a lack of data, and many different forms of evidence must be used in addition to scientific evidence, including the opinions of affected communities. Numerous assumptions must be made, and this is justified, provided that they are made explicitly. There is rarely any opportunity for primary data collection.

Budgeting
A typical impact assessment may require 0.1% of the budget for a new project or programme, and may involve 10 days of field travel by an experienced consultant. The report produced will be used in a negotiating forum, where the costs and benefits of including health safeguards are discussed. A health risk management budget heading can then be added to the total budget. If this budget component is not present, hidden costs associated with negative health-related impacts will be transferred to health sector, but the health sector's small fixed budget means that it will frequently be unable to absorb these costs. The national or local economy will consequently suffer various additional costs in the form of reduced production, pain and suffering, opportunity costs and lower educational achievement. Methods of quantifying all of the costs, are, however, lacking.

Methods
The assessment should be as logical, rapid, simple and structured as possible. Ideally, two independent assessments of the same project, programme or policy should produce the same findings and recommendations. The assessment can rely on published and unpublished literature, key informant interview, focus group discussions and the participation of affected communities. The objective is to determine, in advance, whether a set of health risks will increase, decrease or stay the same, in order to identify mitigating actions in cases where risks will increase, and to provide the basis for recommendations on implementation.

Scoping and bounding
The first step is to determine what to include and what not to include. Development initiatives often have effects over wide geographical areas and over many years into the future. In geographical terms, it is necessary to consider downstream and downwind effects, as well as human migration and circulation. Temporal stages should include construction, operation, late operation and decommissioning or rehabilitation.

Identifying stakeholders
A critical step in the HIA process entails the identification of the various communities who have an interest in the project. This includes the proponents and contractors, but most importantly of all, it includes all the affected communities. Some communities may be beneficiaries and some may be disbeneficiaries, in that a large dam project, for example, can displace tens or even hundreds of thousands of people from their ancestral homelands. The community groups will differ in their vulnerability to the effects of the project, but particularly vulnerable groups may include women, children, the very old, ethnic minorities and the very poor.

Identifying health hazards and analysing health determinants
A health hazard is defined as a potential cause of harm, a health risk, as a measure of the likelihood of the harm affecting a particular stakeholder community at a particular time and in a particular place, and a health impact, as a change in the health risk reasonably attributable to a project, programme or policy. A list of health hazards can be constructed by means of brainstorming exercises and reference to the experience gained from similar projects elsewhere.
Health determinants constitute the factors that are known or postulated to be causally related to states of health. In the analytic process, they lie between hazards and risks, and include pathogens and pollutants, foods and food processing, emotional support, behaviour, physiological and financial states, income, education, employment, access to medical care and housing. Health determinants can be listed and classified. The direction of change associated with a development initiative can, however, only be inferred.

Risk Assessment
After the evidence supporting possible changes in health determinants has been documented, the analysis proceeds as follows. A conclusion must be reached about the likely change in health risk associated with each health hazard for each stakeholder community during each project stage. This risk cannot generally be quantified, but it can be rated in terms of a likely increase, decrease or "no change". Health risks flagged as likely to increase may then require remedial action. This, in turn, requires a system of prioritisation. There is no single system of establishing priorities. Three possible approaches, however, follow:

1. Precautionary principle
2. Win-win solutions
3. Risk perceptions

The precautionary principle is widely used in EIAs. It simply requires that action should be taken to avoid future regret. The win-win approach seeks actions that both safeguard health and improve the project performance. Treatment of wastewater for agriculture through lagoons may, for example, be a better option than activated sludge treatment plants, from both a health-related and an agricultural perspective. The risk perceptions model places the decision in the hands of the affected community, whilst accepting that their perception of risk may be very different to that which is based on scientific evidence.

Recommendations

The final step in the HIA process is to make recommendations aimed both at safeguarding health and at mitigating residual impacts. The recommendations apply to the design, operation and maintenance of the intervention, and if they are to be useful, they should be costed, specific, socially acceptable and introduced during budget negotiations.

Capacity Building

One of the current obstacles to implementation is the lack of trained capacity to advocate, require, manage or undertake HIAs, although courses have been run by regional offices of WHO and in the context of specific sectors (Birley et al. 1996). One important objective of the training is to enable specialists to communicate in an inter-sectoral forum where health-environment linkages can be explored and understood, so that actions can be agreed and implemented. The capacity to enforce environmental assessment regulations in a consistent manner is also critical.

Contribution from Martin Birely, Liverpool School of Tropical Medicine.

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See www.liv.ac.uk/~mhb for an extended reference list, links to other sites, full texts and news of forthcoming events.

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Appendix 1

List of ACP Countries and Human Development Index (HDI)

Countries in Africa	Human Development Index (HDI)
Angola	0.291
Benin	0.332
Botswana	0.763
Burkina Faso	0.228
Burundi	0.286
Cameroon	0.503
Cape Verde	
Central African Republic	0.361
Chad	0.296
Comoros	0.415
Congo	0.384
Congo Brazzaville	0.538
Côte d'Ivoire	0.369
Djibouti	0.336
Equatorial Guinea	0.399
Eritrea	
Ethiopia	0.227
Gabon	0.579
Gambia	0.299
Ghana	0.482
Guinea	0.237
Guinea Bissau	0.293
Kenya	0.481
Lesotho	0.473
Liberia	0.325
Madagascar	0.432
Malawi	0.330
Mali	0.222
Mauritania	0.359
Mauritius	0.821
Mozambique	0.246
Namibia	0.611
Niger	0.207
Nigeria	0.406
Rwanda	0.332
São Tomé & Principe	0.451
Senegal	0.340
Seychelles	0.810
Sierra Leone	0.221
Somalia	0.246
South Africa	0.705
Sudan	0.379
Swaziland	0.522
Tanzania	0.364
Togo	0.409
Uganda	0.329
Zambia	0.425
Zimbabwe	0.539

Countries in the Caribbean	Human Development Index (HDI)
Antigua and Barbuda	0.840
Bahamas	0.894
Barbados	0.900
Belize	0.883
Dominica	0.776
Dominican Republic	0.705
Grenada	0.786
Guyana	0.622
Haiti	0.362
Jamaica	0.721
St Christopher and Nevis	0.873
St Lucia	0.732
St Vincent & the Grenadines	0.761
Suriname	0.762
Trinidad and Tobago	0.872

Countries in the Pacific	Human Development Index (HDI)
Fiji	0.860
Kiribati	
Papua New Guinea	0.508
Solomon Islands	0.511
Tonga	
Tuvalu	
Vanuatu	0.541
Western Samoa	0.651

Source: Human Development Report 1998, UNDP. Oxford University Press.

Appendix 2

The full notes and references to the tables in Appendix 2 are given in the report from which they were derived: *World Resources 1998-1999: A guide to the Global Environment*. Oxford university press (New York). 369p.

Table 6.1: Gross National and Domestic Product Estimates, 1995, page 1

Table 6.1

	Gross National Product (GNP) 1995 (Atlas method)		Gross Domestic Product (GDP) Exchange Rate Based (GDP) (1995 US$)		Gross Domestic Product (GDP) Purchasing Power Parity (PPP) (1995 Int$)		Average Annual Growth Rate (percent) GDP		Distribution of GDP, 1995 (percent)		
	Total (million US$)	Per Capita (US$)	Total (million US$)	Per Capita (US$)	Total (million Int$)	Per Capita (Int$)	1975-85	1985-95	Agriculture	Industry	Services
ACP - AFRICA	276 131	465	307 131	517	809 501	1 362	2	2	1 783	3 127	4 791
ACP - SMALL ISLANDS	30 446	1 178	31 887	1 234	81 477	3 152	2	2	16	29	53
ACP COUNTRIES	306 577	494	339 018	547	890 978	1 436	2,3	1,8	18	31	48
AFRICA	412 161	564	468 225	641	1 347 774	1 845	4	2	16	30	47
ASIA	7 743 865	2 240	8 045 724	2 327	11 800 988	3 413	4	4	7	38	53
CENTRAL AMERICA	371 635	2 984	320 123	2 570	784 731	6 300	4	1	10	25	65
EUROPE	9 138 548	12 653	9 671 537	13 391	8 926 026	12 359	2	2	3	32	62
NORTH AMERICA	7 673 702	25 681	7 520 948	25 170	7 850 667	26 273	3	2	2	27	72
OCEANIA	396 775	13 910	413 177	14 485	428 810	15 033	3	3	4	27	69
SOUTH AMERICA	1 155 405	3 625	1 295 584	4 065	1 913 742	6 004	1,2	3,2	11	35	53
LOW INCOME	1 381 813	430	1 352 256	421	X	X	X	X	25	38	35
MIDDLE INCOME	3 797 316	2 390	3 744 877 a	2 357 a	X	X	X	X	11 a	35 a	52 a
HIGH INCOME	22 508 193	24 930	20 487 539 a	22 692 a	X	X	X	X	2 b	32 b	66 b
WORLD	27 687 323	4 880	27 846 241	4 896	X	X	3,1	3,0	5 a	33 b	63 b
ACP - AFRICA	276 131	465	307 131	517	809 501	1 362	2,4	1,8	18	31	48
Angola	4 422	410	3 722	344	12 655	1 170	X	0,4	12	59	28
Benin	2 034	370	1 522 a	289 a	8 730 a	1 660 a	3,7	X	34 a	12 a	53 a
Botswana	4 381	3 020	4 318	2 978	8 164	5 630	10,8	7,1	5	46	48
Burkina Faso	2 417	230	2 325	222	8 278	790	4,5	2,9	34 a	27 a	39 a
Burundi	984	160	1 062	175	3 881	640	4,6	0,9	56	18	26
Cameroon	8 615	650	7 931	601	30 342	2 300	8,0	-2,1	39	23	38
Central African Rep	1 123	340	1 128	345	3 535	1 080	1,4	1,0	44 a	13 a	43 a
Chad	1 144	180	1 138	180	4 498	710	2,4	2,6	44 b	22 b	35 b
Congo, Dem Rep	5 313	120	8 770 c	243 c	17 056 c	473 c	X	X	30 c	33 c	36 c
Congo, Rep	1 784	680	2 163	834	6 431	2 480	8,4	-0,3	10	38	51
Côte d'Ivoire	9 248	660	10 069	735	24 238	1 770	3,5	0,1	31	20	50
Equatorial Guinea	152	380	169	421	X	X	X	X	50 a	33 a	17 a
Eritrea	X	X	X	X	X	X	X	X	11	20	69
Ethiopia	5 722	100	5 287	94	25 946	460	X	3,6	57 a	10 a	33 a
Gabon	3 759	3 490	4 691	4 360	3 943 d	3 983 d	1,9	-0,5	8 a	52 a	40 a
Gambia, The	354	320	384	346	1 055	950	3,4	2,6	28 a	15 a	58 a
Ghana	6 719	390	6 315	364	35 196	2 030	-0,9	4,4	46	16	38
Guinea	3 593	550	3 686	502	3 694 d	577 d	X	X	24	31	45
Guinea-Bissau	265	250	257	240	855	800	2,6	3,7	46	24	30
Kenya	7 583	280	9 095	335	38 825	1 430	4,5	3,5	29	17	54
Lesotho	1 519	770	1 029	508	2 513	1 240	4,0	7,0	11	40	49
Liberia	X	X	1 202 c	467 c	X	X	0,2	X	X	X	X
Madagascar	3 178	230	3 198	215	10 114	680	0,2	0,9	34	13	53
Malawi	1 623	170	1 465	151	7 448	770	4,0	2,1	42	27	31
Mali	2 410	250	2 431	225	6 045	560	2,6	4,3	46	17	37
Mauritania	1 049	460	1 068	470	3 684	1 620	1,1	3,1	27 b	30 b	43 b
Mauritius	3 815	3 380	3 919	3 508	14 823	13 270	X	5,9	9	33	58
Mozambique	1 353	80	1 469	85	15 707	910	X	5,8	33 a	12 a	55 a
Namibia	3 098	2 000	3 033	1 974	6 298	4 100	X	3,2	14 a	29 a	56 a
Niger	1 961	220	1 860	203	6 863	750	0,8	1,4	39 b	18 b	44 b

Table 6.1

	Gross National Product (GNP) 1995 (Atlas method)		Gross Domestic Product (GDP) Exchange Rate Based (GDP) (1995 US$)		Gross Domestic Product (GDP) Purchasing Power Parity (PPP) (1995 Int$)		Average Annual Growth Rate (percent) GDP		Distribution of GDP, 1995 (percent)		
	Total (million US$)	Per Capita (US$)	Total (million US$)	Per Capita (US$)	Total (million Int$)	Per Capita (Int$)	1975-85	1985-95	Agriculture	Industry	Services
Nigeria	28 411	260	40 477	362	146 355	1 310	0,4	3,8	28	53	18
Rwanda	1 128	180	1 128	218	2 799	540	6,1	-4,8	37	17	46
Senegal	5 070	600	4 867	586	15 211	1 830	2,9	2,8	20	18	62
Sierra Leone	762	180	824	196	2 601	620	2,5	-1,5	42	27	31
Somalia	X	X	917 e	106 e	7 923 c	933 c	6,2	X	X	X	X
South Africa	130 918	3 160	136 035	3 281	217 277	5 240	2,3	1,1	5	31	64
Sudan	X	X	5 989 d	239 d	17 852 f	726 f	3,6	X	X	X	X
Swaziland	1 051	1 170	1 073	1 252	2 528	2 950	3,8	3,5	X	X	X
Tanzania	3 703	120	3 602	120	20 117	670	X	3,6	58	17	24
Togo	1 266	310	1 263	309	4 739	1 160	2,5	0,9	38 a	21 a	41 a
Uganda	4 668	240	5 655	287	29 337	1 490	X	5,7	50	14	36
Zambia	3 605	400	4 073	504	8 000	990	0,1	0,5	22	40	37
Zimbabwe	5 933	540	6 522	583	23 947	2 140	2,6	2,1	15 b	36 b	48 b
ACP - SMALL ISLANDS	30 446	1 178	31 887	1 234	81 477	3 152	2,1	2,4	0,2	0,3	0,5
Belize	560	2 630	578	2 714	1 197	5 620	4,0	6,5	20 a	28 b	53 b
Dominican Rep	11 390	1 460	11 277	1 442	29 258	3 740	3,6	3,6	15	22	64
Fiji	1 895	2 440	2 068	2 638	4 861	6 200	2,1	3,2	20 c	21 c	59 c
Guyana	493	590	595	717	2 141	2 580	-1,7	2,4	36 a	37 a	27 a
Haiti	1 777	250	2 043	287	6 554	920	2,0	-2,8	44 a	12 a	44 a
Jamaica	3 803	1 510	4 406	1 785	12 167	4 930	-1,4	3,6	9	38	53
Papua New Guinea	4 976	1 160	4 901	1 139	11 183	2 600	1,1	4,5	26	38 a	34 a
Solomon Islands	341	910	357	944	843	2 230	6,9	6,1	X	X	X
Suriname	360	880	335	784	905	2 120	3,6	3,7	26 b	26 b	48 b
Trinidad and Tobago	4 851	3 770	5 327	4 139	12 368	9 610	3,2	-0,5	3	42	54

Notes: a. 1994. b. 1993. c. 1989. d. 1992. e. 1990. f. 1991.

Table 6.2

	Average Annual Official Development Assistance (ODA) (million US$) {a}		ODA as a Percentage of GNP {a}	1995 ODA Per Capita	Total External Debt (million US$)		Total Debt Service	Debt Service as a Percentage of Total Exports	Direct Foreign Investment (million US$)
	1983-85	1993-95	1993-95	(US$) {a}	1983-85	1993-95	1993-95	1993-95	1993-95
ACP - AFRICA	7 578	17 126	6	29	87 944	192 540	9 000	18	2 241
ACP - SMALL ISLANDS	890	1 301	4	50	12 842	17 216	2 597	X	936
ACP COUNTRIES	8 468	18 427	6	30	100 786	209 756	11 597	X	3 177
AFRICA	10 012	20 604	5,0	28	156 034	285 694	22 298	23,5	4 009
ASIA	4 111	5 071	0,1	1	213 576	640 992	76 790	X	47 257
CENTRAL AMERICA	1 680	2 726	0,7	22	123 984	188 615	27 043	24,6	8 894
EUROPE	X	X	X	X	X	X	X	X	X
NORTH AMERICA	-10 293	-11 378	-0,1	-38	X	X	X	X	X
OCEANIA	-459	-756	-0,2	-27	2 482	3 230	876	X	219
SOUTH AMERICA	965	2 635	0,2	8	250 438	365 484	39 827	28,6	11 341
LOW INCOME					174 327	505 848		15	
MIDDLE INCOME					767 232	1 419 580		18	
WORLD	X	X	X	X	X	X	X	X	X
ACP - AFRICA	7 578	17 126	6,2	29	87 944	192 540	9 000	17,7	2 241
Angola	87	390	11	39	1 707	11 087	286	9	351
Benin	86	274	13	51	736	1 587	40	7	5
Botswana	101	105	3	63	286	678	92	4	-77
Burkina Faso	189	463	18	46	440	1 171	43	11	0
Burundi	139	240	24	31	370	1 114	39	35	1
Cameroon	155	573	6	34	2 995	8 352	426	21	71
Central African Rep	110	167	14	49	288	900	16	8	-1
Chad	130	227	19	37	211	835	17	8	10
Congo, Dem Rep	91	203	10	48	2 387	5 512	289	26	0
Congo, Rep	307	203	5	4	5 599	12 243	23	X	1
Côte d'Ivoire	132	1 186	13	88	9 021	18 472	1 128	31	41
Equatorial Guinea	14	39	26	82	124	282	2	X	17
Eritrea	X	124	X	46	X	X	X	X	X
Ethiopia	470	1 015	16	16	1 696	4 961	120	13	7
Gabon	67	143	3	133	1 013	4 113	289	11	-89
Gambia, The	48	68	19	42	229	424	28	13	10
Ghana	173	603	9	37	1 962	5 407	349	25	196
Guinea	101	387	12	53	1 356	3 066	121	17	23
Guinea-Bissau	59	131	52	111	290	852	10	43	1
Kenya	412	765	11	26	3 770	7 220	755	28	13
Lesotho	100	124	9	56	147	597	34	6	19
Liberia	113	102	X	56	1 108	2 046	13	X	0
Madagascar	173	318	10	20	2 228	4 079	71	11	10
Malawi	137	465	26	44	926	1 987	85	22	1
Mali	303	451	18	51	1 235	2 839	83	15	9
Mauritania	185	273	26	98	1 362	2 323	117	25	7
Mauritius	34	21	1	21	580	1 414	163	8	16
Mozambique	257	1 159	86	61	1 568	5 547	143	34	33
Namibia	2	160	5	122	X	X	X	X	46
Niger	213	331	16	29	1 038	1 605	72	23	1
Nigeria	38	226	1	2	17 991	33 074	1 645	14	1 318
Rwanda	165	561	42	118	300	943	15	6	2
Senegal	325	604	11	80	2 281	3 757	213	15	22
Sierra Leone	63	230	32	49	658	1 403	91	X	-3
Somalia	349	540	X	20	1 516	2 598	0	X	1
South Africa	X	318	X	9	X	X	X	X	-142

Table 6.2

	Average Annual Official Development Assistance (ODA) (million US$) {a}		ODA as a Percentage of GNP {a}	1995 ODA Per Capita	Total External Debt (million US$)		Total Debt Service (million US$)	Debt Service as a Percentage of Total Exports	Direct Foreign Investment (million US$)
	1983-85	1993-95	1993-95	(US$) {a}	1983-85	1993-95	1993-95	1993-95	1993-95
Sudan	903	365	X	8	8 314	16 792	31	1	0
Swaziland	29	54	5	64	227	238	24	X	66
Tanzania	544	932	24	29	3 677	7 028	207	22	73
Togo	110	137	11	46	889	1 412	27	6	0
Uganda	160	723	19	41	1 103	3 320	148	43	88
Zambia	259	1 207	35	251	4 054	6 761	1 120	78	60
Zimbabwe	248	517	9	44	2 262	4 502	626	19	34
ACP - SMALL ISLANDS	**890**	**1 301**	**4,3**	**50**	**12 842**	**17 216**	**2 597**	**X**	**936**
Belize	17	25	X	70	106	220	29	X	15
Dominican Rep	165	66	1	16	3 181	4 424	425	8	198
Fiji	32	48	3	55	432	290	79	X	54
Guyana	27	92	22	106	1 333	2 032	100	X	2
Haiti	138	486	27	103	652	776	34	17	4
Jamaica	173	110	3	44	3 718	4 232	604	19	121
Papua New Guinea	303	336	7	86	2 003	2 786	786	27	149
Solomon Islands	23	50	16	123	48	154	11	X	16
Suriname	7	72	21	179	X	X	X	X	-21
Trinidad and Tobago	6	17	0	20	1 369	2 302	531	24	398

Notes: a. For Official Development Assistance (ODA), flows to recipients are shown as positive numbers; flows from donors are shown as negative numbers (in parentheses).

b. 1993. c. 1993-94.

Table 7.1: Size and Growth of Population and Labour Force, 1950-2050, page 1

Table 7,1

	Population (thousands)				Average Annual Population Change (percent)			Average Annual Increment to the Population (thousands)			Average Annual Growth of the Labor Force (percent)	
	1950	1998	2025	2050	1985-90	1995-00	2005-10	1985-90	1995-00	2005-10	1980-95	1995-10
ACP - AFRICA	179 135	636 226	1 239 655	1 783 388	2,9	2,7	2,6	13 545	17 255	21 440	X	X
ACP - SMALL ISLANDS	10 352	26 992	40 393	51 102	1,8	1,7	1,6	396	455	499	X	X
ACP COUNTRIES	189 487	663 218	1 280 048	1 834 490	2,8	2,7	2,6	13 940	17 710	21 939	X	X
AFRICA	223 974	778 484	1 453 899	2 046 401	2,8	2,6	2,5	16 330	20 083	24 232	2,7	2,9
ASIA	1 402 021	3 588 877	4 784 833	5 442 567	1,9	1,4	1,2	56 418	50 150	46 369	2,1	1,6
CENTRAL AMERICA	36 925	130 710	189 143	230 425	2,1	1,9	1,5	2 210	2 405	2 253	2,9	2,3
EUROPE	547 318	729 406	701 077	637 585	0,4	0,0	-0,1	3 128	217	-844	0,4	0,1
OCEANIA	12 612	29 460	40 687	45 684	1,6	1,3	1,3	395	390	420	2,1	1,4
NORTH AMERICA	171 617	304 078	369 016	384 054	1,0	0,8	0,8	2 822	2 398	2 436	1,3	0,9
SOUTH AMERICA	112 372	331 889	452 265	523 778	1,9	1,5	1,3	5 246	4 791	4 724	2,8	1,9
DEVELOPING	1 711 191	4 748 310	6 818 880	8 204 983	2,0	1,7	1,4	80 235	77 726	78 204	2,3	1,8
DEVELOPED	812 687	1 181 530	1 220 250	1 161 741	0,6	0,3	0,2	6 761	3 121	1 806	0,7	0,3
WORLD	2 523 878	5 929 839	8 039 130	9 366 724	1,7	1,4	1,2	86 996	80 848	80 011	1,9	1,5
ACP - AFRICA	179 135	636 226	1 239 655	1 783 388	2,9	2,7	2,6	13 545	17 255	21 440	X	X
Angola	4 131	11 967	25 547	38 897	2,9	3,3	2,9	245	393	461	2,4	3,3
Benin	2 046	5 881	12 276	18 095	3,0	2,8	2,9	132	163	227	2,5	3,2
Botswana	389	1 551	2 576	3 320	3,3	2,2	2,0	39	34	39	3,2	2,4
Burkina Faso	3 654	11 402	23 451	35 419	2,8	2,8	2,8	240	316	414	2,2	2,4
Burundi	2 456	6 589	12 341	16 937	2,9	2,8	2,4	148	182	205	2,3	3,0
Cameroon	4 466	14 323	28 521	41 951	2,8	2,7	2,7	301	387	496	2,6	2,9
Central African Rep	1 314	3 489	6 006	8 215	2,4	2,1	2,1	66	73	89	1,8	2,1
Chad	2 658	6 892	12 648	18 004	2,0	2,8	2,3	106	187	200	2,1	2,6
Congo, Dem Rep	12 184	49 208	105 925	164 635	3,3	2,6	3,0	1 142	1 259	1 943	3,1	2,9
Congo, Rep	808	2 822	5 747	8 729	3,0	2,8	2,7	62	78	99	2,8	2,9
Côte d'Ivoire	2 776	14 567	24 397	31 706	3,3	2,0	2,2	359	290	395	3,3	2,6
Equatorial Guinea	226	430	798	1 144	2,4	2,5	2,4	8	10	13	3,6	2,6
Eritrea	1 140	3 548	6 504	8 808	1,3	3,7	2,3	37	128	104	1,8	3,0
Ethiopia	18 434	62 111	136 288	212 732	3,1	3,2	3,0	1 401	1 954	2 480	2,7	3,0
Gabon	469	1 170	2 118	2 952	3,1	2,8	2,3	26	32	34	2,3	2,1
Gambia, The	294	1 194	1 984	2 604	4,2	2,3	2,0	35	27	29	3,6	2,2
Ghana	4 900	18 857	36 341	51 205	3,1	2,8	2,6	436	518	636	3,1	3,0
Guinea	2 550	7 673	15 286	22 914	2,9	1,4	2,8	154	102	272	2,9	2,3
Guinea-Bissau	505	1 134	1 921	2 674	2,0	2,0	2,0	18	22	28	1,6	2,0
Kenya	6 265	29 020	50 202	66 054	3,3	2,2	2,4	721	638	880	3,6	2,9
Lesotho	734	2 184	4 031	5 643	2,6	2,5	2,4	44	53	67	2,4	2,8
Liberia	824	2 748	6 573	9 955	3,2	8,6	3,0	75	227	123	0,8	4,4
Madagascar	4 229	16 348	34 476	50 807	3,4	3,1	3,0	395	504	643	3,0	3,3
Malawi	2 881	10 377	20 391	29 825	5,1	2,5	2,6	417	262	341	2,7	2,5
Mali	3 520	11 832	24 575	36 817	3,0	3,0	2,8	259	353	441	2,7	2,9
Mauritania	825	2 453	4 443	6 077	2,5	2,5	2,4	47	61	73	2,2	2,6
Mauritius	493	1 154	1 481	1 654	0,8	1,1	1,0	8	12	13	2,1	1,3
Mozambique	6 198	18 691	35 444	51 774	0,9	2,5	2,5	128	461	582	2,0	2,5
Namibia	511	1 653	2 999	4 167	2,7	2,4	2,3	35	39	48	2,3	2,4
Niger	2 400	10 119	22 385	34 576	3,1	3,3	3,1	225	331	418	3,0	3,2
Nigeria	32 935	121 773	238 397	338 510	2,9	2,8	2,6	2 617	3 413	4 152	2,6	2,9

Table 7,1

	Population (thousands)				Average Annual Population Change (percent)			Average Annual Increment to the Population (thousands)			Average Annual Growth of the Labor Force (percent)	
	1950	1998	2025	2050	1985-90	1995-00	2005-10	1985-90	1995-00	2005-10	1980-95	1995-10
Rwanda	2 120	6 528	12 981	16 937	2,8	7,9	2,4	180	498	215	0,2	4,6
Senegal	2 500	9 001	16 896	23 442	2,8	2,7	2,5	190	237	286	2,5	2,7
Sierra Leone	1 944	4 577	8 200	11 368	2,2	3,0	2,2	82	134	125	1,5	2,7
Somalia	3 072	10 653	23 669	36 408	1,8	3,9	3,1	150	408	445	2,0	3,3
South Africa	13 683	44 295	71 621	91 466	2,3	2,2	2,0	805	958	1 050	2,6	2,4
Sudan	9 190	28 526	46 850	59 947	2,3	2,2	2,1	520	623	721	2,8	2,7
Swaziland	264	931	1 675	2 228	2,7	2,8	2,4	19	25	28	2,8	3,2
Tanzania	7 886	32 189	62 436	88 963	3,1	2,3	2,6	740	732	1 088	3,2	2,7
Togo	1 329	4 434	8 762	12 655	3,0	2,7	2,6	99	118	150	2,6	2,8
Uganda	4 762	21 318	44 983	66 305	2,4	2,6	2,9	377	554	821	2,5	2,8
Zambia	2 440	8 690	16 163	21 965	2,4	2,5	2,5	163	210	275	2,2	3,0
Zimbabwe	2 730	11 924	19 347	24 904	3,2	2,1	2,0	293	247	293	3,2	2,4
ACP - SMALL ISLANDS	**10 352**	**26 992**	**40 393**	**51 102**	**1,8**	**1,7**	**1,6**	**396**	**455**	**499**	**X**	**X**
Belize	69	230	375	480	2,4	2,5	2,0	4	6	6	3,2	3,3
Dominican Rep	2 353	8 232	11 164	13 141	2,2	1,7	1,2	147	134	117	3,0	2,3
Fiji	289	822	1 170	1 393	0,8	1,6	1,5	5	13	14	2,4	2,9
Guyana	423	856	1 114	1 239	0,1	1,0	1,0	0	9	10	2,2	1,9
Haiti	3 261	7 534	12 513	17 524	2,0	1,9	1,9	122	139	169	1,5	1,8
Jamaica	1 403	2 539	3 370	3 886	0,5	0,9	1,2	11	24	32	1,9	1,5
Papua New Guinea	1 613	4 602	7 546	9 637	2,2	2,2	2,0	79	102	113	2,2	2,3
Solomon Islands	90	417	844	1 192	3,4	3,2	2,8	10	13	16	3,5	3,0
Suriname	215	442	605	711	1,2	1,2	1,3	5	5	6	2,6	2,5
Trinidad and Tobago	636	1 318	1 692	1 899	1,0	0,8	1,1	12	11	15	1,6	2,0

Table 7.2

	Crude Birth Rate (births per 1,000 population)		Life Expectancy at Birth (years)		Total Fertility Rate		Percentage of Population in Specific Age Groups					
							1980			2000		
	1975-80 {a}	1995-00 {b}	1975-80	1995-00	1975-80	1995-00	<15	15-65	>65	<15	15-65	>65
ACP - AFRICA	47,4	73,1	46,5	51,8	X	X	45,2	51,9	2,9	44,7	52,4	0,5
ACP - SMALL ISLANDS	35,0	39,4	58,6	64,3	X	X	41,1	55,0	3,8	35,5	60,2	4,3
ACP COUNTRIES	46,7	71,5	47,1	52,3	X	X	45,0	52,1	2,9	44,3	52,7	0,7
AFRICA	46,0	39,2	47,9	53,8	6,5	5,3	44,7	52,2	3,1	43,0	53,8	3,2
ASIA	29,6	22,3	58,5	66,2	4,2	2,7	37,6	58,0	4,4	30,1	64,1	5,8
CENTRAL AMERICA	38,2	26,5	63,7	71,7	5,4	3,0	45,1	51,2	3,6	34,8	60,7	4,5
EUROPE	14,8	10,5	71,3	72,6	2,0	1,5	22,2	65,5	12,3	17,5	67,9	14,6
NORTH AMERICA	15,1	13,6	73,3	76,9	1,8	1,9	22,5	66,4	11,0	21,2	66,4	12,4
OCEANIA	20,9	18,4	68,2	73,9	2,8	2,5	29,3	62,7	8,0	25,5	64,9	9,7
SOUTH AMERICA	32,0	21,5	62,9	69,0	4,3	2,5	37,8	57,6	4,6	30,2	64,2	5,6
DEVELOPING	32,8	25,4	56,7	63,6	4,7	3,1	39,3	56,6	4,1	32,8	62,2	5,0
DEVELOPED	14,9	11,4	72,2	74,5	1,9	1,6	22,5	65,9	11,6	18,3	67,5	14,2
WORLD	28,3	22,6	59,7	65,6	3,9	2,8	35,2	58,9	5,9	30,0	63,2	6,8
ACP - AFRICA	47,4	73,1	46,5	51,8	X	X	45,2	51,9	2,9	44,7	52,4	0,5
Angola	50,2	47,7	40,0	46,5	6,8	6,7	44,7	52,4	2,9	47,4	49,8	2,8
Benin	51,4	42,0	47,0	54,8	7,1	5,8	45,1	50,8	4,1	46,5	50,7	2,8
Botswana	46,6	35,0	56,4	50,4	6,4	4,5	48,7	49,3	2,0	41,9	55,6	2,4
Burkina Faso	50,8	45,9	42,9	46,0	7,8	6,6	47,4	49,8	2,8	47,0	50,3	2,7
Burundi	44,7	42,5	46,0	47,2	6,8	6,3	44,7	51,8	3,4	45,0	52,3	2,7
Cameroon	45,5	39,3	48,5	55,9	6,5	5,3	44,4	52,0	3,6	43,5	52,9	3,6
Central African Rep	44,1	37,6	44,5	48,6	5,9	5,0	41,7	54,4	4,0	41,6	54,4	4,0
Chad	44,1	41,6	41,0	47,7	5,9	5,5	41,9	54,5	3,6	43,0	53,4	3,6
Congo, Dem Rep	47,8	44,9	48,0	52,9	6,5	6,2	46,0	51,1	2,8	48,0	49,1	2,9
Congo, Rep	45,8	42,5	48,7	50,9	6,3	5,9	45,1	51,5	3,4	45,7	51,1	3,3
Côte d'Ivoire	50,7	37,2	47,9	51,0	7,4	5,1	46,6	51,0	2,5	43,0	54,0	3,0
Equatorial Guinea	42,7	40,8	42,0	50,0	5,7	5,5	41,0	54,8	4,1	43,1	52,9	4,0
Eritrea	45,1	39,8	45,3	50,6	6,1	5,3	44,2	53,1	2,6	43,6	53,3	3,1
Ethiopia	49,0	48,2	42,0	49,9	6,8	7,0	46,1	51,2	2,7	47,1	50,2	2,8
Gabon	32,9	37,6	47,0	55,5	4,4	5,4	34,4	59,5	6,1	39,8	54,6	5,7
Gambia, The	48,8	39,9	39,0	47,0	6,5	5,2	42,6	54,4	2,8	41,2	55,5	3,1
Ghana	45,1	38,2	51,0	58,0	6,5	5,3	44,9	52,3	2,8	43,4	53,6	3,0
Guinea	51,6	48,2	38,8	46,5	7,0	6,6	45,8	51,6	2,6	47,0	50,4	2,6
Guinea-Bissau	42,4	40,3	37,5	43,8	5,6	5,4	39,0	57,0	4,0	41,7	54,2	4,2
Kenya	53,6	36,9	53,4	54,5	8,1	4,9	50,1	46,5	3,4	43,4	53,7	2,9
Lesotho	41,9	35,4	51,8	58,6	5,7	4,9	41,9	53,9	4,2	41,0	55,0	4,1
Liberia	47,4	47,5	49,5	51,5	6,8	6,3	44,3	52,0	3,7	43,7	52,7	3,6
Madagascar	46,9	41,1	49,5	58,5	6,6	5,7	45,9	51,4	2,7	45,8	51,6	2,6
Malawi	57,2	47,7	43,1	40,7	7,6	6,7	47,5	50,3	2,3	46,4	50,9	2,7
Mali	50,7	47,4	40,0	48,0	7,1	6,6	46,8	50,7	2,5	47,2	50,2	2,5
Mauritania	44,7	38,3	45,5	53,5	6,5	5,0	43,7	53,3	3,0	41,5	55,2	3,3
Mauritius	26,7	19,3	64,9	71,6	3,1	2,3	35,6	60,8	3,6	26,6	67,3	6,0
Mozambique	45,4	42,5	43,5	46,9	6,5	6,1	43,4	53,4	3,2	44,7	52,1	3,2
Namibia	41,9	35,9	51,3	55,5	6,0	4,9	43,1	53,4	3,5	41,6	54,6	3,8
Niger	59,7	50,2	40,5	48,5	8,1	7,1	46,8	50,8	2,5	48,6	49,0	2,4
Nigeria	46,6	42,3	45,0	52,4	6,5	6,0	44,3	53,1	2,6	45,0	52,1	2,9

Table 7.2

	Crude Birth Rate (births per 1,000 population)		Life Expectancy at Birth (years)		Total Fertility Rate		Percentage of Population in Specific Age Groups					
							1980			2000		
	1975-80 {a}	1995-00 {b}	1975-80	1995-00	1975-80	1995-00	<15	15-65	>65	<15	15-65	>65
Rwanda	52,8	42,8	45,0	42,1	8,5	6,0	48,8	48,8	2,4	44,7	53,0	2,4
Senegal	49,3	41,1	42,8	51,3	7,0	5,6	45,3	51,8	2,8	43,6	53,4	3,0
Sierra Leone	48,8	46,5	35,2	37,5	6,5	6,1	43,0	53,9	3,1	43,9	53,1	3,0
Somalia	50,4	50,0	42,0	49,0	7,0	7,0	46,0	51,0	3,0	48,0	49,5	2,6
South Africa	37,3	29,7	55,9	65,2	5,1	3,8	40,3	55,9	3,9	36,2	59,3	4,5
Sudan	47,1	33,7	46,7	55,0	6,7	4,6	44,9	52,4	2,7	38,7	58,1	3,2
Swaziland	46,2	36,8	49,9	60,0	6,5	4,5	45,9	51,3	2,9	41,7	55,6	2,7
Tanzania	47,5	41,2	49,0	51,4	6,8	5,5	47,6	50,1	2,3	45,1	52,3	2,6
Togo	45,2	41,9	48,0	50,1	6,6	6,1	44,6	52,3	3,2	45,6	51,3	3,1
Uganda	50,3	51,1	47,0	41,4	6,9	7,1	47,8	49,7	2,5	49,1	48,6	2,2
Zambia	51,6	42,4	49,3	43,0	7,2	5,5	49,4	48,2	2,4	46,3	51,4	2,3
Zimbabwe	44,2	37,1	53,8	48,5	6,6	4,7	47,9	49,5	2,6	43,6	53,7	2,7
ACP - SMALL ISLANDS	**35,0**	**39,4**	**58,6**	**64,3**	X	X	**41,1**	**55,0**	**3,8**	**35,5**	**60,2**	**4,3**
Belize	40,9	31,3	69,7	74,7	6,2	3,7	47,3	48,6	4,8	39,7	55,8	4,1
Dominican Rep	34,9	24,1	62,0	70,9	4,7	2,8	42,3	54,6	3,1	33,1	62,5	4,5
Fiji	33,2	22,6	67,1	72,6	4,0	2,8	39,1	58,0	2,8	31,3	64,3	4,5
Guyana	31,5	21,9	60,7	64,4	3,9	2,3	40,8	55,2	4,0	29,9	65,9	4,2
Haiti	36,8	34,1	50,7	54,4	5,4	4,6	40,7	54,8	4,4	40,0	56,2	3,8
Jamaica	28,8	21,7	70,1	74,6	4,0	2,4	40,2	53,0	6,8	30,2	63,4	6,4
Papua New Guinea	39,6	32,3	49,7	57,9	5,9	4,7	43,0	55,5	1,6	38,7	58,3	3,0
Solomon Islands	45,0	36,1	65,3	71,6	7,1	5,0	47,6	49,3	3,1	43,0	54,1	2,9
Suriname	29,5	21,8	65,1	71,5	4,2	2,4	39,7	55,8	4,5	32,3	62,4	5,5
Trinidad and Tobago	29,3	16,6	68,3	73,7	3,4	2,1	34,2	60,2	5,5	26,1	67,4	6,5

Notes: World and regional totals include countries not listed here. a. ACP regional numbers based on 1980 population estimates from UN Statistical Yearbook 85/86.

b. ACP regional numbers based on 2000 population estimates in this volume.

Table 7.4

	Percentage of Population with Access to: {a}									Health Expenditure as a Percentage of GDP {a}	
	Safe Drinking Water 1990-96			Adequate Sanitation 1990-96			Health Services 1990-96			Total	Public
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	1990-95	1990-95
ACP - AFRICA											
Angola	69	15	32	34	8	16	X	X	X	X	4,0
Benin	41	53	50	54	6	20	X	X	18 b	X	1,7
Botswana	100	91	93 b	91	41	55	X	X	X	X	1,9
Burkina Faso	X	X	78	42	11	18	100	89	90	5,5	2,3 c
Burundi	93	54	59	60	51	51	100	79	80	X	0,9
Cameroon	57	43	50	64	36	50	96	69	80	1,4	1,0
Central African Rep	59	23	38	83	36	52	89	30	52	X	1,7
Chad	48	17	24	73	7	21	64	X	30	X	1,8
Congo, Dem Rep	89	26	42	53	6	18	40	17	26 b	X	X
Congo, Rep	53	7	34	X	X	69	97	70	83 b	6,8	3,6
Côte d'Ivoire	X	X	75	X	X	43	X	X	X	3,4	1,4
Equatorial Guinea	X	X	X	X	X	X	X	X	X	X	X
Eritrea	X	7	X	X	X	X	X	X	X	X	1,1
Ethiopia	91	19	25	97	7	19	X	X	46	X	1,1
Gabon	90	50	68 b	X	X	X	X	X	X	X	0,5
Gambia, The	67	X	48	51	50	37	X	X	93	X	1,8 c
Ghana	88	52	65	62	44	55	92	45	60 b	X	1,0
Guinea	50	56	55	84	10	21	100	70	80	X	0,9
Guinea-Bissau	32	67	59	24	32	30	X	X	40	X	1,1
Kenya	67	49	53	69	81	77	X	X	77	X	1,9
Lesotho	44	58	56	42	25	28	X	X	80 b	X	3,5
Liberia	79	13	46	56	4	30	50	30	39 b	X	X
Madagascar	83	10	29	12	3	3	81	19	38	X	1,0
Malawi	80	32	37	22	4	6	81	29	35	X	2,3
Mali	46	43	45	58	21	31	X	X	40	X	1,3
Mauritania	67	65	66 b	34	X	X b	X	X	63	X	1,5
Mauritius	95	100	99	99	99	99	100	100	100 b	X	2,2
Mozambique	X	X	63	X	X	54	100	30	39 b	X	4,6
Namibia	87	42	57	77	12	34	87	42	59	7,6	3,9
Niger	46	55	54	71	4	15	99	30	32	X	2,2
Nigeria	84	40	51	84	48	58	X	X	51	X	X
Rwanda	X	79	X	X	85	X	X	X	80	X	1,9
Senegal	85	28	52	83	40	58	100	85	90	1,6	X c
Sierra Leone	58	21	34	17	8	11	90	20	38	X	1,6
Somalia	X	28	31	6	2	12	X	X	X	X	X
South Africa	99	53	99	85	12	53	X	X	X	7,9	3,6
Sudan	84	41	60	79	4	22	X	X	70	0,3	X
Swaziland	X	X	X	X	X	X	X	X	X	X	X
Tanzania	73	29	38	96	84	86	X	X	42	X	2,8
Togo	74	58	63	56	10	23	80	X	X	X	1,7
Uganda	60	35	38	96	47	64	99	42	49	3,9	1,8
Zambia	50	17	27	89	43	64	X	X	X	3,3	2,6
Zimbabwe	99	64	77	99	48	66	96	80	85	X	2,1
ACP - SMALL ISLANDS											
Belize	X	X	X	X	X	X	X	X	X	X	X
Dominican Rep	80	X	65	76	83	78	84	67	78	5,3	2,0

Table 7.4

	Percentage of Population with Access to: {a}									Health Expenditure as a Percentage of GDP {a}	
	Safe Drinking Water 1990-96			Adequate Sanitation 1990-96			Health Services 1990-96			Total	Public
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	1990-95	1990-95
Fiji	X	X	X	X	X	X	X	X	X	X	X
Guyana	X	X	X	X	X	X	X	X	X	X	X
Haiti	37	23	28	42	16	24	X	39	60	3,6	1,3
Jamaica	X	X	86	100	80	89	X	X	90 b	5,4	3,0
Papua New Guinea	84	17	28	82	11	22	X	X	96 b	X	2,8
Solomon Islands	X	X	X	X	X	X	X	X	X	X	X
Suriname	X	X	X	X	X	X	X	X	X	X	X
Trinidad and Tobago	99	91	97	99	98	79	100	99	100	3,9	2,6

Notes: a. Data are for the most recent year available, within the range given. b. Data are for years other than noted, differ from the standard definition, or refer to only part of a country. c. Refers to number of administrative units; number of service points is likely the same or greater.

Table 8.2

	Crude Death Rate (per 1,000)			Infant Mortality Rate {a} (per 1,000 live births)			Under-5 Mortality Rate (per 1,000 live births)			Average Annual Change in Under-5 Mortality (percent)		Maternal Mortality Rate (per 100,000 live births)
	1975-80	1995-00	2015-20	1975-80	1995-00	2015-20	1960	1980	1995	1960-80	1980-95	1990
ACP - AFRICA	18,8	14,4	X	120,0	89,2	X	X	X	X	X	X	X
ACP - SMALL ISLANDS	11,2	8,3	X	81,4	49,4	X	X	X	X	X	X	X
ACP COUNTRIES	18,4	14,1	X	118,6	87,7	X	X	X	X	X	X	X
AFRICA	17,7	12,9	8,4	120	86	55	X	X	X	X	X	X
ASIA	10,5	7,9	7,4	94	56	32	X	X	X	X	X	X
CENTRAL AMERICA	8,3	5,3	5,5	62	33	22	X	X	X	X	X	X
EUROPE	10,5	11,5	12,4	22	12	8	X	X	X	X	X	X
NORTH AMERICA	8,5	8,6	8,8	14	7	5	X	X	X	X	X	X
OCEANIA	8,7	7,7	7,6	35	24	15	X	X	X	X	X	X
SOUTH AMERICA	8,9	6,8	6,8	72	36	23	X	X	X	X	X	X
DEVELOPING	11,5	8,5	7,4	98	62	38	X	X	X	X	X	X
DEVELOPED	9,5	10,3	11,2	18	9	7	X	X	X	X	X	X
WORLD	11,0	8,9	8,0	87	57	35	X	X	X	X	X	X
ACP - AFRICA	18,8	14,4	X	120	89	X	X	X	X	X	X	X
Angola	24,4	18,7	11,1	160	124	79	345	261	292	-1,4	0,7	X
Benin	21,1	12,4	6,9	122	84	46	310	176	142	-2,8	-1,4	990
Botswana	11,3	13,0	7,5	76	56	33	170	94	52	-3,0	-3,9	250
Burkina Faso	21,9	17,7	10,7	127	97	63	318	218	164	-1,3	-2,7	930
Burundi	18,8	17,0	10,8	127	114	78	255	193	176	-1,4	-0,6	1 300
Cameroon	17,6	11,9	6,5	102	58	34	264	173	106	-2,1	-3,3	550
Central African Rep	20,6	16,4	10,3	122	96	60	294	202	165	-1,9	-1,4	700
Chad	23,1	17,3	11,3	154	115	79	325	254	152	-2,3	-2,0	1 500
Congo, Dem Rep	17,5	13,5	8,0	117	89	53	286	204	185	-1,7	-0,6	870
Congo, Rep	17,4	14,6	8,5	91	90	55	220	125	108	-2,8	-1,0	890
Côte d'Ivoire	17,5	13,8	8,7	117	86	54	300	180	150	-2,8	-0,8	810
Equatorial Guinea	22,7	16,2	10,7	149	107	73	316	243	X	X	X	X
Eritrea	18,9	14,7	9,0	130	98	57	X	X	195	-0,6	-1,9	1 400
Ethiopia	22,1	16,2	9,4	149	107	65	294	260	195	-0,6	-1,9	1 400
Gabon	19,2	14,3	9,3	122	85	47	287	194	148	-2,0	-1,8	500
Gambia, The	24,9	17,4	12,3	167	122	85	375	278	110	-2,0	-5,5	1 100
Ghana	15,3	10,4	6,9	103	73	43	215	157	130	-1,6	-1,2	740
Guinea	25,4	18,4	12,1	167	124	87	337	276	219	-1,0	-1,5	1 600
Guinea-Bissau	26,2	20,6	14,0	176	132	94	336	290	227	-0,7	-1,6	910
Kenya	15,5	11,3	6,2	88	65	37	202	112	90	-2,9	-1,5	650
Lesotho	16,5	10,6	6,6	121	72	37	204	173	154	-0,8	-0,8	610
Liberia	18,1	15,3	8,0	167	153	67	288	235	216	-1,0	-0,6	560
Madagascar	16,1	9,9	6,0	150	77	42	364	216	164	-2,6	-1,8	490
Malawi	24,0	22,4	12,6	177	142	93	365	290	219	-1,1	-1,9	560
Mali	24,1	17,1	11,1	191	149	107	400	310	210	-1,3	-2,6	1 200
Mauritania	20,0	13,1	8,8	125	92	59	321	249	195	-1,3	-1,6	930
Mauritius	6,3	6,5	6,9	38	15	8	84	42	23	-3,4	-4,1	120
Mozambique	20,8	17,5	11,1	160	110	74	331	269	275	-1,0	0,1	1 500
Namibia	15,1	11,8	7,4	98	60	36	206	114	78	-3,0	-2,5	370
Niger	23,8	17,1	10,9	157	114	79	320	320	320	0,0	0,0	X
Nigeria	19,2	13,9	9,2	105	77	51	204	196	191	-0,2	-0,2	1 000

Table 8.2

	Crude Death Rate (per 1,000)			Infant Mortality Rate {a} (per 1,000 live births)			Under-5 Mortality Rate (per 1,000 live births)			Average Annual Change in Under-5 Mortality (percent)		Maternal Mortality Rate (per 100,000 live births)
	1975-80	1995-00	2015-20	1975-80	1995-00	2015-20	1960	1980	1995	1960-80	1980-95	1990
Rwanda	20,2	19,7	11,7	133	125	84	191	222	139	0,8	-3,1	1 300
Senegal	21,7	14,5	9,6	97	62	39	303	221	110	-1,6	-4,6	1 200
Sierra Leone	29,0	25,7	16,1	192	169	114	385	301	284	-1,2	-0,4	1 800
Somalia	22,7	16,9	10,7	149	112	77	294	246	211	-0,9	-1,0	1 600
South Africa	12,4	7,9	6,0	72	48	27	126	91	67	-1,6	-2,1	230
Sudan	17,8	11,7	8,4	97	71	45	292	210	115	-1,9	-3,7	660
Swaziland	16,0	9,2	5,7	108	65	34	233	151	X	X	X	X
Tanzania	16,4	13,5	8,0	113	80	51	249	202	160	-1,6	-0,8	770
Togo	17,4	14,9	8,5	117	86	52	264	175	128	-2,0	-2,1	640
Uganda	17,6	21,0	10,7	114	113	72	218	181	185	-0,9	0,2	1 200
Zambia	16,5	18,0	9,3	94	103	55	220	160	203	-1,6	1,6	940
Zimbabwe	13,1	14,6	8,0	86	68	39	181	125	74	-1,8	-3,5	570
ACP - SMALL ISLANDS	**11,2**	**8,3**	**X**	**81**	**49**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Belize	6,5	4,3	3,6	45	30	21	X	X	X	X	X	X
Dominican Rep	8,4	5,3	5,6	84	34	19	152	94	44	-2,4	-5,0	110
Fiji	5,8	4,6	5,5	37	20	10	97	42	X	X	X	X
Guyana	9,2	7,4	7,0	67	58	37	126	88	X	X	X	X
Haiti	16,0	12,8	8,8	121	82	51	270	195	124	-1,4	-3,0	1 000
Jamaica	7,4	5,8	5,3	26	12	7	76	39	13	-3,4	-7,2	120
Papua New Guinea	15,0	9,9	7,0	77	61	37	248	95	95	-4,8	0,0	930
Solomon Islands	7,4	4,1	3,4	47	23	12	X	X	X	X	X	X
Suriname	7,3	5,5	5,4	44	24	12	96	52	X	X	X	X
Trinidad and Tobago	7,1	6,0	6,4	32	14	7	73	40	18	-3,0	-5,3	90

Note: a. Under 1 year of age.

Table 8.3 — **Cases per 100,000 Population**

	Tuberculosis			Measles			Malaria			Polio			Cholera		
	1985	1990	1995	1985	1990	1995	1988	1991	1994	1980	1988	1995	1987	1991	1995
AFRICA	70	87	83	224	79	47	X	X	3 945	2,3	0,9	0,2	5,4	23,7	9,9
ASIA	X	X	X	35	13	5	125	127	155	1,4	1,0	0,1	0,6	1,5	1,5
CENTRAL AMERICA	X	X	X	53	107	0	253	198	138	1,1	0,1	0,0	X	7,5	33,1
EUROPE	X	X	X	50	18	10	X	X	1	0,0	0,0	0,0	X	0,0	0,1
NORTH AMERICA	X	X	X	2	10	1	X	X	1	0,0	0,0	0,0	X	0,0	0,0
OCEANIA	X	X	X	32	22	19	682	914	2 742	0,1	0,1	0,0	X	X	0,0
SOUTH AMERICA	X	X	X	52	34	1	304	337	300	0,7	0,1	0,0	X	128,5	14,1
WORLD	X	X	X	58	25	11	101	104	620	1,2	0,7	0,1	1,0	11,1	3,7
ACP - AFRICA															
Angola	108	112	72	285	315	6	X	X	6 377	0,5	0,2	1,4	191,8	90,3	30,5
Benin	51	45	44	328	72 e	194	X	X	10 398	4,5	0,7	0,1	X	154,9	3,8
Botswana	251	230	380	156	96	16	X	X	2 089	0,1	0,0	0,0	X	X	X
Burkina Faso	58	17	14	222	108	54	X	X	4 637	2,1	0,2	0,1	X	5,7	13,8
Burundi	49	83	62 a	774	242	244	X	X	14 022	1,0	0,2	0,2	10,4	0,1	37,9
Cameroon	34	51	57 a	473	184	19	X	X	1 065	2,9	1,1	0,1	0,9	34,1	4,7
Central African Rep	20	73	101	94	44	28	X	X	2 562	0,9	1,9	0,1	X	X	X
Chad	30	47	50	128	132	10	X	X	X	0,0	0,0	3,0	X	244,7	X
Congo, Dem Rep	15 b	55 c	91	62	12	12	X	X	X	X	X	X	3,4	10,4	1,2
Congo, Rep	138	26	140	395	162	84	X	X	1 428	8,1	0,0	0,0	X	X	X
Côte d'Ivoire	58	65	84	90	152	219	X	X	X	0,6	0,3	0,9	X	5,0	36,5
Equatorial Guinea	5	74	77	149	9	11	X	X	1 241	0,0	0,0	0,0	X	X	X
Eritrea	X	120	608	X	X	6	X	X	X	0,0	0,0	0,3	X	X	X
Ethiopia	174	187	26	162	4	1	X	X	X	0,6	0,3	0,4	X	X	X
Gabon	87	80	84	650	79	X	X	X	X	10,1	0,3	0,8	X	X	X
Gambia, The	X	X	92	219	0	12	X	X	X	0,2	0,6	0,0	X	X	1,4
Ghana	25	43	24	503	215	232	X	X	X	1,3	0,4	0,2	X	85,2	27,1
Guinea	26	35	52	60	222	15	X	X	8 567	0,7	4,8	0,4	X	X	88,5
Guinea-Bissau	61	121	163	152	27	49	X	X	X	0,4	0,5	0,0	269,6	X	11,1
Kenya	53	50	100	561	328	12	X	X	23 068	2,7	7,7	0,0	1,2	X	5,7
Lesotho	187	141	236	471	123	15	X	X	X	2,6	0,0	0,0	X	X	X
Liberia	19	37 d	46	122	72 e	3	X	X	X	5,2	0,2	0,0	1,4	5,3	161,1
Madagascar	30	50	80	655	114	79	X	X	X	0,7	0,4	0,0	X	X	X
Malawi	74	132	172	1 747	0	44	X	X	49 410	1,1	0,1	0,0	X	85,1	0,0
Mali	20	32	29	376	15	31	X	X	X	3,4	1,4	0,2	4,2	X	19,0
Mauritania	249	264	169	856	69	9	X	X	X	10,3	0,9	0,2	84,9	X	X
Mauritius	11	11	14	0	0	1	X	X	3	0,0	0,0	0,0	X	X	X
Mozambique	42	112	112	122	127	24	X	X	X	0,5	0,1	0,0	X	53,6	X
Namibia	411	198	100	X	350 d	112	X	X	27 209	0,0	0,0	1,0	X	X	X
Niger	11	67	22	979	265	743	X	X	9 238	5,6	0,5	0,4	X	40,5	2,9
Nigeria	18	21	12	195	120	11	X	X	X	1,1	1,6	0,4	1,5	60,0	0,9
Rwanda	22	91	38	277	129	541	X	X	X	0,5	0,1	0,0	1,5	10,2	0,1
Senegal	17	68	91	104 c	68	73 a	X	X	X	2,5	0,3	0,0	46,7	X	38,8
Sierra Leone	24	16	43	93	21	8	X	X	X	0,3	0,1	0,0	14,8	X	245,2
Somalia	35	15 e	31	2	12 e	X	X	X	X	0,0	0,6	0,0	X	X	97,5
South Africa	180	217	210	54	29	3	X	X	25	0,4	0,5	0,0	0,1	0,0	X
Sudan	7	1	39	315	58	3	X	X	X	22,2	0,4	0,1	X	X	X
Swaziland	319 f	193 e	240	501	197	20	X	X	X	34,3	0,3	0,0	X	X	X
Tanzania	63	87	134	211	59	11	X	X	27 343	0,5	0,0	0,1	8,2	21,5	5,7
Togo	25	37	37	850	129	150	X	X	8 274	6,8	0,8	0,1	X	66,0	1,6

Table 8.3 — **Cases per 100,000 Population**

	Tuberculosis			Measles			Malaria			Polio			Cholera		
	1985	**1990**	**1995**	**1985**	**1990**	**1995**	**1988**	**1991**	**1994**	**1980**	**1988**	**1995**	**1987**	**1991**	**1995**
Uganda	9 b	82	120	X	16	217	X	X	X	0,3	0,1	0,5	0,9	1,6	2,7
Zambia	98	281	135	796	93	106	X	X	44 498	4,8	1,2	0,1	X	178,0	X
Zimbabwe	57	92	274	266	139	50	X	X	2 964	0,4	0,0	0,0	X	X	X
ACP - SMALL ISLANDS															
Belize	15	30	28	4	33	2	1 531	1 728	4 787	2,1	0,0	0,0	X	X	8,9
Dominican Rep	37	37	52	69	49	0	16	5	22	2,6	0,0	0,0	X	X	X
Fiji	33	31	26	22	4	53	X	X	X	0,0	0,0	0,0	X	X	X
Guyana	27	21	35	11	0	0	4 467	5 282	4 819	0,0	0,0	0,0	X	X	X
Haiti	85	155 c	X	36	22	X	198	387	331	0,4	0,1	0,0	X	X	X
Jamaica	6	5	4	3	154	1	X	X	0	0,0	0,0	0,0	X	X	X
Papua New Guinea	100	65	187	165	119	87	2 285	2 204	14 974	0,7	0,5	0,0	X	X	X
Solomon Islands	140	119	93	1	107	0	21 369	42 731	35 980	0,0	0,0	0,0	X	X	X
Suriname	13	21	13 a	29	7	0	688	367	1 115	0,0	0,0	0,0	X	X	X
Trinidad and Tobago	10	10	14	301	41	0	X	X	2	0,0	0,0	0,0	X	X	X

Notes: a. Data are for 1994. b. Data are for 1986. c. Data are for 1991. d. Data are for 1988. e. Data are for 1989. f. Data are for 1983.

Table 8.4	Percentage of Births Attended by Trained Personnel	Percentage of 1-Year-Olds Immunized Against					Percentage of Pregnant Women Immunized for Tetanus	ORT {a,d} Use (percent)	Contraceptive Prevalence (percent) Any / Modern Methods	Population per {a}			
		TB {b}	DPT {c}	Polio	Measles					Doctor		Nurse	
	1990-96 {a}	1992-95 {a}	1992-95 {a}	1992-95 {a}	1980	1995	1992-95 {a}	1990-96	1971-96 {a}	1980-83	1990-93	1980-83	1990-93
AFRICA	X	X	X	X	X	X	X	X	X	X	X	X	X
ASIA	X	X	X	X	X	X	X	X	59/55	X	X	X	X
CENTRAL AMERICA	X	X	X	X	X	X	X	X	X	X	X	X	X
EUROPE	X	X	X	X	X	X	X	X	72/45	X	X	X	X
NORTH AMERICA	X	X	X	X	X	X	X	X	71/67	X	X	X	X
OCEANIA	X	X	X	X	X	X	X	X	X	X	X	X	X
SOUTH AMERICA	X	X	X	X	X	X	X	X	X	X	X	X	X
WORLD	X	X	X	X	X	X	X	X	57/49	3 770	X	X	X
ACP - AFRICA													
Angola	X	40	21	23	X	32	14	X	X	X	23 725	X	X
Benin	45	91	79	79	X	81	77	60	9/0.5	13 408	X	1 755	4 182
Botswana	78	81	78	78	63	68	56	X	33/32	6 906	X	703	X
Burkina Faso	42	78	47	47	X	55	39	100	8/4	57 181	X	1 683	X
Burundi	19	77	63	62	X	44	30	X	9/1	X	17 153	X	4 778
Cameroon	64	54	46	46	X	51	12	X	16/4	X	11 996	X	1 999
Central African Rep	46	73	38	37	12	70	50	34	24/4	23 302	25 920	2 193	11 309
Chad	15	36	17	16	X	X	50	X	1 e	X	30 030	X	X
Congo, Dem Rep	X	46	26	27	18	41	33	90	8/2	X	15 150	X	1 355
Congo, Rep	X	94	79	79	X	39	75	41	X	8 425	3 713	595	1 401
Côte d'Ivoire	45	48	40	40	X	57	22	18	11/4	X	11 739	X	3 244
Equatorial Guinea	X	X	X	X	X	X	X	X	X	X	3 556	X	2 286
Eritrea	21	57	45	45	X	29	19	38	5/4	X	X	X	X
Ethiopia	14	63	51	48	4	38	22	95	4/3	88 119	X	4 998	X
Gabon	80	73	56	57	X	X	29	X	X	2 305	X	225	X
Gambia, The	44	98	90	92	X	X	93	X	12/7	X	X	X	X
Ghana	44	70	55	55	16	54	64	93	20/10	X	X	640	X
Guinea	31	86	73	73	X	X	56	38	2/1	46 401	7 445	5 161	5 166
Guinea-Bissau	27	100	100	98	X	X	53	X	1 e	7 491	X	1 130	X
Kenya	45	92	84	84	X	35	72	76	33/27	8 319	21 970	942	8 675
Lesotho	40	59	58	59	X	X	12	42	23/19	X	24 095	X	2 040
Liberia	58	92	62	62	X	X	77	94	6/5	9 396	X	1 382	X
Madagascar	57	77	64	63	X	59	33	85	17/5	9 891	8 385	1 721	3 736
Malawi	55	91	76	80	49	X	77	78	13/7	53 605	X	3 024	X
Mali	24	75	46	46	X	49	19	X	7/5	25 997	X	1 348	X
Mauritania	40	93	50	50	X	X	28	31	3/1	X	15 772	X	2 261
Mauritius	97	87	89	89	X	X	78	X	75/49	1 817	X	583	X
Mozambique	25	58	46	46	X	71	61	83	4 e	37 948	X	5 759	X
Namibia	68	94	76	74	X	57	72	66	29/26	X	4 328	X	317
Niger	X	32	18	18	X	38	57	20	4/2	X	53 986	X	3 765
Nigeria	31	57	27	27	X	X	21	X	6/4	6 709	X	856	X
Rwanda	26	86	57	57	X	X	88	47	21/13	34 797	X	3 659	X
Senegal	46	90	80	80	X	80	39	18	7/5	13 039	18 192	1 931	13 174
Sierra Leone	25	60	43	43	36	X	61	X	4 e	18 973	X	2 078	X
Somalia	2	37	28	28	9	X	11	97	1 e	25 334	X	2 809	X
South Africa	82	95	73	72	X	X	26	X	50/48	X	X	X	X
Sudan	69	88	76	77	X	77	65	X	8/7	9 582	X	1 408	X

Table 8.4	Percentage of Births Attended by Trained Personnel	Percentage of 1-Year-Olds Immunized Against					Percentage of Pregnant Women Immunized for Tetanus	ORT {a,d} Use (percent)	Contraceptive Prevalence (percent) Any / Modern Methods	Population per {a}			
		TB {b}	DPT {c}	Polio	Measles					Doctor		Nurse	
	1990-96 {a}	1992-95 {a}	1992-95 {a}	1992-95 {a}	1980	1995	1992-95 {a}	1990-96	1971-96 {a}	1980-83	1990-93	1980-83	1990-93
Swaziland	X	X	X	X	X	94	X	X	20/17	18 698	9 566	1 046	628
Tanzania	53	92	88	86	45	75	71	76	20/13	X	X	X	X
Togo	54	81	73	71	X	65	43	X	12/3	21 357	11 385	1 657	3 060
Uganda	38	98	79	78	X	X	76	46	15/8	21 832	X	2 049	X
Zambia	51	63	72	72	X	78	44	99	15/9	7 327	10 917	765	X
Zimbabwe	69	95	80	80	X	X	46	60	48/42	7 074	7 384	997	1 594
ACP - SMALL ISLANDS													
Belize	X	X	X	X	21	87	X	X	47/42	X	2 028	X	490
Dominican Rep	92	74	83	80	29	85	52	X	56/52	X	949	1 239	X
Fiji	X	X	X	X	32	178	X	X	41/35	2 025	X	490	X
Guyana	X	X	X	X	X	77	X	X	31/28	X	8 948	X	893
Haiti	21	68	34	34	X	X	49	31	18/14	9 079	10 855	X	8 945
Jamaica	82	100	92	92	X	89	82	X	62/58	2 786	6 420	X	489
Papua New Guinea	20	78	50	55	X	63	31	X	4 e	16 018	12 754	957	1 569
Solomon Islands	X	X	X	X	X	68	X	X	X	X	6 154	X	716
Suriname	X	X	X	X	X	79	X	X	X	X	1 274	X	270
Trinidad and Tobago	98	X	89	90	X	90	19	X	53/44	1 485	1 520	386	247

Notes: a. Data are for most recent year available. b. TB: tuberculosis c. DPT: diphtheria, pertussis (whooping cough), and tetanus. d. ORT: Oral rehydration therapy. e. Data are from UNICEF for the most recent year available from 1990 to 1996 and refer to any method.

Table 8.6	Lead in Gasoline			
	Consumption of Motor Gasoline (million liters) 1995	Gasoline Cost per Liter (US$) 1996	Market Share of Leaded Gasoline (percent) 1992-1996 {a}	Maximum Concentration of Lead in Gasoline (grams/liter) 1992-1996 {a}
ACP - AFRICA	19 883	X	X	X
ACP - SMALL ISLANDS	2 021	X	X	X
ACP COUNTRIES	21 904	X	X	X
AFRICA	28 407	X	X	X
ASIA	191 643	X	X	X
CENTRAL AMERICA	40 579	X	X	X
EUROPE	239 823	X	X	X
NORTH AMERICA	487 037	X	X	X
OCEANIA	20 611	X	X	X
SOUTH AMERICA	56 180	X	X	X
WORLD	1 064 280	X	X	X
ACP - AFRICA	19 883	X	X	X
Angola	99	X	100	0,77
Benin	88	0,36	100	0,84
Botswana	X	0,38	100	0,44
Burkina Faso	91	0,81	100	0,84
Burundi	34	0,52	100	0,84
Cameroon	478	0,68	100	0,84
Central African Rep	22	0,82	X	X
Chad	9	0,80	100	0,84
Congo, Dem Rep	200	X	X	X
Congo, Rep	70	X	X	X
Côte d'Ivoire	769	0,83	100	0,26
Equatorial Guinea	7	X	X	X
Eritrea	X	X	X	X
Ethiopia	172	0,32	100	0,76
Gabon	38	X	100	0,80
Gambia, The	38	X	X	X
Ghana	455	0,38	100	0,63
Guinea	99	X	X	X
Guinea-Bissau	20	X	X	X
Kenya	458	0,56	100	0,40
Lesotho	X	X	X	X
Liberia	36	X	100	0,77
Madagascar	105	0,47	100	0,80
Malawi	92	X	100	0,53
Mali	82	0,82	100	0,80
Mauritania	359	0,94	100	0,25
Mauritius	113	0,53	100	0,40
Mozambique	53	X	100	0,65
Namibia	X	X	100	0,40
Niger	63	0,79	100	0,65
Nigeria	4 199	0,13	100	0,66
Rwanda	45	X	X	X
Senegal	242	0,94	100	0,60

Table 8.6	Lead in Gasoline			
	Consumption of Motor Gasoline (million liters) 1995	Gasoline Cost per Liter (US$) 1996	Market Share of Leaded Gasoline (percent) 1992-1996 {a}	Maximum Concentration of Lead in Gasoline (grams/liter) 1992-1996 {a}
Sierra Leone	41	X	X	X
Somalia	X	X	X	X
South Africa	10 133	0,48	88	0,40
Sudan	262	0,50	X	X
Swaziland	X	X	X	X
Tanzania	149	0,56	X	X
Togo	86	0,47	X	X
Uganda	127	0,98	100	0,84
Zambia	145	0,60	X	X
Zimbabwe	405	X	100	0,84
ACP - SMALL ISLANDS	**2 021**	**X**	**X**	**0,77**
Belize	35	X	X	X
Dominican Rep	811	X	69	0,40
Fiji	61	X	X	X
Guyana	97	X	X	X
Haiti	73	X	X	X
Jamaica	467	0,27	70	0,77
Papua New Guinea	108	X	X	X
Solomon Islands	11	X	X	X
Suriname	85	X	100	X
Trinidad and Tobago	273	0,48	99	X

Notes: a. Data are for most recent year available.

Table 8.7

	Year of DHS Survey	Percentage of Households Without: Piped Water		Own Flush Toilet		Finished Floor		Refrigerator		Radio or Television		Maximum Number of Households Surveyed	Percentage of Children Under 5 With: Diarrhea		a Cough		Maximum Number of Households Surveyed
		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural		Urban	Rural	Urban	Rural	
ACP - AFRICA																	
Burkina Faso	1992-93	74	99	97	100	14	83	87	100	25	59	4 877	19	21	29	32	5 522
Cameroon	1991	85	99	86	99	25	78	75	98	29	55	3 407	17	18	30	27	3 188
Central African Rep	1994-95	96	100	98	100	74	97	96	100	39	64	5 387	20	25	65	59	2 577
Côte d'Ivoire	1994	49	96	80	99	2	43	79	96	33	55	5 815	25	20	37	33	3 645
Ghana	1993	63	98	90	100	2	23	77	99	43	66	5 637	17	21	21	24	2 053
Kenya	1993	43	89	77	99	21	80	88	99	31	52	7 532	12	14	37	43	5 620
Madagascar	1992	70	99	91	100	63	93	92	100	34	69	5 961	11	13	41	37	5 007
Namibia	1992	18	87	17	94	12	80	44	95	19	41	3 927	14	24	37	45	3 573
Niger	1992	77	100	97	100	36	97	87	100	38	72	5 173	20	29	17	23	5 702
Nigeria	1990	X	X	X	X	X	X	X	X	X	X	X	12	20	17	20	7 069
Rwanda	1992	93	100	100	100	43	92	90	100	X	X	5 976	21	22	37	46	5 020
Senegal	1992-93	46	93	86	99	8	67	79	99	19	35	3 362	16	23	26	30	5 108
Tanzania	1991-92	59	98	97	100	47	92	96	100	43	74	8 026	15	13	34	27	7 230
Uganda	1995	87	100	93	100	33	93	95	100	32	67	7 368	20	24	42	50	5 431
Zambia	1992	45	97	57	99	15	84	85	99	39	77	5 872	20	25	X	X	5 387
Zimbabwe	1994	8	96	34	98	5	59	76	98	33	68	5 786	18	26	42	51	2 221
ACP - SMALL ISLANDS																	
Dominican Rep	1991	72	92	50	93	3	24	42	82	17	41	6 228	17	16	34	38	3 645

Table 9.1

	Urban Population (000)			Percentage Urban			Population Growth Rate (percent)						Population in Urban Agglomerations > 750,000 (percent)	
							Urban			Rural				
	1980	2000	2020	1980	2000	2020	1980-1985	2000-2005	2020-2025	1980-1985	2000-2005	2020-2025	1995	2015
ACP - AFRICA	88 340	229 581	515 577	23	34	46	4,8	4,4	3,3	2,2	1,7	1,0	X	X
ACP - SMALL ISLANDS	6 955	12 674	20 733	36	45	55	3,3	2,6	2,1	1,1	0,7	0,2	X	X
ACP COUNTRIES	95 295	242 255	536 310	24	35	47	4,7	4,3	3,3	2,2	1,7	1,0	X	X
AFRICA	129 842	309 651	646 106	27	38	49	4,4	4,0	3,0	2,2	1,6	0,9	X	X
ASIA	706 203	1 386 721	2 275 015	27	38	50	3,6	2,8	2,0	1,2	0,3	-0,3	X	X
CENTRAL AMERICA	54 083	91 244	131 046	60	67	73	3,1	2,0	1,5	0,8	0,9	-0,2	X	X
EUROPE	480 186	546 162	570 353	69	75	80	0,8	0,3	0,1	-0,6	-1,2	-1,6	X	X
NORTH AMERICA	188 603	238 271	293 832	74	77	82	1,2	1,0	0,9	0,4	-0,3	-0,7	X	X
OCEANIA	16 152	21 180	27 966	71	70	72	1,4	1,3	1,3	1,8	1,3	0,2	X	X
SOUTH AMERICA	163 450	272 495	369 853	68	80	85	3,1	1,8	1,1	-0,2	-0,7	-0,4	X	X
WORLD	1 754 308	2 889 855	4 346 897	39	47	57	2,6	2,2	1,7	1,1	0,4	-0,1	X	X
ACP - AFRICA	88 340	229 581	515 577	23	34	46	4,8	4,4	3,3	2,2	1,7	1,0	X	X
Angola	1 467	4 371	10 697	21	34	47	5,6	4,9	3,8	1,8	2,0	1,2	19	25
Benin	946	2 630	6 109	27	42	56	5,4	4,6	3,3	2,1	1,5	1,0	0	0
Botswana	137	1 191	2 142	15	74	89	13,7	4,2	1,6	0,9	-5,5	0,2	0	0
Burkina Faso	585	2 226	6 343	8	18	31	8,6	5,6	4,4	2,0	2,1	1,5	8	14
Burundi	179	625	1 875	4	9	17	6,5	5,9	4,7	2,6	2,1	1,4	0	0
Cameroon	2 719	7 401	15 671	31	49	62	5,4	4,2	3,1	1,5	1,2	0,9	18	24
Central African Rep	811	1 499	2 897	35	41	53	3,0	3,3	2,9	1,9	1,3	0,5	0	0
Chad	843	1 729	3 909	19	24	34	3,4	4,0	3,9	2,0	1,9	1,0	13	18
Congo, Dem Rep	7 756	15 670	39 648	29	30	43	2,7	4,5	4,1	3,4	2,3	1,4	11	14
Congo, Rep	685	1 865	3 671	41	63	72	5,8	3,7	2,9	0,5	1,0	1,1	39	46
Côte d'Ivoire	2 849	7 046	13 351	35	47	59	5,3	3,6	2,2	2,9	1,1	0,0	20	25
Equatorial Guinea	59	218	461	27	48	64	8,9	4,5	2,8	6,6	0,3	0,7	0	0
Eritrea	322	714	1 738	14	19	29	4,3	4,4	3,9	2,2	1,9	0,9	0	0
Ethiopia	3 812	11 679	34 429	10	18	29	4,6	5,7	4,7	2,2	2,5	1,7	4	6
Gabon	235	682	1 319	34	55	68	5,8	4,0	2,5	1,4	0,4	0,5	0	0
Gambia, The	126	404	838	20	32	46	5,8	4,1	3,0	2,3	1,0	0,4	0	0
Ghana	3 368	7 644	16 742	31	38	51	4,2	4,2	3,2	3,1	1,7	0,7	10	12
Guinea	852	2 577	6 269	19	33	46	5,3	4,9	3,7	1,4	1,8	1,1	21	30
Guinea-Bissau	135	280	613	17	24	35	3,6	3,9	3,6	1,5	1,4	0,8	0	0
Kenya	2 673	10 043	22 468	16	33	48	7,7	5,0	2,6	2,7	1,2	0,1	7	10
Lesotho	183	641	1 544	13	28	42	6,8	5,1	3,4	2,0	1,3	0,8	0	0
Liberia	656	1 560	3 457	35	48	60	5,5	4,5	3,4	1,8	2,1	1,1	45	51
Madagascar	1 660	5 133	13 088	18	30	43	5,8	5,1	3,8	2,6	2,1	1,1	6	8
Malawi	565	1 686	4 657	9	15	26	5,8	5,2	4,5	2,9	2,0	1,4	0	0
Mali	1 267	3 773	9 462	18	30	43	5,4	5,0	3,8	2,2	1,9	1,2	9	12
Mauritania	424	1 489	2 865	27	58	71	7,5	4,1	2,4	0,4	-0,1	0,5	0	0
Mauritius	409	487	737	42	41	52	0,5	1,8	1,9	1,4	0,5	-0,5	0	0
Mozambique	1 586	7 869	17 344	13	40	55	10,1	4,8	3,2	0,8	0,7	0,9	13	19
Namibia	235	708	1 528	23	41	56	5,7	4,5	2,9	1,7	0,7	0,6	0	0
Niger	704	2 222	6 362	13	21	32	5,8	5,6	4,5	3,0	2,5	1,6	0	0
Nigeria	19 353	56 651	124 888	27	44	58	5,5	4,6	3,0	1,8	1,2	0,8	11	14
Rwanda	243	472	1 248	5	6	10	4,4	4,5	4,8	3,1	2,2	1,3	0	0
Senegal	1 988	4 463	9 090	36	47	59	3,9	4,0	2,8	2,2	1,3	0,6	21	25
Sierra Leone	779	1 783	3 719	24	37	50	4,3	4,0	3,1	1,3	1,1	0,6	0	0

Table 9.1

	Urban Population (000)			Percentage Urban			Population Growth Rate (percent)						Population in Urban Agglomerations > 750,000 (percent)	
							Urban			Rural				
	1980	2000	2020	1980	2000	2020	1980-1985	2000-2005	2020-2025	1980-1985	2000-2005	2020-2025	1995	2015
Somalia	1 492	3 170	8 183	22	27	39	4,1	4,8	4,1	2,9	2,5	1,4	11	14
South Africa	14 043	23 291	39 548	48	50	59	2,6	2,7	2,2	2,4	1,5	0,0	30	34
Sudan	3 728	10 772	22 667	20	36	52	5,1	4,6	2,5	2,2	0,7	0,1	8	12
Swaziland	100	351	777	18	36	50	7,0	4,9	2,8	2,0	1,2	0,4	0	0
Tanzania	2 741	9 376	23 354	15	28	42	6,7	5,2	3,7	2,5	1,7	1,0	9	14
Togo	599	1 556	3 589	23	33	46	5,9	4,3	3,6	2,0	1,8	1,0	0	0
Uganda	1 154	3 180	9 333	9	14	23	4,8	5,5	4,8	2,1	2,5	1,7	5	7
Zambia	2 285	4 067	8 019	40	45	55	2,8	3,3	2,9	1,8	1,8	0,6	16	22
Zimbabwe	1 587	4 387	8 928	22	35	49	5,8	4,1	2,5	2,5	1,0	0,0	13	19
ACP - SMALL ISLANDS	6 955	12 674	20 733	36	45	55	3,3	2,6	2,1	1,1	0,7	0,2	X	X
Belize	72	112	188	49	47	54	2,2	2,6	2,5	2,9	2,0	0,2	0	0
Dominican Rep	2 877	5 537	8 013	51	65	75	3,8	2,3	1,2	0,5	-0,3	-0,6	57	66
Fiji	239	359	596	38	42	54	2,4	2,6	2,1	1,7	0,8	-0,3	0	0
Guyana	232	334	547	31	38	51	1,6	2,7	2,0	0,6	-0,1	-0,5	0	0
Haiti	1 269	2 727	5 471	24	35	48	3,7	3,6	3,1	1,2	0,8	0,6	21	29
Jamaica	998	1 451	2 116	47	56	66	2,6	1,8	1,7	0,7	-0,2	-0,4	0	0
Papua New Guinea	403	838	1 880	13	17	27	3,6	4,0	3,6	2,0	1,7	0,5	0	0
Solomon Islands	24	87	242	11	20	32	6,8	5,8	4,0	3,1	2,3	1,1	0	0
Suriname	159	236	364	45	52	63	1,5	2,1	1,8	1,0	-0,3	-0,3	0	0
Trinidad and Tobago	682	993	1 316	63	74	81	2,7	1,5	1,0	0,0	-0,6	-0,6	0	0

Table 10.1

	Index of Agricultural Production (1989-91 = 100)								Average Production of Cereals		of Roots and Tubers		of Pulses	
	Total		Per Capita		Total (1989-91 = 100)		Per Capita		(000 metric tons)	% Change Since	(000 metric tons)	% Change Since	(000 metric tons)	% Change Since
	84-86	94-96	84-86	94-96	84-86	94-96	84-86	94-96	94-96	84-86	94-96	84-86	94-96	84-86
ACP - AFRICA	X	X	X	X	X	X	X	X	86 144	18	122 383	35	6 511	17
ACP - SMALL ISLANDS	X	X	X	X	X	X	X	X	1 722	19	2 865	7	182	-8
ACP COUNTRIES	X	X	X	X	X	X	X	X	87 866	18	125 248	34	6 693	16
AFRICA	84	112	97	98	96	98	84	112	113 585	30	135 876	38	7 268	27
ASIA	X	X	X	X	X	X	X	X	948 317	X	260 294	X	27 384	X
CENTRAL AMERICA	X	X	X	X	X	X	X	X	31 357	3	4 154	8	2 086	18
EUROPE	X	X	X	X	X	X	X	X	383 382	X	147 785	X	10 461	X
NORTH AMERICA	94	91	100	88	100	88	94	91	375 707	0	25 643	20	3 584	57
OCEANIA	97	111	105	104	105	107	97	115	26 928	0	3 137	8	2 050	45
SOUTH AMERICA	88	115	97	106	96	108	88	118	91 056	15	45 148	8	3 964	17
DEVELOPING	85	122	94	111	94	113	85	123	1 137 967	19	436 491	21	40 442	15
DEVELOPED	98	96	101	94	101	94	98	97	832 364	-7	185 545	-20	16 357	4
WORLD	91	110	99	102	99	103	91	111	1 970 331	8	622 036	9	56 798	12
ACP - AFRICA	X	X	X	X	X	X	X	X	86 144	18	122 383	35	6 511	17
Angola	98	125	113	106	112	108	97	126	372	13	2 641	41	169	76
Benin	79	140	92	122	94	108	81	125	687	26	2 595	40	72	37
Botswana	97	95	115	83	115	83	97	95	60	73	9	22	14	2
Burkina Faso	82	119	94	103	96	105	83	121	2 420	37	66	-109	65	10
Burundi	88	94	102	85	102	85	88	94	255	3	1 318	6	314	0
Cameroon	94	112	108	97	107	99	93	114	1 162	26	2 183	6	91	31
Central African Rep	87	108	98	97	96	99	85	110	107	-21	827	-2	25	54
Chad	77	121	85	106	88	109	80	124	966	41	535	-7	34	-16
Congo, Dem Rep	85	101	101	83	100	84	84	102	1 680	33	4 761	17	8	0
Congo, Rep	94	112	109	96	108	96	93	112	27	35	770	3	10	27
Côte d'Ivoire	83	114	98	98	100	105	85	123	1 768	39	1 953	19	463	20
Equatorial Guinea	96	95	109	84	107	82	94	93	X	X	109	X	42	X
Eritrea	X	113	X	103	X	103	X	114	211	X	2 127	X	1 057	X
Ethiopia	89	117	103	X	103	X	89	117	9 401	X	407	21	0	16
Gabon	88	105	102	92	102	92	88	106	27	40	6	0	4	-1
Gambia, The	99	85	122	70	122	69	99	83	100	-2	9 953	55	20	26
Ghana	87	144	102	125	102	123	87	142	1 740	45	781	19	60	21
Guinea	91	124	106	98	110	99	95	125	817	17	61	13	2	9
Guinea-Bissau	89	111	98	100	97	100	88	111	188	15	1 676	24	265	20
Kenya	80	103	94	89	94	88	80	102	3 278	19	62	55	5	-5
Lesotho	93	113	106	99	104	93	91	106	197	27	523	39	3	-5
Liberia	X	X	X	X	X	X	X	X	54	-443	129	19	12	9
Madagascar	94	104	111	88	110	89	93	105	2 673	13	569	7	271	14
Malawi	91	106	116	101	122	97	96	102	1 610	12	26	7	36	-27
Mali	78	116	91	99	94	97	81	114	2 319	41	5	-7	17	-29
Mauritania	84	100	96	88	96	88	84	100	218	56	20	-7	2	16
Mauritius	98	101	102	96	99	98	96	103	2	-209	989	26	212	-77
Mozambique	93	105	98	87	98	86	93	105	1 067	30	225	11	8	19
Namibia	83	107	95	94	94	94	82	107	88	12	263	7	435	54
Niger	79	121	92	102	92	102	79	121	2 300	31	55 829	69	1 663	63

Table 10.1

	Index of Agricultural Production (1989-91 = 100)								Average Production of Cereals (000 metric tons)	% Change Since	of Roots and Tubers (000 metric tons)	% Change Since	of Pulses (000 metric tons)	% Change Since
	Total		Per Capita		Total		Per Capita							
	84-86	94-96	84-86	94-96	84-86	94-96	84-86	94-96	94-96	84-86	94-96	84-86	94-96	84-86
Nigeria	71	132	82	114	83	114	71	133	21 077	41	1 347	-31	126	-133
Rwanda	100	71	114	92	114	94	100	72	158	-96	75	21	36	-29
Senegal	83	112	95	98	95	98	83	111	1 017	7	294	56	41	21
Sierra Leone	92	94	102	89	103	88	93	93	415	-31	42	-4	13	-38
Somalia	X	X	X	X	X	X	X	X	361	-47	1 473	27	76	-33
South Africa	88	95	99	85	98	87	87	97	12 408	19	159	-51	111	-6
Sudan	104	126	116	113	113	116	101	129	4 565	32	8	-25	5	24
Swaziland	93	92	107	80	110	84	96	97	107	-55	7 003	-21	355	-12
Tanzania	90	99	106	84	106	84	91	98	4 160	15	846	2	29	-17
Togo	78	106	91	91	98	90	84	104	534	27	250	39	72	-3
Uganda	82	116	92	98	91	96	80	113	2 047	48	18 702	12	200	10
Zambia	81	96	91	86	91	86	81	97	1 208	5	588	37	24	70
Zimbabwe	93	97	109	85	109	80	93	91	2 292	-15	176	37	46	-7
ACP - SMALL ISLANDS	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**1 722**	**19**	**2 865**	**7**	**182**	**-8**
Belize	78	134	88	117	88	117	78	134	35	34	4	14	3	56
Dominican Rep	95	103	106	94	103	96	93	105	555	-8	258	13	84	-1
Fiji	95	107	98	99	99	99	95	107	20	-32	48	-40	1	56
Guyana	124	170	125	163	124	163	124	170	475	41	47	37	1	5
Haiti	110	91	121	83	122	84	110	92	391	-15	771	0	78	-18
Jamaica	92	115	94	110	94	110	92	115	4	-101	341	27	8	5
Papua New Guinea	98	108	109	96	110	96	99	107	3	29	1 267	6	2	22
Solomon Islands	121	106	144	90	144	90	121	106	X	X	111	14	2	2
Suriname	112	93	119	88	119	88	112	93	221	-36	7	46	0	100
Trinidad and Tobago	93	105	98	101	98	102	93	106	18	59	12	22	2	-14

Table 10.3

	Average Daily Per Capita Calorie Supply (kilocalories)		Average Daily Per Capita Protein Supply (grams)		Average Yield of Cereals		Average Yield of Roots and Tubers	
					Kilograms Per Hectare	Percent Change Since	Kilograms Per Hectare	Percent Change Since
	1982-84	1992-94	1982-84	1992-94	1994-96	1984-86	1994-96	1984-86
ACP - AFRICA	2 109	2 182	44	46	1 163	2,9	5 518	-6,5
ACP - SMALL ISLANDS	2 299	2 196	40	40	2 825	8,7	7 571	4,9
ACP COUNTRIES	2 118	2 183	44	46	1 207	3,5	5 573	-6,0
AFRICA	X	X	X	X	1 220	9,5	8 161	17
ASIA	X	X	X	X	2 895	X	15 195	X
CENTRAL AMERICA	X	X	X	X	X	X	X	X
EUROPE	X	X	X	X	2 884	X	15 134	X
NORTH AMERICA	X	X	X	X	X	X	22 863	38
OCEANIA	X	X	X	X	1 779	11,5	11 198	2
SOUTH AMERICA	X	X X	X	X	2 547	19,9	12 320	7
DEVELOPING	2 406	2 555	58	64	2 598	14,5	11 617	8
DEVELOPED	3 260	3 223	72	98	3 183	6,9	16 570	-5
WORLD	2 624	2 709	62	72	2 817	10,1	12 752	2
ACP - AFRICA	2 109	2 182	44	46	1 163	2,9	5 518	-6,5
Angola	1 986	1 756	50	39	405	-6,7	6 041	38
Benin	1 983	2 325	46	56	1 008	17,6	9 275	10
Botswana	2 215	2 268	70	69	300	43,6	6 000	10
Burkina Faso	1 698	2 471	50	72	808	17,6	5 219	-55
Burundi	1 904	1 802	61	57	1 298	10,7	6 471	-7
Cameroon	2 247	2 167	55	51	1 313	8,3	6 076	0
Central African Rep	2 154	1 959	36	41	790	-28,2	3 280	-23
Chad	1 441	1 840	41	53	639	14,0	4 163	-17
Congo, Dem Rep	2 080	2 032	34	32	793	-2,5	8 174	6
Congo, Rep	2 312	2 188	47	49	936	19,7	6 894	-3
Côte d'Ivoire	2 740	2 358	56	50	1 111	14,9	5 792	-1
Equatorial Guinea	X	X	X	X	X	X	2 632	-19
Eritrea	X	1 608 b	X	X	699	X	2 812	X
Ethiopia	1 681	1 661	X	X	1 354	24,4	3 679	2
Gabon	2 523	2 472	75	73	1 779	10,0	5 449	3
Gambia, The	2 226	2 295	49	47	1 106	-19,7	3 000	0
Ghana	1 862	2 360	40	50	1 399	35,3	10 995	50
Guinea	2 251	2 346	51	46	1 219	26,1	7 091	4
Guinea-Bissau	2 191	2 571	46	50	1 389	15,9	7 038	4
Kenya	2 042	1 914	55	50	1 822	11,2	8 031	9
Lesotho	2 267	2 164	67	60	1 560	56,2	14 804	-4
Liberia	2 496	1 728	X	X	1 110	-13,3	7 356	15
Madagascar	2 419	2 056	57	48	2 010	12,5	6 707	9
Malawi	2 188	1 911	64	54	1 194	4,4	4 632	5
Mali	1 954	2 040	56	56	809	-6,5	5 007	17
Mauritania	2 317	2 578	78	78	750	18,2	2 000	5
Mauritius	2 669	2 942	61	78	4 339	-4,4	17 489	-35
Mozambique	1 809	1 685	32	31	647	18,3	4 099	0
Namibia	2 179	2 174	62	60	264	-43,5	8 438	-3
Niger	2 139	2 154	61	62	338	-8,4	7 450	-8
Nigeria	1 973	2 589	42	54	1 172	-13,5	10 573	22
Rwanda	2 238	1 861	X	X	1 491	21,0	6 278	-22

Table 10.3

	Average Daily Per Capita Calorie Supply (kilocalories)		Average Daily Per Capita Protein Supply (grams)		Average Yield of Cereals		Average Yield of Roots and Tubers	
	1982-84	1992-94	1982-84	1992-94	Kilograms Per Hectare 1994-96	Percent Change Since 1984-86	Kilograms Per Hectare 1994-96	Percent Change Since 1984-86
Senegal	2 368	2 288	68	66	824	11,3	3 394	-28
Sierra Leone	1 974	1 888	42	43	1 192	-19,4	4 968	19
Somalia	1 969	1 533	X	X	426	-81,1	10 000	-7
South Africa	2 867	2 776	75	72	1 918	23,7	21 062	34
Sudan	2 138	2 274	62	70	527	9,4	2 964	-1
Swaziland	2 529	2 653	64	63	1 735	-12,0	1 930	-29
Tanzania	2 286	2 054	56	49	1 310	3,6	7 713	-15
Togo	2 108	2 052	48	49	762	-10,3	5 716	-37
Uganda	2 246	2 160	50	52	1 552	20,7	5 727	-9
Zambia	2 114	1 954	55	51	1 538	-17,4	5 370	-2
Zimbabwe	2 162	1 999	55	49	1 163	-24,6	4 508	-12
ACP - SMALL ISLANDS	2 299	2 196	40	40	2 825	8,7	7 571	4,9
Belize	2 585	2 683	67	67	1 888	15,3	21 765	5
Dominican Rep	2 304	2 275	50	51	4 034	11,5	6 845	8
Fiji	2 571	3 023	64	73	2 533	11,4	5 502	-60
Guyana	2 512	2 410	54	64	3 807	16,1	10 523	32
Haiti	2 026	1 721	X	X	929	-9,2	3 815	0
Jamaica	2 576	2 662	63	67	1 374	-27,6	15 291	20
Papua New Guinea	2 167	2 237	44	48	1 698	-30,0	7 073	-1
Solomon Islands	2 229	2 046	57	44	X	X	17 251	6
Suriname	2 507	2 580	66	65	3 778	-5,9	11 827	51
Trinidad and Tobago	3 056	2 499	81	59	3 649	33,9	10 222	6

Table 11.4: Land Area and Use, 1982-94, page 1

Table 11.4			Domes-	Land Use (000 hectares)							
		Population	ticated	Cropland		Permanent Pasture		Forest & Woodland		Other Land	
	Land Area (000 hectares)	Density (per 1,000 hectares) 1996	Land as a % of Land Area {a} 1994	1992-94	Percent Change Since 1982-84	1992-94	Percent Change Since 1982-84	1992-94	Percent Change Since 1982-84	1992-94	Percent Change Since 1982-84
ACP - AFRICA	2 359 655	255	41	161 596	7,4	814 316	1,7	699 145	-0,4	684 599	-3,2
ACP - SMALL ISLANDS	96 667	270	9	4 379	12,7	4 456	0,7	80 354	0,1	7 480	-7,9
ACP COUNTRIES	2 456 322	256	40	165 975	7,5	818 772	1,7	779 499	-0,3	692 079	-3,3
AFRICA	2 963 468	249	36	189 803	6,5	889 350	0,0	713 405	-0,3	1 171 024	-0,8
ASIA	3 085 414	1 130	51	520 175	X	1 051 311	X	556 996	X	956 913	X
CENTRAL AMERICA	264 835	475	53	40 053	5,4	98 503	6,2	74 524	1,2	85 910	-9,2
EUROPE	2 260 320	322	22	317 837	X	178 549	X	947 761	X	816 036	X
NORTH AMERICA	1 838 009	163	27	233 276	-1,1	267 072	-1,2	749 290	2,9	588 371	-2,6
OCEANIA	849 135	34	57	51 553	1,4	430 077	-2,8	200 252	-0,2	164 807	6,3
SOUTH AMERICA	1 752 925	184	35	113 116	9,0	495 341	3,0	934 860	0,6	209 471	-12,3
DEVELOPING	7 585 948	605	39	797 124	4,8	2 194 347	4,6	2 273 406	0,0	2 320 992	-5,4
DEVELOPED	5 462 356	215	34	668 690	-1,1	1 215 856	1,0	1 903 683	-4,8	1 671 541	5,9
WORLD {b}	13 048 300	442	37	1 465 814	2,0	3 410 203	3,2	4 177 088	-2,2	3 992 533	-1,0
ACP - AFRICA	2 359 655	255	41	161 596	7,4	814 316	1,7	699 145	-0,4	684 599	-3,2
Angola	124 670	90	46	3 500	2,9	54 000	0,0	23 000	-0,9	44 170	0,2
Benin	11 062	503	21	1 880	3,9	442	0,0	3 400	-11,0	5 340	7,0
Botswana	56 673	26	46	420	5,0	25 600	0,0	26 500	0,0	4 153	-0,5
Burkina Faso	27 360	394	34	3 465	18,0	6 000	0,0	13 800	0,0	4 082	-11,7
Burundi	2 568	2 423	86	1 120	-5,1	1 080	9,1	325	0,0	43	-41,1
Cameroon	46 540	291	19	7 040	1,2	2 000	0,0	35 900	0,0	1 600	-4,9
Central African Rep	62 298	54	8	2 020	2,5	3 000	0,0	46 700	0,0	10 578	-0,5
Chad	125 920	52	38	3 256	3,4	45 000	0,0	32 400	0,0	45 264	-0,2
Congo, Dem Rep	34 150	78	30	170	9,9	10 000	0,0	19 900	0,0	4 080	-0,4
Congo, Rep	226 705	206	10	7 900	2,5	15 000	0,0	166 000	0,0	37 805	-0,5
Côte d'Ivoire	31 800	441	54	4 031	22,5	13 000	0,0	9 600	-5,9	5 149	-3,0
Equatorial Guinea	2 805	146	12	230	0,0	104	0,0	1 830	0,0	641	0,0
Eritrea	10 000	328	75	366	X	4 622	X	523	X	1 155	X
Ethiopia	100 000	582	31	12 197	X	28 267	X	13 633	X	49 269	X
Gabon	25 767	43	20	460	1,8	4 700	0,0	19 900	-0,4	707	11,3
Gambia, The	1 000	1 141	37	165	-10,6	194	2,1	94	-6,0	547	4,1
Ghana	22 754	784	57	4 407	15,0	8 400	0,0	9 300	-3,1	647	-29,7
Guinea	24 572	306	47	787	10,2	10 700	0,0	6 700	0,0	6 385	-1,1
Guinea-Bissau	2 812	388	50	340	10,3	1 080	0,0	1 070	0,0	322	-9,0
Kenya	56 914	488	45	4 520	5,6	21 300	0,0	16 800	0,0	14 294	-1,6
Lesotho	3 035	685	76	320	10,6	2 000	0,0	X	X	715	-4,1
Liberia	9 632	233	25	371	-0,1	2 000	0,0	4 600	0,0	2 661	0,0
Madagascar	58 154	264	47	3 105	3,1	24 000	0,0	23 200	0,0	7 849	-1,2
Malawi	9 408	1 046	38	1 700	19,9	1 840	0,0	3 700	-1,1	2 168	-10,0
Mali	122 019	91	27	2 569	25,1	30 000	0,0	11 800	-1,7	77 650	-0,4
Mauritania	102 522	23	38	208	6,7	39 250	0,0	4 410	-2,0	58 654	0,1
Mauritius	203	5 562	56	106	-0,9	7	0,0	44	-24,1	46	48,4
Mozambique	78 409	227	60	3 180	3,2	44 000	0,0	17 300	0,0	13 929	-0,7
Namibia	82 329	19	47	704	6,6	38 000	0,0	12 500	0,0	31 125	-0,1
Niger	126 670	75	12	4 035	13,9	10 440	13,1	2 500	0,0	109 695	-1,5
Nigeria	91 077	1 263	80	32 579	6,1	40 000	0,0	14 300	-10,6	4 198	-3,9
Rwanda	2 467	2 188	75	1 150	5,4	695	-0,7	250	0,0	372	-12,7

Table 11.4: Land Area and Use, 1982-94, page 2

Table 11.4			Domes-	Land Use (000 hectares)							
		Population	ticated	Cropland		Permanent Pasture		Forest & Woodland		Other Land	
	Land Area (000 hectares)	Density (per 1,000 hectares) 1996	Land as a % of Land Area {a} 1994	1992-94	Percent Change Since 1982-84	1992-94	Percent Change Since 1982-84	1992-94	Percent Change Since 1982-84	1992-94	Percent Change Since 1982-84
Senegal	19 253	443	42	2 355	0,2	5 700	0,0	7 467	-1,8	3 731	3,6
Sierra Leone	7 162	600	38	540	4,4	2 201	-0,1	1 947	2,5	2 474	-2,6
Somalia	62 734	157	70	1 026	1,1	43 000	0,0	16 000	6,7	2 708	-27,2
South Africa	122 104	347	79	15 200	15,4	81 433	0,1	8 200	0,0	17 271	-10,8
Sudan	237 600	115	52	12 975	3,3	110 000	12,2	42 367	-1,5	72 258	-14,0
Swaziland	1 720	512	73	191	24,3	1 070	-5,1	119	16,6	340	0,9
Tanzania	88 359	349	44	3 660	23,7	35 000	0,0	33 067	-1,9	16 632	-0,4
Togo	5 439	772	48	2 420	2,5	200	0,0	900	-11,8	1 919	3,2
Uganda	19 965	1 015	43	6 780	9,1	1 800	0,0	6 300	5,0	5 085	-14,6
Zambia	74 339	111	47	5 273	2,2	30 000	0,0	32 000	6,7	7 066	-23,0
Zimbabwe	38 685	296	52	2 876	2,5	17 190	0,5	8 800	-7,4	9 819	5,8
ACP - SMALL ISLANDS	96 667	270	9	4 379	12,7	4 456	0,7	80 354	0,1	7 480	-7,9
Belize	2 280	96	6	81	52,2	49	11,4	2 100	0,0	50	-39,4
Dominican Rep	4 838	1 646	81	1 743	21,9	2 090	-0,1	603	-4,1	401	-41,6
Fiji	1 827	436	24	260	40,5	174	29,1	1 185	0,0	208	-35,5
Guyana	19 685	43	9	496	0,2	1 230	0,3	16 456	0,5	1 503	-5,7
Haiti	2 756	2 634	51	910	1,2	495	-2,2	140	0,0	1 211	0,0
Jamaica	1 083	2 300	44	219	-1,9	257	0,0	185	-3,8	422	2,8
Papua New Guinea	45 286	97	1	423	13,4	90	-4,6	42 000	0,0	2 776	-1,5
Solomon Islands	2 799	140	3	57	6,9	39	0,0	2 450	-2,8	253	35,5
Suriname	15 600	28	1	68	19,3	21	12,5	15 000	0,8	511	-21,3
Trinidad and Tobago	513	2 528	26	122	3,4	11	0,0	235	3,5	145	-7,6
ACP COUNTRIES	2 456 322		40	165 975	7,6						
acp countries	2 456 322	256	0	165 975	7,5	818 772	1,7	779 499	-0,3	692 079	-3,3

Notes: a. Domesticated land is the sum of cropland and permanent pasture. b. Does not include Antarctica. World and regional totals include countries not listed here.

Table 12.1

	Annual Internal Renewable Water Resources			Annual Withdrawals					
	1998			Total	Percentage	Per Capita			
	Total	Per Capita	Year of	(cubic	of Water	(cubic	Sectoral Withdrawals (percent)		
	(cubic km)	(cubic meters)	Data	km)	Resources	meters)	Domestic	Industrial	Agricultural
ACP - AFRICA	3 937,3	6 189	X	X	X	X	X	X	X
ACP - SMALL ISLANDS	1 375,7	50 965	X	X	X	X	X	X	X
ACP COUNTRIES	5 313,0	8 011	X	X	X	X	X	X	X
AFRICA	3 996,0	5 133	1995	145,1	4	202	7	5	88
ASIA	13 206,7	3 680	1987	1 633,9	12	542	6	9	85
CENTRAL AMERICA	1 056,7	8 084	1987	96,0	9	916	6	8	86
EUROPE	6 234,6	8 547	1995	455,3	7	625	14	55	31
NORTH AMERICA	5 308,6	17 458	1991	512,4	10	1 798	13	47	39
OCEANIA	1 614,3	54 795	1995	16,7	1	591	64	2	34
SOUTH AMERICA	9 526,0	28 702	1995	106,2	1	335	18	23	59
WORLD	41 022,0	6 918	1987	3 240,0	8	645	8	23	69
ACP - AFRICA	3 937,3	6 189	X	X	X	X	X	X	X
Angola	184,0	15 376	1987	0,5	0	57	14	10	76
Benin	10,3	1 751	1994	0,1	1	28	23	10	67
Botswana	2,9	1 870	1992	0,1	4	84	32	20	48
Burkina Faso	17,5	1 535	1992	0,4	2	39	19	0	81
Burundi	3,6	546	1987	0,1	3	20	36	0	64
Cameroon	268,0	18 711	1987	0,4	0	38	46	19	35
Central African Rep	141,0	40 413	1987	0,1	0	26	21	5	74
Chad	15,0	2 176	1987	0,2	1	34	16	2	82
Congo, Dem Rep	935,0	19 001	1990	0,4	0	10	61	16	23
Congo, Rep	222,0	78 668	1987	0,0	0	20	62	27	11
Côte d'Ivoire	76,7	5 265	1987	0,7	1	67	22	11	67
Equatorial Guinea	30,0	69 767	1987	0,0	0	15	81	13	6
Eritrea	2,8	789	X	X	X	X	X	X	X
Ethiopia	110,0	1 771	1987	2,2	2	51	11	3	86
Gabon	164,0	140 171	1987	0,1	0	70	72	22	6
Gambia, The	3,0	2 513	1982	0,0	1	29	7	2	91
Ghana	30,3	1 607	1970	0,3	1	35	35	13	52
Guinea	226,0	29 454	1987	0,7	0	142	10	3	87
Guinea-Bissau	16,0	14 109	1991	0,0	0	17	60	4	36
Kenya	20,2	696	1990	2,0	10	87	20	4	76
Lesotho	5,2	2 395	1987	0,1	1	30	22	22	56
Liberia	200,0	72 780	1987	0,1	0	54	27	13	60
Madagascar	337,0	20 614	1984	16,3	5	1 579	1	0	99
Malawi	17,5	1 690	1994	0,9	5	98	10	3	86
Mali	60,0	5 071	1987	1,4	2	162	2	1	97
Mauritania	0,4	163	1985	1,6	408	923	6	2	92
Mauritius	2,2	1 915	1974	0,4	16	410	16	7	77
Mozambique	100,0	5 350	1992	0,6	1	40	9	2	89
Namibia	6,2	3 751	1991	0,2	4	179	29	3	68
Niger	3,5	346	1988	0,5	14	69	16	2	82
Nigeria	221,0	1 815	1987	3,6	2	41	31	15	54
Rwanda	6,3	965	1993	0,8	12	135	5	2	94
Senegal	26,4	2 933	1987	1,4	5	202	5	3	92
Sierra Leone	160,0	34 957	1987	0,4	0	98	7	4	89
Somalia	6,0	563	1987	0,8	14	99	3	0	97

Table 12.1

	Annual Internal Renewable Water Resources			Annual Withdrawals					
	1998			Total	Percentage	Per Capita			
	Total	Per Capita	Year of	(cubic	of Water	(cubic	Sectoral Withdrawals (percent)		
	(cubic km)	(cubic meters)	Data	km)	Resources	meters)	Domestic	Industrial	Agricultural
South Africa	44,8	1 011	1990	13,3	30	359	17	11	72
Sudan	35,0	1 227	1995	17,8	51	666	4	1	94
Swaziland	2,6	2 836	1980	0,7	25	1 171	2	2	96
Tanzania	80,0	2 485	1994	1,2	1	40	9	2	89
Togo	11,5	2 594	1987	0,1	1	28	62	13	25
Uganda	39,0	1 829	1970	0,2	1	20	32	8	60
Zambia	80,2	9 229	1994	1,7	2	216	16	7	77
Zimbabwe	14,1	1 182	1987	1,2	9	136	14	7	79
ACP - SMALL ISLANDS	1 375,7	50 965	X	X	X	X	X	X	X
Belize	16,0	69 565	1987	0,0	0	109	10	0	90 a
Dominican Rep	20,0	2 430	1987	3,0	15	446	5	6	89 a
Fiji	28,6	34 732	1987	0,0	0	42	20	20	60 a
Guyana	241,0	281 542	1992	1,5	1	1 819	1	0	99 a
Haiti	11,0	1 460	1987	0,0	0	7	24	8	68 a
Jamaica	8,3	3 269	1975	0,3	4	159	7	7	86 a
Papua New Guinea	801,0	174 055	1987	0,1	0	28	29	22	49 a
Solomon Islands	44,7	107 194	1987	0,0	0	0	40	20	40 a
Suriname	200,0	452 489	1987	0,5	0	1 192	6	5	89 a
Trinidad and Tobago	5,1	3 869	1975	0,2	3	148	27	38	35 a

Notes: a. Sectoral withdrawal estimates are for 1987. Regional and world totals include countries not listed. Total withdrawals may exceed 100 percent due to groundwater drawdowns, withdrawals from river inflows, and the operation of desalinization plants.

Table 13.1	Average Annual Marine Catch {a}		Average Annual Freshwater Catch {a}		Average Annual Balance of Trade {b} 1993-95 (million US$)			Per Capita Annual Food Supply from Fish and Seafood	
	(000 metric tons) 1993-95	Percent Change Since 1983-85	(000 metric tons) 1993-95	Percent Change Since 1983-85	Fish	Molluscs & Crustaceans	Fish Meal	Total 1993-95 (kg)	% Change Since 1983-85
ACP - AFRICA	2 798,0	21,5	1 180,6	16,7	105,6	414,1	-54,2	X	X
ACP - SMALL ISLANDS	191,8	24,1	24,1	33,1	-65,6	52,8	-0,4	X	X
ACP COUNTRIES	2 989,8	21,7	1 204,7	17,0	39,9	466,9	-54,6	X	X
AFRICA	3 916,9	31	1 373,1	19	299,6	868,2	-62,4	6,8	-13,6
ASIA {e}	40 904,7	X	14 336,7	X	-3 635,0	-667,2	-1 078,3	13,4	X
CENTRAL AMERICA	1 512,1	-1	205,0	59	-39,0	846,5	-21,9	12,6	0,9
EUROPE {e}	17 507,2	X	544,1	X	-504,4	-2 194,5	-200,4	17,8	X
NORTH AMERICA	6 574,6	11	289,3	45	10,7	-2 275,6	-50,2	22,2	16,0
OCEANIA	910,0	83	16,3	4	294,0	741,2	-13,0	21,6	5,7
SOUTH AMERICA	19 750,8	104	388,2	13	1 211,9	1 422,4	1 128,7	8,8	15,4
DEVELOPING	58 676,4	78	16 159,1	120	5 852,0	9 697,6	276,0	10,1	36,3
DEVELOPED	32 542,6	-21	993,7	-13	-7 895,8	-10 912,1	-557,6	25,0	22,5
WORLD {c}	91 219,2	23	17 152,7	102	X	X	X	13,4	9,2
ACP - AFRICA	2 798,0	21	1 180,6	17	105,6	414,1	-54,2	X	X
Angola	77,5	-1	6,7	-11	-6,6	-2,7	0,0	12,4	-51,1
Benin	13,5	192	25,2	-18	-9,0	0,6	0,0	10,2	-5,8
Botswana	X	X	2,0	41	-4,6	-0,6	-0,1	7,1	98,4
Burkina Faso	X	X	7,7	5	-3,6	0,0	0,0	1,3	-22,3
Burundi	20,9	246	0,4	-92	-0,6	0,0	0,0	3,8	39,3
Cameroon	41,9	-25	23,2	15	-22,2	1,7	-0,3	8,5	-41,2
Central African Rep	X	X	13,3	1	-0,7	0,0	0,0	4,5	-19,7
Chad	X	X	75,8	57	-0,3	0,0	0,0	5,9	102,1
Congo, Dem Rep	4,0	140	166,7	27	-40,1	-0,1	0,0	5,1	-44,1
Congo, Rep	17,5	-8	18,8	38	-18,5	0,0	0,0	31,4	-23,9
Côte d'Ivoire	57,5	-22	14,1	-41	12,1	4,4	0,8	12,5	-22,6
Equatorial Guinea	3,3	15	0,4	48	-1,6	0,0	0,0	X	X
Eritrea	2,4	X	0,0	X	0,0	X	0,0	X	X
Ethiopia {d}	0,3	X	5,0	X	-0,3	0,0	0,0	X	X
Gabon	24,0	28	2,5	39	-10,3	3,2	0,0	44,0	-18,8
Gambia, The	19,5	124	2,5	-9	0,8	3,1	0,0	17,5	8,2
Ghana	299,6	34	52,7	24	17,7	5,9	-0,9	22,8	5,5
Guinea	60,3	130	4,1	130	2,0	4,8	0,0	6,7	-18,0
Guinea-Bissau	5,3	75	0,3	317	0,6	0,1	0,0	5,6	149,4
Kenya	107,6	86	86,0	112	20,1	0,9	-0,3	5,7	12,4
Lesotho	0,0	367	0,0	66	0,0	0,0	0,0	4,0	13,7
Liberia	3,8	-61	3,9	-3	-0,9	0,3	0,0	X	X
Madagascar	85,1	180	32,0	-12	17,6	60,5	0,5	7,3	21,4
Malawi	X	X	57,5	-11	0,1	0,0	-0,6	6,8	-25,9
Mali	5,2	53	81,6	53	-1,5	0,0	0,0	6,4	-12,4
Mauritania	86,6	0	5,2	-14	19,7	127,0	0,0	16,2	23,4
Mauritius	19,0	74	0,1	270	6,9	-3,7	-2,2	27,7	56,4
Mozambique	24,8	-27	3,4	-15	-10,7	69,8	-0,1	2,1	-40,6
Namibia	304,5	2 336	1,1	183	58,7	0,0	6,7	10,8	5,0
Niger	X	X	2,8	0	-1,6	0,4	0,0	0,4	-28,1
Nigeria	187,0	14	114,2	19	-138,6	35,4	-1,3	6,9	-27,1
Rwanda	X	X	3,5	247	-0,2	0,0	0,0	X	X

Table 13.1	Average Annual Marine Catch {a}		Average Annual Freshwater Catch {a}		Average Annual Balance of Trade {b} 1993-95 (million US$)			Per Capita Annual Food Supply from Fish and Seafood	
	(000 metric tons) 1993-95	Percent Change Since 1983-85	(000 metric tons) 1993-95	Percent Change Since 1983-85	Fish	Molluscs & Crustaceans	Fish Meal	Total 1993-95 (kg)	% Change Since 1983-85
Senegal	329,7	43	30,7	45	88,7	32,2	0,6	26,8	22,1
Sierra Leone	47,1	34	14,7	-10	3,4	10,6	0,0	15,0	-16,8
Somalia	15,4	-3	0,3	-6	5,0	2,5	0,0	X	X
South Africa	552,2	-32	0,9	16	119,5	50,2	-56,1	7,6	-14,7
Sudan	3,5	70	39,6	50	-2,4	0,0	0,0	1,7	23,9
Swaziland	X	X	0,1	29	X	X	X	0,0	X
Tanzania	243,4	68	100,1	-21	9,8	6,9	0,0	11,8	-8,5
Togo	8,7	-23	5,9	69	-12,4	1,5	0,0	10,7	-12,0
Uganda	96,3	6	117,6	29	18,9	0,0	0,0	10,4	-17,6
Zambia	11,0	-1	57,1	3	-1,0	0,0	-0,4	9,2	-17,1
Zimbabwe	19,6	72	1,1	-74	-8,4	-0,7	-0,5	2,2	7,1
ACP - SMALL ISLANDS	191,8	24	24,1	33	-65,6	52,8	-0,4	X	X
Belize	2,1	48	0,0	260	-0,1	13,1	0,0	7,7	26,5
Dominican Rep	15,8	21	4,7	59	-34,4	0,1	0,0	12,3	22,5
Fiji	28,8	14	3,3	44	6,7	1,8	0,0	33,4	-15,0
Guyana	44,8	25	0,8	-4	4,2	13,1	0,0	42,1	-4,0
Haiti	4,9	-22	0,5	78	-3,7	1,9	0,0	X	X
Jamaica	9,7	8	3,6	525	-28,3	9,2	0,0	22,1	-14,3
Papua New Guinea	14,7	71	11,0	-1	-43,6	9,9	-0,4	27,4	-5,5
Solomon Islands	46,4	-1	X	X	28,0	0,9	0,0	21,3	-64,7
Suriname	12,2	225	0,2	21	4,9	0,1	0,0	19,2	60,7
Trinidad and Tobago	12,5	182	0,0	X	0,6	2,8	0,0	9,4	-60,5

Notes: a. Aquaculture production is included in country totals. b. Exports minus imports. Surpluses of imports over exports are shown in parentheses.

c. World and regional totals include countries not listed here. d. Prior to 1992, Ethiopia included Eritrea, therefore percent change since 1983-85 is not meaningful and has been omitted.

Table 15.1 & 16.1	Total Energy Consumption					
	Commercial Energy		Traditional Fuels			
	(peta-joules) 1995	Percent Change Since 1985	(peta-joules) 1995	Percent Change Since 1985	Carbon Dioxide Emissions, 1995 (metric tons) Total	Per Capita
ACP - AFRICA	5 175	-8	5 110	29	476 459	0,8
ACP - SMALL ISLANDS	671	41	183	7	45 445	1,8
ACP COUNTRIES	5 846	-4	5 293	28	521 904	0,8
AFRICA	8 976	15	5 227	26	745 595	1,1
ASIA	106 770	X	10 308	X	8 270 648	2,3
CENTRAL AMERICA	99 404	1 746	765	-1	477 045	3,6
EUROPE	105 553	X	1 725	X	6 247 094	8,5
NORTH AMERICA	9 749	-87	3 910	249	5 904 312	19,9
OCEANIA	4 888	46	234	26	322 535	11,3
SOUTH AMERICA	11 923	61	2 730	-4	747 331	2,4
WORLD	347 262	19	24 941	41	22 714 561	3,9
ACP - AFRICA	5 175	-8	5 110	29	476 459	0,8
Angola	26	-15	59	50	4 602	0,4
Benin	7	3	55	34	634	0,1
Botswana	X	X	X	X	2 242	1,5
Burkina Faso	14	123	94	31	956	0,0
Burundi	3	38	48	9	213	0,0
Cameroon	56	15	222	136	4 144	0,3
Central African Rep	4	63	32	12	234	0,1
Chad	1	-67	39	30	95	0,0
Congo, Dem Rep	44	-28	448	59	2 099	0,0
Congo, Rep	23	92	24	34	1 268	0,5
Côte d'Ivoire	98	34	117	38	10 362	0,8
Equatorial Guinea	2	121	4	-8	132	0,3
Eritrea	X	X	X	X	X	X
Ethiopia	43	64	449	29	3 525	0,7
Gabon	61	167	29	36	3 543	3,3
Gambia, The	3	24	11	30	216	0,2
Ghana	67	51	246	63	4 045	0,2
Guinea	16	15	41	15	1 081	0,1
Guinea-Bissau	3	50	4	-3	231	0,2
Kenya	111	82	388	17	6 683	0,3
Lesotho	X	X	X	X	X	X
Liberia	5	-53	52	36	319	0,1
Madagascar	17	13	105	66	1 125	0,1
Malawi	12	38	103	-22	725	0,1
Mali	7	15	60	32	465	0,0
Mauritania	40	347	0	-100	3 067	1,4
Mauritius	21	134	13	-26	1 491	1,3
Mozambique	16	8	170	21	993	0,1
Namibia	X	X	X	X	X	X
Niger	15	16	54	50	1 118	0,1
Nigeria	465	8	1 005	17	90 717	0,8
Rwanda	7	22	53	-3	491	0,1

Table 15.1 & 16.1	Total Energy Consumption					
	Commercial Energy		Traditional Fuels			
	(peta-joules) 1995	Percent Change Since 1985	(peta-joules) 1995	Percent Change Since 1985	Carbon Dioxide Emissions, 1995 (metric tons) Total	Per Capita
Senegal	38	21	46	9	3 063	0,4
Sierra Leone	5	-40	31	21	443	0,1
Somalia	X	X	X	X	11	0,0
South Africa {a}	3 659	-16	151	13	305 805	7,4
Sudan	49	4	237	27	3 499	0,1
Swaziland	X	X	X	X	454	0,5
Tanzania	34	24	341	29	2 440	0,1
Togo	9	191	21	257	744	0,2
Uganda	16	65	149	38	1 044	0,0
Zambia	50	-10	135	29	2 404	0,3
Zimbabwe	128	-7	74	7	9 735	0,9
ACP - SMALL ISLANDS	**671**	**41**	**183**	**7**	**45 445**	**1,8**
Belize	6	124	4	0	414	1,9
Dominican Rep	162	107	22	-31	11 769	1,5
Fiji	11	32	12	25	736	1,0
Guyana	13	-33	7	5	934	1,1
Haiti	9	-11	61	20	638	0,1
Jamaica	124	81	11	104	9 050	3,7
Papua New Guinea	36	17	60	6	2 481	0,6
Solomon Islands	2	(5)	3	0	161	0,4
Suriname	25	8	0	-100	2 151	5,0
Trinidad and Tobago	283	22	3	30	17 111	13,3

Notes: a. Data are for the South Africa Customs Union (Botswana, Lesotho, Namibia, South Africa, and Swaziland).