A SUSTAINABLE FUTURE FOR MELANESIA?
NATURAL RESOURCES, POPULATION AND
DEVELOPMENT

Bob Thistelthwaite and Derrin Davis
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PACIFIC
2010
A Sustainable Future for Melanesia?
natural resources, population
and development

Bob Thistlethwaite and Derrin Davis
## Contents

Acknowledgments vii  
Authors vii  
Abbreviations viii  
Foreword ix  
Preface xii  

1 Sustainability 1  

Natural resource endowment and usage 17  
2 Melanesia 19  
3 Papua New Guinea 41  
4 Solomon Islands 57  
5 Vanuatu 72  
6 Fiji 90  
7 Sustainability: population, resources, environment and development 103  
8 Principles and policies for sustainable development 127  
9 Strategies for sustainable development 153  

References 170  
Melanesian region map  
Figures  
7.1 Economy–environment–society interactions 125  
7.2 Economy–environment–society overlap 126  

Tables  
2.1 General indicators 20  
2.2 Rate of population increase in Melanesia 37  
3.1 Principal mining activities in Papua New Guinea 51  
3.2 Papua New Guinea: major exports by volume and value, 1994 55  
4.1 Solomon Islands: exports by volume and value, 1989–94 70
5.1 Vanuatu: domestic exports by volume and value, 1989–94


6.2 Fiji: principal domestic exports by per cent value, 1989–94


7.1 Projected population at year 2010

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### Exchange rates

(US$ average)

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<td>Fiji (F$)</td>
<td>1.4303</td>
<td>1.4833</td>
<td>1.4809</td>
<td>1.4689</td>
<td>1.5076</td>
<td>1.5408</td>
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<td>2.2932</td>
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<tr>
<td>Vanuatu (vatu)</td>
<td>104.43</td>
<td>116.04</td>
<td>117.06</td>
<td>111.68</td>
<td>113.39</td>
<td>121.11</td>
<td>116.24</td>
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* at December 1994

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### Symbols

- n.a. not applicable
- .. not available
- - zero
- . insignificant
Acknowledgments

This book had an extended gestation due to a number of factors, including the relocation of two contributors to the original draft, Maureen Rogers and Neil Byron. The authors gratefully acknowledge the contributions Maureen and Neil made to the paper, in drafting material on the natural resource endowments and usage for Vanuatu and Fiji respectively. Maureen Rogers can be contacted at Charles Sturt University where she is a PhD candidate while Dr Neil Byron has joined the staff of CIFOR at Bogor, Indonesia. The authors would also like to thank the National Centre for Development Studies for its support and acknowledge the generous assistance of the Australian Agency for International Development in providing funding for this study.

Authors

Dr Bob Thistlethwaite is Regional Manager of the Forestry and Natural Resources Division of AXIS Environmental Consultants Ltd. Bob has worked extensively in most Pacific countries over the past decade, the last seven years as a private consultant in the forestry and environmental policy fields and almost exclusively in the Pacific. He formerly lived in Papua New Guinea where he was the Chief Research Officer of the (then) Department of Forests.

Derrin Davis is Senior Lecturer in the Faculty of Resource Science and Management of the Southern Cross University. Derrin is a resources and environmental economist who has considerable experience as a private consultant in the Pacific. He formerly lived in Solomon Islands where he was an economic adviser to the Solomon Islands government.
<table>
<thead>
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<th>Abbreviation</th>
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<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>AIDAB</td>
<td>Australian International Development Assistance Bureau (now known as AusAID)</td>
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<tr>
<td>AusAID</td>
<td>Australian Agency for International Development (formerly AIDAB)</td>
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<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation (Australia)</td>
</tr>
<tr>
<td>DPIFS</td>
<td>Queensland Department of Primary Industries Forest Service</td>
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<tr>
<td>f.o.b.</td>
<td>Free on board</td>
</tr>
<tr>
<td>FSP</td>
<td>Foundation for the Peoples of the South Pacific</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
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<tr>
<td>GNP</td>
<td>Gross national product</td>
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<tr>
<td>IUCN</td>
<td>The World Conservation Union</td>
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<td>PNGRIS</td>
<td>Papua New Guinea Resource Information System</td>
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<td>SOLFRIS</td>
<td>Solomon Islands Forest Resource Information System</td>
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<tr>
<td>SPREP</td>
<td>South Pacific Regional Environment Programme</td>
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<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<tr>
<td>VANRIS</td>
<td>Vanuatu Resource Information System</td>
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<td>WCED</td>
<td>World Commission on Environment and Development</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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In late 1993 the Islands/Australia Program at the National Centre for Development Studies convened a meeting of representatives from a number of Pacific Island states, both public servants and graduate students, to review a series of demographic projections and to consider the possible implications of these for the future well-being of the countries concerned.

This meeting recognised that expanding island populations, especially in the Melanesian countries, called for closer analysis of other sectors of island economies with the objective of alerting national leaders and international donor agencies to the need to take into account demographic issues in day-to-day policy initiatives which could have implications for the future. A consequence of this recognition was the identification of a series of discrete study topics that, funded by the Australian Agency for International Development (AusAID), have been carried out over the last two years. The results of these studies have been published or are in the process of publication: topics covered include strategies for future agricultural development and urbanisation in both Melanesia and Polynesia, the role of women in Solomon Islands, non-formal education in Melanesia, health issues in a number of island states and issues affecting the informal sector and development generally in the Republic of Vanuatu. Given the nature of Melanesian economies, relying as they do so much on the natural bounty of the islands, the environment was considered to be a priority topic. The outcome is *A Sustainable Future for Melanesia? Natural resources, population and sustainable development*.

I take this opportunity of expressing to the authors and those who undertook the initial work on this study, Neil Byron and Maureen Rogers, the grateful thanks of the National Centre for Development Studies for their contribution to enhancing an understanding of the Melanesian environment. I acknowledge the contribution of my predecessor, Rodney Cole, in maintaining the enthusiasm of these
and other authors of Pacific 2010 papers at times when the priorities of their formal commitments seemed of more importance. I also warmly applaud the work of Maree Tait and her colleagues of the Centre's Publications Unit for the manner in which they have prepared and presented this and other manuscripts in the Pacific 2010 series. I am especially appreciative of the support, both financial and in terms of enthusiasm, offered to the Pacific 2010 project by the South Pacific and Training Branch of AusAID: without this the people of the Pacific would have been denied what I and my colleagues believe to be a valuable contribution to ensuring the future of our children.

Ila Temu
Research Director
Islands/Australia Program
The tenet of sustainable use of resources applies to Melanesia as anywhere else in the world. Papua New Guinea, Solomon Islands, Vanuatu and, to a lesser degree, Fiji, have limited prospects for a sustainable future while they continue on their present course of resource usage and economic control. The pace of economic growth in Melanesia has not kept pace with population growth throughout the 1980s and significant declines in per capita incomes indicate that development may already be unsustainable. With rapidly growing populations and a shrinking resource base, this pattern towards unsustainability can only be reinforced, and Melanesian states will increasingly assume the posture of supplicants for aid hand-outs, thereby transferring into foreign hands much of their hard-won independence and national identity.

The four countries will have merely swapped one form of colonialism for another. Aid donors already attach various environmental and economic strictures to their technical assistance packages, in effect forcing policy change along a development path perceived by the donor. No country wants to remain in vassalage to the economic powers, and repeatedly in national development plans Melanesian countries proclaim economic independence as one of their national goals—a goal which would seem to be growing ever more elusive.

Forces within Melanesia see the need for fundamental change to ensure that economic and social gains can be achieved and sustained through future generations. Some changes have already been foreshadowed or are proceeding, but the pace of change may need to be increased to avoid the risk of foreclosure of resource use options, due to intense population pressures resulting from the high natural growth rates ranging from 2.2 per cent per year in Fiji to 3.5 per cent in Solomon Islands. These fundamental shifts in economic and resource policy, once instituted, will need to be pursued with an unwavering focus on sustainable development.
For all their geographical, ecological and ethnic similarities, the independent Melanesian countries are a diverse group of unique environmental, cultural, socioeconomic and political entities. Each country is endowed with its own set of resources, with different population pressures, different technologies and different assimilative capacities. Their aspirations differ. Yet all are confronted by a need to manage their resources sustainably in the pursuit of economic and social development.

How each country manages its subsistence and commercial agricultural production, its renewable natural resources of forests and fisheries, its non-renewable mineral resources, together with its human assets and cultural and indigenous knowledge is critical to ensuring that future generations of Melanesians have a standard of living and quality of life at least equal to today’s generation.

The independent Melanesian countries have not yet reached a point in their development where a sustainable future has been foreclosed by resource limitations, environmental constraints or population growth. However, the current road of over-exploitation of some resources, environmental abuse and unchecked population growth can lead to only one end, if not sooner then later. Education may help check that trend, but the risk is that the pace of development will be faster than the education process, and that by the time a nation’s citizens become fully aware of the awful consequences of improper use of natural resources, environmental damage will have become more widespread and severe, renewable resources will have dwindled to the point where their sustainability is unlikely outside of forest and marine reserves, and the wealth of their mineral inheritance will have been dissipated locally and abroad.

Sustainable development is a concept endorsed by all Melanesian countries at regional and international fora, and enshrined in one form or another within national development plans. However, the objective of sustainable resource use has not yet been translated into action. Sustainable development largely remains a concept, one which is becoming more and more politically acceptable, but nevertheless a concept. The result to date has been a greener shade of rhetoric.
Yet there are many encouraging signs of environmental activism appearing now throughout the region, offering hope that the remnant resources may yet be conserved and environmental values protected. It is now for governments to adopt sustainable development as the pivotal policy around which all other policies rotate, and thereby ensure that future generations inherit from our hands an estate at least as good as the one we inherited.

Bob Thistlethwaite and Derrin Davis
April 1996
The ability to think and plan ahead sets humans apart from other mammals. Never has this ability been more severely tested than now, when the Earth must sustain an increasing number of people, many of whom fail to acknowledge the fragility of the environment within which they live. All is not lost, however, as the human race comes to appreciate the delicate balances of nature and the need to conserve those resources which are finite.

Perhaps, more than other countries, it is those island states of the southwest Pacific, with their rapidly expanding populations and limited natural resources, where the utmost skill will be required to determine the direction of social and economic endeavour to meet both present and future needs.

Herein lies the dilemma faced by many Pacific leaders today. Failure to address the needs of the present will call down political retribution and ultimately loss of office; failure to recognise the implications of today’s decisions for future generations is irresponsible or worse. Sadly the option often taken, often out of necessity, is the obvious one—let the future take care of itself.

This examination of natural resources, population and sustainable development focuses on the independent Melanesian states of Papua New Guinea, Solomon Islands, Vanuatu and Fiji, where there is a high level of interdependence between the environment and the economy. The current and future utilisation of natural resources in
Melanesia are evaluated and, recognising their population growth rates, the paper seeks to erect a policy framework and identify initiatives which will allow the achievement of sustainability in resource use and development.

The sustainability concept

The term ‘sustainability’ has been defined in many ways in the literature, reflecting a range of differing approaches, reflecting different environmental ideologies (Turner, Pearce and Bateman 1994). While there is no universally accepted definition (Pearce et al. 1990), sustainability is an important and useful concept which has gained widespread acceptance, particularly since the publication of *Our Common Future* (WCED 1987) and built upon in *Caring for the Earth: A Strategy for Sustainable Living* (IUCN/UNEP/WWF 1991). Despite the many definitions, certain common elements typify views of sustainable development:

- equity, both between people in the present (intra-generational equity) and between today’s generation and future generations (inter-generational equity)
- equality of the environment and its ability to continue supporting the community at a certain level (which does not decline through time)
- concepts of quality of life and satisfaction of human needs.

In this context, recent definitions of sustainability include:

...sustainable development involves maximising the net benefits of economic development, subject to maintaining the services and quality of natural resources over time (Pearce and Turner 1990:24).

The sustainability criterion suggests that, at a minimum, future generations should be left no worse off than current generations (Tietenberg 1992:36).
An operational definition of sustainable (feasible) development can be advanced as 'the set of development programmes that meet the targets of human needs satisfaction without violating long-term natural resource capacities, and standards of environmental quality and social equity (Bartelmus 1992:15).

It is, therefore, generally agreed that sustainable development is economic development that endures over the long run (Turner et al. 1994:55). But the more difficult task is to determine the necessary and sufficient conditions for achieving sustainable development. How do we compensate future generations for damage that our activities today might cause? The answer, they say, is through the transfer of capital bequests. That is, this generation makes sure it leaves the next generation a stock of capital no less than that available to the present generation. This capital may however, be natural or human-made, and it is normally assumed that human-made capital will replace, or substitute for, natural capital to some extent as development proceeds.

**Sustainability and development**

The expression ‘sustainable development’ is now found in almost every development oriented document produced since the term appeared in the Brundtland Report (World Commission on Environment and Development 1987). The often shallow usage of the term may have undermined its significance, but it is a useful concept which emphasises that

- the world’s resources are finite
- degradation and pollution of the environment can seriously hamper prospects for economic development and reduce social well-being through declining standards of living and quality of life
- many past practices in the name of ‘development’ have not been sustainable and, worse still, have reduced the options of future generations irreversibly.
The many definitions of, and continuing debate on, sustainable development, imply a shift in the accepted view of economic development. Development has typically been thought of in terms of material gains, which are ultimately measured as increases in real per capita incomes. While income gains continue to be an important component of economic development, increases in other elements of social welfare—such as access to services, quality of life indicators, and greater individual freedoms—have all become accepted as guiding norms to economic development (see Pearce, Barbier and Marandya 1989; Bartelmus 1992).

A comprehensive concept of development has to cover both quantitative and qualitative aspects of human needs satisfaction, including consumption levels or standards of living and non-economic standards and targets of an environmental, social, cultural or political nature (Bartelmus 1992:13).

The concept of sustainable development, although defined in many different ways, is relevant and meaningful. But the translation of sustainability principles into practice remains uncertain, and any general framework of rules for sustainability will need to be adapted to the specific economic and environmental circumstances confronted by the Melanesian nations of the South Pacific (Turner et al. 1994).

Sustainable development issues in other parts of the world are equally relevant to Melanesian countries, with perhaps different emphases or added complexity, due to their relatively small, isolated land masses, dispersed populations, poorly developed infrastructure and social services, and a high level of reliance on natural resources for both subsistence and commercial activities. These factors, combined with a rapidly increasing population, make it clear that any prospect of a sustainable future for Melanesia will depend on correct development decisions now.

In recognition of the vulnerability of the region to environmental degradation as a result of over-exploitation of natural resources and prevalent natural disasters, each government has pledged, through the South Pacific Forum, the achievement of ecologically sustainable development. But there is a limited cognisance of the future impacts
rapid population growth will have on environmental values, long-term economic development, and national well-being.

The important issues facing each Melanesian government are

- how to become more self-reliant, less dependent on aid and imported goods and services
- how to raise local revenue
- how to develop in a uniquely ‘Pacific Way’, drawing on the best elements of Western practice and traditional culture.

These issues are critical to the way each country will manage its natural and human capital assets—forests, fisheries, minerals, agricultural lands and cultural and indigenous knowledge—while ensuring future generations of Melanesians a standard of living and quality of life at least equal to today’s generation.

**Ultimate sustainability**

The four independent countries of Melanesia have not by any means reached a point where the path towards sustainable development is foreclosed. The region is resource rich. Papua New Guinea is a treasure trove of minerals and, despite the history of recent over-exploitation of its native forests, still has vast areas of unlogged forests. Although incompletely known, there are indications of considerable mineral wealth also in other Melanesian countries. Throughout the region, there are abundant off-shore fisheries, which are widely considered to be under-utilised. And there is abundant arable land to meet needs for food production for an expanding population to the year 2010 and beyond.

Forests in Papua New Guinea and Solomon Islands in particular have been grossly over-exploited, but measures, both external and internal, have been or are currently being taken which aim to correct the excesses of this resource exploitation and return forest utilisation to a sustainable footing.
Environmental damage is generally localised and not severe to the point of being irrecoverable, with some notable exceptions including the damage to riparian systems of the Fly River in Papua New Guinea from the Ok Tedi and Panguna mines. Despite the continuing high natural rates of population growth, population densities are still low and severe land pressures are mostly confined to the urban fringe. The independent Melanesian countries are thus in the fortunate position of being able to ‘pick their future’ and decide where they would like their country to be in 2010. They have a golden opportunity to learn from the experience of those countries which have preceded them along the slippery path of national development from a less-developed to a more-developed status, and avoid their mistakes.

**Melanesia at the crossroads**

The four countries have reached a major crossroads in their development. Will they pursue the quest for a sustainable future or let the opportunity slip by? Broadly, the signposts indicate there are three possible roads ahead of Melanesian governments.

Most trails will eventually lead to some sort of destination, albeit some trails will do so more swiftly, directly and easily than others. The road which permits the rate of unsustainable resource usage to increase and the population growth to rise unchecked is a road to further deterioration and degradation—a dead end. Sustainability would be an impossibility, and nations would become beggar vassals of the donor powers.

However, no Melanesian country is likely to reduce or abandon those controls already imposed on resource exploitation, nor is the actual rate of over-exploitation of natural resources now likely to increase. Indeed, all the signs are to the contrary, with curbs imposed both by the countries themselves and through funding controls by the major aid donors against environmental degradation. With forests, for example, it is believed that the rate of exploitation has peaked and is now declining, perhaps in part a forced decline as the resource base shrinks, but also one strongly encouraged by bilateral and multilateral partners in development assistance.
This route would be accompanied by an increasing pool of unemployed, particularly youth, increasing malnutrition, increasing pollution, increasing disease, increasing crime and social unrest, and rapidly depleting and degrading natural resources. The duality of the economy would be exaggerated and inequities of economic status, opportunities, and access to services would increase. Social welfare would decline as governments had more and more difficulty keeping pace with the demands for health, education and other services in the face of both increasing numbers of people and increasing unemployment.

The second road is one which continues along the present course of resource usage and economic control, with little prospect for a sustainable future. Nevertheless, providing recent, somewhat tentative moves towards adoption of the ethic of sustainable development accelerate, a sustainable future is not unobtainable. But while the pace of the attitudinal change towards sustainable resource use and population control remains slow, the road will be long, and difficult to travel, with perhaps many side detours.

It is encouraging that under the current national leadership of some Melanesian countries, greater attention is being paid to the question of sustainability, as the leaders themselves become educated to environmental issues and the level of environmental awareness of the population at large is raised. However, there is a risk that the pace of development will be faster than the education process, and that by the time a nation’s citizens become fully aware of the awful consequences of improper use of their natural resources, environmental damage will have become more widespread and severe, renewable resources will have dwindled to the point where their sustainability is unlikely outside of forest or marine reserves, and the wealth of their mineral inheritance will have been dissipated locally and abroad.

There have been many recent national activities aimed at sustainable development including the endorsement by all Melanesian governments of national environmental management strategies or their equivalent, national forest inventories, land-use planning
controls, and the like. However, at this point, sustainable development largely remains a concept, one which is becoming more and more acceptable politically, but nevertheless a concept. The result to date is a greener shade of rhetoric but little real action on the ground.

The objective of sustainable resource use has not yet been translated into action. Ministers of state will one week pontificate on the need for sustainable development and the very next week approve a timber licence many times the level of sustainable yield for the forest in question. Or the nod will be given to a fish transhipment operation without any real attention to offshore profits and onshore benefits.

What is a likely outcome if the independent Melanesian countries continue on their current course? At the regional level, it is suggested there will be an increasing reliance on aid (perhaps with the exception of Fiji), with donors retaining considerable influence over the development programs of individual countries and hence over national development policy. Melanesia will be comprised of mendicant states, to a certain extent vassals of those countries providing aid. There will be a continued focus on capital-driven development, and this implies a narrow range of local employment opportunities for the increasing numbers who will be seeking work.

At the individual country level in all countries save Fiji, the population will continue to grow rapidly (given the age structure), although the rate of increase could decline with increasing material affluence and the (unlikely) development of social service benefits such as old age pensions. However, the rate of increase will still be such that the current momentum of population growth will be reinforced with all its concomitant ills. The economies of Papua New Guinea, Solomon Islands and Vanuatu are likely to decline in terms of economic growth, per capita income, and national income—and this despite the vast resource wealth of Papua New Guinea and the likelihood of future mineral wealth for Solomon Islands and Vanuatu. There will be a continued reliance on commodity exports, and thus the economic decline will not be a steady process but experience pronounced peaks and troughs—but the long-term trend will be downward. This will be accompanied by a long-term decline in social welfare.
For Fiji, the prospects seem brighter. While it has a higher population density, it has a more diversified economic base, and steady improvements in its economy are anticipated. Population growth rates are still high but lower than elsewhere in Melanesia, and it is expected these rates will decline as the population becomes increasingly urbanised.

By 2010, some natural resources will be depleted and the environment degraded at a rapid rate, particularly in Papua New Guinea and Solomon Islands, but less so in Vanuatu where there is now a very low population density. But with a 2.8 per cent natural annual population growth rate, the evil day for Vanuatu is merely postponed. Due to a reduced reliance on shifting cultivation and an increasing emphasis on harvesting of industrial forest plantations, Fiji may be able to prevent significant environmental deterioration of remnant native forests, and afford rehabilitation programs for some currently degraded areas.

All Melanesian countries will face severe industrial-urban problems in their main urban centres, with the management of waste and pollution of air and water becoming critical. The ugly face of urban poverty now evident in Suva and Port Moresby will be more pronounced as the gap between richer and poorer widens, and this malaise will extend to other urban centres as they continue to serve as magnets for a growing army of the unemployed.

The third road presents a smoother, faster course towards a sustainable future. This is a road where nations take comprehensive action promptly to adopt sustainable development as the pivotal policy upon which all other policies hang. By such comprehensive action the Melanesian countries ensure that future generations inherit from their hands an estate at least as good as the one they inherited. The quest for a sustainable future will then be victorious.

It is not suggested that this road is a multi-lane, fully paved, high speed highway. It would be quite unrealistic for the Melanesian countries to swing directly from the second road to such an extreme. Road three is, rather, an engineered road line which has been formed...
and is being gradually paved step by step, year by year. It has the potential to become that multi-lane highway.

To set out on this road, the current shift towards the sustainable use of renewable resources must be accelerated, and the environmental consequences of the exploitation of non-renewable mineral resources must be minimised and localised. In order to assure a sustainable future by 2010, this shift must start today with today’s decisions on resource use.

The failure to recognise the future implications of today’s decisions is at best highly irresponsible, perhaps criminal. But out of political expediency and the fight to retain power, hard decisions to reduce the rate of population growth, and to balance the protection of environmental, cultural and heritage values with the need for economic development, will call for brave political leaders, who are prepared to stake loss of office on a vision for a sustainable future. Where there is no vision, then government will blunder on from day to day and leave the future to take care of itself.

With this third road, the pace of economic development in the short term may not be quite as spectacular as it would be under a policy regime where governments condone or encourage the non-sustainable use of their living resources while the economic benefits of exploitation of their non-living resources are squandered. There would be less of a ‘boom-or-bust’ cycle and a steady upward trend in the economy, accompanied by improved social welfare, greater national harmony, increased economic independence and reduced aid flows.

If the quest for a sustainable future for the people of Melanesia rested only in the hands of some politicians or bureaucrats of recent years, then, based on past performance and the available evidence, one could be forgiven for predicting that the second road, or even the first dead-
end road, might be the likely outcome. But, ultimately, sustainable development in the democratic countries of Melanesia rests not with governments, not with the bureaucracy, and not with industry. It rests squarely with the resource owners.

Being democratic societies, the people of Melanesia can exercise their voice through the ballot box and thereby persuade governments to embrace sustainable development principles and take action in accord with those principles. However, while the local environment is of concern to all, everywhere, many people take their environment for granted, either through ignorance or complacency.

Environmental education programs must remain constant elements of aid projects. Donors recognise that they can better influence progress towards sustainable development in the longer term by educating people about environmental issues, thereby empowering them to take action which supports future sustainability. Such education programs would need to be supported by programs which foster the development and application of techniques which conserve the environment, while serving as a vehicle for the improved economic well-being to which all aspire.

**The way forward** What can Melanesian countries do to move away from the path represented by the analogy of the second road, and stride out along the better path to a sustainable future?

**Resource accounting.** A series of key policies and strategies for sustainable development in Melanesia have been discussed. The major strategy is that of adopting resource accounting within the system of national accounts. No one suggests that will be easy, especially as it will first require an adjustment in the economic mindset of many government leaders and officials to stop treating the consumption of natural capital as income. Nor is it suggested that a resource accounting system should replace the current system of national accounts based on measures of GDP and GNP. It is important to assess the value of final goods and services produced within a country. Rather it is likely that a resource accounting process will be a satellite to the GNP/GDP-based System of National Accounts.
The shift in the economic mind-set will not occur swiftly as there is a measure of the 'chicken and egg' syndrome involved. Without a change in economic perception, resource accounting systems will not be adopted, yet due to the lack of perception, limited attention has been paid to the development of detailed resource accounting case studies which would help change perceptions. However, the increasing focus on resource accounting over the past five years has been such that it is realistic to suggest that resource accounting will become widely accepted within the next decade.

If that premise is accepted, countries will need to begin a process now which will facilitate the introduction of resource accounting. Each Melanesian country should now commence to review its current economic database to ensure that all data relevant to natural resource management are recorded; develop comprehensive data sets on natural resource assets; and commence the process of assigning values to significant natural assets, drawing on the current work of the World Wildlife Fund, the World Bank and the US Statistical Office.

While these actions can be instituted by the countries from their own resources, given the appropriate budgetary priority, the process would be speeded up considerably with the assistance of international aid donors, particularly with respect to the further development of comprehensive data sets of resource assets. For example, now that there is better knowledge on the types, distributions and conditions of forest types in Melanesia at the national level of resource survey, areas of special floristic, fauna or of other biodiversity importance should be targeted for more intensive survey. Coastal and marine resources are only partly charted and assessed, water resources imperfectly evaluated, soil erosivity and erodibility needs closer study, and the history of resource use often poorly recorded.

Land ownership. Underpinning much of this work is the need to determine land ownership once and for all from an agreed, fixed time base, have boundaries surveyed and tenure documents filed. This fundamental need is universally recognised, but the magnitude of the task is such that countries baulk and donors flinch. Yet without it there is an ever present threat of resource insecurity for the investor and a real risk that the thrust for sustainable economic development
by Melanesian countries will founder in a quagmire of legal claims and counter-claims. Resource-based investment must suffer accordingly.

**Resource taxes.** Being heavily reliant on natural resources for economic activity, Melanesian countries can institute a policy of raising public revenue through the introduction of a resource impost which taxes those exploiting the resources in accord with the throughput and scarcity of the resources in question, together with some element to cover the external costs associated with the use of the resources.

**Investment in natural capital.** A further area for policy adjustment entails putting in place measures which promote, or force, investment in natural capital or in its substitution, according to the peculiar circumstances. With a wealth of the resource base in Melanesia, the governments have the economic luxury of deliberately directing resource use to those natural assets which will attract the highest prices at the time, reserving for future exploitation those which may attract a premium future price because of their increasing international scarcity.

**Selective embargos.** With mineral-rich Papua New Guinea, the government has the golden opportunity of investing some of the proceeds from mineral exploitation into and expanded or higher value renewable asset base. In the face of the diminishing natural forest asset, both in Papua New Guinea and elsewhere in Melanesia, governments can impose and strictly enforce embargos on the export of any logs or timber products sourced from custom land unless logging companies have firm commitments to reforestation and particularly management of the regeneration of logged-over areas. Forest management taxes can be imposed on logging companies to support the costs to government of policing the forest industry, and all companies be subjected to stiff performance bonds.

**Limiting population growth.** In tandem with these policy moves, Melanesia will need to take specific action to control family size. The region generally recognises the need to slow the rate of natural population growth, and most countries have in place a suite of policies, mainly educational programs directed towards women on natural
and artificial means of avoiding pregnancy. While such education is undeniably important, it is considered that family planning efforts will make greater headway, especially among the bulk of the rural population, when the social security net is improved to the point where parents are convinced there is less need to have large families to provide security for their old age. Social security measures such as an old age pension, improved health care and nursing for the infirm, housing support and the like can be instituted only if the monetary society has developed to the point where it can sustain a taxation system to support those measures. Such a system may emerge in time from the resource-based development process which is taking place in the Melanesian countries, but not in the short-term.

Measures taken now will have little noticeable effect on the rate of natural population growth by 2010, but the growth rate must be hauled back in the longer term if the renewable resource base is to be able to continue to support the expanding population. Right now the environmental impacts of the population growth have not been severe, except for some pockets of high population density, and in the urban/peri-urban situation. The population densities are quite low by standards elsewhere, and there is some breathing space for Melanesia in attempting to curb the growth rate. The risk is that this may engender complacency in addressing the religiously and socially contentious issue of contraception, when in reality it must be given high priority now if sustainability is to be achievable in the long term.

The environmental damage which will be an inevitable consequence of unchecked population growth may, in time, far outstrip the damage observed now from economic development activity such as logging of the renewable rainforests and exploitation of mineral resources. This is not always clearly seen because there is a tendency among vested interest groups and the media to blame environmental damage primarily on the actions of foreign developers, when by far the greatest environmental impact stems from the actions of custom landowners themselves. It is they who permit or invite despoliation of their land for short-term economic gain. In masking this reality, the people are shielded from a recognition of the consequences of their actions by thinking in terms of individual actions rather than of the collective result of the whole.
The governments of Melanesia are in a position to take a conscious decision to constrain the rate of population increase, and guide the use of natural resources in such a way that a sustainable future is assured, even by the year 2010. But this will require hard and often unpopular policies, and the immediate adoption of strategies which support sustainable development. The choice is there.
Natural resource endowments and usage: country studies
The Melanesian countries addressed are Papua New Guinea, Solomon Islands, Vanuatu and Fiji. These countries, all once governed by colonial powers, are now independent, with Vanuatu being the most recent to attain that status in 1980. For all their similarities and regional union, these countries are a diverse group of unique environmental, cultural, socio-economic and political entities which must not be mistaken as homogeneous. Each is endowed with its own set of resources, with different population pressures, different technologies and different assimilative capacities. Their aspirations differ. Yet all are confronted by a need to manage their resources sustainably in the pursuit of economic and social development.

Resource base and knowledge

The Melanesian countries all have relatively abundant fertile soils, forests, minerals and marine resources (World Bank 1991) and each is highly dependent on its natural resources for both domestic and export income. The most resource-rich nation of the four is Papua New Guinea, particularly in mineral and forest wealth, while Vanuatu is perhaps the least fortunate in this regard.

While each nation looks to its natural resources to supply desperately-needed foreign exchange, subsistence agriculture (and fishing in some areas) is expected to continue to be the basis of island economies for
Table 2.1  **General indicators**

<table>
<thead>
<tr>
<th></th>
<th>Fiji</th>
<th>Solomon Islands</th>
<th>Papua New Guinea</th>
<th>Vanuatu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>0.783</td>
<td>0.30</td>
<td>4.2</td>
<td>0.17</td>
</tr>
<tr>
<td>Natural population growth (per cent per year)</td>
<td>1.8</td>
<td>3.5</td>
<td>2.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.5</td>
</tr>
<tr>
<td>Land area (km&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>18,270</td>
<td>27,990</td>
<td>452,860</td>
<td>12,190</td>
</tr>
<tr>
<td>Persons per km&lt;sup&gt;2&lt;/sup&gt;</td>
<td>43</td>
<td>11</td>
<td>9.3</td>
<td>14</td>
</tr>
<tr>
<td>GNP ($US millions)</td>
<td>1,330</td>
<td>130</td>
<td>2,830</td>
<td>120</td>
</tr>
<tr>
<td>GNP/capita (US$)</td>
<td>1540</td>
<td>430</td>
<td>750</td>
<td>820</td>
</tr>
</tbody>
</table>

<sup>a</sup> At 1995 or most recent available year.
<sup>b</sup> Estimate only (from Unisearch PNG (1991) who suggested that this is an underestimate).

**Sources:** South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.

decades to come (Wenzel 1989). Subsistence agriculture, supplemented by some cash cropping, will remain the predominant employer of Melanesians well into the twenty-first century.

Although considered resource rich, detailed knowledge about the occurrence and extent of resources in the Melanesian countries is patchy. This is true of the entire Pacific. Little is known either about environmentally-safe levels of utilisation of renewable resources, or about environmentally-safe means of exploitation of non-renewable resources within the tropical setting.

### Resource knowledge

Resource knowledge is fundamental to sustainable development. There have been a number of resources surveys in the Melanesian countries, usually at a national (large scale) level of sampling intensity. However, those surveys have become very dated, making the need for new surveys and inventories urgent. For example, concern by aid donors for the fate of the tropical forests prompted significant financial
support to all four countries to update previous inventories or resurvey forest resources. As a result, desktop computer-based resource information systems were developed in Solomon Islands (SOLFRIS) and in Vanuatu (VANRIS), and the Papua New Guinea Resource Information System (PNGRIS), developed by Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO), was revamped.

In no country has there yet been a systematic, nationwide, comprehensive study of land and marine resources. Many surveys have been undertaken for specific purposes, or in pursuit of particular scientific interests, creating a patchwork of ad hoc scientific information, characterised by major gaps, both spatially and temporally.

Resource surveys need to be updated constantly because of the vulnerability of the Melanesian countries to natural disasters and resultant significant changes in the non-renewable resource base, particularly vegetative cover. Surveys are expensive, but are essential planning tools, and should be regarded as high priority activities. Unfortunately, in a tight fiscal climate, governments tend to give a low priority to updating databases. Sustainable development decisions are then made on the basis of obsolete information, projections and conjecture, rather than on fact.

**Legislation and resource administration**

Each country has its own resource legislation, mostly sectoral in nature, such as Forestry, Agriculture, Fisheries, Livestock, Water Resources, and Fauna and Flora Protection Acts. Much of this legislation is a relic of the colonial period when environmental perceptions were less acute than they are today and badly need revision and consolidation. The penalties provided for in the legislation are insignificant by today’s standards.

**Sectoral legislation** Much of the legislation applies to specific developmental and commercial activities, such as individual
mines. Because of this sectoral approach it is not uncommon to find areas of conflict or overlap between Acts. The degree of precedence of one Act over another is not always clear, so conflict can arise within government over which administrative unit has the responsibility for a particular aspect of resource management, with resultant 'grey' areas of administration.

Even where lines of authority are clear, the government authority assigned the functional responsibility may not be given the resources necessary for the proper administration of an Act. And, because of the sectoral approach, some aspects of resource use or protection may be overlooked.

Many sectoral Acts do have some important environmental management role. For example, Fiji's National Report to the United Nations Conference on Environment and Development states that

\[
\text{at least 25 Acts [in Fiji] have some important role in what is today perceived as environmental management, and they are administered by at least 14 different ministries, statutory bodies or other agencies. Most of the laws are old and ineffective in a modern environmental management context or suffer from lack of enforcement of regulations through inadequate staffing, lack of technical resources and funding, or through administrative failures (Chape and Watling 1992).}
\]


"Much of the legislation is a relic of the colonial period when environmental perceptions were less acute than they are today and badly needs revision and consolidation."
However, while Papua New Guinea has an excellent body of environmental legislation, it appears that some has not been implemented (for example, the Conservation Areas Act 1978). In commenting on Papua New Guinea’s good progress in introducing legislation covering a range of conservation and environment management fields, Carew-Reid (1989) noted:

> [d]espite having one of the most comprehensive legislative frameworks for environment control, a lack of expertise, appropriate standards and information on the natural systems of the areas to be developed hampers legal implementation. Serious staff shortages prevent effective site inspection work and enforcement of environmental conditions and standards. The government has severely cut the Department’s budget over recent years which has limited its capacity to fulfil its mandate and restricted the level of co-operation received from other government agencies (Carew-Reid 1989:32–33).

That situation persists today. But by comparison, Papua New Guinea has the most elaborate and resource-endowed environmental administrative unit in Melanesia. This reflects badly on the lack of environmental administrative capacity elsewhere for environmental monitoring and enforcement of existing legal provisions, particularly in Vanuatu and Solomon Islands. Everywhere in the Pacific, environmental units are starved of the funds and personnel necessary to fulfil the tasks mandated by their governments.

This situation is not unique to the environmental units. There is a recognised lack of capacity throughout Melanesia (and the southwest Pacific as a whole) to enforce the provisions of resource-oriented legislation, and aid donors are now placing a high priority on strengthening institutional capability and capacity for resource conservation and protection.

**Cultural ‘fit’**

Some legislation based on western models is quite inappropriate for Melanesia. Legislation commonly ignores traditional methods of resource management and control, and the reliance on the imposition of monetary penalties and imprisonment has little relevance to the cultural base of the region. It is a brave person indeed who, in the very close-knit clan...
and tribal associations of Melanesia, would attempt to charge one of his relatives with an offence. There is an increasing emphasis on the incorporation of custom law and penalties into western-style legislation; however, this meld of traditional and western styles is made difficult in some areas where the power and authority of traditional chiefs and leaders has been severely eroded.

**Land tenure**
The customary land ownership system of communal tenure is often cited in the literature as a hindrance to resource development and control. Customary land tenure presents a special challenge for resource control, and practical systems have yet to be devised which facilitate development while protecting the assets of the resource owners. A fundamental problem is the identification of land ownership boundaries; these often only come into dispute when the land in question suddenly assumes importance because of a proposed development promising monetary benefits.

In Solomon Islands and Vanuatu, while there is a large body of resource legislation (some of it now quite dated), environmental legislation has yet to be enacted. Both governments have signalled a desire to develop and implement environmental legislation, but the process has been protracted.

**Environmental legislation**
In Melanesian societies where there is a high degree of interaction between the human population and natural systems, environmental legislation must recognise the rights and needs of customary landowners. In Solomon Islands and Vanuatu, the proposed legislation strives to integrate traditional practices with ‘modern’ management.

In Vanuatu, legislation has recently been ratified for the creation of National Parks and Protected Areas, and the first such area—the Erromango Kauri Protected Area—has now been created. While the initial lease is only for five years, the creation of such a reserve is a significant breakthrough.

While such developments are encouraging, the overall tardiness to enact and/or to implement environmental legislation reflects the generally low level of commitment by senior bureaucrats and
government officials to environmental matters. This may flow from the low priority placed on environmental issues by the general community throughout Melanesia. The low priority may well be due to a preoccupation with the quest for survival, rather than to a fundamental lack of concern by the people for the environment.

There is now a growing and increasingly vocal segment of the population actively trying to raise the level of environmental awareness of Melanesians and alert the community to real or foreshadowed environmental concerns which may well have a profound effect on daily patterns of existence.

Flora and fauna

Papua New Guinea appears to be a meeting ground of South American, Australasian and Indo-Malesian vegetation, with phenomenal variety and richness. The diversity of the flora of Solomon Islands ranks second only to that of Papua New Guinea. Fiji’s flora is also rich in endemic species and is highly diverse, but in Melanesian terms, much less so than that of Papua New Guinea and Solomon Islands. The flora of Vanuatu is, by comparison, impoverished.

Vanuatu is at the eastern limit of the distribution of Indo-Malesian vegetation and the western limit of many Pacific species. Its impoverished state is due to the relative youth of the land mass and the country’s isolation in the Pacific. Species of the northern islands reflect their proximity to Solomon Islands, while the southern islands, which have the largest number of species, reflect floristic links with New Caledonia and Australia (CSIRO/DPIFS 1993). Nevertheless, because of Vanuatu’s isolation, a considerable number of endemic...
species have evolved, and more endemics may yet be identified as the country's flora and fauna are still incompletely known scientifically.

**National parks and reserves**

The conservation needs of each country's flora are being addressed in various ways, with Papua New Guinea leading the way in the establishment of national parks and reserves. In Solomon Islands, proposals to declare World Heritage Areas in Marovo Lagoon in Western Province and in Rennell Island in Central Province have been developed. Landowners have expressed concerns about their rights if these areas are listed as World Heritage sites, although customary rights should not be impacted. Pilot projects have also begun into eco-tourism in two locations on Guadalcanal, and at one location on Savo Island. These may provide evidence that commercial opportunities can be realised without depleting important and limited natural resources.

Vanuatu's conservation needs are beginning to be addressed with the first biological reserve on Erromango, where approximately 3,000 hectares of undisturbed Kauri (*Agathis macrophylla*) have been leased from the customary landowners. The landowners will continue to use the area for traditional activities but road-building and logging are restricted (Tacconi and Bennett 1994). The Vanuatu Forest Resource Survey Project, through the Vanuatu Resource Information System (VANRIS) developed for the Survey, has published a classification and atlas of the natural resources of Vanuatu and their current use (CSIRO/DPIFS 1993), facilitating the identification of other significant biological and cultural areas. The conservation values of Vanuatu's forests have also been the subject of recent research sponsored by the Australian Centre for International Agricultural Research (Tacconi and Bennett 1992, 1993a, 1993b).

**Marine environments**

Many of the reef systems in Melanesia are extensive and complex and include barrier, fringing and platform reefs. Because coral reefs are damaged by siltation, pollution, fresh water, and overuse, they are increasingly at risk as population increases; as urban areas grow, bringing eutrophication of adjacent waters and siltation from dredging and
construction; and as uncontrolled logging continues, resulting in sedimentation from erosion.

Reef degradation is reported in localised areas, particularly near major urban centres where they are constantly gleaned, and where the reefs are a tourist attraction. Deterioration is not all human induced; cyclones play an important recurrent role in reef degradation in the Solomon Island–Vanuatu–Fiji belt. Outbreaks of the coral-eating crown-of-thorns starfish (*Acanthaster planci*) have also caused damage.

The supply of fish in local waters (and perhaps in deeper waters) depends to some extent upon mangroves, which supply a nursery shelter and large amounts of nutrient detritus to the marine food chain. Extensive areas of mangroves are found in Papua New Guinea and Solomon Islands, and these have generally not been severely disturbed since World War II, except for small localised areas which have been infilled for house or factory sites, or are sources of firewood. There are no mangrove logging operations.

In Vanuatu, mangroves are not as extensive, generally being found only in small clumps scattered along low-energy coastlines. The notable exception is a mangrove area of 1,975 hectares on Malakula.

The best estimate of the area of mangroves in Fiji is 42,000 hectares (Chape and Watling 1992). The largest formations are found in deltaic formations at the mouths of some of the larger rivers—Ba, Rewa, Nadi and Labasa.

**Assessing wildlife diversity**

As with flora, Papua New Guinea also has a greater diversity of terrestrial fauna than any other Pacific island nation. Solomon Islands' animal life is also richly diverse. Even though data are relatively limited, a high level of species endemism is known to exist, and speciation and population variation among islands is extraordinary.

Because little is known about the distribution, status, ecology and habitat requirements of Melanesian wildlife, it is difficult to assess the potential threat of large-scale habitat changes and identify threatened species. Fiji has benefited from more scientific survey than the other countries, and is therefore in a better position to manage its
wildlife, but even in Fiji there are still some areas awaiting detailed survey.

Because of this limited knowledge, the real impact of hunting pressure on wildlife for food and custom decoration also cannot be assessed with any confidence. Hunting traditionally supplies protein for the subsistence diet of a high proportion of the rural community, perhaps greater than 50 per cent, and the sale of wildlife products such as meat, feathers and eggs may represent a significant or even sole source of cash income for some communities in Papua New Guinea (Unisearch PNG 1991). It is also claimed that monetisation in Papua New Guinea has led to the depletion of turtle, dugong, reef fish, coral for lime and ‘tabu’ shell. Hunting and animal products remain important in the other countries, perhaps less so in the more monetised society of Fiji.

Technology and biodiversity loss

Technology has had a major impact on wildlife in Melanesia. Shotguns, steel axes, matches, outboard motors and vehicles have all increased the efficiency of hunting and its range. The combined effects of technology and population growth represent a clear danger to wildlife, especially near population centres. Wildlife protection, especially of endemic species considered rare or endangered, is urgent, and in order to scientifically assess the threat immediate attention must be paid to wildlife surveys.

Rapid population growth poses considerable dangers to the maintenance of biodiversity and to the sustainable use of flora and fauna in Melanesia. Biodiversity loss has already occurred with marine organisms such as giant clams, and it seems certain to occur with terrestrial species as conservative traditional practices fade away in the face of rapid population growth, intensive agriculture and unfettered commercial forestry.
Water

Many areas of Melanesia are subject to severe drought. The central mountain spine of many islands lies athwart the prevailing moisture-laden wind systems, creating wet and dry sides to those islands. In Fiji, water shortages continue to be a problem on the drier western side of the main islands.

**Water quality**

In some areas, rural water quality is a grave concern, and the protection of water quality through catchment management is a topical issue. Water quality in urban areas has declined markedly in some Melanesian countries since independence, as a consequence of the growing demand for water from rapidly expanding urban populations coupled with the failure to maintain water treatment works adequately and to invest in additional treatment capacity.

**Water quantity**

Water quantity is also being affected by resource use or, more correctly, misuse in Melanesia. For example, in the Gogol Valley, south-west of Madang, 20 years of clearfelling of the natural rainforest for a major woodchip/sawlog operation have resulted in some streams which formerly supplied village water needs now having dried up, or become unfit for drinking due to pollution and siltation. This may have resulted from a combination of increased transpiration from young secondary regrowth, reduced infiltration capacity due to structural damage and compaction of soil from logging machinery, increased surface runoff during storm events and reduced soil water storage. No temporal or spatial studies have been undertaken into the changes to the hydrologic balance caused by the woodchip operation.

The loss of perennial water supply to villages has many ramifications. To provide water, villagers now have to construct rainwater catchments. The galvanised iron, piping and storage tank are expensive items and their purchase pressures the households to increase cash income. The only source of income is to sell the logging rights to more forest or to increase the effort on market gardening, either through increased garden area or more intensive use of existing garden sites. In both cases, there is an attendant risk of accelerated
environmental degradation. There is also a direct social cost. While gardening activity is often shared, the real burden of more intensive market gardening often passes to the women of the household, adding to their already heavy task load.

Some islands have no surface streams, and the hamlets are heavily dependent on springs or groundwater wells for water supply. When these dry up, as occurred in 1992 in Vanuatu on Nguna Island, the island population has to rely on ocean bathing and on coconuts for drinking water. Village groundwater supplies are highly susceptible to pollution, particularly by human waste, unless close attention is paid to the siting of wells and of toilets or sullage pits.

In Vanuatu and Fiji, the governments' emphasis has been on the provision of clean, reticulated water to urban and rural settlements wherever possible, and in Fiji the proportion of the population with piped water has risen from 60 per cent in the mid-1970s to 70 per cent in 1992. This has been heavily subsidised through aid programs and government support for rural self-help schemes.

**Landform and soils**

The lands of Melanesia comprise a complex mix of volcanics, volcanic-derived sediments and coral reef deposits. Melanesia is located in an unstable area of the earth's crust in the convergence zone between the Australian and Pacific tectonic plates. As a result, there is frequent earthquake activity. Major earthquakes are accompanied by landslides, massive slumping, and sometimes tsunami (a seismic sea wave or large ocean wave generated by an undersea earthquake). Fiji, for example, has recorded 21 major earthquakes since 1850, and Chape and Watling (1992) report that an earthquake analysis indicated that large earthquakes of magnitude 7.0 on the Richter Scale are likely to occur somewhere in Fiji every 30–35 years.

There are many active volcanos in an arc stretching from Papua New Guinea to Tanna Island in Vanuatu. In 1993, Rabaul, the main city on
the island of New Britain in Papua New Guinea, was destroyed by volcanic eruption.

The mainly volcanic islands of Melanesia are dominated by steep, mountainous country, often deeply incised by rivers and streams, coral terraces, and riverine plains, swamps, beach ridge plains, and deltaic sedimentary fans. They are geologically young and, because of their recent emergence, many islands are surrounded by uplifted coral terraces. Atolls and coral cays are also present in all countries, and in Solomon Islands take the form of upraised coral platforms or uplifted reef encircling a volcanic core. Because of the rugged terrain, often with extremely steep slopes, a large proportion is unsuitable for use.

Soil fertility

In wetter areas, the soils of the coral terraces are generally shallow overlying hard or broken up coral limestone. In drier areas, moderately deep clay to heavy clay soils have developed and, although generally of high fertility, are subject to waterlogging. On the riverine plains, the alluvial soils are generally well drained and of moderate to high fertility. Beach ridge plains are characterised by sandy, generally infertile soils, and subject to water stress during low rainfall periods.

Except for young sandy soils formed around an island's coasts, skeletal upland soils, or gleys and peats occupying low-lying areas, most Melanesian soils are fertile, with areas of deep, highly fertile, and agriculturally important alluvial soils occupying valley bottoms and some upland plateaux. However, due to rapid leaching, some soils impoverish quickly once the overstory is removed and, often in conjunction with a regime of firestick management, may convert to relatively infertile grasslands. Much of the nutrient supply available to plants is bound up in the surface organic matter. This layer is thin due to rapid decomposition and provides only limited soil protection when overstory vegetation is removed. In the traditional gardening system, with loss of the organic matter soil fertility declines very rapidly, and gardens rarely extend production beyond three years, and then producing primarily to produce crops such as cassava which can tolerate lower nutrient levels.
Soil erosion

Because of recent volcanic activity, there are extensive areas of moderately deep to deep soils formed from volcanic materials (including ash 'tuff soils) which contain particles of unweathered parent material. These soils are often highly susceptible to erosion.

Landslides and erosion of the geologically young landscapes with their steep topography are major contributors to the high sediment loads in the larger rivers, and the build up of large deltaic fans. Some soils have a high erosivity and when vegetation is cleared for agriculture, logging, mining, or road building, rapid erosion will occur. Torrential rainfall, often associated with cyclones (with the exception of Papua New Guinea which escapes most cyclonic activity), can cause multiple landslides in localised areas, irrespective of land use. In Papua New Guinea, some Highland soils are thixotropic, and highly dangerous mudslides can be triggered under the prevailing high rainfall conditions when soil moisture content has reached saturation point.

Environmental management

In some political and administrative circles in Melanesia a view prevails that the environment is not under serious threat. Concern about the environment and its protection has often been entirely subjugated to the pursuit of economic development, and it is evident from their various public statements that many politicians still have scant regard for environmental values, despite official government protestations about sustainable development and the protection of the environment.

'The environment and its protection has often been subjugated to the pursuit of economic development.'
That view is gradually changing, possibly as a result of the much greater exposure given to environmental concerns in recent years in international and regional fora, but certainly as a necessary response to the environmental conditions attached by bilateral and multilateral aid donors to their development assistance.

In the National Development Plans of Solomon Islands (1985) and Vanuatu (1988), it was claimed that environmental degradation was not a significant concern, although the Solomon Islands' government acknowledged that this could change if the population continued to double every 20 years. This reticence to acknowledge potential problems may reflect the contention that 'many choices that degrade the environment are made in the developing countries because of the imperative of immediate survival, not because of a lack of concern for the future' (UNDP 1990:7).

The limited capacity to enforce environmental legislation (where it exists), or environmental provisions in sectoral legislation, further hampers the ability of governments to introduce sustainable development strategies. But the mere existence of legislation will not mitigate environmental degradation, particularly if that degradation is related to people's survival. Legislation should be seen as an adjunct to actions in other areas such as research and public education, and a line of last resort, rather than the sole answer to environmental concerns. Where population pressures force people into non-sustainable resource use, no legislation, even under a strongly authoritarian government with harsh powers of enforcement, will have any effect—the legislation will simply be ignored.

Guidelines In Melanesia a strongly consensual approach is taken to problem resolution. To support environmental legislation, practical guidelines have to be prepared through extensive consultation and widely disseminated.

There have been few instances in the Pacific where practical and relevant guidelines for environmental management have been developed. Such guidelines are desperately needed to inform both private and public sectors on what is required of them and to serve as tools for government staff called upon to monitor/audit resource-use practices.
For example, for many years forestry departments operated without any practical environmental guide for forest utilisation. Some broad requirements for environmental protection were often incorporated in forestry regulations, but these provisions were lost in the text of logging or timber purchase agreements and were too general to be of any real value in the field.

In recent years both Fiji and Papua New Guinea developed a Code of Logging Practice (or Key Standards), and these have now been revised and extended to Solomon Islands and Vanuatu. The ongoing task is to ensure that both government staff and industry employees have a detailed knowledge of these codes and standards, that both government agencies and industry adopt them, and that there is strict enforcement.

**Education and training** Throughout Melanesia there is a clear need for greater emphasis on environmental education and training—both informal instruction of the public at large, and formal education within the primary and secondary school systems. This is recognised by all governments and there have been many programs to rekindle public awareness of environmental issues and to build a cadre of trained personnel to handle the range of environmental management tasks. These programs have begun to bear fruit but they must continue in order to permeate throughout the community to every village.

**Personnel** The development of a reasonably stable cadre of environmental personnel has been a perpetual problem for Melanesia. It is difficult to attract high calibre students into the natural resource professions. Resource management is highly complex and the failure of the resource-based professions to attract such recruits may stem, partly, from inadequate financial reward and recognition, but may be more a consequence of poor information on alternative professional careers being readily available to secondary teachers and students.

Environmental management requires a rapid transmission of information throughout the community. Extension staff in agriculture, forestry, livestock and other resource departments play a central role in this aspect of community education, together with non-
governmental organisations, ‘grass roots’ and church organisations. However, government extension organisations are under-funded, understaffed, and often under-trained for the task.

**Urbanisation**

The social and other impacts of urbanisation in Melanesia are discussed elsewhere in the Pacific 2010 series.

[A] distinctive form of urbanisation has appeared, based overwhelmingly on the rights to customary land of different groups of urban residents. Cities are characterised by rapidly growing uncontrolled areas of peri-urban customary land, often on the fringes, and pockets of traditional villages now swallowed up by the expanding town. Modern offices, new tourist establishments and the expensive dwellings of the élite (still mostly expatriate in much of the region) coexist with the low-income Melanesian suburbs and place huge demands on the poorly developed network of infrastructure services (Connell and Lea 1993:1).

While no Melanesian country can be described as being heavily populated, each is experiencing a rapidly increasing level of urbanisation of its population. There is a hunger for material benefits and improved living standards. These material needs can be met only through a cash economy, so the capital and other main population centres are a strong magnet for the rural cash-poor. By the time disillusionment sets in, the immigrant family is often trapped without the financial means to return to their village and, in the universal absence of social services, become an economic and social burden on their better-off relatives.

As a consequence, unplanned fringe settlements grow rapidly, health services lag well behind demand, and urban crime flourishes. These are commonly slums from the outset. With the inability of the municipal authorities to fund infrastructure maintenance and provide comprehensive water, waste disposal, sanitary, and allied services, some suburban areas have rapidly become slums.
Connell and Lea (1993) discuss urbanisation primarily in the context of the Melanesian cities, and focus on the capitals of the four countries, and other cities such as Lae in Papua New Guinea and Lautoka/Nadi in Fiji, where much of the growth has occurred. The difficulties accompanying rapid urbanisation are, however, also clearly evident in smaller urban centres, though perhaps to a lesser degree, such as the rapidly growing provincial towns of Vanimo, Madang, Wewak, Kimbe, and Mt Hagen in Papua New Guinea, Labasa in Fiji and Luganville in Vanuatu.

**Migration**  
A continuing high rate of migration from outer islands or rural areas to island urban centres, and from outlying areas to the capital city is a well-documented feature of island demographics. The high rate of urban growth of the national capitals and other major urban centres primarily reflects that migratory pattern (Table 2.2). Such migration is particularly marked in Solomon Islands where there is little urban growth outside of Honiara.

**Impacts of urban growth**  
Environmental impacts associated with the continued growth of urban areas include

- strain on the supply of utilities such as water and electricity
- localised impacts where sewage disposal systems do not exist, and pollution from ocean outfalls where such disposal systems are in place
- increased problems with littering and solid waste disposal
- fuelwood shortages nearby to urban areas.

Serious problems in waste disposal are beginning to emerge because of the combinations of urban population density, increasing per capita consumption, inadequate funding for sewerage infrastructure and sites unsuitable for septic systems.

The collection and disposal of household waste leaves much to be desired throughout Melanesia. Most landfills are poorly managed. Many have been established in coastal or mangrove areas, with unfortunate environmental effects. The need for better solid waste disposal systems and management is well recognised and attempts
Table 2.2 Rate of population increase of urban centres in Melanesia

<table>
<thead>
<tr>
<th>Country</th>
<th>1980</th>
<th>1990</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papua New Guinea</td>
<td>123,624</td>
<td>194,295</td>
<td>57.2</td>
</tr>
<tr>
<td>Port Moresby (NCD)</td>
<td>61,617</td>
<td>80,655</td>
<td>30.9</td>
</tr>
<tr>
<td>Lae</td>
<td>1976</td>
<td>1986</td>
<td></td>
</tr>
<tr>
<td>Fiji</td>
<td>1976</td>
<td>1986</td>
<td></td>
</tr>
<tr>
<td>Suva</td>
<td>117,827</td>
<td>141,273</td>
<td>19.9</td>
</tr>
<tr>
<td>Lautoka/Nadi</td>
<td>41,803</td>
<td>54,357</td>
<td>30.0</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>1979</td>
<td>1989</td>
<td></td>
</tr>
<tr>
<td>Port Vila</td>
<td>14,598</td>
<td>19,311</td>
<td>32.3</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>1976</td>
<td>1986</td>
<td></td>
</tr>
<tr>
<td>Honiara</td>
<td>14,993</td>
<td>30,413</td>
<td>102.9</td>
</tr>
</tbody>
</table>

Note: Some Papua New Guinea urban centres are known to be under-counted in the 1990 census and Connell and Lea (1993) consider Lae almost certainly had a population of over 95,000 at that time; using that figure, the rate of increase would be 54.2 per cent, only slightly behind that of Port Moresby.


are being made to rectify past mistakes. In Fiji, for example, Suva’s coastal landfill has now been relocated. Apart from household garbage, it had also been the repository for industrial wastes, some of which were improperly disposed, causing serious and widespread concern.

Throughout the region, the use of the local environment as a sink for waste products has been taken for granted. Major pollution problems due to sewage, domestic and industrial wastes have been documented by the South Pacific Regional Environmental Programme (SPREP) in the series of National Environmental Management Strategies prepared for 12 Pacific countries over the period 1991–94, and in other SPREP documentation. Sewerage and waste disposal services are likely to come under increasing pressure, with population growth, changed consumption habits and increased tourism. Simply maintaining the existing levels of service will require additional funding, yet cost recovery in the past has been low.
Marine pollution is an increasing issue in almost all provincial centres because of inadequate sewage disposal, suspended sediment outflow with subsequent damage to reefs, and discharge of untreated effluent in some locations from industrial plants.

**Fuelwood shortages**

A shortage of fuelwood is rapidly becoming a serious problem for Port Moresby and Honiara, with increased pressure on remnant timber resources in their vicinity. Firewood sells for a premium in Port Moresby and Honiara markets and the cost of fuelwood is likely to escalate. Outside the capitals, a firewood shortage is also becoming pronounced at other larger urban centres with resultant environmental impacts; for example, the cutting of trees for firewood on the hills surrounding Lae in Papua New Guinea has led to increased flash flooding and soil erosion (Unisearch PNG 1991).

The first book in the *Pacific 2010* series, *Challenging the Future* (Cole 1993) projected the high levels of population growth to continue some time into the next century, particularly in Solomon Islands and Vanuatu. That growth is likely to be accompanied by a continued migration to the major urban centres and increased consumption patterns, resulting in an even greater pressure on the scant resources and inadequate infrastructure that currently exists. It is clear that the environmental impacts will intensify as the rapid trend to urbanisation continues.

**Tourism**

Tourism is often seen in the Pacific islands as the universal panacea for economic malaise. Certainly there is much in Melanesia to attract tourists, and in Fiji the government has estimated that tourism generates almost 17 per cent of GDP, 15 per cent of total employment, and more foreign exchange than the sugar industry. It is crucial to the economy. Fiji is by far the most popular tourist destination of the four Melanesian countries, with Vanuatu the second most popular.

Fiji’s tourism is concentrated on the island of Viti Levu, but resort development is also expanding rapidly on the second major island
of Vanua Levu. Apart from the large, foreign-owned ‘four-star’ resorts on those islands, there have been many new initiatives for community and family-based ‘secondary tourism’ to capture the interests of tourists in Fiji’s cultural and environmental features. This will provide additional employment and income opportunities, and should increase the proportion of the tourist dollar retained in Fiji. Tourism has many implications for resource use, regional planning and environmental management practices. Fiji’s environmental assets are an essential part of the tourist package and must be carefully protected. This calls for careful, integrated coastal management which has the active support of landowner, government, tourist operators, and the tourists themselves.

Vanuatu already offers an exciting blend of sophisticated tourist attractions and nature tourism and is offering a wide range of discounted packages to promote its tourism industry. Much of that activity is currently confined to the capital island of Efate, with common side excursions to Tanna with its active volcano, Yasur, and to Santo.

Solomon Islands is also now attracting increasing tourist numbers, particularly of scuba divers and eco-tourists to its spectacular coastal, lagoon and reef systems. Solomon Islands is keenly pursuing the path of secondary tourism which is seen to be least disruptive of social values and cultural heritage. Eco-tourism has good financial prospects because of the enormous scenic, biological, and cultural diversity of the country. Marovo Lagoon already attracts increasing numbers of tourists, while the Western Province has long been a favourite destination for discriminating eco-tourists. Solomon Islands has also been able to capitalise well on its history as a major battleground of the Pacific conflict of World War II, and attracted many ex-servicemen, their relatives and friends, during the 50th anniversary of the battle for Guadalcanal.

Papua New Guinea’s internal airline and hotel cost structure have been major bars to increased tourism despite the country’s many attractions, but the recent devaluation of the kina may bring Papua New Guinea within economic reach of the average Australian or New Zealand tourist and make it more attractive financially to American
and Japanese clients. Tourism also suffers from Papua New Guinea's image of lawlessness. However exaggerated this may be in the foreign press, the perception remains and repels potential visitors. The current Prime Minister has called for greater attention to the problem and that, together with the reducing cost of internal travel and accommodation, will undoubtedly increase Papua New Guinea's attractiveness to tourists.
Papua New Guinea is the largest of the Melanesian countries, with a land area of 452,860 square kilometres, a marine area of 800,000 square kilometres, and a population approaching four million. Papua New Guinea’s population is diverse, with hundreds of indigenous language groups. Broad ethnic classifications divide the country into ‘highlands’ and ‘coastal’ people on the main island, along with ‘islands’ people in other parts of the country.

Papua New Guinea is, on many social criteria, a poor country (Jarrett 1990) yet is extremely resource rich. Most people live in traditional rural villages, although the population is highly mobile between the highlands, outer islands and urban centres. With high fertility rates the population is growing rapidly and is expected to exceed six million by 2010 (McMurray 1993). The young age structure will likely sustain a high natural population growth after 2010, and may even increase further due to improved health services, lower infant mortality and improved longevity.

About 30 per cent of the population live on relatively flat terrain, comprising mangrove swamps, beach ridges, raised coral reefs, riverine environments and alluvial fans. The remainder live on the steep lands of the highlands. Only around 7 per cent of the country is used for agriculture, including village food production, smallholder cash crop production and plantation operations, on a regular basis.
A further 8 per cent is used at very low levels of intensity where the population density is less than five persons per square kilometre (Keig et al. 1987). Of the remaining land about 70 per cent is unsuitable for major development in the foreseeable future, although some is intensively used by the village rural sector for non-agricultural food production such as fishing.

More than 85 per cent of the population of Papua New Guinea is rural and gains its livelihood from agricultural activities. In the other Melanesian countries, most of the population lives in the coastal fringes. Papua New Guinea is the only Melanesian country with a substantial inland population.

The World Bank (1991) has estimated that 75 per cent of the rural population lives below the absolute poverty income level. However, as pointed out by Jarrett (1990) such estimates must be treated with caution in an economy typified by heavy reliance on subsistence agriculture.

Land tenure is still based on customary ownership, with around 97 per cent of all land held in this system. Land tenure conflicts have hindered the development of resource extraction projects in minerals and forestry in particular, but have been less of a problem in agriculture.

**Population growth**

The official estimate of population growth is 2.3 per cent per annum (Table 2.1). Data on population growth rates in Papua New Guinea are not reliable, but the consensus is that the rate is between 2 and 3 per cent. This figure may, however, disguise differing regional rates of growth. For example, in the period 1966–80 when the nationwide population growth rate was 2.3 per cent, some Highlands provinces experienced rates of 2.8 per cent, West New Britain saw a rate of 4.9 per cent and North Solomons 4 per cent (Jarrett 1990).

**Population density**

Population density is a critical factor in terms of environmental degradation and agricultural productivity. The average population density is around 9.3 per square kilometre in Papua New Guinea (Table 2.1). But like population growth rates, this figure disguises regional and local situations.
where population pressures are impacting upon the environment. It also disguises the fact that large areas of the country are inaccessible or otherwise unsuited to agricultural production.

Unisearch PNG (1991) provide a case study of two adjacent rural areas. In one, the population density is 19.2 persons per square kilometre. This area is typified by declining garden productivity, increased forest destruction, poor forest regeneration, virtual elimination of bananas from the cropping cycle, and increased food insecurity. The second area has a population density of 1.1 per square kilometre, and experiences high levels of food security, minimal forest destruction, a relatively long cropping cycle of around five years and long fallow periods (often in excess of 30 years). Notwithstanding such situations, Unisearch argues that 'population density is not currently an impediment to improved levels of living, nor is it a primary determinant of environmental deterioration in most parts of the country' (Unisearch PNG 1991:6).

Population pressure

There are a number of indications that population pressure is important and will become more important. Thistlethwaite and Votaw (1992) noted that shifting cultivation is the main cause of forest degradation and destruction. This conclusion is supported by Unisearch who comment that the expansion of subsistence agriculture into previously forested areas is causing major environmental problems in some areas. It is estimated that more than 200,000 hectares of forest are cleared annually through shifting cultivation. Commercial logging leads to 70,000 hectares being cut over each year (but not deforested), while mining, urban and other infrastructure developments combine to account for 60,000–90,000 hectares of cleared forest per annum.

Land in cultivation is also susceptible to soil erosion, and substantial soil losses have been recorded in Papua New Guinea’s traditional gardens under intensive cultivation (Thistlethwaite and Votaw 1992). More land is being cleared for cash and plantation crops because smallholders have few other opportunities to earn cash income.

While Unisearch PNG (1991) have suggested that current population densities do not present a problem, the question remains as to whether future levels will do so. If the population reaches six million by 2010,
then the overall population density will have increased to 12 persons per square kilometre, a figure which is still low by international standards.

Food and agriculture

Agriculture in Papua New Guinea has two main components, subsistence food production and cash cropping. Eighty per cent of the country’s inhabitants are rural village dwellers obtaining most of their diet from subsistence root crop production from a short to long bush fallow farming system. Cash cropping is predominantly export-orientated tree crops (coffee, cacao, tea, palm oil, rubber and copra). Some food is produced for local markets—mostly subsistence production surplus.

The export agricultural sector earns substantial income but the market prices have been declining for commodities such as copra, are highly variable for other crops such as coffee, and the outlook for future exports is not encouraging. The value of exports in 19994 was 374.7 million kina, below the peak of 380.6 million kina earned in 1984 (Bank of Papua New Guinea 1992, 1994). Earnings from coffee were 204.8 million kina, close to the peak 1986 production of 208.5 million kina. Only two years before, in 1992, coffee exports yielded only 68.1 million kina. Palm oil exports are the second largest agricultural earner yielding 77.5 million kina in 1994. Next in order of importance is copra and coconut oil; while the production of copra has been decreasing for some years, export production still totalled 34.8 million kina in 1994. Substantial income is also derived from cocoa, with an export value of 29.9 million kina in 1994.

Growth in the informal sector in recent years has largely offset declines in rural incomes. For example, the value of fruit, vegetables, fish, meat and betel nut sold in local markets was estimated at 45 million kina in 1988, exceeding the returns from oil palm exports in that year. More recent estimates of the value of this informal sector are not available, but its economic importance would have increased considerably with the growth of the rural cash economy.
Land use

Less than 10 per cent of the land in Papua New Guinea is used for agriculture and only 5 per cent is used at levels of significant land use intensity. In any one year, 2,000 square kilometres of the total land area are in current food production with about 30,000 square kilometres under fallow. The location of the 30,000 square kilometres remains fairly constant over long time periods. Agriculturally-used areas do not appear to be expanding in response to the high population growth rates. Rather, intensification of use is taking place. It is this intensification which has the potential to cause agricultural degradation and there is evidence that this process has already begun in peri-urban areas and in localised points of very high population pressure. In conjunction with little-controlled forest clearing, the potential for degradation to appear in the immediate future is considerable.

Environmental constraints on the main form of agriculture, subsistence food production, are ameliorated under quite sophisticated and conservative farming practices. Except on raised coral reef landforms, virtually all agriculture is carried out on moderate to steep sloping land, thus avoiding the problem of waterlogging in high rainfall. Significantly the alluvial plain environments, which in Southeast Asia would be densely populated, are either unoccupied or only lightly used despite their having high agricultural potential. Erosion on steep slopes is minimised (but still evident) through the use of traditional control measures.

In a similar manner cash cropping is carried out in environments and under practices which minimise environmental constraints to production. As a result the effect of agriculture on the environment following land clearing has not been great and the farming systems used have been generally sustainable over centuries, under a low population density regime.

The rapidly growing rural population will continue to rely heavily on subsistence farming for some time to come. At present, the land is capable of sustaining those communities which rely on it. For these people staple products include sweet potatoes, taro, yams, cassava, sago and bananas. Pigs, chickens and, on the coast, fish, are the chief traditional sources of protein, supplemented by hunting.
The heavy reliance of the populace on agriculture raises a number of issues. Thistlethwaite and Votaw (1992) claim that domestic food production has not grown enough to continue to meet food and nutrition requirements. Additionally, urban food requirements cannot be satisfied because of poor infrastructure, and a significant proportion of urban food supplies is imported. These difficulties are expected to intensify given that agriculture, both subsistence and commercial, currently supports most of Papua New Guinea's four million people and by 2010 will have to support an additional two million (Allen 1993).

The bush fallow shifting agricultural system, as practiced in much of Papua New Guinea, holds the key to future agricultural and ecological sustainability for the increasing population. Brooksbank (1982) noted that '...conventional wisdom suggests that [shifting agriculture] can be ecologically stable provided population pressures do not exceed the carrying capacity of the land' (1982: 43; emphasis added). But what is the carrying capacity of a shifting agriculture system? Whitmore (quoted in Brooksbank 1982) has suggested that the system is roughly capable of supporting a shifting agriculture population density of only about seven persons per square kilometre—a figure already exceeded in many parts of Papua New Guinea.

Commercial agricultural activities are also causing environmental problems through pollution from processing factories. This is particularly so in the case of coffee and oil palm production. For example, some 300,000 tonnes of coffee pulp waste are dumped each year into highland rivers and streams by both large and small-scale processors (Unisearch PNG 1991).

There are many challenges to be met if the traditional agricultural system of Papua New Guinea is to be rendered sustainable in the face of increasing population densities. As observed by Bellamy (1987), population growth rates, coupled with rising social and economic expectations, indicate the need for rapid increases in both the amount and variety of food produced. The bulk of this increase will come predominantly from subsistence agriculture.
Given that people will be motivated by both survival and cash needs, and that these needs will moderate or override environmental considerations (Pernetta and Hill 1980 as quoted by Unisearch PNG 1991; Bayliss-Smith 1991), a range of strategies are required. Without implying that the proportion of the population who are farmers will be, or should be, constant, these strategies could include

- modification of traditional agricultural practices to prevent soil erosion
- development of ways to shorten fallow periods while maintaining soil fertility
- intensification of crop production through such methods as intercropping and composting
- research, development and extension related to sustainable agricultural systems
- a research and development focus (initially) on regions and areas which are experiencing the greatest population pressures.

It is clear that Papua New Guinea has time on its side in relation to combating the impact of population pressure on the environment in the agricultural sector. However, that time buffer is running out quickly, and the opportunity to take a pro-active or anticipatory approach to the foreshadowed problems must be grasped in the immediate future.

**Forests and forestry**

The total forested area of Papua New Guinea is estimated at 34 million hectares. Of this, an estimated 7–7.5 million hectares is now widely regarded as commercial forest (AIDAB 1993). The export of forest produce in 1994, particularly as unprocessed logs (2.94 million cubic metres), was a major revenue earner for the country, with a value of 494.5 million kina or 18.6 per cent of the total export earnings. The reported 1993 harvest of 3.5 million cubic metres was at the estimated
sustainable yield nationally (Duncan 1994). However, logging in certain areas is well in excess of the sustainable yield, with glaring examples in West New Britain Province and in New Ireland Province. The timber permits issued in Papua New Guinea are stated (PNG Forest Authority 1993) to total more than 8 million cubic metres but the rate of logging has not approached this level.

Just under one million hectares of operable forests have so far been logged, although in a forthcoming report from the Institute of National Affairs, unofficial estimates suggest that more than two million hectares of forest have already been harvested. In the same report it is suggested that present rates of logging are three times the estimated sustainable harvest level.

Much of the total land area of Papua New Guinea remains covered with some of the world’s least-disturbed tropical forest (World Resources Institute 1993). Traditionally, the forests of Papua New Guinea have been an important part of the rural production systems on which most people depend. Recent concerns have been expressed about uncontrolled logging which seriously threatens environmental stability in some areas, particularly causing mass erosion and landslides. The high level of species endemism is also threatened.

Public concern has been raised about the increased rate of deforestation and logging companies’ general disregard for watershed and other aspects of environmental protection. In response to the findings of the Commission of Inquiry into Aspects of the Forest Industry (Barnett 1989), new legislation and policies have been introduced which seek to ensure a sustainable yield and the adding of value to forest exports.

It is estimated that about 15 million hectares of the forest are accessible for timber extraction (Papua New Guinea 1991). The diversity of tree species and the low density of commercially-known species in accessible areas is problematic for commercial exploitation. Nonetheless, the decline in tropical timber supplies from elsewhere in the Asia Pacific region, and an increase in log bans in certain countries, has increased pressure for forest exploitation in Papua New Guinea (Callick 1993).
There appear to be considerable difficulties in managing Papua New Guinea’s forest resource, due to three main factors. First, very little is known about the ecological requirements of commercial timber species. Therefore, how much of the forest is actually suitable for commercial harvesting and to what extent these resources can be logged sustainably is not known. Second, the volumes of exploitable species per hectare are relatively small (compared to Africa, for example) and many species remain virtually unknown in world markets. The value of the species currently not internationally recognised has not been estimated. Third, most (97 per cent) of the land is customarily owned so that the government’s power to manage land use is very limited.

In 1991 the Forestry Act repealed the Private Dealings Act and customary landowners can no longer deal directly with logging companies. Additionally, a moratorium on the issue of new timber concessions is also in place. Officials in the Department of Environment and Conservation have welcomed the new Act and the moratorium, and believe that these actions will overcome many of the environmental impacts previously caused by inappropriate logging activities. However, as Callick (1993) observed, logging rates and export volumes in 1993 may be as much as three times the 1992 levels, and there are few indications that this green ‘goldrush’ can or will be stopped. That is, despite certain legislative efforts and requirements for environmental impact assessments in areas to be logged, the sector is poorly controlled and appears to be expanding rapidly. Asian companies are particularly active in primary forest harvesting in Papua New Guinea.

Fish and fisheries

The marine areas of Papua New Guinea are little exploited and there appears to be considerable potential for commercial deep sea and near-shore fisheries. Only 15 vessels are currently licensed to fish in the Gulf of Papua, with most of these being foreign owned. While there has been little effort to establish a sizeable local commercial
fisheries sector, tuna is seen as having promise for export. World Bank (1988) estimated that a sustainable harvest of skipjack tuna of 150,000 tonnes per annum was possible, with a projected value of 30–50 million kina. The skipjack tuna fishery, however, is frequently inactive due to low prices (Unisearch PNG 1991). After a 13-year struggle to replace the canning of imported mackerel (Unisearch PNG 1991), a cannery to process 30,000 tonnes of tuna each year is currently being constructed at Madang.

Exports of prawns and crayfish caught in the Gulf of Papua have been close to the estimated sustainable harvest of 1,200 to 1,500 tonnes per annum in recent years (Unisearch PNG 1991). However, stocks of marine resources are not well understood and so continual monitoring of harvests is essential.

Increased human populations in some coastal areas are also placing pressure on mangrove forests as they are cleared for settlement and urban development, industrial development, subsistence agriculture and commercial prawn farming. While the losses of such coastal resources are not yet severe by international standards, continued pressure is likely to be placed on them as development proceeds, per capita incomes rise and populations increase. Development activities in the coastal zone are also likely to impact on wetlands and beaches through pollution from sewerage and other wastes.

**Minerals and mining**

The principal source of economic growth in Papua New Guinea since the early 1970s has been from mining. In 1994, the value of Papua New Guinea’s domestic natural resources exports totalled 2,662 million kina (Table 3.2) of which 1,782.7 million kina (67 per cent) was mineral products (including oil). The 1991 GDP totalled 3,605.7 million kina of which 2,992.8 million kina was non-mining. Since 1991 there has not only been increased mineral export, but the Kutubu Oil Project which commenced exporting in June 1992 is now in full production with export receipts of 702.7 million kina in 1994.
Gold and copper

In 1994, Papua New Guinea ranked as the eighth largest gold-producing nation and the 12th largest copper exporter (Keith-Reid 1995). The key mining sites now are the Porgera, Mt Kare and Ok Tedi mines which are producing substantial volumes of gold (55.8 tonnes) and copper (207,000 tonnes) (Table 3.1).

Mineral exports will receive a further boost with the imminent opening of three medium-sized mines at Tolukuma, Wapolu and Ewatinona. But the major boost will come with anticipated production of gold from September 1997 from Lihir Island in New Ireland Province, which will be one of the world’s biggest gold mines. Gold production at Lihir is expected to peak at about 1.19 million ounces of gold a year, with a projected mine life of at least 30 years. The area of mineralisation has not been fully explored and there is little doubt that more than the currently assessed 42 million ounces exists.

Oil and natural gas

In addition to minerals, there are real hopes for additional oil strikes, and a projected pipeline for

Table 3.1 Principal mining activities in Papua New Guinea

<table>
<thead>
<tr>
<th>Mine</th>
<th>Mineral</th>
<th>Activity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bougainville</td>
<td>copper &amp; gold</td>
<td>expected to reopen</td>
<td>Bougainville Island</td>
</tr>
<tr>
<td>Ok Tedi</td>
<td>copper &amp; gold</td>
<td>operating</td>
<td>Fly River catchment</td>
</tr>
<tr>
<td>Misima</td>
<td>gold &amp; silver</td>
<td>operating</td>
<td>Misima Island</td>
</tr>
<tr>
<td>Porgera</td>
<td>gold</td>
<td>operating</td>
<td>Fly River catchment</td>
</tr>
<tr>
<td>Mt Kare</td>
<td>gold</td>
<td>closed</td>
<td></td>
</tr>
<tr>
<td>Lihir</td>
<td>gold</td>
<td>development commenced 1995</td>
<td>Lihir Island</td>
</tr>
<tr>
<td>Hide</td>
<td>natural gas</td>
<td>operating</td>
<td>Kikori River catchment</td>
</tr>
<tr>
<td>Kutubu</td>
<td>petroleum</td>
<td>operating</td>
<td>Kikori River catchment</td>
</tr>
<tr>
<td>South East</td>
<td>petroleum</td>
<td>prospective</td>
<td>n.a.</td>
</tr>
<tr>
<td>Gobe</td>
<td></td>
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</tr>
</tbody>
</table>

transporting liquefied natural gas from the Highlands. Papua New Guinea’s economic reliance on its mineral wealth will continue to grow as such new mines, and oil and gas ventures come on line.

**Mining and development** Mining is not 'population-driven' in the sense that higher population growth rates engender higher levels of mineral exploitation. There are, however, some indirect links between mining and population growth. First, a burgeoning population will create additional pressure for wage employment, and new industries will be required to absorb at least some of this labour. Second, the country’s economic performance, and consequently its ability to provide education, health and other services to the community, relies heavily on successful export industries. If per capita indexes of welfare are to keep pace with population growth, then pressure to expand extractive industries will continue to increase.

To this end the government of Papua New Guinea has embraced a strategy of exploiting its natural resources as a means of obtaining the necessary revenue to finance development. This approach is based on a World Bank recommendation that

> [t]he central development strategy for Papua New Guinea in the foreseeable future must be to use a very small number of enclave projects based on natural resources to generate the financial resources needed to carry out the Government’s development objectives (World Bank 1982, as quoted in Kreye 1991:16–17).

Consequently, the exploitation of minerals is undertaken mainly by foreign companies which bring in capital and technology. The government’s intent is to skim off a portion of the revenues raised to finance rural development.

"The main environmental issues in Papua New Guinea are associated with the disposal of tailings and soil erosion."
It is also expected that a number of desirable spillover effects, at a local level, would accompany mining. These include employment creation through spin-off business activities and sub-contracting opportunities, the extension of infrastructure which would also benefit other activities, the creation of a growing demand for locally-produced goods and services (Kreye 1991) and skills development.

At this point, the success of this mineral-based wealth developmental strategy is unclear. Two main issues arise: first, mining must inevitably be accompanied by environmental impacts; and second, there is a danger that the 'rents' from mineral exploitation will be dissipated through their use in recurrent budgets rather than being devoted to development. This has already happened in Papua New Guinea, as manifested by the financial crisis of 1994 and the depletion of the Mineral Revenues Stabilisation Fund.

Mining and the environment

The main environmental issues in Papua New Guinea are associated with the disposal of tailings and soil erosion. Chemical waste, mine run-off and sediment are all likely to enter river systems and impact on the riparian, deltaic and marine ecosystems as wastes move downstream. Such environmental impacts are of concern with the Ok Tedi, Porgera, Hides and Kutubu sites which are all located at the headwaters or in the catchments of major rivers which flow into the Gulf of Papua.

The problems of tailing disposal are more severe in areas of rugged terrain, high intensity rainfall and earthquakes (Trudiger and van Veldhuizen 1992). The steep slopes of mountainous areas are commonly unstable, particularly when cleared of forest vegetation. Trudiger and van Veldhuizen suggest that land disposal is the most feasible and acceptable means of tailing disposal in Papua New Guinea, although marine disposal may need to be considered in volcanic areas.

However, the Papua New Guinea Department of Environment and Conservation has claimed not to be overly concerned with the mining sector. The preparation of professional environmental impact statements, and the fact that any problems are relatively confined
and easily monitored are seen by the Department as advantages of enclave developments. Informal, small-scale mining in the vicinity of major goldmines can be far more environmentally damaging, and almost impossible to regulate and monitor effectively.

The impact of a growing population on mining may be a reduction in the area available for waste disposal. There may also be more land-use conflicts as people compete for cropping land. Alternatively, the impact of mining on a growing population will be felt through a decline in ecosystem productivity as a result of mine run-off and waste disposal. Mining waste which degrades the water supply, the riverine flora and fauna, and the mangrove forests downstream will result in reductions in food source productivity and supply.

### Economic directions

Minerals, agricultural commodities and forest products are the primary determinants of economic growth and development, employment opportunities and long-term structural adjustment in the economy of Papua New Guinea (Table 3.2). The contribution of minerals, including oil, is expected to increase sharply over the next two to three years. However, the economy continued to be severely affected by the shut-down of the Bougainville copper mine and suffers from substantial falls in the terms of trade for primary commodities.

GDP grew steadily over the period 1980 to 1988 from 1708 million kina to 3170 million kina respectively, but then growth tailed off and actually fell sightly in 1989. By 1991, GDP had recovered to 3605 million kina, with GDP projections for the period 1992–97 estimated to reach 6374 million kina. The GDP recovery has been mainly through the construction of several large resource extraction projects for gold, copper, petroleum and natural gas. Apart from this, there has been very little other investment, nor any discernible recovery in employment levels. Some concern has been expressed that while mining is underpinning economic growth, the ‘mining boom’ has been accompanied by stagnation in the rest of the economy (Callick, pers. comm.). Such a situation is not sustainable over time as it implies
that both non-renewable and renewable resources are being depleted, and that the government's policy of diverting mineral earnings to rural development is meeting with little success.

In terms of natural resource management, perhaps the greatest constraint to sustainable development remains the limited recognition by successive governments of environmental concerns in its development decisions, and an apparent limited capability to control the actions of the more rapacious developers adversely affecting environmental and social values. This is despite the extensive support given by successive Papua New Guinea governments for a wide range of environmental initiatives, including Papua New Guinea's

<table>
<thead>
<tr>
<th>Table 3.2</th>
<th>Papua New Guinea: major exports by volume and value, 1994</th>
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<tbody>
<tr>
<td></td>
<td>Volume (million kina)</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
</tr>
<tr>
<td>Gold (tonnes)</td>
<td>55.8</td>
</tr>
<tr>
<td>Copper ('000 tonnes)</td>
<td>207.2</td>
</tr>
<tr>
<td>Silver</td>
<td>n.a.</td>
</tr>
<tr>
<td>Crude oil (million barrels)</td>
<td>43.5</td>
</tr>
<tr>
<td>Agricultural ('000 tonnes)</td>
<td></td>
</tr>
<tr>
<td>Coffee</td>
<td>64.7</td>
</tr>
<tr>
<td>Cocoa</td>
<td>26.0</td>
</tr>
<tr>
<td>Copra</td>
<td>50.3</td>
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<tr>
<td>Coconut oil</td>
<td>32.4</td>
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<tr>
<td>Palm oil</td>
<td>230.8</td>
</tr>
<tr>
<td>Rubber</td>
<td>3.4</td>
</tr>
<tr>
<td>Tea</td>
<td>3.4</td>
</tr>
<tr>
<td>Other</td>
<td>21.4</td>
</tr>
<tr>
<td>Forestry</td>
<td></td>
</tr>
<tr>
<td>Logs ('000 m³)</td>
<td>2943.9</td>
</tr>
<tr>
<td>Other</td>
<td>11.3</td>
</tr>
<tr>
<td>Marine ('000 tonnes)</td>
<td>4.7</td>
</tr>
<tr>
<td>Total</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Sources: South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.
comprehensive environmental legislation, and its participation in the United Nations Conference on Environment and Development (the 1992 Earth Summit in Rio de Janeiro), its adoption of a major UNCED outcome, Agenda 21, and its active involvement in other regional and international environmental fora, such as the Global Conference on the Sustainable Development of Small Island Developing States held in Barbados, 1994.

Papua New Guinea's major development objectives are employment creation and increased economic activity, and agriculture is seen as the main vehicle for achieving those objectives.
Solomon Islands is second to Papua New Guinea in land area (28,369 square kilometres) with a population currently estimated at well over 325,000. Solomon Islands consists of six major islands, some 30 smaller islands, and about 962 islets and coralline atolls (Solomon Islands 1993). The island chain extends over approximately 1,600 kilometres, and has an exclusive economic zone of 1.34 million square kilometres. The islands range from large, rugged mountainous forests covered with primary rainforest, to small, bare sand and coralline atolls (Leary 1993).

Solomon Islands lies on the boundary of the Australian and Pacific tectonic plates with a number of active volcanos, and constant seismic activity, particularly earthquakes. Many of the tropical cyclones which affect the South Pacific region breed in Solomon Islands’ waters, and as a consequence the periodicity of major damaging cyclones within the country is low compared, for instance, with neighbouring Vanuatu. However, Solomon Islands has been the victim of some cyclones in the past which have caused major damage from wind, water and, in the case of Cyclone Namu in 1986, mud flows. The clean-up and rehabilitation costs may be substantial and cause a diversion of development funds away from other, planned activities.

Solomon Islands is well endowed with natural resources, perhaps second only in the region to Papua New Guinea. Forests and forest
resources have traditionally been important to Solomon Islanders. They provide food, medicine, timber, housing materials, fuel, fishing materials, and carving and weaving materials (Leary 1993). The forests have also been integral to the traditional shifting cultivation agricultural system. The extent and status of the forests has recently been investigated through a national forest resource inventory.

In a developmental context Solomon Islands is typified by some special attributes which serve to constrain development.

- A population growth rate of 3.5 per cent per annum (equating to a doubling of the population every 20 years), one of the highest rates in the world (Table 2.1). Taking some decline in both fertility and mortality into account, the population is predicted to increase from its present level of around 325,000 to at least 584,000 by 2011.

- The young age of the population, with more than 46 per cent being in the 0–14 age bracket, suggests that population growth will continue to be rapid. Wenzel (1989) referred to ‘population momentum’, with the number of women entering child-bearing age likely to keep population growth rates high.

- The population is scattered over a number of islands with few roads and generally poorly developed transport and communications infrastructure. Population pressures are greatest on the island of Malaita and in the capital Honiara and surrounding areas of Guadalcanal, but are also important on some small islands such as Santa Ana in Makira Province.

- More than 85 per cent of the population lives in rural areas and there is a high level of dependence on subsistence agriculture.

- Rural–urban migration, principally to Honiara, has been rapid, while international migration has been negligible. Migration from North Malaita to Honiara has been particularly prevalent.

- There is a relatively narrow base of economic activity with less than 20 per cent of the population between the ages of 15 and 54 being employed in the monetised sector, indicating
the high level of dependence on subsistence activities (PDP Australia 1991).

- Solomon Islands has the lowest level of indicated per capita income and wealth in Melanesia with a GNP of US$430 per capita (Table 2.1).

- There is a view amongst some government officials, and particularly amongst non-government organisations, that the development focus and investment have been too centralised and that significantly greater efforts are required to shift the focus to rural development and employment in the rural areas.

The environmental issues identified as being important in Solomon Islands include the status of forests and the terrestrial flora and fauna found in forest areas, population growth, the need for institutional strengthening, a lack of environmental information, degradation and over-harvesting of coastal and marine resources, pollution and waste disposal especially in the urban and industrial setting, peri-urban issues and land degradation.

Food and agriculture

Solomon Islands is predominantly an agrarian society in which both subsistence agriculture and cash cropping are important land uses. Subsistence agriculture accounts for around 17 per cent of the nation's GNP while an estimated 40 per cent of garden food growers sell some of their produce for cash (Thistlethwaite and Votaw 1992).

Root crops such as sweet potato, taro and yams, together with some native leaf vegetables, fruits and nuts are important in the diet. When such crops yield a surplus to household and customary needs, they are sold or bartered on local markets. The coconut is important both for food and drink, while the shells, fronds and timber have an enormous range of utilitarian uses. Agricultural cash crops include copra, betel nut, gnali nut, pineapples, pigs, poultry and cattle.
The focus of agricultural development has been on export crops, particularly coconuts, cocoa and oil palm. Coconuts and cocoa have been produced in both the plantation and smallholder sectors, while oil palm has been developed as a commercial plantation crop on the Guadalcanal Plain. A recent initiative (Smallholder Development Programme) has aimed at both intensification and diversification of smallholder agriculture, but the focus continues to be coconuts and cocoa, with some diversification into other commercial crops such as Nepalese chillies.

**Land use and population**

Solomon Islands is sometimes said to be typified by 'subsistence affluence': the village-household sector is self-sufficient and there is plenty of food for everyone. However, population pressure is affecting this level of self-sufficiency. This is partly a consequence of village food production systems and technology remaining largely unchanged despite the need to feed growing populations. For example, multi-canopy intercropping has not been adopted and practiced to any significant degree in Solomon Islands although such agricultural and agroforestry systems are common elsewhere, for example, in some areas of Papua New Guinea. As a result, there has been a steady demand for additional land on which to grow crops. Satellite imagery provides evidence that the area under shifting cultivation has doubled over the last 20 years, matching the increase in population (Thistlethwaite and Votaw 1992). Food production has expanded in area, rather than intensified.

**Land scarcity**

There is also considerable evidence that fallow periods are shortening in some regions as population densities increase and suitable agricultural land becomes scarcer. In some areas of Solomon Islands, the cropping cycles have traditionally allowed more than 25 years of fallow, but these...
cycles now have a fallow period of only four years. This change has been accompanied by reduced crop yields and increased rates of soil erosion (Eyles, cited in Wenzel 1989).

Also due to the increased scarcity of land in areas of high population density, food cropping has moved on to less suitable land, particularly steep and forested areas which are both difficult to farm and extremely susceptible to erosion. For example, in the Honiara hinterland, gardening is now being attempted on highly degraded, steep, grassland areas, while an area formerly set aside as a national park has been lost to gardening activity. Only about 12 per cent of Solomon Islands' land area is judged suitable for cultivation, and effective population densities are much higher than the overall figure of 11 per square kilometre reported by the World Bank.

A telling comment in relation to land scarcity resulting from population growth, is from the Food and Agriculture Organisation (cited in Thistlethwaite and Votaw 1992) that ‘food production in Solomon Islands has slipped about 10 per cent below levels achieved a decade ago, back to levels of 20 years ago and significantly below the average for comparable lower-middle income countries in Asia’ (in Thistlethwaite and Votaw 1992:77). These are clear danger signals related to population growth in Solomon Islands.

Efficient and sustainable food production

There is a clear need to place greater emphasis on intensification subsistence cropping in Solomon Islands, perhaps inter-cropped with cash crops, in order to foster more efficient food production systems from existing land without needing to garden marginal agricultural lands, with its attendant environmental risks. Such intensification would be firmly based on sustainable development principles, and pay careful attention to social values, and particularly the health and nutrition of village communities. The role of women in subsistence production is especially significant although only dimly recognised. The Women’s Extension Programme being developed by the Ministry of Agriculture and Lands is a major initiative through which the government can provide appropriate gender-based assistance at the village level.
Forests and forestry

Probably every economic report prepared on Solomon Islands in the past decade has highlighted problems related to commercial forestry, and the National Environmental Management Strategy has identified commercial logging by both multi-national and local companies as the main environmental issue facing Solomon Islands.

Solomon Islands has a natural forest area of around 2.4 million hectares—between 80 and 85 per cent of the total land area. However, less than 20 per cent is thought to be commercially exploitable, the remainder being on very steep or inaccessible areas, or scattered over small islands. The AusAID-funded national forest inventory estimated 13.3 million cubic metres of commercial standing timber.

Commercial logging

The recorded cut in 1991 was 292,000 cubic metres, more than doubling by 1993 to 686,000 cubic metres. About 590,000 cubic metres of the 1993 cut was exported as logs. At the 1993 rate, the remnant primary rainforest would be cut over in about 20 years. Much of this cut-over forest would regenerate and this secondary forest would be harvestable for medium-sized sawlog in about 40 years. Pulpwood thinnings could be cut after about 20 years. The secondary forest would have only a fraction of the timber volume of the primary rainforest and hence it would be possible to sustain the current level of cut only if a plantation reforestation is instituted simultaneously. (Plantations yield many times the volume of the natural forest.)

Around 8,000 hectares per year are logged intensively—almost entirely on customary land. At the same time, about 1,000 to 1,300 hectares of plantation is established each year—mostly on the small area of available government land. In order to place commercial forestry on a sustainable basis, it is estimated that Solomon Islands needs 65,000 hectares of plantations. Only about 25,000 hectares have been established to date (Davis and Abbott 1989).

The discussion on forest utilisation does not include areas of forest cleared for subsistence and cash cropping, nor those cleared for agricultural plantations. No data are available on this aspect of forest...
removal but it appears to be growing in significance as the population expands. The Environment Division has expressed particular concern for land cleared for subsistence agriculture, particularly where this extends on to less suitable areas, such as steep slopes.

**Current rates unsustainable** Commercial forestry, at present rates of harvest, is clearly not sustainable in Solomon Islands, with most estimates indicating that exploitable forest resources will be exhausted some time early next century, if not before (World Bank 1991; Davis and Abbott 1989; Leary 1993). Pressure for continued natural forest exploitation has come from a variety of sources, including the following.

- International logging companies wishing to harvest large volumes to gain economies of size and shipping efficiency, and the ability of these companies to negotiate logging concessions with customary landowners.

- The need for foreign exchange, with the timber industry being the largest source of foreign exchange in 1990.

- The payment of duties, taxes and royalties to the government, with these contributing between 4 and 8 per cent of total government revenue since 1985 (PDP Australia 1991).

- The payment of royalties to customary landowners who are, therefore, encouraged to allow logging concessions on their land.

**Government response** The government has responded to concerns expressed about the forestry industry, particularly since the publication of the Forestry Policy Statement in August 1989 (Solomon Islands Government 1989), including

- the strengthening of the Forestry Division with a Timber Control Unit (through an AusAID-funded Timber Control Unit Project—now defunct)

- the recently completed National Forest Resource Inventory (SOLFRIS, financed by AusAID)

- continued efforts to foster commercial reforestation on customary land (an initial pilot project on Malaita and its
more broadly focused sequel were funded by New Zealand ODA)

- and the major reforestation program on government land on Kolombangara Island (implemented by the Kolombangara Forest Products Limited (KFPL) Project).

Unfortunately, despite the often-voiced concern for the forests, their protection against over-exploitation, and the need for a reduced, more sustainable level of annual cut, pressure on forests in Solomon Islands has intensified rather than diminished. Until the late 1980s, despite the issue of logging licences which would permit the annual removal of almost one million cubic metres of timber, less than 300,000 cubic metres was harvested in most years, principally because logging operations were relatively inefficient. Since then, new companies, mainly from Malaysia, have brought to the industry a new level of efficiency, resulting in about 600,000 cubic metres being harvested in recent years (Tony Fearnside, pers. comm. 1994).

Monitoring

Concern by the Forestry Division about its capability to monitor log production, logging practices, adherence to license provisions and royalty payments, led to the implementation in 1991 of a Timber Control Unit Project. The major objectives of the project are as follows.

First, expand the government’s ability to monitor logging operations throughout the country to ensure that

- environmental damage by logging is minimised
- wastage is minimised
- timber rights agreements are adhered to
- information on utilisation of the resource is accurate and up-to-date
- information on production and revenue, and the invoicing on manifests are all correct.

Second, train and support customary landowners to ensure that

- logging contracts are negotiated on a more informed basis
• they are more aware of the environmental dangers of logging
• that they are able to monitor logging on their land.

Reforestation Other issues of importance to forestry in Solomon Islands include the shortfall between logging (approximately 8,000 hectares per year) and replanting (1,000 to 1,300 hectares per year). Apart from the Kolombangara project, reforestation activity has to be carried out on customary land. A New Zealand-funded reforestation pilot project on customary land was implemented on Malaita and subsequently attempts were made to extend the initiative to Guadalcanal, Makira and Western Province. Some customary land was previously replanted by the Forestry Division in Santa Cruz. However the funds allocated to reforestation are a fraction of that needed to balance the rate of forest exploitation.

Ostensibly, foreign logging companies can make deals to harvest an area directly with the customary owners. The government has a number of avenues of control, especially where the logs or timber are to be exported. Unless the proceeds of logging have been invested in ways that create viable alternative livelihoods, the potential downturn in export income as the exploitable forest nears exhaustion will lower per capita income and wealth, reduce government income and, consequently, make it more difficult for government to maintain a range of services. Hopefully, the Kolombangara project will ease in a new dependence on reforested areas and reduce the impact of the downturn in natural forest yields.

Population growth may also make it more difficult in many areas to reforest customary land which, following logging, has been converted to agricultural use. The reverse side of this is that logging roads provide access to new agricultural areas which may be developed for subsistence and cash cropping. However, PDP Australia (1991) comment on the conflicts between logging and agricultural land use, including the need for effective watershed management. Survey data from the National Forest Resource Inventory Project indicated that land use and customary ownership conflicts are likely to increase after logging has been completed (PDP Australia 1991). This has led, in turn, to increased water pollution and soil damage, particularly in lowland areas. PDP Australia concluded that the potential benefits
of opening up new land for cropping have been offset by ‘environmental damage which has reduced the capacity of clan households to derive agricultural and livelihood benefits from logged and adjacent areas’ (PDP Australia 1991:32). Such damage is even more likely with further pressure for commercial exploitation to fund government services (and landowner groups), with a danger of accelerated environmental degradation in logged over areas.

Alternatives to logging

Another option to logging and to the investment of its proceeds in alternative livelihoods is the identification of viable alternative uses of existing forest resources which can provide a sustainable stream of benefits. This is an area of increasing interest to custom landowners who are concerned for the loss of traditional forest values which result from intensive logging activity. They need the cash which logging can generate but do not want its environmental and cultural consequences. Consequently there is a keen search for alternative cash-generating activities which do not have the same level of impact on the forest. Commercial eco-tourism ventures are one form of cash activity which holds strong appeal for some custom owners.

Non-timber forest resources

Considerable concern has been raised in Solomon Islands about the future of non-timber forest resources. Villagers use a wide range of native plants for food, as well as for building materials, medicines, animal fodder, traditional craft materials and tools (Leary 1993). Many of these uses have been documented in the National Forest Resources Inventory. Where logging is deemed the most viable cash option, there remains a concern that it be undertaken in a manner which is sensitive to the preservation of these other non-timber values.

Fish and fisheries

Commercial deepwater fishing in the Solomon Islands’ exclusive economic zone is a major source of foreign exchange for the nation. Fishing of this kind is undertaken using fleets mainly of national boats, rather than allowing foreign vessels to harvest the deepwater
resources. The Fisheries Division of the Ministry of Natural Resources has implemented and run an ongoing monitoring program on the overall catch size, species composition and size of fish in each species. This program is designed to show up any changes in these indicators, highlighting any diminution in fish stocks. Currently, it appears that the commercial fish catch of the industrial fishery in Solomon Islands is sustainable.

**Commercial fisheries**

The predominant commercial fishery is skipjack and yellowfin tuna for both canning and export as frozen fish. Solomon Islands now has the largest domestic tuna fishing fleet of the Pacific island countries. In 1992 close to 12,000 tonnes of tuna was canned at Solomon Taiyo Limited’s Noro cannery. The cannery has a capacity of more than double this amount, but canning has been constrained by a lack of accommodation for cannery workers at Noro. Most of the remaining fish goes to Japan as frozen fish, although small quantities are also sold through local markets, mainly in Honiara and Gizo.

The commercial tuna fishery of Solomon Islands relies on baitfish caught in lagoon and other near-shore areas. This resource has also been monitored, with Tiroba et al. (1989) reporting that baitfishing has not affected subsistence fisheries because the species harvested for baitfish are not favoured by village fishermen, nor are they a significant food resource for those species which are favoured by these fishermen.

**Subsistence fishing**

In addition to the importance of commercial fisheries, subsistence fishing is also important, with many village households engaging part-time in fishing mainly for their own consumption, but with an estimated 15 per cent of the catch being sold for cash (Thistlethwaite and Votaw 1992). Crabs and trochus are an important part of the catch.

Reef fish are also very important to both subsistence and village commercial activities. The total production of this fishery is not known precisely as most is consumed for subsistence purposes, although the annual subsistence harvest of all species is estimated to be of the order of 10,000 tonnes. Around 70 tonnes of reef fish is reported to be sold in the local fresh fish market each year. In addition, a European
Union funded artisanal fisheries project, based mainly on deepwater bottom fish (which are not currently used for subsistence), is expected to yield a total catch of up to 500 tonnes per year. There is general agreement that reef fish stocks are healthy and that there is potential for expanded harvest of this resource.

**Impact of population growth**

The adverse impacts of population growth on fisheries and marine resources are being felt most in near-shore areas. The National Report for Solomon Islands to UNCED lists, among the matters requiring urgent attention, the depletion of marine resources such as shells, giant clams, turtles, bèche-de-mer and crocodiles—all products of importance to artisanal and/or subsistence fisheries (Leary 1993). The pollution of lagoons (principally from sediment washed into the lagoons from logging and agricultural activity) and the cutting of mangroves are also listed as high priority issues. While such issues are recognised by the government, the budgetary allocation does not indicate any degree of urgency.

As the population continues to expand, marine resources will come under greater pressure, and as local resources disappear, such concerns will then take on an impelling urgency; but the fear is that by the time appropriate recognition is accorded the problems, many areas near the main population centres will be degraded beyond the point of recovery. Needs once met through direct subsistence activity will then be satisfied only through commercial activities further afield and at a significant cost, both in social and cash income terms.

**Minerals and mining**

Solomon Islands is the least prospected part of Melanesia and mining is currently of little significance, although several gold deposits and some nickel deposits are known.

Gold has been mined in small quantities at Gold Ridge on Guadalcanal for many years, but it is only now after many false starts that development of the mine is proceeding, with an expectation that
the mine will be in production by late 1997. However, compared to mines in Papua New Guinea, the level of gold mineralisation at Gold Ridge is not high. Low grade nickel deposits also occur on Santa Isabel and San Jorge, but the prospect has not been sufficiently attractive to secure investment for development of a nickel mining venture.

A number of prospective areas are known, but there is little further prospecting activity. In recent years there has been a marked decline in prospecting interest due to uncertainty about access to customary land, related concerns about the Bougainville situation in nearby Papua New Guinea (Central Bank of Solomon Islands 1991) and investment security. PDP Australia (1991) express pessimism about mining development in Solomon Islands for these reasons.

An aeromagnetic survey of the country would no doubt reactivate interest in mineral prospecting, as has been the case in neighbouring Vanuatu, and, where highly prospective mineralisation is discovered, the experience in Papua New Guinea and Fiji suggests that concerns about access and investment security will be quickly addressed and mining investment will follow. At that point Solomon Islands will need to address environmental protection issues with greater vigour if it is to avoid or mitigate some of the environmental problems which have arisen with mining elsewhere in the region.

**Economic directions**

The people and the economy of Solomon Islands both rely heavily on natural resources. Most of the population are rural and rely on subsistence agriculture. Agriculture is also the main source of cash income for smallholder farmers.

The major cash crops in Solomon Islands, in descending order of importance, are oil palm, coconuts and cocoa (Table 4.1). Oil palm is produced only by the plantation sector, while coconuts and cocoa are grown by both smallholders and the plantation sector. Copra production halved over the period 1989–94, while in the same period palm oil production almost trebled, and cocoa production nearly
doubled. Copra is still an important smallholder and plantation crop but its percentage contribution to exports has markedly declined. The total area of productive coconuts is estimated at 60,000 hectares, with production at around 26,000 tonnes per year.

Over the 1988–92 period, log exports exceeded a quarter-million cubic metres annually, with 392,000, 543,000 and 659,000 cubic metres.

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<thead>
<tr>
<th>Table 4.1 Solomon Islands: exports by volume and value, 1989–94</th>
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<tr>
<td>Volume</td>
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<tr>
<td>Minerals</td>
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<tr>
<td>Gold (kg)</td>
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<tr>
<td>Agricultural (‘000 tonnes)</td>
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<tr>
<td>Cocoa</td>
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<tr>
<td>Copra</td>
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<td>Palm oil</td>
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<td>Forestry:</td>
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<td>Logs (‘000 m³)</td>
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<tr>
<td>Sawn (‘000 m³)</td>
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<tr>
<td>Marine—Fish (‘000 tonnes)</td>
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<tr>
<td>Frozen and smoked</td>
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<tr>
<td>Canned</td>
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<tr>
<td>Total value (US$ million)</td>
</tr>
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Per cent value of exports

| Minerals                                                      |
| Gold                                                         | 0.7  | 0.7  | 0.6  | 0.4  | 0.23 | 0.1 |
| Agricultural                                                 |
| Cocoa                                                        | 4.8  | 6.4  | 6.1  | 4.5  | 4.1  | 2.1 |
| Copra                                                        | 12.7 | 6.3  | 4.7  | 7.6  | 4.5  | 4.0 |
| Coconut oil                                                  | -    | 1.5  | 0.8  | 1.3  | 1.1  | 0.4 |
| Palm Oil                                                     | 11.0 | 10.4 | 7.4  | 10.7 | 8.8  | 8.1 |
| Forestry                                                     |
| Logs                                                          | 23.5 | 32.8 | 22.4 | 34.6 | 54.4 | 58.4|
| Sawn timber                                                  | 1.5  | 2.5  | 1.9  | 2.1  | 2.5  | 2.1 |
| Marine—Fish (‘000 tonnes)                                    |
| Frozen and smoked                                            | 34.0 | 20.2 | 31.6 | 17.1 | 8.5  | 8.4 |
| Canned                                                       | 5.5  | 10.7 | 16.3 | 12.3 | 11.8 | 13.2|
| Other                                                        | 6.2  | 5.5  | 8.4  | 9.5  | 3.2  | 2.0 |

Note: Values have been rounded to the nearest decimal point.
Source: South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.
exported in 1990, 1992 and 1994 respectively—a 68 per cent increase over the period 1990–94. The reported value to Solomon Islands of these log exports in 1994 was US$8.4 million. Sawn timber production trebled over the same period with a 148 per cent increase in the volume exported, one apparent outcome of pressure for increased local processing and value-adding. While the export forestry output has escalated, fish production has remained fairly static, with a notable increase in the export volume of canned fish. The Solomon Islands local market also consumes large volumes of canned fish, bolstered by special levies on imported product.

GDP was estimated to be US$245 million in 1993 at current market prices, up from US$170.5 million in 1988 (Asian Development Bank 1994). In GDP terms these products, along with subsistence food production, account for more than 47 per cent of economic activity in Solomon Islands. The service sector accounts for around a further 46 per cent of GDP, with construction and manufacturing the remaining 7 per cent (World Bank 1991). Imports of goods and services well exceeded exports, and also exceeded expenditure on GDP. The direction of exports was principally towards Japan and Korea, while imports were sourced mainly from the United States, Australia, Japan and Singapore.

In summary, there is a very high level of reliance on the living natural resource base in Solomon Islands. With a rapidly expanding population, and few impending developments in other industries/sectors, this reliance will grow significantly in the period to 2010 and beyond. There is a possibility of an increased contribution to the economy from minerals due to the country’s location on the Pacific volcanic ‘fire rim’, but only if the current exploration drive proves successful. Past exploration efforts have been disappointing.

Solomon Islands has no alternative but to use its renewable resources sustainably to provide future income. Simultaneously, it should promote exploration for non-renewable mineral and oil resources to use as a springboard to greater national prosperity and improved standard of living, while investing some of the proceeds back into its renewable resource capital, helping to secure improved prosperity.
Vanuatu comprises some 80 islands with a total land area of 12,270 square kilometres (Bellamy 1993), with an exclusive economic zone of 710,000 square kilometres. The archipelago stretches over 1,300 kilometres between 13.5° and 22° South latitude in the southwest Pacific. Its immediate neighbours are Solomon Islands to the north west, New Caledonia to the south west and Fiji to the east. The eight largest islands make up 87 per cent of the total land area, with Espiritu Santo and Malakula the two largest with an area of 4,248 square kilometres and 2,053 square kilometres, respectively (Weightman 1989). Most islands are mountainous and rugged due to their volcanic origin but there are a number of low-lying islands, particularly in the Maskelyn group. Many of the smallest islands are little more than uninhabited rocky outcrops.

The islands are subject to periodic natural catastrophic events, particularly from cyclones which breed in Solomon Islands waters and strike Vanuatu with often devastating intensity. Vanuatu exists because of volcanic activity at the interface of two tectonic plates, a process which is continuing. There are a number of active volcanos on Ambrym, Gaua and Tanna. Occasionally they erupt with ash deposits causing crop damage; however, it is also the widespread deposition of this material that is responsible for the high fertility and periodic rejuvenation of the very young soils of those areas of Vanuatu (Weightman 1989).
Most of the islands of Vanuatu have fringing live coral reefs. In the past as a result of tectonic activity older reefs have been uplifted above current sea level, resulting in a distinct environment of a coastal band of coral terraces. Although these terraces occupy only 5 per cent of the area of Vanuatu, they support 26 per cent of its population (Vanuatu Resource Information System 1992).

As a result of volcanism and tectonic activity, soils are derived either from volcanic rock or from coralline limestone. The volcanic soils are generally fertile except on the plains and volcanic footslopes formed of redistributed pyroclastic parent material of very young age where the soils are deep, coarse textured, of low fertility and droughty. The older volcanics of Tanna, Aneityum and particularly Erromango are highly susceptible to erosion, particularly when the protective, organic-rich topsoil has been removed, and are strongly dissected.

The climate of Vanuatu ranges from tropical in the north to subtropical in the south. Mean temperatures range from 21°-27°C with 75 to 80 per cent humidity. The rainy season is generally between November and April, during which time cyclones are most commonly experienced. Damage to food gardens, tree crops and forest, and the destruction of buildings and infrastructure, is generally localised as cyclones affect only one or two islands in passing.

Although the people of Vanuatu have lived a relatively sustainable way of life for some thousands of years, this was at a comparatively low level of well-being which is no longer considered adequate. The country aspires to greater material benefits, the labour-saving advantages of modern technologies, and social services which will make life safer, healthier and more enjoyable. This requires increased cash incomes and foreign exchange and changes in lifestyle. But, if that development in pursuit of ‘health, wealth and happiness’ is not tuned carefully to the need for environmental protection, then that development may well be fleeting, incapable of being sustained in the longer term.

The Government of Vanuatu is well aware of the need to balance the drive for economic improvement with protection of the environment. And there is a very strong sentiment that the cultures and traditions ...
of the people must not be undermined in the push for development. Fundamental to these cultures are traditional resource-use systems developed over thousands of years, and conserving natural resources of land and sea.

This society is diverse, with over 115 indigenous languages, and many cultures and agricultural systems. Bislama (Vanuatu pidgin) is the declared national language, but English and French are the principal languages of education and trade. Most ni-Vanuatu speak three languages, and often four or more.

**Population** Vanuatu has a total population of 142,944 (1989 Census) with more than 90 per cent being indigenous ni-Vanuatu, and of which over 80 per cent live traditional village lives. The rate of ni-Vanuatu population growth is estimated to average 2.5 per cent per year and is expected to remain high for some time due to the young age structure (Table 2.1; Arif 1993). The proportion of non-indigenous people has declined from 6 per cent in 1979 to 2 per cent in 1989.

The overall population density is 14 persons per square kilometre (Table 2.1) with a rural density of 9.5 persons per square kilometre. This distribution varies greatly from island to island, with the highest regional density in the Shepherd Islands (46 persons per square kilometre) and the lowest in Espiritu Santo/Malo (4 persons per square kilometre) (Vanuatu Resource Information System 1992).

Vanuatu society is structured into two exogamous clans and tribes forming two types of social organisation (matrilineal and patrilineal) which affect land ownership, land use, and migration patterns. As a result of this exogamous marriage pattern, population mobility has always been part of the social structure. However, 'mobility was highly seasonal and of a short-term and circular nature' (Haberkorn 1989). Today there is also an increasing rate of urban migration (currently 1.4 per cent per year) (Arif 1993), but some also believe that these urban migrants will be short-term or cyclic residents, later returning to their villages while others take their place.

Haberkorn (1989) questions this and also questions whether natural population growth is the main reason for the urban growth rate. He
found that the shift of both men and women away from their origins is self-perpetuating, as the inability of a village in decline to produce sufficient food instigates further migration in search of cash-based employment.

There is a system of organised community work groups (Kamparis) and in Haberkorn’s study they were often cited as the reason for out-migration because they are considered to occupy too much time, leaving none for earning money and taking care of private affairs. The reduced village labour force means an increased work load for those who remain, and a steady emigration continues.

An impetus for urban migration comes from the need to purchase food to supplement the diet, a desire to buy convenience canned or packaged food, the need for money to pay for schooling, and the trend to cash payments in marital negotiations. With these imperatives for increased cash income, and the lure of the urban centres as source of that cash, it is unrealistic to assume that people will return to rural life after a taste of urban living.

Environment and population growth

The environmental concerns arising from the growing population, the urban shift and industrial development rest primarily on the intensity of resource use in both urban and rural settings. If the rapid urban expansion continues, an equally rapid expansion in economic activities will be needed to avoid the development of urban slums. Under the current development model, this means expansion of the commercial exploitation of resources. Given the meagre resource base of Vanuatu, compared to its Melanesian neighbours, the ability to sustain resource-based development which produces full employment will be uppermost in policymakers’ minds.

Carew-Reid (1989) considered Vanuatu has the potential for self-sufficiency as it ‘possesses extensive agricultural, forestry and fisheries resources, and a strong subsistence sector with good potential for increased tourism’ (Carew-Reid 1989:8). This is an overstatement with regard to forestry and fisheries, and the target of self-sufficiency itself is questionable. There is scope for Vanuatu to achieve significant
economic growth through natural resource development and tourism. The challenge will be to continue development without depleting or destroying the resources which constitute the basis for that development.

Food and agriculture

As with the other Melanesian countries, there is a dual economic system of subsistence and market activities, with some overlap. The main agricultural activities include cattle grazing, copra, cocoa and coffee plantations, kava production, and vegetable gardens. There is also some pig and poultry production for subsistence and commercial purposes, and ceremonial purposes in the case of pigs.

The traditional bush fallow agricultural system entails clearing the primary forest—or secondary regrowth if the area has previously been gardened and set to fallow—burning the dried vegetation, and planting into the ashbed. The garden is then tended from one to three years depending on the crops being grown to keep them free of vegetative competition, particularly from woody weeds and scrambling vines. The garden is then set to fallow for a number of years. In general, cleared primary forest will be replaced by advanced secondary regrowth if a sufficiently long fallow period is permitted. With increasing population pressures and shortening fallow periods, or where there is a history of repeated cyclonic disturbance, thickets or infestations of woody weeds and vines will ultimately result.

As the majority of ni-Vanuatu continue to live a traditional lifestyle, agricultural activity is predominantly small scale. Throughout Vanuatu a mixed farming system operates based on the growth of permanent cash crops such as coconuts, together with multi-crop annual food gardens for subsistence.

The proportion of cash crops to food crops (and hence the size and distribution of agricultural plots) varies greatly between families and islands depending on land availability, altitude and the adherence to traditional cropping systems. According to Weightman (1989) the level
of cash cropping in west Ambae has expanded beyond the production capacity of food gardens to provide subsistence supplies. In contrast, food production on Tanna is regularly in surplus of local needs.

**Ratio of land to people**

Each of the islands in Vanuatu has a different arable ratio of land to people, and this ratio changes with the different rates of population growth and emigration. For example, the densely populated island of Paama has the highest level of emigration in Vanuatu. The limited available land is used almost totally for food production. Conversely, the larger island of Pentecost, which has a lower population density, is able to support a high level of commercial activity. According to Haberkorn (1989), 91 per cent of the population of Pentecost is involved in both subsistence and commercial agriculture.

**Coconut plantations**

Coconut plantations have been a part of village crops since their introduction by Europeans over a century ago. Many of the palms are now senile with low productivity and, with declining market prices for copra, are being converted to cattle grazing, rather than being replanted with more productive coconut varieties. For many small land holders, for whom the planting of young palms over increasing areas was once possible, the pressures of population growth and alternative development have virtually cut off this replanting option, irrespective of the market price for copra. The Foundation for the Peoples of the South Pacific in Vanuatu is encouraging the development of village-based milling of coconut trees for timber, thereby providing smallholders with a cash incentive to mill senile trees and replant. However, replanting does not generally occur, perhaps due to land use claims by absent clan members.

**Cattle industry**

The cattle industry is seen as having great domestic and export potential—Vanuatu is renowned in the Pacific for the quality of its beef—and supports two

"Fluctuations in economic growth have been closely correlated to agricultural performance."
abattoirs and a meat canning works. People are encouraged to buy beef instead of imported tinned fish. According to the Department of Agriculture, the many ni-Vanuatu graziers tend to be smallholders, with rough pasture and produce low grade ‘hamburger’ beef. The Department’s aim, therefore, is to promote economically viable pasture improvement measures, and to improve cattle husbandry skills of the existing smallholders rather than encourage more smallholders into the industry.

Without proper pasture maintenance, areas cleared to graze cattle are succumbing to land degradation from infestation by woody weeds and thickets after about seven years’ use. In the past graziers, like traditional farmers, have overcome this decline in productivity by clearing more primary forest. The Departments of Agriculture and Forestry are together working to establish cost-effective ways for handling the weed and thicket encroachment problem so that clearing of primary forest is the less economical way to retain productivity levels.

In the longer term, the expansion of cattle industry depends on Vanuatu increasing its meat exports, particularly to the Pacific region, having in the late 1980s lost its previous favoured entry to French markets. It is likely that this beef will be produced by a smaller number of large grazing properties rather than by smallholders who have limited capital for stock purchase, restricted land availability, and generally inadequate management and husbandry skills.

Any environmental implications will be allied with the maintenance of pasture and grazing intensity in the quest for export earnings, and not directly associated with population growth.

**Forests and forestry**

Commercial exploitation of the native forests of Vanuatu began in the early to mid-19th century with the cutting of sandalwood, a resource which was rapidly depleted. Sawlog operations concentrated mainly on Kauri (*Agathis macrophylla*), with only small remnant stands
surviving, primarily on Erromango and north-west Espiritu Santo. Current logging focuses on Milktree (Antiaris toxicara), Whitewood (Endospermum medullosum), Myristica fatua and Calophyllum spp, with small volumes of valuable cabinet-wood species also cut including Rosewood (Pterocarpus indicus), Merbau (Intsia bijuga) and Black Bean (Castanospermum australe).

The tropical forest of Vanuatu is different to that in neighbouring countries. It is significantly less diverse and is damaged much more by the frequent cyclones. In addition, there seems to be a greater threat to natural forest regeneration from scrambling and climbing vines when the forest overstory is heavily disturbed.

Of the total Vanuatu land area of about 12,270 square kilometre of land, only 35 per cent is now forested, but only 17 per cent is mid-height forest (20–30 metres) (there is no tall forest in Vanuatu, that is, greater than 30 metres) and of that 6 per cent grows on slopes greater than 30 degrees, where logging is not permitted. Incoll (1994) considered that only 20 per cent of the total forest volume of 9.35 million cubic metres is considered merchantable. This reduction is due to such factors as steepness, dissection and access, small areas considered uneconomic to harvest, areas with an uneconomic yield of less than 10 to 15 cubic metres per hectare, stream protection strips and non-harvestable fruit and nut trees.

Baldwin et al. (1993), in their final report on the Forest Resource Inventory Project, estimated a maximum allowable cut for species considered merchantable in the Pacific of 22,800 cubic metres per year as a contribution to the achievement of sustainable timber yield. This estimate assumed a 50-year return period (cutting cycle or rotation) among other limiting parameters. This forest timber output would feed only one medium-sized sawmill.

Revising Baldwin’s sustainable yield estimate, Incoll (1994) estimated a sustainable forest yield of 52,000 cubic metres per year. In production terms, this is only a minor adjustment, and confirms Baldwin’s estimate that the forests of Vanuatu have an extremely limited capacity to support a forest industry. No doubt, these estimates could be further
revised and it is well to remember that the adoption of specific parameters is always subject to criticism (Tacconi 1995).

In early 1994, the maximum allowable cut for approved timber licences was in excess of 150,000 cubic metres per year. This has since been cut back by the government through licence cancellations, but still remains well in excess of the estimated sustainable yield level. However, it should be stressed that these are maximum allowable cuts—the actual volume cut is much less because many licences are inoperative, and others only partly so. The total volume harvested in 1994 was 43,874 cubic metres (Department of Forests). This compares with an average annual harvest of 26,865 cubic metres over the period 1983–90, ranging from a low of 11,927 cubic metres in 1983 to a high of 39,277 cubic metres in 1987 (Bule 1991'). The contribution to GDP is in the order of 1 per cent.

**Thickets and plantations** About 40 per cent of the land is covered by thickets and shrub lands of species such as *burao* (*Hibiscus tiliaceus*), shrub lands and grassland. Because they are not, by definition, forest, the thickets were excluded from the forest resource inventory. Nevertheless, these thickets and young secondary regrowth on garden areas, not the primary forest (*dabbus*), supply much of the roundwood used in village house construction and firewood.

In addition to the indigenous forests, plantations of exotic, fast-growing and cyclone-resistant species have been established since the early 1970s. By 1991, 1,166 hectares of industrial plantations of *Cordia alliodora* (320 hectares) and *Pinus caribaea* (846 hectares) had been established on the islands of Aneityum and Erromango. An area of about 5,500 hectares of plantation was planned for Santo and was planted (mainly the indigenous whitewood). Customary land use problems have arisen which may jeopardise that venture. The Department of Forests recently called for public tenders for plantation establishment by private industry, and the mechanisms being explored offer promise that land-leasing concerns, in particular, will be overcome. In addition to these commercial plantations, about 946 hectares of extension plantings (Local Supply Plantations) had been established at some 23 sites ranging in area from 5 to 130 hectares.
However, a number of these plantings have been poorly maintained and offer little resource value.

**Timber imports**

Vanuatu imports significant volumes of timber products. Exactly what volume is unknown. The most recent estimates of value is 62.6 million vatu (US$0.5 million) in 1989 (Bule 1991). If Vanuatu is to increase its timber yield to satisfy domestic markets for hardwood and softwood, let alone export, then a major plantation and forest regeneration establishment program will need to be mounted. It will not come from the indigenous forests. Such a program requires full involvement by custom landowners, through land use companies, joint ventures or other participatory arrangements. The establishment of community-based and managed forest plantations will lend itself to a range of timber processing and value-adding options.

**Portable sawmilling**

The use of small, portable sawmills, has been promoted by the Foundation for the Peoples of the South Pacific (FSP) and the Department of Forests as a means for improving local supply of sawn timber for villages, providing local employment opportunity, and reducing the environmental impact often associated with larger logging operations in Vanuatu. Some 500 Wokabaut Somils (Mamum and Konabe 1992), plus an unknown number of other mill designs, have been sold in Papua New Guinea, while Thorpe (1992) estimated over 700 had been sold in Solomon Islands. Only a small number are currently operating in Vanuatu. Training programs on sustainable forest management have been provided in all Melanesian countries, and FSP is developing market access in ‘eco timber’. The expectation has been that such portable sawmill operations will be more environmentally ‘friendly’ (Fry and Devoe 1992).

While such mills may supply lumber needs at the village level, and they do provide some cash income, they have yet to be proven to be commercially viable lumber producers, the average daily output being very low, wastage is high (from 45 per cent upwards), and the product sizing and finish too variable. However, portable mills may prove economically viable as primary breakdown units of higher quality
'cabinet' woods. Flitches are cut from the logs where they are felled and then portered to a point for shipment to a full-scale sawmill for resawing, kiln drying and dressing. This system is working quite profitably in remote north-west Santo, where very high royalties are paid to the custom owners for top quality flitches of furniture species. The custom owners say they earn more from the sale of sawn flitches from a few trees with minimal disturbance to the forest than they would from a full-scale logging operation (Sela Molissa, M.P. 1995, pers. comm.), which would inevitably cause much greater environmental damage.

The strongest argument in favour of portable sawmills is that without them the custom landowners must choose between no felling of trees for cash and large-scale logging by foreign companies, usually for quite low royalties and with generally quite extensive environmental effects. With the portable mill, landowners can earn a greater return from their resource than would be possible when the resource is logged by a third party, and can directly control the pace and locale of operations.

When used as intended, with on-the-spot milling of individual logs and the mill being constantly relocated from site to site, damage to soil and forest can be minimised. Where the portable mills are used to cut timber from trees felled in the traditional gardening system, no further environmental damage is caused, waste which would otherwise be burned or left to rot is utilised, and the native forest resource thus conserved.

However, there is a considerable risk that the uncontrolled use of such portable sawmills can exacerbate a number of environmental problems rather than minimise them. One of the most important factors from the Vanuatu viewpoint is that the portable mills are designed for use with larger diameter trees, not with small diameter or pole-sized trees. Even medium-sized trees (for example, 60 cm diameter) are not well suited to such a mill because for the same effort in setting up the mill, much more sawn timber can be obtained from a larger diameter bole in a shorter period. The larger trees are found only in the primary rainforest, or old secondary regrowth areas.
In the village context, the portable sawmills would produce sawn timber for cladding for village housing (replacing woven smoked cane or coconut leaf walls) and sawn posts, studs, bearers, and purlins, in each case replacing small-diameter roundwood material. Sawn timber would be produced mainly from trees felled in the primary forest, while the small roundwood poles come mostly from young secondary forest, usually gardening areas. It is conceivable that with the portable sawmills, pressure on the primary rainforest resource could actually increase, while young pole-sized thinnings from gardened areas could be under-utilised.

The use of portable sawmills should be strictly controlled, with the intention that they be used primarily to salvage felled timber on new garden areas, together with carefully monitored permits for milling timber from forest areas. The Department of Forests is currently strengthening its control over the issue of licences for portable mills, and the licensing of operators who have completed training on the operation of the mill.

Should these controls fail and portable sawmills are introduced to Vanuatu at the rate which has occurred in Papua New Guinea and Solomon Islands, then the increased pressure this will place on the remnant areas of rainforest will stem, not from population growth, but from the introduction of a technology which induces change in the traditional pattern of resource use.

Regeneration There are clear alternatives in Vanuatu to further harvest of timber from the forest for village use. There is a recognised level of silvicultural expertise among ni-Vanuatu and in areas of limited timber supply, villagers plant seedlings and tend naturally regenerated trees in their gardens specifically for their future timber needs. The Department of Forests is building on this through its extension programs to encourage tree lots and agroforestry enterprises which blend timber production with fruit, nut, leaf and root crop production. On Santo, plots of native and exotic species of cabinet timber species are being established under old coconut plantations. Such actions can provide for both future village timber needs for housing and firewood close to the village.
By promoting the continued use of roundwood, and actively discouraging the replacement of roundwood with sawn timber where that is structurally feasible, coupled with the controls on portable sawmills, the government would help conserve forest areas and discourage activity which would serve to clear remnant rainforest.

Villagers are experts in architectural design and engineering with roundwood. These designs are elegant, aesthetically pleasing and eminently practical for the climate. The design of easily applied, gang-nail fastening systems, rather than the more laborious use of vines, coupled with the introduction of simple timber preservation systems would help promote the continued use of traditional basic building methods and materials.

**Fish and fisheries**

There are two main types of fisheries in Vanuatu: offshore pelagic and demersal fisheries primarily for export, and nearshore fin-fish and sedentary fisheries harvested mostly for domestic consumption. Vanuatu’s waters are not as rich in pelagic fish as many other countries in the Pacific and commercial fishing industry is small scale, with limited capital investment and small vessels. As only 1.5 per cent of territorial waters is shallow enough (between 100 and 400 metres) for deep bottom handlining and the strong trade winds which blow for half the year restrict small fishing vessels to the sheltered sides of islands, foreign concerns dominate in the offshore fishery.

Fish resources in the region are also more abundant in the open sea than near shore. The narrow fringe of reef receives limited organic material and is therefore less productive. Over-exploitation of the pelagic stocks also affects the abundance of nearshore stocks. In the 1950s an industrial pelagic tuna fishing industry was started, with annual catches peaking to 15,600 tonnes in 1972. Government emphasis is still officially on industrial fishing but efforts have been redirected towards small-scale fisheries and artisanal exploitation of the reef shelf (David 1987).
Prior to small-scale artisanal and commercial fishing, people who wanted fish caught it themselves or were supplied by another household which had caught fish in excess of their immediate needs. Because catches are not recorded and because very little is known about the consumption of fresh fish at the village level, a belief that ni-Vanuatu are more oriented toward the land and agriculture ‘having turned their backs on the sea and its resources’ prevails (Rodman 1989:29). According to Rodman this is a fallacy and, in fact, fishing is more than a marginal source of food. The 1983 National Census found that it is a widespread activity in which about half of Vanuatu's rural households participate.

A further fallacy, according to Rodman, is the belief that islanders are substituting tinned fish for fresh fish out of preference. While both types of food are a popular item in their diet, a paradox exists which must be understood prior to the development of a fisheries plan. Currently, the plan includes a goal of substituting imported tinned fish with domestically produced tinned fish. Similarly, the beef industry aims to substitute imported tinned fish with domestically produced beef.

While a strong, domestic, on-shore fishing industry would bring greater economic rewards through employment, improved port facilities, and local processing opportunities, the reality is that nearshore fish stocks are already at such low levels that people are being forced to purchase imported tinned fish. This situation is not likely to improve with high population growth and more people moving into small-scale commercial fishing.

However, in order to move a community towards industrial fishery production, a cultural transition is necessary. According to Rodman (1989) many islanders are wary of becoming too involved in commercial fishing because they may find themselves doing nothing but fishing just to make loan repayments on equipment.

Improved surveys of nearshore stocks of fish and sedentary species are required, together with repeated surveys of the local catch by villagers and of household consumption, and the recording of commercial catches.
With a time series of these data, the resource and its rate of decline can be assessed, and provide a factual basis for planning for the management of the resource on a sustainable basis.

Environmentally, it is important to note that in most reports on the fishing industry in Vanuatu, or the South Pacific generally, there is little or no mention of fish stocks, appropriate technologies and whether traditional fishing practices have anything to offer in terms of achieving the sustainability objective.

**Sustainability and the environment**

The traditional system of tenure over nearshore resources may, under modern pressures for cash income, work against resource sustainability. In the traditional subsistence situation, common property rights made possible the sustainability of the nearshore resource because if people caught large amounts of fish surplus to household needs, they would distribute the fish so that others did not need to go out fishing. With increasing pressures for cash, people catch as much as they can without regard to future supplies. It could be that common property rights are ultimately responsible for much of the depletion the resource.

If resources are to be used sustainably, then it would seem that the effect of traditional common property rights should be closely examined. While the system of land and sea tenure in Vanuatu is virtually sacrosanct, it may be necessary to modify the system and curb access to the resource for other than immediate household needs. While commercial fishing activities must be licensed, artisanal or semi-commercial access may need to be more closely controlled, and fish markets and other sales outlets more closely monitored.

**Minerals and mining**

There is currently no significant mining operation in Vanuatu, although there is active exploration for gold, with highly prospective gold and silver ore deposits found, along with prospects of manganese and copper. There are also encouraging petroleum prospects. The
pace of mineral exploration will quicken in the wake of the 1994 aeromagnetic survey of the country.

**Economic directions**

Since independence in 1980, Vanuatu's overall economic performance has been modest with a real economic growth averaging 2.3 per cent in the period 1983–90, but fluctuating wildly from 6.5 per cent in 1984 to -2 per cent in 1986. This was compounded by the devastating Cyclone Uma which struck Efate in 1987. Real income per capita has declined slightly since 1983 and the balance of payments deficit has increased annually, reaching 9.3 billion vatu in 1990 (Callick 1991). Imports of all manner of consumer goods fill the shops to service those in the cash economy, along with tourists.

The economy is dominated by the agricultural sector, with a heavy dependence on copra, and as a result the economy is sensitive to fluctuations in market price (Table 5.1). The wide fluctuation in the value contribution from timber reflects the clamp placed on the export of logs in 1990, its easing during the 1993 financial year, and reintroduction in 1994.

Except for the period 1984–85, fluctuations in economic growth have been closely correlated to agricultural performance. The agricultural sector is struggling. With the main export being copra of notably the worst quality in the world (Rodman 1989) the challenge for Vanuatu is substantial. However, there are positive signs for an improvement of the sector. Large plantings of cocoa and coffee are underway and the cattle industry has made noteworthy progress in improving beef quality and international market access. Vanuatu beef is widely noted in the Pacific for its quality and some product is now marketed in Solomon Islands and Fiji. Because of its favourable disease status compared to Australia, access for Vanuatu beef to the Australian market is being sought. There is an expectation that locally produced beef, both fresh and canned, will in time replace the consumption of imported tinned fish, although this might be somewhat optimistic.
### Table 5.1  Vanuatu: exports by volume and value, 1989–94

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<td>24.1</td>
<td>28.0</td>
<td>26.4</td>
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<tr>
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<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.6</td>
<td>1.61</td>
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<td>Timber (’000 m³)</td>
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<td>1.7</td>
<td>2.3</td>
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<td>Other (’000 tonnes)*</td>
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<td>0.7</td>
<td>2.5</td>
<td>2.7</td>
<td>3.0</td>
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<td><strong>Total value (US$ million)</strong></td>
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<td>15.2</td>
<td>14.3</td>
<td>17.9</td>
<td>18.4</td>
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<tr>
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* This category includes cowhides, shells, kava, coffee, and other minor products. As the combined percentage value of this category now equals the main commodity value of copra, this statistical category should be broken down further.

**Note:** Values have been rounded to the nearest decimal point.

**Source:** South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.

In reading Weightman’s (1989) historical account of commercial agriculture in Vanuatu it becomes clear that the country’s natural endowments are more than capable of successfully producing a wide range of commodities. There is also scope for an expanded fishing industry. This industry is now barely in its infancy, with people citing the lack of canoes and equipment, and a fear of shark attacks as the main drawbacks to a local small-scale fishery.

Vanuatu is an increasingly attractive tourist destination, with 43,554 visitors recorded in 1995. Several resort developments on the capital island of Efate operate to a high standard, with further tourism infrastructure development in progress.
Overall, the level of commercial development in Vanuatu remains relatively low and confined mainly to the activities of the minority group of non-ni-Vanuatu settlers. There are no severe environmental problems. However, with planned expansion of current activities in agricultural, forestry and tourism sectors, coupled with population growth and an increasing interest by ni-Vanuatu in business prospects, problems will emerge if the commitment to a sustainable future is not given high priority. There are already warning signs for water pollution, waste disposal, soil erosion and other land degradation, particularly on Efate.

The failure of Vanuatu to achieve some of its economic targets has been largely due to high transportation costs both domestically and internationally, natural disasters and political uncertainty. There is a recognised need for Vanuatu to focus its efforts on diversifying its economic base, particularly in reducing its economic reliance on copra as the main export earner, and to strive for greater competitiveness on the international market.

Endnote

1 Note that these data are calculated from information presented in Appendix 2 to the country report on Vanuatu presented to the 1991 Heads of Forestry Meeting in Lautoka, Fiji. Errors of addition in the tabled information presented there have been corrected. These volumes include logs cut for domestic processing over the period, together with logs cut for export over the period 1983–89. A moratorium was imposed on all log exports over the period 1990–93.
Land and people

Fiji consists of an archipelago of over 300 islands although the two main (high) islands of Viti Levu and Vanua Levu account for over 87 per cent of the land area and 75 per cent of the population. Less than 20 per cent of the total land area of 18,272 square kilometres is considered capable of supporting intensive agriculture, while a further 10 per cent could do so with relatively minor improvements. Some 49 per cent is forested.

Fiji is a special Melanesian case, almost anomalous. Some would prefer to group Fiji with Polynesia rather than Melanesia. Crocombe has succinctly commented that '...physically (ethnic) Fijians are similar to many other Melanesian peoples, but their culture has more in common with Polynesia' (Crocombe 1989:20). Fiji has long been a place of a blending of Polynesian peoples to the east with Melanesian to the west. However, indigenous Fijians comprise almost half of the country’s estimated population of 753,000, with Indians, mostly Fiji-born, comprising around 49 per cent, and a polyglot of persons of European or Chinese extraction and other Pacific islanders making up the small remainder.

Population growth

Fiji’s population has been growing at less than 2 per cent per annum. This statistic is affected by the significant emigration of Fiji Indians after the 1987 coups which not only significantly changed the overall composition
of the society, but also tends to mask the continuing higher birthrates amongst indigenous Fijians. Growth rates are likely to continue to rise, and the number of new entrants to the labour-force will also continue to rise (Gannicott 1992).

By the year 2010 it is expected that there will be about 7,400 new entrants to the labour force each year. In contrast, during the decade 1976–86, only 1,100 new jobs per year appeared in Fiji’s formal sectors. One challenge for future economic and environmental planning is the future gainful employment of Fijians in productive but sustainable activities.

Significantly, most of the wage employment has been in the public sector, supported by aid in-flows (Gannicott 1992). For a variety of domestic and international reasons, growth in public sector employment may well decline.

Population density  The average population density of 43 persons per square kilometre is relatively low by world standards though high for Melanesia (Table 2.1). Yet this average conceals densities of up to 170 persons per square kilometre of arable land. Although 60 per cent of the population is still rural, migration to the towns and cities is increasing steadily. As the Fiji National Environment Strategy observes

[d]uring the next 20 years, the country will be transformed from a predominantly rural residency and lifestyle to a predominantly urban one. This has widespread and profound implications for the environment in urban and peri-urban localities (Fiji 1993b:3).

Pacific 2010 projections are that the urban population in Fiji will rise by 50 per cent, up from 277,000 out of 715,000 in 1986, to 415,000 out of 976,000 by the year 2010 (Seniloli 1993).

Land use  There is no doubt that Fiji still has quite abundant ‘under-utilised land’ (although this could also be regarded as land under long-term fallow for traditional gardening or shifting cultivation). The critical question may be how, or if, this land can be used more intensively, but in a sustainable, non-degrading way. The coastal zone is most heavily populated, and most important
to both economic production and the maintenance of environmental values. As with Solomon Islands and Vanuatu, and the coastal areas of Papua New Guinea, coastal zone management combined with land use planning is important in Fiji.

Food and agriculture

Agriculture constitutes 22 per cent of Fiji’s GDP and about 47 per cent of total employment (Table 6.3). Sugar alone accounted for up to 60 per cent of total export earnings prior to 1987, and about 40 per cent since then. Fiji’s second major crop, coconuts, has faced depressed world markets since about 1989, and there is little optimism for quick resurgence. In many islands, coconuts are simply not being harvested at all. Similarly, cocoa is another export and diversification crop for which current prices are generally unattractive. The Fiji government has sought for some years and with some success to diversify the agricultural production base, exploiting lucrative niche markets for ginger exports, and for taro (dalo), fresh fruit and vegetables, and kava (yaqona) for domestic and for export markets.

Fiji has a growing commercial livestock industry, while raising pigs, goats and chickens for household consumption is common practice. However, Fiji is not self-sufficient in meat, and imports large quantities of frozen chicken, lamb and beef, and smaller volumes of fresh meat, some of which is from Vanuatu. Again, Fiji has sought to intensify and diversify production through pasture improvement, breeding, disease control, and improved animal husbandry.

Forests and forestry

Fiji’s forestry sector contributes 1.5 per cent to GDP and timber products now constitute Fiji’s fifth largest export commodity (Table 6.3). The forestry sector is expected to earn around F$100 million in foreign exchange and employ over 1000 workers by the year 2000.
(Fiji 1993). The sector consists of three discrete sub-sectors: exotic pine plantations, hardwood plantations and native forests.

**Plantations**

About 50,000 hectares of pine plantations, mostly *Pinus caribaea* var. *hondurensis*, have been established mainly on degraded grasslands in western Viti Levu and in Vanua Levu. This plantation establishment was formerly undertaken by the Government with development aid assistance but now by Fiji Pine Ltd. The objectives of the plantation program are to produce foreign exchange, increase employment opportunity and improve the livelihood for indigenous Fijians. Fiji Pine Ltd expects to increase the plantation area to 64,000 hectares by the year 2000. Based on this plantation resource, a large, modern and capital-intensive mill complex has been established at Drasa near Lautoka to produce sawn-timber and woodchips for export. The mill has the capacity to process over 100,000 cubic metres of pine sawlogs annually.

The Fiji Forestry Department has been establishing hardwood plantations for almost 40 years, primarily of moderately fast-growing, but potentially very valuable hardwood species such as mahogany (*Swietenia macrophylla*) to supply future export markets (mainly Europe and North America). These plantations were established on logged-over rainforest areas, initially by clearing the remnant stand, but for many years now as environmentally less-destructive interplanting with subsequent poisoning of the competing overstory.

This plantation resource is just beginning to be harvested, and processing operations oriented to export markets are being established. Various international experts consider that this sector has great potential for creating value-added processing, employment and foreign exchange earnings, starting after 1995–2000, and building up to peak in the period 2010–2030.

**Logging rainforest**

Logging of natural rainforest (usually under the supervision of the Native Lands Trust Board) has generated incomes (royalties) for customary owners over many years, and supports around 40 licensed sawmills varying in potential roundwood input from 2,000 cubic metres to 40,000 cubic metres per year and producing timber primarily for the domestic
construction markets. Ten of these mills employ a portable mill either as a single unit or in combination with other resawing facilities (Swarup 1992).

Rainforest logging takes two different forms—clear-felling for agricultural development and selective logging. The latter comprises more than 80 per cent of the volume harvested (Swarup 1992). Portable sawmill operations draw logs from small licence areas and agricultural clearing. The type of portable sawmill used in Fiji does permit logs as small as 20 centimetres in diameter to be milled, albeit with questionable commercial viability.

With the pine and mahogany plantations set to supply future needs for utility and high quality timber for both the domestic and export market, together with the increased recognition of the conservation and cultural values of the rainforests, it is likely that commercial logging operations in the rainforest will be phased out progressively by about 2000. Some selective logging of rainforest will continue, especially by portable sawmills cutting baulks for later resawing for furniture manufacture, and for salvage operations from expanding agricultural areas.

Fish and fisheries

Fiji is a net exporter of fish with the main export markets being Canada and the United Kingdom.

While fishing currently represents only 1.6 per cent of GDP (Table 6.3), it appears to offer considerable potential for expansion for exports, particularly with the pelagic and demersal fishes of the exclusive economic zone, notably of skipjack, yellowfin, albacore and bigeye tuna, and also deepwater snapper. In general, these resources are fished at levels considered to be below the estimated maximum sustainable yield. The maximum sustainable yield for tunas is estimated at 30,000 tonnes per year, and 1,000 tonnes per year or deepwater snapper. The current level of harvest is now 10,000 tonnes per year for tuna and 200 tonnes for snapper.
Export expansion

Expansion will require considerable private investment and extensive infrastructure development (jetties, and repair facilities), especially if the lucrative Japanese sashimi market is to be targeted.

Foreign companies have a major interest in the offshore fishery, with foreign fishing vessels taking most of the albacore tuna, while foreign interests have a controlling interest in the domestic longline fleet. The offshore skipjack tuna fishery is overwhelmingly dominated by local commercial concerns.

Inshore fisheries

The inshore fisheries provide the bulk of domestic fish consumed and are an extremely important resource, with most of Fiji’s coastal villages and hamlets relying on subsistence fishing for a large part of their dietary protein. Fish excess to household needs are traded on local markets. In addition to subsistence activity, these fisheries support small-scale commercial/artisanal activity, and as in Solomon Islands and Vanuatu, more subsistence fishermen are gradually moving to small-scale commercial fishing. The commercial inshore catch of fin-fish for domestic markets in 1990 was around 4,400 tonnes, with an estimated 16,000 tonnes caught and eaten by subsistence fishermen.

The inshore sedentary resources are fished mainly at the subsistence level, commonly by women gleaning the reefs. There is also small-scale commercial harvesting of bèche-de-mer, trochus and pearl shell for export.

Common opinion is that inshore fisheries as a whole are approaching their maximum sustainable yields, at least near the urban centres of the larger islands. However, Chape and Watling (1991) stated that the coastal fin-fish fisheries still appear to be in good shape while several sedentary resources are already overfished. They point to the common quandary of outer islanders for whom non-perishable sedentary resources such as trochus and dried bèche-de-mer provide a major source of cash income.

Chape and Watling (1991) include as solutions to the inshore sedentary resource problem a reduction in fishing effort, introduction of management measures such as the rotation of harvesting areas and
creation of breeding reserves, and better marketing to maximise the value of the existing resource.

**Traditional fishing rights** As with other areas of Melanesia where this applies, traditional clan-based property rights to inshore fisheries supported resource sustainability. The custom owners have a strong common interest in their sustainable use and in preventing outsiders from accessing their resources. By providing limited support, such as assistance with the identification of breeding areas and determination of harvest rotation periods, national management agencies might help common property owners manage their inshore fisheries better for long-term sustainability.

However, where traditional fishing rights and controls on harvest were once a potent force for fisheries conservation, increasingly custom owners consider their resources as a source of disposable income to be tapped for immediate gain, or to attract joint-venture partners in a commercial enterprise.

For the inshore fisheries, away from the main urban centres, there appears to be some scope for increased harvest of fin-fish for domestic markets, and some prospects for more tourism-related fishing. However, spatial and temporal data on the resource and catch rates are inadequate to discriminate between those fisheries which are already being harvested to their maximum sustainable yield and those for which there is developmental potential.

**Minerals and mining**

The mining industry in Fiji is small (0.3 per cent of GDP and 0.6 per cent of total employment). It has been dominated by the relatively large Emperor gold mine at Vatukoula in Viti Levu (employing about 1400 people), although the extent of its operations varies with world gold prices. Gold exports in 1994 were worth about US$47.5 million. Vatukoula has been operating for 60 years.

Although located in the mineral-rich 'Pacific rim of fire', Fiji has not been explored or mined to the extent of Papua New Guinea, for
example. There is a prospect of reopening the Mt Kasi mine near Savusavu on Vanua Levu which closed in World War II, and a small but potentially very rich gold prospect near Nadi (Tuvatu) will shortly commence production. There has also been a proposal for working a low-grade copper prospect at Namosi near Suva, known since the 1970s, but this is now in jeopardy. Namosi has been compared in scale to the Bougainville mine in Papua New Guinea. If Namosi proceeds, it is likely to have a major impact on the macroeconomy, labour force, society and environment in the late 1990s and beyond.

Economic directions

Fiji is one of the more economically advanced countries of the Pacific island region, with a well developed manufacturing and service sector, and a booming tourism sector. Agriculture (especially sugar), tourism, and garment manufacture are the current mainstays of Fiji’s economy.

In the agricultural sector, the performance of sugar in recent years has been quite flat, but still contributed an average of 39.5 per cent of export values over the period 1989–94 (Table 6.1 and 6.2). Future prospects for sugar are generally not considered particularly bright. Planned increased production of irrigated sugar in northern Queensland, Australia will compete strongly with Fiji production. Copra, once an important agricultural commodity, has now dwindled almost into insignificance on the national scale. But while conventional bulk agricultural commodities seem to be in decline, Fiji has been able to exploit new market niches for such export commodities as processed ginger and taro; the market window for such products is often of only short duration, and it is therefore essential to remain on the alert for further prospects, and to ensure the industry has the capability to respond quickly to the demand.

Fiji’s fishing industry contributes significantly to GDP, with a major export canning works, together with the export of frozen fish, and high-priced tuna sashimi to the Japanese market (Table 6.3).
Table 6.1  Fiji: principal domestic exports by volume, 1989–94

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<tr>
<td>Gold ('000 grammes)</td>
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<td>2706</td>
<td>3694</td>
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<td>Sugar</td>
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<td>394</td>
<td>357</td>
<td>365</td>
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<td>88</td>
<td>155</td>
<td>137</td>
<td>118</td>
<td>140</td>
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<td>Coconut oil</td>
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<td>11</td>
<td>4</td>
<td>8</td>
<td>7</td>
<td>4</td>
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<tr>
<td>Taro ('000 kg)</td>
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<td>2188</td>
<td>863</td>
<td>1550</td>
<td>512</td>
<td>3491</td>
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<tr>
<td>Ginger</td>
<td>2.7</td>
<td>2.3</td>
<td>1.9</td>
<td>2.1</td>
<td>1.0</td>
<td>1.0</td>
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<td>Forestry*</td>
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<tr>
<td>Plywood ('000 m³)</td>
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<td>414b</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Veneer ('000 m³)</td>
<td>4846b</td>
<td>3825</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Trochus shell ('000 kg)</td>
<td>-</td>
<td>212</td>
<td>100</td>
<td>71</td>
<td>52</td>
<td>66</td>
</tr>
<tr>
<td>Fish (canned) ('000 tonnes)</td>
<td>7.2</td>
<td>6.8</td>
<td>5.7</td>
<td>5.7</td>
<td>4.7</td>
<td>9.8</td>
</tr>
<tr>
<td>Other</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Paints ('000 litres)</td>
<td>145</td>
<td>217</td>
<td>258</td>
<td>190</td>
<td>198</td>
<td>251</td>
</tr>
<tr>
<td>Bakery products ('000 kg)</td>
<td>1165</td>
<td>1111</td>
<td>949</td>
<td>1112</td>
<td>1355</td>
<td>1094</td>
</tr>
<tr>
<td>Total value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(US$ million)*</td>
<td>364.1</td>
<td>395.3</td>
<td>377.7</td>
<td>353.2</td>
<td>381.9</td>
<td>461.2</td>
</tr>
</tbody>
</table>

* Forestry production also includes timber and wood chip production. See Table 6.2.

b Before 1991, the volume of veneer and plywood was expressed in square metres rather than cubic metres.

Source: South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.

Fiji is now benefiting from the long-term planning and capitalisation which has gone into the forest plantation sector over the past 20 years, with timber exports of a value similar to the fishing industry (Table 6.3). These exports primarily take the form of sawn timber (mostly pine) and also veneers and plywood. At the same time there has been a rapid increase in the degree of value-adding in the industry, mostly in the form of high quality furniture, both of natural and plantation timber, and also from the wood of the coconut palm.

The tourism sector continues to expand (with annual visitor numbers increasing from 190,000 in 1987 to 280,000 in 1992) and still offers potential for considerably greater growth in both size and economic value. Prospects for lower airfares, Fiji’s ready access on international
### Table 6.2 Fiji: principal domestic exports by per cent value, 1989–94

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<td><strong>Minerals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold</td>
<td>13.8</td>
<td>13.0</td>
<td>8.4</td>
<td>10.9</td>
<td>11.3</td>
<td>9.5</td>
</tr>
<tr>
<td><strong>Agricultural</strong></td>
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</tr>
<tr>
<td>Sugar</td>
<td>41.3</td>
<td>38.2</td>
<td>39.7</td>
<td>39.9</td>
<td>39.2</td>
<td>38.4</td>
</tr>
<tr>
<td>Molasses</td>
<td>0.8</td>
<td>1.1</td>
<td>2.4</td>
<td>2.4</td>
<td>1.7</td>
<td>2.1</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>1.0</td>
<td>0.8</td>
<td>0.4</td>
<td>1.0</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Ginger</td>
<td>0.7</td>
<td>1.0</td>
<td>1.2</td>
<td>0.7</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Taro</td>
<td>-</td>
<td>0.5</td>
<td>0.2</td>
<td>0.4</td>
<td>0.1</td>
<td>0.8</td>
</tr>
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<td><strong>Forestry</strong></td>
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<td></td>
</tr>
<tr>
<td>Timber &amp; wood chips</td>
<td>2.4</td>
<td>2.6</td>
<td>1.4</td>
<td>1.3</td>
<td>2.2</td>
<td>2.3</td>
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<tr>
<td>Plywood</td>
<td>-</td>
<td>0.4</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Veneer</td>
<td>0.8</td>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Marine</strong></td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Trochus shell</td>
<td>-</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Fish</td>
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<td>7.1</td>
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<tr>
<td>Garments</td>
<td>18.0</td>
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<td>21.5</td>
</tr>
<tr>
<td>Iron and steel</td>
<td>-</td>
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<td>0.5</td>
<td>0.8</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Cartons</td>
<td>-</td>
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<td>0.7</td>
<td>0.7</td>
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<td>0.7</td>
</tr>
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<td>Paints</td>
<td>-</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Bakery products</td>
<td>-</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.3</td>
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<tr>
<td>Pasta</td>
<td>-</td>
<td>0.4</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
<td>0.7</td>
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<tr>
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<td>7.2</td>
<td>8.7</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Note: Values have been rounded to the nearest decimal point. Consequently the total value does not add up to 100 per cent.

Source: South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.

Flight routes, and worldwide interest in eco-tourism and cultural tourism, give rise to optimistic expectations for the sector.

A strongly emerging sector in Fiji's economy has been in textiles and garments with export substantially assisted by regional agreements such as the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) which gives Fiji-manufactured goods preferential entry to the Australasian market. Garment manufactures contributed 21.5 per cent of 1994 export value.
| Table 6.3  Fiji gross domestic product by sector* (F$ million) |
|-----------------|-------|-------|-------|-------|-------|-------|
| Agriculture    | 189.6 | 182.8 | 181.7 | 186.9 | 186.4 | 207.3 |
| Sugarcane      | 79.0  | 70.0  | 66.7  | 73.1  | 75.6  | 88.2  |
| Other crop     | 26.4  | 27.8  | 28.3  | 26.9  | 25.0  | 28.1  |
| Livestock      |       |       |       |       |       |       |
| products       | 7.4   | 7.5   | 7.7   | 7.9   | 7.8   | 8.7   |
| Fishing        | 13.0  | 12.8  | 13.2  | 13.6  | 11.7  | 15.0  |
| Forestry       | 12.5  | 12.9  | 13.2  | 12.1  | 14.6  | 14.6  |
| Subsistence    | 51.2  | 51.8  | 52.5  | 53.3  | 51.7  | 52.7  |
| GDP per cent   | 23.2  | 21.4  | 21.1  | 21.1  | 20.7  | 22.0  |
| Industry       | 138.9 | 148.5 | 161.7 | 173.1 | 164.4 | 163.0 |
| Mining and     |       |       |       |       |       |       |
| quarrying      | 1.9   | 1.8   | 1.2   | 1.6   | 1.6   | 1.5   |
| Manufacturing  | 92.8  | 99.0  | 103.7 | 102.9 | 107.9 | 116.7 |
| Sugar          | 30.6  | 27.0  | 25.8  | 28.2  | 29.3  | 34.3  |
| Other food,    |       |       |       |       |       |       |
| drink and     |       |       |       |       |       |       |
| tobacco        | 27.4  | 29.1  | 32.1  | 31.6  | 30.1  | 32.9  |
| Other         | 32.2  | 40.2  | 43.1  | 40.3  | 45.7  | 46.7  |
| manufacturing  | 2.6   | 2.7   | 2.7   | 2.7   | 2.8   | 2.8   |
| Self-employment|       |       |       |       |       |       |
| GDP per cent   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   | 0.3   |
| Electricity,   |       |       |       |       |       |       |
| gas and water  | 10.1  | 10.6  | 11.0  | 12.0  | 12.3  | 13.3  |
| GDP per cent   | 1.2   | 1.2   | 1.3   | 1.4   | 1.4   | 1.4   |
| Building and   |       |       |       |       |       |       |
| construction   | 34.1  | 37.1  | 45.8  | 56.5  | 42.6  | 31.5  |
| GDP per cent   | 4.2   | 4.3   | 5.3   | 6.4   | 4.7   | 3.3   |

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<td>12.4</td>
<td>12.9</td>
<td>13.1</td>
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<td>12.3</td>
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<td>Community and</td>
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<td>144.9</td>
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<td>social services</td>
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<td>16.7</td>
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<td>Other n.e.c.</td>
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<tr>
<td>GDP per cent</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Less imputed bank service charges</td>
<td>24.4</td>
<td>28.6</td>
<td>31.5</td>
<td>34.1</td>
<td>35.9</td>
<td>31.8</td>
</tr>
<tr>
<td>Gross domestic product (fc)</td>
<td>815.5</td>
<td>854.8</td>
<td>860.6</td>
<td>885.9</td>
<td>899.4</td>
<td>941.4</td>
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<tr>
<td>(GDP growth rate)</td>
<td>12.0</td>
<td>4.8</td>
<td>0.7</td>
<td>2.9</td>
<td>1.5</td>
<td>4.7</td>
</tr>
</tbody>
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\* Provisional
\* Residual
\* Other n.e.c. for 1988 onwards is included in Community and social services.
Source: South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.
It is clear that population growth in Fiji is not expected to produce the changes in form or extent of natural resource use that will occur in the other Melanesian countries. Fiji has embarked on a reform program which is already showing benefits and presents the opportunity to achieve sustainable levels of economic growth.

The coming decade will be accompanied by a reduction in the importance of agriculture, forestry and fisheries sector to the economy, with increasing growth in secondary industry and the manufacturing sector. With this economic shift will come an increasing concern for environmental problems of the urban and peri-urban environment, particularly with waste management and pollution control. Without particular attention to these environmental issues, urban health will be of growing concern, particularly in the main urban centres where financially disadvantaged sections of the community have limited access to high quality health services.
Population growth

Discussing the use of the carrying capacity concept in 1991, Herman Daly, commenting on Paraguay, wrote

Paraguay's greatest environmental advantage has been its small population (some 3 million in 1972, and close to 4 million today). At the current 2.5 per cent annual rate of population growth (doubling time of 28 years or roughly one generation), this advantage is rapidly disappearing (Daly 1991).

Daly may well have been discussing the Melanesian countries of the South Pacific which currently have low population densities ranging from 9.3 (Papua New Guinea) to 43 (Fiji) persons per square kilometre but have an annual population growth rate ranging from a 'low' of 1.8 per cent in Fiji to the exceptionally high 3.5 per cent of Solomon Islands. Papua New Guinea's natural annual growth rate is stated at 2.3 per cent although this is considered an underestimate (Unisearch 1991)^1, while Vanuatu has a rate of 2.5 per cent per year (Table 2.1).

Many people have stressed the issue of population growth for the Pacific island nations and the impact uncurbed growth will have on
Table 7.1 Melanesia: projected populations at year 2010 (millions)

<table>
<thead>
<tr>
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<th>Low variant</th>
<th>High variant</th>
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<tbody>
<tr>
<td>Papua New Guinea</td>
<td>5.19</td>
<td>6.42</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>0.49</td>
<td>0.66</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>Fiji</td>
<td>0.91</td>
<td>1.16</td>
</tr>
</tbody>
</table>

Source: South Pacific Economic and Social Database, National Centre for Development Studies, The Australian National University, Canberra.

natural resource assets, and the social and cultural well-being of each nation.

Another major development challenge is to reduce the very high fertility rates currently prevalent in the region, particularly in the Melanesian countries... Without more active family planning programs, population growth will continue to reduce substantially the benefits of growth and will further strain the limited capacities of governments to provide basic services and maintain adequate nutritional standards (World Bank 1991:65).

While family planning programs may produce some reduction in the birth rates, the likelihood of such programs having a major impact is considered small while there is no social service net which guarantees food and care in one’s old age. The only real means of gaining such security is through having a large family—large enough to ensure that some will outlive their parents, and by maintaining close family ties, ensure adequate food supplies, cash, care and companionship.

With social security, family planning efforts may make greater headway, especially as the benefits of economic growth filter down to the village communities and economic well-being is raised. For it is the commonly expressed view that population growth will decline as a result of an increase in economic well-being.

This view is somewhat simplistic in the Melanesian context. In the more economically affluent developing economies of Papua New
Guinea and Fiji, there is an increasing inequity in the distribution of wealth. There is an increasing gap between rich and poor, and this will continue to widen while the development process continues in its current form. For the emerging elite group, success in their search for material benefits and a recognition that such benefits, when focused on one or two children, provide those children with maximum training, career and economic opportunities, may reasonably result in a decline in family size. But for the majority, it remains true that large families are the only realistic path to social security.

In other words, in a developing monetary society (as in developed ones) economic well-being may be allied to social well-being. Where society has a monetary base and can sustain a taxation system which will support social services, such as an old-age pension and medical benefits, then the need for a large number of offspring is diminished. For the subsistence based society, economic well-being is assured through having large numbers of children who will remit funds to support household and collective community needs. For such people, the opportunity for education for their children is paramount in their minds, as they well recognise that through education their offspring stand a better chance to earn money and therefore better support their extended family. Education is quite expensive and highly competitive; the urgent need for money to pay for children’s education is frequently the paramount cause in the ‘firesale’ of custom-owned natural resource assets.

It is also considered the people of Melanesia have a different value set from their western counterparts, one in which family considerations over-rule all else. Melanesian culture is such that while social well-being may be allied to economic well-being, personal wealth is not a large factor in the equation; material wealth is sought more for the sake of the clan or tribe, not for individuals or their immediate family.

A severe economic downturn in Melanesia would most affect that small section of the urbanised élite who have to a large degree cut themselves off from their subsistence past, and indeed may even be totally reliant on the cash economy. If that élite already supports the
principle of a small family in order to provide maximum educational and material benefits for their offspring, then a downturn would serve to reinforce that principle, through further limitations on family size or delayed procreation. That is, the population growth rate among the more affluent minority will then reduce whether their strong economic position is maintained or declines.

But, the cash-poor majority within Melanesia would not be affected by an economic downturn, not having previously experienced any social and economic compensations for limiting their offspring. Indeed, all their experience is to the contrary, associating social and financial security with a large number of children.

The argument also that economic hardship would force reduced family sizes in the overcrowded urban shanty towns (slums) does not seem to be borne out in practice either in developed or developing economies. The extremely poor simply cannot afford the cost of contraception measures.

It is unlikely that the traditional approach in Melanesia to large families will be modified significantly by 2010. Furthermore, it will only be in 15 to 20 years time when they enter the workforce and then themselves start a family that children being born now will have their impact.

Family planning programs, particularly contraception education, are being instituted throughout the region. Contraceptive devices made freely available and long-term programs should eventually help to curb the rate of population growth, or at least contain it. However, it is well to sound a note of caution. Government-sponsored contraception programs would be socially dangerous in Melanesia in the absence of complementary financial and social support for the aged who would no longer have the safety net of a large number of offspring.
Population and economic growth

The relationship between population and economic growth is important to Pacific countries. The World Bank (1991) suggested that Pacific nations have been typified by sluggish growth performance during the 1980s. This occurred even though these nations received some of the highest per capita development assistance levels in the world. The World Bank reported that, as a group, their six Pacific island member countries—Fiji, Kiribati, Solomon Islands, Tonga, Vanuatu and Western Samoa—recorded an average growth rate in real GNP of only 0.6 per cent per annum in the period from 1980 to 1988, while population grew at 2 per cent per year (World Bank 1991). There was a significant decline in real per capita incomes—one indication that development has not been sustained.

Further support for this view comes from a range of sources. Reti (1990) concluded that 'environmental trends today point to severe problems for tomorrow with more and more people having to rely on a rapidly shrinking resource base' (1990:317). Reti continued with a call to his government 'to recognise that a move towards a balance between population and resources is a valuable, indeed essential, investment in...future prosperity'. Reti was discussing the situation in Western Samoa, but could have been referring to any island nation of the Pacific.

Reti questions the likelihood of a sustainable future in Pacific nations, particularly given the population factors at play in many of them. This theme was also pursued in the regional report to UNCED (Thistlethwaite and Votaw 1992) where, for example, it was noted that the stress on agricultural systems has become obvious, with rural activities unable to provide sufficient work or income to keep pace with population growth and the desire for higher living standards. According to the report, high population growth in rural areas is forcing people 'to farm land which is not well-suited to cultivation, shorten fallow periods, encroach on previously protected havens of biodiversity...neglect tree cover, and adopt other strategies which promise short-term relief but threaten to undermine long-run productivity' (Thistlethwaite and Votaw 1992:3).
In essence, the literature argues that the real resource base is shrinking on a per capita basis. This sounds an alarm for future prospects for sustainable economic activity and growth.

Fairbairn (1990) noted that the development plans of Pacific island nations have generally neglected the importance of population pressure on land and other key resources. Rural–urban migration has tended to aggravate population-induced environmental impacts and population pressure is impacting on resources and the environment, including urban slums (squatter settlements), destruction of forests, shortening of bush fallow periods, soil erosion, damage to water resources, and depletion of coastal and lagoon fisheries.

However, the Melanesian countries have relatively small populations and, more importantly, low population densities—11, 14, and 9.3 persons per square kilometre in Solomon Islands, Vanuatu and Papua New Guinea, respectively, and 43 in Fiji (Table 2.1). Thus the potential environmental impacts of population growth have not, in general, been severe.

Nevertheless, it is very likely that the current advantages of small populations and low densities will begin to disappear in the next two decades and major impacts on the natural environments of each country will arise (amongst other major impacts). In fact there may be some commercial advantages from having a larger or more densely settled population, such as reduced unit transport costs and larger domestic markets.

Expedient short-term activities to feed growing populations and to satisfy higher economic aspirations will threaten the long-term sustainability of local systems for providing food and other basic supplies (Thistlethwaite and Votaw 1992). New or modified production systems developed to cope with the increased population density must take a long-term perspective if the environmental impacts of intensified economic activity are to be minimised.

Two additional perspectives on population densities were provided by Carew-Reid (1989). The first concerns the availability of suitable
agricultural land. Only 19 per cent of Fiji is classed as highly suitable for agricultural development, while 38 per cent is considered quite unsuitable. In Papua New Guinea, a country generally not regarded as facing a shortage of productive land, only 24 per cent of its land area is assessed as suitable for arable crops. More than 50 per cent is considered to have little or no agricultural potential because of steepness, drainage, landform, erosion or degradation. In Solomon Islands only about 12 per cent of land is classed as having above average agricultural potential. Consequently, the effective population densities in these countries are much higher than are suggested by the ‘nominal’ figures derived by the simple division of total population into total land area.

A second perspective arises from a comparison of population densities within Melanesia with those of other Pacific countries. Such comparisons suggest that Melanesian nations currently enjoy a considerable safety margin in terms of population density. For example, Tonga and Kiribati have population densities respectively of 136 and 98 persons per square kilometre (Carew-Reid 1989:11). However, such comparisons can be misleading. Different countries are at different stages of economic development and pursue different production systems.

Tonga is generally typified by fertile volcanic soils, a traditional (sustainable) multi-canopy agricultural system, and relies to a significant extent on remittances from Tongans living abroad. Due primarily to out-migration to New Zealand, Australia and the United States, the overall average annual growth rate for Tonga for the intercensal period 1976–86 was 0.5 per cent. Such out-migration provides a population safety net for Tonga. There is a similar pattern elsewhere in Polynesia in the Cook Islands, Niue, Tokelau, Tuvalu and Western Samoa.

Atoll nations such as Kiribati or Marshall Islands within Micronesia have poor terrestrial resources and instead rely heavily on fishing and marine resources. I-Kiribati also benefit from remittances of their compatriots working overseas, notably on foreign fishing and cargo vessels, while Marshallese have been free to secure employment within the United States and its territories. While the pattern of out-
migration in Micronesia is not as marked as that of Polynesia, it is nevertheless significant and compensates to some degree for the limitations on availability and usage of natural resources in an atoll environment.

However, as a strategy to relieve the economic pressure of population growth, out-migration is not so readily available to Melanesians, nor adopted by them in the same way as in Polynesia.

Carew-Reid (1989) also pointed out the close relationship between sustainability and self-reliance in island nations. Aid donors have traditionally espoused the goal of self-reliance in their aid program. Self-reliance in turn requires that development programs and projects are sustainable beyond the project phase. However, Carew-Reid argued that ‘[s]ustainable use is not attainable without proper understanding of the environment and of the total resource base in which development proceeds’ (1989:3). Carew-Reid called on the definition of economic self-reliance developed by the United States Office for Technology Assessment (USOTA) to support his arguments.

Economic self-reliance is an economy’s capacity to meet as many domestic needs as is economically feasible and to gain the revenue, through exports, to pay for imports required to support an acceptable standard of living. Island development is then said to be sustainable if it does not

- reduce the long-term productivity of the resources involved
- degrade nearby or ‘downstream’ environments, be they terrestrial, riverine or marine
- irrevocably reduce future development options or
- unacceptably conflict with local cultures and customs (US/OTA 1987, quoted in Carew-Reid 1989:3).

Wenzel (1989) noted that population growth is at the heart of the sustainable development concept in the Pacific. Where land masses are small and isolated and employment possibilities limited, a high population growth rate creates high risk. Carew-Reid supported this view, adding that the redistribution of people from outlying to more central islands, from rural to urban centres, and from the inland to the coast, is making population pressure one of the primary causes
of long-term environmental degradation in the Pacific region. The growth capacity and potential for self-sufficiency can be undermined by a growing population with its demand for employment, social services and welfare. If populations become too great to be sustained by island resources then worsening environmental problems will inevitably be experienced.

The question which arises is whether or not development and natural resource usage have been sustainable in Melanesia. There is little evidence that natural resources have been used in a sustainable fashion, and much to the contrary. The diminution of forest resources in Solomon Islands provides one example of non-sustainable resource exploitation, while there are also doubts over Papua New Guinea’s ability to convert its non-renewable mineral wealth to a sustainable stream of economic and social benefits.

Population and natural resources

Melanesian countries remain heavily dependent on natural resources for commercial activities and to earn foreign exchange. The principal exports from Melanesia are agricultural (mainly tree crops), gold and other minerals, with tourism being a major export industry in Fiji and, to a lesser extent, Vanuatu. Tourism also relies heavily on natural resources, particularly exploitation of the coastal environment. Melanesian countries all rely heavily on natural resources for subsistence production, supplemented by cash cropping.

It is therefore no surprise that the Melanesian concern for sustainability is manifested most strongly in natural resources, and environmental issues coupled with their use. State of the environment reports (Papua New Guinea, Solomon Islands and Fiji), national environmental management strategies (Solomon Islands and Fiji), national conservation strategy (Vanuatu), and forest inventory and land use intensity studies (Papua New Guinea, Solomon Islands, Vanuatu and Fiji) have all been undertaken within the past decade under a prime directive for the sustainable use of natural resources. The pre-eminent theme of the most comprehensive effort to date to
address environmental concerns and opportunities for Pacific island nations—the regional report prepared for UNCED in 1992 (Thistlethwaite and Votaw 1992)—is the sustainable use of natural resources, reflecting this prime focus of Pacific peoples.

Each Melanesian nation strives to make maximum use of the natural resources with which they are liberally endowed. No Melanesian country can hope to emulate Singapore, for example, and achieve a high level of economic development in an almost total absence of natural resources. By comparison, Pacific island nations have tiny populations and are not on any major trade routes from one major centre of population to another. Indeed they, together with Australia and New Zealand, are, when compared to nearby Southeast Asia, backwaters.

It is primarily through their natural resources that Melanesian countries can aspire to significant, long-term economic development. Such development will be founded mainly on two resource-based sources of wealth—minerals and tourism. Mineral wealth will inevitably dry up one day, and tourists are fickle in their choices of destinations. Thus the economic benefits derived from mineral exploitation must not be squandered but used to capitalise a renewable resource-based economy. It is also reasonable to assume that, in a continuing state of political stability, tourism will continue to provide a steady revenue while the natural attractions which lure tourist interest are carefully nurtured.

For Papua New Guinea, Solomon Islands and Fiji, a third significant source of resource wealth which could underpin economic development is their forests, although the value of this asset has been diminishing rapidly in recent years in Papua New Guinea and Solomon Islands due to virtually uncontrolled exploitation; nevertheless a significant forest resource remains and could be a recipient of some of the benefits of mineral exploitation.

Throughout Melanesia there is major and escalating environmental abuse, often accompanied by much breast-beating in public fora, but little real action to curtail or contain abuse, and little real commitment of government resources for environmental protection.
Environmental damage comes from many sources. The media would have one believe that environmental abuse is the result primarily of the actions of some foreign bands of economic and environmental pirates. The press reports instances of Asian logging companies 'raping' the forest resources of Papua New Guinea or Solomon Islands, or, again, of international mining companies causing massive downstream pollution of the Fly River system in Papua New Guinea. These reports are not false, and the damage such companies cause should rightly be deplored and strong measures taken to correct blatant excesses. It is the speed with which such massive environmental degradation can occur which is frightening.

While such activities are spectacularly newsworthy from the national perspective, damage is comparatively localised and it is suggested that we must look to two other sources for much of the extensive and severe environmental damage seen within the region.

The most dramatic source of damage is natural—cyclones, earthquakes, volcanic blast, flood, massive slumping, forest fires and even periods of severe frost (in the western highlands of Papua New Guinea). With the exception of Papua New Guinea, cyclones are a frequent occurrence in the region, and can be accompanied by massive mud flows, river pollution, blasted forests, mauled fauna populations, destruction of infrastructure, and sometimes loss of life. When these cyclones are accompanied by tidal surge, the damage to coastal areas can be extremely severe. While a volcanic blast is only an occasional event on the human time scale, its consequences are clearly evident for many years afterwards. Earthquake, on the other hand, is very common and can trigger massive land slumping with consequent damage to the vegetation, forest degradation through stem damage (whiplash), severe erosion and polluted rivers.

But perhaps by far the greatest environmental impact stems from the actions of the people themselves, the customary landowners, sometimes unwittingly and sometimes quite deliberately. The tendency to blame external groups or influences for environmental damage serves to mask this fact. Some degree of environmental
damage can be laid at the door of ignorance of the consequences of modern introduced technology and 'western' resource use practices, pointing to a lack of environmental education. Other damage results from inappropriate traditional practices or, perhaps more correctly, from traditional practices which become inappropriate when applied in a more intensive fashion, or where western technology has reduced the labour component of traditional practices.

Common examples are the excessive burning of vegetation aided by the safety match, hunting of animals to sell for meat, assisted by the shot-gun, intensified fishing through the use of the outboard motor, and ever-shortening periods of bush fallow in the traditional gardening system in an attempt to meet the increased demand for subsistence food and for cash crops.

Most peoples of the Pacific, under traditional systems of tribal discipline, applied a number of resource use practices which served to conserve the environment. Taboos were placed on the use of certain resources at specific times, either to ensure that there would be sufficient to meet future needs, or to help a resource recover after a period of excessive use following, for example, a ceremony or feast. However, such eminently sensible traditional systems have to some extent been glorified to the point where some environmental literature implies that under traditional resource management there was no environmental damage, that mankind lived continually in close harmony with the environment.

This is a myth. It was not true of civilisations in India, Mesopotamia, China or Egypt which are known to have induced desertification due to unsustainable use of their natural resources. Nor is it true for Melanesia, as some extensive areas of pre-European-contact grasslands of Papua New Guinea give witness.

Traditional resource use

Traditional systems of resource use control should be fostered and carefully preserved, for through them lies the best chance for longer-term environmental protection in the face of modern resource demands. However, while traditional authority and discipline remains strong in many
areas of Melanesia, the general consensus view of the people themselves (Thistlethwaite and Votaw 1992) is that it is slipping, young people are less interested in learning traditional ways, and some young people seem to accept that new technology will replace traditional cultural values. Each country is taking steps to preserve its cultures but there often remains a strong area of incompatibility between statutory law based on the western model and traditional oral law, particularly in the area of dispute resolution over land ownership claims.

While traditional resource use systems can have both beneficial and detrimental effects on the environment, the questions are how much of the environmental degradation seen today results from increased population pressure, and what environmental impacts are likely as the population rapidly grows.

**Impacts of population growth**

Identification of potential impacts arising from population growth is the first step toward planning for improved resource management. These are the worst-case scenarios.

- Soil erosion, declining soil fertility and downstream siltation from increased pressure on agricultural land and shortening fallow periods.
- Degradation or death of coral reefs through choking silt deposition from intensified, land-based activity.
- Erosion, soil and water degradation from intensive and extensive forms of forest logging which clear large areas of vegetation.
- Reduction in biodiversity from reduced forest cover, from agricultural and urban expansion, and from exploitation of wildlife as a ready source of cash income.
- Reduced fish stocks and dwindling fish catches through overfishing, particularly in lagoon and inshore areas.
- Mangrove destruction for housing and other developments, thereby reducing breeding habitats for marine organisms.
• Pollution of surface and groundwater supplies from sewage, and industrial waste such as that from mining, the processing of agricultural crops, fish processing and manufacturing.

• Air pollution in densely populated areas from cooking fires and increased numbers of poorly maintained motor vehicles.

• The spread of settlement and cropping to ecologically fragile areas, particularly very steep slopes with thin soil and marginal fertility.

The relationship between population growth and environmental effects would be exponential, the effects compounding and the rate of degradation accelerating as population pressure increases. This can be illustrated by the effect of shortening periods of bush fallow in the traditional agricultural system. There is a threshold period of fallow below which soil fertility simply cannot be maintained without special provision for nutrient inputs. When population pressure forces intensive cropping to the extent that the threshold is overstepped, without the introduction of new technology, and expensive mineral fertiliser application, the soil may become so degraded that it cannot support further cropping, even of cassava which has a low nutrient requirement.

Subsistence cropping pressure will be transferred to a shrinking pool of available arable land, forcing shorter fallow periods. As the effect compounds, the rate of degradation of the entire arable area will escalate. Farmers are less and less capable of earning cash from the sale of excess subsistence crop yields to buy fertiliser or to establish green manure crops. Larger areas of cropping are required to supply the increasing food needs of the expanding population from a shrinking reservoir of arable land. Inevitably, cropping must extend further afield on to the more marginal sites, often steeper and more prone to environmental degradation. It is a classic downwards spiral.

This spiral can be arrested if caught in the early stages through education on low cost agronomic techniques to conserve soil and retain or even enhance fertility. Aid donors have been active in this field, particularly in Southeast Asia, but the time is ripe for greatly increased support for such projects within Melanesia to forestall...
anticipated land degradation as agricultural production systems inevitably intensify.

**Population pressure on land**

The low ‘average’ population densities quoted for the Melanesian countries are estimated from total land area and therefore give rise to a false perception that, outside of the main urban centres, there is still a long lead time before the pressures from population growth will necessitate serious consideration about the allocation and utilisation of rural resources.

Large areas of land are not arable for many reasons, and are virtually uninhabited, so population densities are considerably higher than generally thought. Pockets of high rural population density already exist, such as in areas of the Papua New Guinea highlands.

Elsewhere in the region, when the natural resources in an area can no longer sustain the population pressure, formal or informal transmigration programs are instituted or simply happen. Kiribati attempted to relocate people from overcrowded Tarawa to outlying Kiritimati Islands; while in Tonga, there has been a large exodus of people from Ha’apai to Tongatapu. In Melanesia, however, because of the very diverse ethnic groups and customary land ownership, transmigration to tackle (or postpone) the social problems which may accompany population growth, will not be an option.

One social effect which may well accompany population growth is an emerging urban landless class; another is marginalised groups of wage labourers (Bayliss-Smith 1991). Such groups may place additional strains on agricultural, forestry and fisheries resources within the vicinity of urban centres in their quest for survival.

Conversely, the move to a market economy leads to the use of wage labour, which becomes an outlet for population growth. Papua New Guinea presently accords employment creation a high priority, although employment growth is generally slow in Melanesia. In the 1980s employment growth in Papua New Guinea was less than 1000 positions per year, not nearly enough to accommodate the 37,000 new entrants to the labour market per year projected for 2010 (Cole 1992).
In Fiji, employment growth in the 1980s was less than 800 per year, yet it is projected there will be over 7,000 job seekers per year in 2010. It appears extremely unlikely that the job market will expand sufficiently to absorb the increasing numbers of job seekers in these countries.

Environmental and resource degradation does not proceed entirely from population growth. The drive for economic development typically culminates in expansion of commercial agricultural, forestry, fisheries and mining operations, all of which impact on the environment to varying degrees, depending on the level of their intensity. Infrastructure and industrial development will also produce a range of negative impacts. Population growth puts additional pressure on the economic system to convert natural capital into human capital. It also increases the pressure on the natural system to provide subsistence needs.

New technologies Industrial development brings with it new technologies which do not always produce a net benefit when traditional practices are not modified to suit. For example, the introduction of matches, steel axes, chainsaws and shotguns intensify the pressure on forests and wildlife, although assisting individuals improve their quality of life and economic well-being. Where hunting was traditionally aided by fire, the introduction of the shotgun might have been expected to reduce the incidence of deliberate firing of grassland areas for that purpose. The traditional practice of dry-season firing has not noticeably abated, and grassland areas increase in size as the rainforest margins retreat under repeated annual firing.

New technologies should not, however, be resisted simply because they bring with them new threats to the sustainable use of resources. Rather, the focus must be on ensuring that those technologies are used for the benefits they can bring, through, for example, reduced manual labour and more productive agricultural systems, by providing community education and awareness programs to ensure the wise use of the technology in question. Radio broadcasts and information provided at the point of sale would be two basic strategies.
Environmental degradation arises out of a complex set of factors. Development activities and the desire for economic growth play a central role. Modern population growth is a destabilising influence, but not the only cause of environmental problems (Bayliss-Smith 1991). Such problems can also result from increasing affluence, consumption or urbanisation, even if total population size is static.

In the quest to reduce the impact of resource exploitation and economic development, careful consideration must be given to any proposed introduction of new or different technology ostensibly directed to reducing environmental impacts. For example, pressure for reduced-impact logging practices may lead to a call for high lead logging or logging by helicopter or balloon.

While such technology reduces the direct effects of tractor snigging of logs, it permits logging to proceed on slopes much steeper than those to which current logging is confined. As commercially accessible forest resources decline, there will be increasing pressure to reduce the minimum allowable diameter of trees to be felled, to increase the rate of cut, and to move onto ever-steeper slopes. The scramble then for resource exploitation to provide short-term economic gain may be masked in such proposals as high lead or helicopter logging. But high-lead systems are more costly to operate and the hourly rate for helicopters is very costly indeed. To justify such costs, larger volumes of timber must be extracted from a unit area, and these areas will most likely also be the most environmentally vulnerable sites.

Interdependence of environment and economic development

Recognition by the region of this interdependence between the environment and sustainable economic development is mirrored in the recent preparation by Fiji, Solomon Islands, Vanuatu and Papua New Guinea of national environmental or conservation management strategies. Each national strategy stressed the dependence of such development on a healthy environment and generally also sought to
achieve a balance between economic development and environmental protection.

While this significant step has been taken, and often given the full endorsement of government at the highest level, the level of commitment at political and senior bureaucratic levels to the implementation of these strategies is questionable.

Administrative structures which automatically examine government policy and development proposals equally from economic and environment perspectives are needed. Proposals of the private sector should also receive close scrutiny for their potential environmental impacts, both positive and negative.

Most aid-funded development activity, in theory, receives close environmental scrutiny by the donor agencies in feasibility, inception and review phases of the project cycle. However, the reality is that having received initial environmental assessment, once they are initiated projects often receive only intermittent scrutiny. Yet environmental damage, such as erosion, can occur extremely rapidly under tropical conditions. As there is little or no in-country capability to monitor the environmental impacts of development activity, aid donors must be held accountable for any environmental damage engendered by projects they sponsor, if necessary providing additional funds by way of compensation, or funding direct corrective or rehabilitation measures.

The administrative structures in Melanesian countries are currently deficient for providing close scrutiny of development proposals from the environmental viewpoint at the senior decision-making level. Such scrutiny is undertaken, if at all, at quite a junior level, and consequently environmental advice often receives scant attention, if it is sought at all. Most countries have special groups to provide high level advice on economic development activity, but this is not balanced by environmental input. Consequently, sustainable development is not high on the agenda.

Melanesian countries might consider the advantages of the creation of an Office of Sustainable Development (or other appropriate title)
as a body corporate or an Authority under its own Act and responsible directly to the Prime Minister and Cabinet. Such an authority would incorporate existing government functional areas of policy evaluation, economic planning, physical planning, and environmental planning and protection. The environmental unit should include environmental planning and assessment, environmental education and information, and environmental protection functions. Conservation aspects might be better placed with a National Parks and Wildlife Service or a sector ministry such as Primary Industries. The authority would be able to act as an honest broker between the sometimes conflicting aspects of economic development and resource protection, would place economic and environmental considerations on an equal footing, and bring balanced arguments directly before the Prime Minister and Cabinet. The authority could also serve as a ‘one-stop shop’ for proponents of development projects to reduce the administrative red tape commonly involved now with project proposals, and facilitate the investment process.

An alternative approach would be the establishment of a National Planning and Assessment Board which should report directly to the Prime Minister or Cabinet Minister, the Board directing the affairs of an Office of Planning and Assessment located within the Department of the Prime Minister. Again such an Office might include economic planning, policy evaluation, and environmental planning and protection units, with the latter including environmental protection and environmental planning and assessment divisions. By placing economic planning and environmental planning together within the Department of the Prime Minister and with the same status, a clear signal would be sent both within government and externally of the importance attached by the government to sustainable development.

Membership of a planning and assessment board might comprise senior representatives of the economic, and resource ministries, representatives from private industry and commerce, and possibly also appointed representatives from environmentally concerned non-government organisations and other community groups. For Papua New Guinea, Solomon Islands and Vanuatu, representation from provincial or regional government would be desirable on matters affecting their province.
The functions of a National Planning and Assessment Board might include

- advising on national development initiatives and proposals
- advising on environmental policy and long-term strategic plans for sustainable development
- advising on national policy related to economic development, environmental protection and conservation, and ensuring that policies are consistent with national development plans, national environmental management strategies and the like
- advising on the resolution of controversial environmental and developmental issues surrounding government or private industry project activity
- monitoring environmental regulatory and enforcement policies
- overseeing a collaborative process with line ministries on the formulation of policy and programs relating to environmental matters
- tasking special groups for the conduct of specific economic or environmental studies directed towards sustainable development.

A National Planning and Assessment Board would ensure that a national approach to economic and environmental planning would entail close consultation with all tiers of government—provincial, regional, island, and village councils—and for specific projects, particularly with the relevant local landowners/communities.

Such a structure assumes that an environment unit already exists within government administration. While that is so in all Melanesian countries, those in Solomon Islands and Vanuatu are tenuous, being grossly under-resourced for staff and funds. Far greater resources
MELANESIAN ENVIRONMENT

have been directed towards economic planning functions. This imbalance in resource allocation would need to be addressed in order to strengthen environmental management capability.

While the suggested administrative structure would provide a mechanism for ensuring that the interdependence between environment and economic development is fully recognised within government, two other mechanisms would help keep the linkage under constant surveillance.

The first of these is the proper use of the process of environmental impact assessment as a routine part of government which is applied to all environmentally significant, resource-based, development proposals and policies, both of the public and private sectors. Environmental impact assessment are used to predict the likely economic, social, cultural and biological consequences of a proposed activity. It is a major planning tool for government, but unfortunately due to occasional abuse, the assessment process is sometimes regarded by government as something which sets out to thwart economic development. On the contrary, its role is to identify potential problems and thus aid planning to prevent adverse impacts, or to reduce them to acceptable levels, before investment is committed. The investor can save a great deal of money through such constructive scrutiny.

The second is a simple administrative mechanism of requiring all submissions to Cabinet to include comment on potential environmental impacts, in the same manner that possible impacts on security, economic, human resources, and other concerns of government are commonly made.

Environment–economy–society interactions

The discussion has highlighted many interactions between economic development, the environment and society. Economic development relies on the environment for the resources which are used to gain export income, pay for government services and finance development activities (Figure 7.1). In the Melanesian countries, the predominant
industries are based on natural resources—the living resources of agriculture, forestry, fisheries, and (in Papua New Guinea and Fiji) non-living mineral resources.

The environment provides for the subsistence needs of the community through gardening, fishing, hunting and gathering. Within the environment is bound up all the culture and traditions of society garnered over the centuries, and still conveys strong religious significance to the people within a general Christian framework. Land is the mother and father of all, and absolutely integral to the identity and existence of the society. Melanesians may sell rights to the resources growing on or found in their land, but the land itself is rarely a commodity for barter or sale.

Because of the generally slow pace of traditional resource use, the bounds of sustainable use were only occasionally breached, such as in the development of the anthropogenic grasslands of the Papua New Guinea highlands and western Viti Levu in Fiji. So the concept that the land itself may be destroyed because of improper use of the resources found on it has not always been easy to grasp—so much so, that the only way foresters could convey to villagers the degree of devastation and land degradation that can accompany rapacious logging activity is to transport a group of village representatives to another area which had already suffered from such activity. The horror then seen is never forgotten.

Nevertheless Melanesian society today needs to earn cash income from activities undertaken in their environment in order to purchase goods produced in other ecosystems. The long history of use by Melanesians of their ecosystems has produced significant indigenous technologies which may contribute to sustainable economic development through the application of appropriate uses of environmental resources. Many of these technologies are often only poorly known by the larger community, and the risk facing Melanesia is that such technology and traditional systems of control of resource use are rapidly being lost as traditional authority fades and the cultural base of the people is eroded in the face of ‘Western’ values and technology.
While on the one hand the environment provides subsistence needs for society and also cash from commercial resource ventures, it also serves as a sink which is required to accept the residues of both development and subsistence activities. Mine tailings and chemicals are diverted into rivers, silt from eroded gardens and farmland finds its way into streams, and human garbage and sewage are dumped on land or into the sea. The resilience of the ecosystem can be destroyed by exceeding its ability to absorb wastes.

The extraordinary level of biodiversity found generally in Melanesia is dependent on the health of the complex but fragile ecosystems characteristic of small, isolated island masses—and the importance of biological diversity in maintaining ecological resilience cannot be overstated.

**Figure 7.1** Economy–environment–society interactions
Finally, there is an inextricable link between the economy and the culture and well-being of society. People hire out their labour for use in economic activity, while the economy, generally via government, provides services of various kinds back to the community. Without a healthy and productive environment, the health and productivity of the labour force will be diminished, impacting directly on economic activity and cultural ingenuity and creativity.

The environment, the economy and the society and their interactions must be considered in making decisions about economic development (Figure 7.2). There may be only a relatively small area of overlap between these three elements of development, however, it is those activities which achieve this overlap which are more likely to be sustainable and of benefit to the whole society.

Endnote

1 However, the Asian Development Bank (1994) in their annual publication on key indicators for Asian and Pacific countries, indicate the population of Papua New Guinea has increased from 3.22 million to 3.77 million over the 10 year period 1983–92 which represents an average annual growth rate of only 1.7 per cent. While recognising that the Papua New Guinea 1990 Census has a number of problems and that analysis is still in progress, McMurray (1993a) cites an average annual growth rate of 2.2 per cent for the period 1966–80.
Establishing an appropriate economic development policy framework and, consequently, the design and implementation of workable strategies is essential if sustainable development is to be achieved in Melanesia.

The first step in the design of policies and strategies is to decide precisely what is to be achieved. Melanesian governments have typically expressed this through the goals stated in national plans.

The list of goals provided by Melanesian governments vary to some degree from country to country, but are normally typified by considerations involving

- greater independence, political freedom and economic self-reliance
- improvements in the quality of life of the nation's citizens
- a pattern of development and resource use which is sustainable.

It is clear that these considerations are not mutually exclusive—there is a degree of overlap and interdependence between them. For example, economic self-reliance and enhanced quality of life rely on approaches to economic development which are genuinely
sustainable. Additionally, as with all policy development, there are trade-offs to be identified and accepted to achieve the ultimate goal, in this case sustainable economic development.

A review of the earlier chapters will reveal some pessimism about the achievement of the goals listed above. It is likely that there will be greater rather than less reliance on aid donors in the future, and this will undermine to some extent the prospects for independence and economic self-reliance. The pressure on forests and certain other natural resources, along with the difficulties inherent in providing social and economic infrastructure in the Melanesian countries, means also that improvements in the quality of life of the people are difficult to achieve, other than in areas near to population centres. In such areas there are other factors, such as increased crime and poor access to food gardening areas which, in other ways, detract from quality of life. Finally, development and resource use has not been sustainable in many instances. Exploitation of the native forests for both timber and agriculture is possibly the best known example of unsustainable practices. Additionally, the use of non-renewable resources to finance development may be unsustainable if capital substitution is not occurring as these resources are exploited.

If the goals of development are not being achieved, the obvious question relates to why this is so. It is not population growth that is the root cause of a lack of success in achieving national development goals, nor is it a result of basing development on the exploitation of natural resources, whether renewable or non-renewable. Rather, it is the pattern of resource use which is the problem: a pattern which arises because of a poorly developed policy framework, an inability to manage natural resources adequately—especially an inability to police resource usage and implement monitoring programs—and difficulties encountered in translating the exploitation of natural resources into long-term productive capital formation in other parts of the economy.

'Economic independence is a goal which would seem to be growing ever more elusive.'
Principles for sustainable development

Melanesian governments are confronted by the challenge of establishing and maintaining a policy environment that encourages sustainable development, promotes constructive innovation and makes efficient and equitable use of natural resources which, ultimately, are in scarce supply.

Of particular importance is the development of a transparent policy environment—one where the rules for conducting economic activities and natural resource exploitation are clear and widely accepted. There is a need also to reconcile development needs with environmental constraints, and several principles may be espoused which will assist in the achievement of that result. These principles together will guide Melanesian countries to the goal of sustainable development.

The precautionary principle

Where there is real uncertainty about the effects of human actions on critical environmental assets, those assets should be left intact until such time as potential impacts are clearly understood (Thistlethwaite and Votaw 1992).

Different assets will be critical in different countries and circumstances. Air, soil, and water are the basic building blocks of life and must be closely guarded. Other assets have to be taken on a case by case, country by country basis. Some may be locally significant, while others may be regarded as having national, regional or even global importance. Also, a sequence or compounding of local impacts may have a much wider impact at the regional and even the global level.

For a country which is fostering tourism, the preservation of those environmental assets which are an integral part of the tourist attraction is critical. These might be aesthetic, cultural or heritage attractions, and part of the natural or the built environment—a country cannot afford to take risks with these assets. Where a proposed action might conceivably have adverse effects, then the precautionary principle should come into play—defer action until there is improved knowledge of its likely consequences and
confidence that the asset will be unharmed. The penalty for disregarding the principle may be the loss of the tourism business to another country.

At the other extreme, some assets such as a unique species of a bird, lizard, or plant, may be regarded as critical from the perspective of global biodiversity, although in a particular country their occurrence may be quite common. Because of their local abundance, the precautionary principle may not appear so important, but to disregard it may bring future consequences of global dimensions. Biological diversity may, for example, contribute in the future to presently unknown medical benefits. The removal of areas typified by significant biological diversity may impose significant opportunity costs, these being foregone possibilities for future benefits. Nevertheless the application of the precautionary principle at the local or national level is less clear cut; decision-makers need to see the wider picture, not simply their own limited national horizons.

A practical application of the precautionary principle within Melanesia would be the reservation of a percentage of each native forest community, with due heed to the principles of comprehensiveness, adequacy and representativeness. In this regard, there has been a call, internationally, for the reservation of 10 per cent of each forest type. Melanesian countries are urged to meet that call, but extend it beyond forest types to broader vegetation communities and to marine ecosystems.

Further reserves should also be established to protect areas containing significant biological diversity which are not fully served by the reserve system for forest communities and vegetation types. For example, some species of bats or reptiles may require special reserve consideration.

The creation of land or marine reserves is not that difficult where the resources reserved are considered to be relatively abundant or of little immediate commercial worth, even in the context of Melanesian custom land tenure, as has been recently demonstrated on Malakula in Vanuatu where a number of reserves are now being promulgated at the landowners’ behest. This is not to say there will be no conflict
between those who would seek immediate use of the resources in a proposed reserve and those who regard the untouched resources as valued assets.

But it is when resources become scarce and there is intense pressure on a government for their utilisation that the application of the precautionary principle becomes more difficult, and it can be expected that the principle will on occasion be ignored in the future as it has in the past, even when it is acknowledged that a proposed utilisation process would be accompanied by undetermined environmental risk. Those leaders who take the expedient course must accept that in doing so they may earn the lasting opprobrium of their countrymen and pay the price at the ballot box. It might be of less concern to them that those most affected by their action may not be their constituents, but generations to come, who can do no more than condemn an historical act and suffer its consequences.

National accounting for resource depletion

The United Nations’ System of National Accounts constitutes the standard framework for measuring a country’s macroeconomic performance, with an underlying aim of providing an information framework suitable for analysing the performance of the economic system.

The national income accounts are used to derive regular estimates of gross national product (GNP) which is the measure of national income. Policymakers tend to work also with gross domestic product (GDP) and use it as a measure of the economic health of a nation. GDP is a short-term measure of total economic activity for which exchange occurs in monetary terms within a given year. In general, national accounts data, reported as GDP, are used for overall economic monitoring, economic management and policymaking, and for comparing economic performance internationally.

In the derivation of national income figures, statisticians estimate the depreciation of the nation’s existing stock of capital. Importantly, human-made capital is the only capital stock depreciated. No allowance is made for the natural capital assets of the nation, such as forests, fisheries, agricultural land, mineral deposits and so on.
Consequently, the national income measure of GDP does not reflect true, sustainable national income because it neglects to pay attention to environmental costs, failing to take into account the degradation and/or depletion of natural resources. Yet the Melanesian countries rely heavily on natural resources for subsistence, commercial activities and export income.

While the World Bank, the United Nations Statistical Office and others are striving to rectify these shortcomings in the national income accounts, it is still the case that the present suite of economic indicators used in all countries do not foster the sustainable management of natural resources for the benefit of future generations, but instead militate against sustainable use.

A proper system for gauging a nation’s economic well-being will assign economic values to the depletion or degradation of environmental assets.

Valuing externalities and adjusting for market failure

Many projects have direct and indirect impacts, both positive and negative. For example, mining projects have direct financial, employment and infrastructure benefits, but may result in environmental externalities or spillovers such as tailings which enter riverine and marine environments. Agricultural development and forest utilisation may have negative external impacts through increased erosion and degradation of waterways, while positive externalities can include improved roads, communications and health facilities, providing benefits well beyond those communities directly involved in the project.

In the appraisal of projects it is important that every effort be made to identify and, where possible, value their external impacts, both positive and negative. Only then will a full understanding of the benefits and costs of the project be available to policymakers and funding agencies. When complete information is available, policies can be tailored to reduce negative externalities.

A related issue is that of market failure, which occurs when companies use unpriced natural resources in their production processes and,
consequently, treat those resources as free goods. For example, if a company discharges effluent into a river but does not pay for that discharge, it is treating the assimilative capacity of the river as a production input for which it does not have to pay. Consequently, in making its production decisions, the company will not take into account the environmental costs of its effluent discharges. In such a case, economists would argue for the introduction of a 'polluter pays' system, with a sufficiently high level of tax or fee being set which will induce the company to reduce its polluting activities, perhaps through improved management practices or the introduction of new technology.

Most recent work by environmental economists has focused on correcting market failure where it occurs. The proactive approach would be to identify the potential for market failure to occur in the initial appraisal of development projects and then formulate and institute countervailing strategies such as taxes, charges and levies on the use of environmental resources.

**Investment in natural assets**

The requirements of intergenerational equity might be enhanced if those who exploit natural resources commercially are also required to invest in the natural assets they are accessing.

In the timber industry, for example, investment in natural forest management, encouraging natural regeneration, enrichment planting, and the establishment of plantations might be a requirement for the issue of a timber utilisation permit. Vanuatu, for example, has for some years imposed a levy to support reforestation, but the levy was not always applied to this end. Reforestation activity was considered the role of the Department of Forests with no requirement for those harvesting the forest to institute reforestation measures. This is now changing. New timber permits in Vanuatu stipulate specific reforestation requirements while some logging companies have already instituted their own plantation establishment programs in an attempt to secure future timber supplies. Solomon Islands also imposes a levy for tree planting following logging, although its implementation has proven difficult.
The requirement for investment of some of a company's returns from the utilisation of natural resources back into the resource sector is a policy area worthy of investigation. 'Asset investment schemes' with appropriate taxation rebates merit particular attention. At the same time, policymakers in government need to formulate strategies for the use of a proportion of government revenue derived from resource exploitation in asset replacement or enhancement.

However, it needs to be recognised, particularly in the case of non-renewable resources such as minerals, that such investment might be in alternative or substitute resources. One example would be the use of mining proceeds in Papua New Guinea for rural development. The danger is that government revenue from resource use is entirely siphoned off for other uses.

Because it is a reality that government levies on resource use are often simply swallowed up in consolidated revenue, the companies which are licensed to exploit natural resources should themselves be required to invest directly in renewable natural resources, or in agreed substitute sources of economic activity, employment and community well-being. Government's role is to ensure such investment is not evaded.

**Efficiency and equity** Appropriate policy options imply attention to both efficiency and equity. The efficient use of natural resources means that the net social benefits from resource exploitation are maximised. However, the most efficient allocation of resources may not be the most equitable—there may be both winners and losers. Consequently, policymakers are confronted with a need to assess the equity effects of their policies and to decide on the required trade-offs between equity and efficiency.

"The proactive approach would be to identify the potential for market failure to occur in the initial appraisal of development projects and then formulate and institute countervailing strategies such as taxes, charges and levies on the use of environmental resources."
The challenges for Melanesian countries, if they are to achieve sustainable resource use, development and incomes, are many. However, there are a number of policy responses which will take the nations down the path towards sustainability. Their implementation will require appropriate support from international agencies which may need to be encouraged to work with the nations' own agenda, rather than their own.

Melanesian decision-makers must first establish the policy framework within which they wish to work, make this framework transparent, and be willing to be innovative in policy development.

The policy action framework

A number of policies and strategies which Melanesian countries could adopt in their quest for sustainable development and improved quality of life are addressed here. But first some wider considerations in establishing suitable policies are discussed. This policy framework is constructed on the foundation of ideas and proposals advanced particularly by Daly (1994), Repetto (1992) and Kopp (1992).

Particular attention is paid to four suggestions made by Daly (1994)\(^1\) to the World Bank for a more effective fostering of environmentally sustainable development. Two of these suggestions are relatively non-controversial, the third a subject of debate, while the fourth is quite controversial.

**Stop treating the consumption of natural capital as income**

Daly’s first and non-controversial proposal was to stop counting the consumption of natural capital as income (Daly 1994:183). This proposal has been the subject of considerable discussion, debate, and research since 1989, and has been actively promoted by Repetto (1992) and others. In 1995, the World Wildlife Fund facilitated the establishment of an international group on natural resources accounting, and is working with the World Bank and the
United States Statistical Office on further development of the concept, with case studies.

Non-controversial it might be but most governments, of both developing and industrial nations, have yet to adjust their economic policy mind-set to stop treating the consumption of natural capital as income.

By definition, income is the maximum amount that a society can consume this year and still be able to consume the same amount next year (Daly 1994). That is, the capacity to produce and consume at a certain level stays intact from one year to the next. Therefore, sustainability is built into the very definition of income—in this case national income. This definition also drives home the need for economic growth because a growing population will require a greater total output to maintain the capacity to produce and consume (that is, productive capacity must be maintained to maintain per capita income).

A true definition of income encompasses not only current earnings, such as those from the exploitation and sale of natural resources, but also changes in asset positions. Capital gains represent an increase in income, capital losses a reduction. Unfortunately, productive capacity has been thought of as human-made capital, natural capital has been counted as a free good, and the consumption of natural capital has been counted as income. Repetto et al. (1989) stated that ‘[a] country could exhaust its mineral deposits, cut down its forests, erode its soils, pollute its aquifers and hunt its wildlife to extinction, but measured income would not be affected as these assets disappeared’ (Repetto et al. 1989:2)

Furthermore, sustainable development might be thought of in terms of a ‘sustainable flow of income’ (Turner, Pearce and Bateman 1994). This is the level of income that a nation can afford to receive without depreciating its overall capital stock. According to Turner et al. (1994), the danger is that a failure to account for natural capital adequately and the contribution it makes to economic welfare and income will lead to false perceptions about how well an economy is really performing. This point is picked up again below.
There are two areas where the incorrect accounting for natural resource consumption shows up in the United Nations' System of National Accounts and in international balance of payments accounting.

The System of National Accounts (SNA) constitutes the standard framework for measuring a country's macroeconomic performance. The national income accounts, derived via the SNA, are used to provide estimates of gross national product (GNP), the national measure of income. Net national product (NNP), which is GNP less depreciation of the existing capital stock, is also derived in the SNA. Importantly, that depreciation is only of human-made capital. No account is taken of any decline in the value of natural resource stocks.

National income accounts are the information framework used by all Melanesian countries to analyse economic performance, and guide economic management and policymaking. National income accounts are also used internationally to compare the economic health of nations.

Notwithstanding their widespread use, national income accounts derived via the SNA have several shortcomings. One shortcoming relates to the preoccupation with activities that occur within well-defined markets and where production is always reflected in monetary terms (Peskin 1989). Other controversial issues, reported by El Serafy and Lutz (1990), include the treatment of leisure, household and subsistence production, and other non-market transactions, each of which is significant in the Melanesian context.

However, the issue which has come to the fore in recent years, particularly with the increasing concern for sustainable development, is the way in which the SNA treats the environment and natural resources.

The national income measure of GDP as now calculated does not adequately represent true, sustainable income because of two shortcomings. These relate to the treatment of environmental protection costs (referred to as 'defensive expenditures') and the degradation and depletion of natural resources.
The fact that these issues are not, or not properly dealt with in the current UN System of National Accounts (SNA) is a serious flaw from an accounting point of view. As a result, policy advice based on measurements produced under the SNA can be faulty to the extent that GDP does not adequately reflect environmental and natural resource erosion (El Serafy and Lutz 1990:34).

There has been widespread agreement on this fundamental flaw in the SNA amongst economists, statisticians and environmentalists. The Asian Development Bank (1990) noted that the SNA does not provide a mechanism which allows natural resources, used during production, to be written off against the value of production in the same way that depreciation of capital equipment and other human made capital is accounted for. The Bank commented that the SNA ‘...is in danger of passing erroneous signals to policymakers with the risk of destroying natural resources in the name of economic development’ (Asian Development Bank 1990:97).

The fact that the SNA does not capture the value of natural resources adequately means that development strategies that rely on standard income accounting techniques may not result in sustainable development (Lutz and Munasinghe 1991:19).

For these reasons, various attempts have been made in recent years to adjust national income accounts by accounting for the consumption of natural resource capital. These attempts have all been focused on less developed countries that rely heavily on their natural resources. For example, Bartelmus, Lutz and Schweinfest (1992) undertook a case study of Papua New Guinea in which they attempted to adjust the national income accounts by estimating the cost of the depletion in the agriculture, forestry, mining and energy sectors. The answers gained were said to be far more illustrative than precise and, consequently, not useful for policy formulation. The researchers were, however, hindered by the availability and accuracy of data, along with problems in valuing environmental impacts. This case study, along with others (for example, Repetto et al. 1989; Solorzano et al. 1991; van Tongeren et al. 1991), illustrated that the approach to
incorporating environmental values into national income accounts remains contentious and needs further refinement. As previously noted, further refinements are the subject of collaborative, ongoing work in a number of international agencies.

Consequently Melanesian governments are not yet able to stop counting the consumption of natural capital as income. However, three tasks could be undertaken by each Melanesian government to underpin future development of natural resource accounts.

- Conduct a thorough review of data collected and assembled by national statistics offices to determine if the data recorded are relevant to policy development, including natural resource management. Are some data superfluous to needs or collected only for historical reasons? What gaps in the national statistics need to be plugged?

- Develop comprehensive data sets on environmental and natural resource assets.

- Where possible, assign values to significant natural assets.

The development of physical accounts will provide the information vital to policymaking which takes into account natural resources and the environment. Such accounts would also augment the information assembled in the preparation of the recent series of State of the Environment Reports and National Environmental Management Strategies in Melanesia. The Papua New Guinea Resource Information System (PNGRIS), the Vanuatu Resource Information System (VANRIS) and the Solomon Islands Forest Resource Information System (SOLFRIS) developed recently in association with national forest inventories, and resource information systems developed in Fiji may each provide a useful framework for a series of natural resource asset databases. When a new system of national accounts
which recognises natural resource assets is instituted at some future
time, these physical accounts will provide much of the needed
background information.

An important and related shortcoming reported by Daly (1994) is
the way in which natural resources are treated in international balance
of payment accounts. As with national income accounts, natural
capital is counted as income. Balance of payments accounts include
a current account element and a capital account element. But the
export of natural capital such as timber, minerals and so on, is entered
only in the current account. Daly (1994) argued correctly that some
portion of these natural capital assets should be included in the capital
account—that is, they should be treated as the sale of a capital asset—
and concluded

[i]f this were properly done, some countries would see their
apparent balance of trade surplus converted into a true deficit,
one that is being financed by drawdown and transfer abroad
of their stock of natural capital (Daly 1994:184).

Clearly, such a result would convey a different policy message to
governments, and to organisations such as the International Monetary
Fund which wield considerable influence on policy development in
many countries, including those of Melanesia.

The mode of evaluation of projects is also of concern, where natural
capital is often counted as a free good. The returns from projects which
deplete natural capital have typically been overstated, and the
correction of this bias is a logical first step towards a policy of
sustainable development (Daly 1994). This has a clear significance to
Melanesian countries which rely very heavily on the returns from
natural resource exploitation for economic development.

There is a further argument that the assimilative capacity of the
natural environment should be considered in project appraisal. For
example, in Papua New Guinea, rivers are being used to carry away
wastes from mining activities, and near-shore areas are expected to
assimilate those wastes. While it is recognised that the derivation of
these user costs is difficult, if they are ignored, as is now happening,
then natural capital is being assigned a zero value.
Therefore, attempts should be made to estimate these user costs, possibly by basing such estimates on the costs of the technology which would have to be used if the natural environment did not provide the assimilative or waste transfer services required by the project.

Natural resources and the services they provide are not free goods and should not be treated as such. In both national income accounting and international balance of payments of accounts there is a need to consider the value and use of natural assets. This will require further development of appropriate physical accounts and increased efforts to place values on important resource assets and services.

Lower tax on labour and income while raising tax on resource use

Governments have tended to subsidise resource usage activities such as water allocation, deforestation and mineral exploitation (Daly 1994). In the southwest Pacific, subsidisation policies have been pursued by Australia and New Zealand, as well as by the countries of Melanesia. In no country are the external costs to the environment and the community from resource exploitation charged against those resources.

This is again an example of market failure, and economists typically argue that external costs should be internalised through such approaches as taxing 'resource throughput', that is, tax each tonne of ore, kilogram of mineral, barrel of oil, or cubic metre of timber rather than basing taxation on the income earned from those commodities.

Daly (1994) argued that present taxation systems are highly distortionary and contended that, by taxing labour and income in the face of high unemployment, governments are discouraging just what they want to see more of. This is true of the Melanesian countries which typically have low levels of formal employment.

Yet public revenue must be raised in some manner. A possible solution is to tax resource throughput by such means as resource rentals. These taxes should be based on the scarcity rent that is being appropriated by those who are exploiting the resources. Additionally, such taxes should include a component to cover the external costs associated with the use of these resources.
Such an approach might be attractive to Melanesian countries and, indeed, to any country which relies heavily on its natural resources for economic activity—including Australia. The advantages include

- an improved throughput efficiency and, depending on the level at which the tax is set, the likelihood of some resource conservation

- external costs are internalised, and met by those who are exploiting the resource in question, leading to a reduction in pollution and other external effects as users attempt to reduce these costs

- hopefully, increased levels of employment.

Any shift to a new taxation structure would need to be carried out gradually to minimise the disruption to commercial activities. There may also be a need to support such a policy shift through regulation, such as a moratorium on new rainforest logging or fishing licences or fishing activities, or a freezing of the allowable rate of harvest of forests to forestall any rush by timber companies to escalate their rate of logging before the new tax rules become fully operational.

Maximise natural capital productivity and invest in its supply

Daly’s third suggestion—maximising the productivity of natural capital and investing in its supply—is, again, one which has potential application in Melanesia. The need to invest in natural capital was emphasised also by Kopp (1992). The time factor is important in this proposal. Natural resources are scarce and, with a need to maximise productivity in the short term, will become scarcer each day. Conversely, investing in the supply of natural capital will take time but the outlook and returns are long term.

How can the productivity of natural capital be maximised? The immediate answer is to increase the price of natural assets by applying taxes. This will more adequately indicate the scarcity of those resources and, simultaneously, provide an incentive for their use as efficiently as possible.

Investing in natural capital raises questions about whether the focus should be on the enhancement of existing natural capital or on its
substitution. Enhancement might involve allowing this year’s growth increment to be added to the capital stock rather than harvesting it now.

This approach is pertinent to renewable assets such as fisheries and forests, but of little relevance to non-renewable assets such as minerals and oil. For such non-renewables, the pertinent decisions are about the desirable rate of liquidation and investment of the proceeds. Papua New Guinea has focused on these questions in relation to its mining sector, and has an explicit policy of investing mining proceeds in rural development. A further question in Papua New Guinea’s case is whether some of these proceeds should be invested in other forms of renewable natural capital. Furthermore, if the tax base were changed, more investment funds may become available.

With increasing scarcity, resources of any type will experience price increases. But this raises the question of which resources will see the greatest, and most sustainable, price increases over the long term. It serves also to highlight that natural resources have two values—a use value when exploited, and an asset value when held back for future exploitation. The asset value will, in almost all cases, increase as time goes by. Furthermore, the capability to maximise productivity in the medium to long term must be considered, and this will assist the determination of policy on how different resources are to be exploited. Consequently, the preferred approach will be to concentrate on the use of those natural assets which are likely to attract the highest sustainable prices at that time. This does not imply, necessarily, that some resources are left totally untouched, but that the rate of use through time will be different for different natural assets and, importantly, that this should be a matter for careful analysis and planning.

With its extraordinary mineral wealth, there is currently a focus in Papua New Guinea on the exploitation of these non-renewable assets, notably gold, copper and oil, from which the government’s proceeds are intended, at least partially, to support rural development. Some proportion of those proceeds—particularly if the tax base was changed—could be directed to the proper management of renewable assets such as the natural rainforests, and to investment in forestry
activities that ensure long-term productivity of the nation’s forests and forestry sector.

The export of logs of cabinet-grade timber or of unprocessed baulks of rainforest timber would be reduced and, with certain scarce, high value species, banned altogether. Processed cabinet-grade timber would continue to be exported, but not beyond the sustainable yield of the forest species being utilised. Investment in rainforest silviculture and management of regeneration, enrichment plantings following logging, and plantation establishment of such scarce species where feasible, would increase the renewable asset stock.

Such investment activity should be supported by further investment in other productivity enhancing areas, such as fine veneers, finished furniture or other activities which add value. On the premise of an almost certain increase in market price due to increasing world scarcity of quality furniture timbers, the value of the nation’s resource capital would be greatly enhanced.

Fiji provides a good example. Fiji now has a total hardwood plantation estate area of some 43,000 hectares, mostly mahogany (*Swietenia macrophylla*). The older mahogany plantation compartments (from 1961) are reaching an economically harvestable rotation age of 35 years. (A small area of about 500 hectares which was planted between 1950–60 has reached rotation age.) Over 7,600 hectares of mahogany was classified as mature by the 1990/91 inventory of the Fiji Forestry Department’s plantations. Some 4,385 cubic metres of logs have been produced over the period 1992–94 from areas damaged by Cyclone Kina in 1992. The 1995 local selling price for plantation mahogany sawn timber was as high as US$590 per cubic metre (FF Select) with a drop to US$408 per cubic metre for FF Standard and Cut-of-log. Exported, green rough sawn timber fetched from US$637 to 667 per cubic metre on the Australian market in 1994.

Natural mahogany from stands in Brazil, Peru and Bolivia (mostly Brazil) attracts (1995) about US$1,000 per cubic metre for top grade, kiln dried flitches on the world market. These virgin mahogany stands are rapidly depleting and, in 1993, it was reported that there was a sudden step-up by the environmental lobby in the United
Kingdom against the use of Brazilian mahogany. Prices are expected to continue their upward trend. As the natural resource dries up, prices are likely to escalate sharply, and plantation grown mahogany will command a high market price. Fiji is not the only country growing mahogany in plantations but it is by far the largest in the Pacific region. In time, Fiji may become one of a small number of world sources of mahogany, and is likely to be able to command very high prices for fine furniture.

For Fiji a possible strategy which could be pursued now would be to delay harvest of its mahogany plantations, and expand its plantation establishment program as fast as it can in logged-over rainforest or other suitable areas. This strategy fits with Daly's suggestion (1994) to invest in the supply of national capital. This increased investment in mahogany might be financed, for example, from the proceeds of Vatukola gold, and from aid sources, inducing an increase in natural asset values over time. As in Papua New Guinea, careful planning of the use of different types of renewable and non-renewable resources through time is the key to resource use and sustainable development.

Substitution of natural capital clearly implies a greater focus on 'human-made natural capital' which could include plantations or aquaculture ventures. Such investments may serve the country well in the medium to longer term as there is a slowdown in the availability of the 'true' natural product.

There have, of course, been investments in natural capital in Melanesia, plantation forestry being the most notable example. However, in all countries, the area replanted or regenerated remains a small proportion of that harvested. If the answer to a question of whether such natural capital investments have been large enough is 'no', then what are the constraints on increasing that investment level?

Again the path to increased investment may lie through the taxation system. However, such investment must also extend to increasing government capability either to police reforestation of private (customary) land by logging companies, or to ensure such companies fund the reforestation and ongoing silvicultural management of that private land by government forestry agencies.
Solomon Islands has for many years stipulated that logging companies replace/replant trees, but successful plantation establishment has occurred there almost entirely on non-customary land placed under the control of the Forestry Division.

There is, perhaps, a need to sharpen the focus on the use of economic incentives. Such measures might include the following.

- An embargo on the export of any timber or forest products harvested from customary land unless the logging company has in place a firm contract with the landowners to reforest, or promote and manage regeneration of the logged-over areas. This contract would stipulate (to the satisfaction of the government’s forestry agency) a management plan for, say, a five-year forest establishment period, as it is pointless simply planting trees if they are not tended to ensure they are free from grass or vine competition or from undesirable woody species.

- Where timber is harvested for the local market, a reforestation contract should be part of the timber permit. A ‘reforestation tax’ should be imposed where a logging company does not intend to carry out the reforestation itself or through a government-approved agent. That tax should be set at a sufficiently high level to make it attractive for the logging company to undertake the replanting themselves, rather than leaving it to landowners or the government.

- An alternative approach could be to use ‘performance bonds’. Such bonds are used in many parts of the world as part of mining approvals, and are used also by organisations such as the Great Barrier Reef Marine Park Authority in relation to coastal and marine developments. In mining and coastal development, performance bonds must be provided by the miner or developer (the resource user) to cover the costs of the maintenance of structures and facilities, the costs of insurance premiums, the costs of removing structures and facilities from the site, and for site rehabilitation if the user defaults on any of their responsibilities.

Bonds are usually provided in the form of a guarantee from an approved financial institution such as a bank, although other forms, such as cash deposits, may be used. This approach could be adopted
for forestry activities, with the bond covering replanting, rehabilitation if needed, and any other environmental clean-up costs. It should be set at a level that not only covers potential costs but serves as an incentive for the forest users to undertake this work themselves. Performance bonds also have obvious applications in mining, particularly in relation to the management of mine tailings.

Domestic production and internal markets

Daly's (1994) final suggestion is to shift the focus from free trade and export-led growth to the development of domestic production for internal markets. This is contentious and, at this point in time, has little relevance for Melanesia. It assumes that the domestic production capability is in place and that local markets are developed to an extent which will catalyse economic growth and development. This is generally not the case in Melanesia, with perhaps only Fiji close to such a situation, partially as a result of the success of the export tourism industry.

Furthermore, where there is interest in (and a policy focus on) investing in natural assets, countries need economic surpluses to undertake such investments (Kopp 1992). Such surpluses will be difficult to create in Melanesia if internal markets are deemed the vehicle for economic development, with export markets relegated to a less significant role.

Melanesian countries will be well served by looking to world markets, and by becoming and remaining competitive in those markets. If this approach is supported by appropriate domestic resource management policies then exports of commodities will successfully underpin a level of economic growth and development which is of benefit to the people of Melanesia.

Institutional structures for sustainable development

The successful development and implementation of policies requires an appropriate institutional structure and capability. Furthermore, the management of natural assets requires an ability to assess their value
and the external costs associated with their use, the capability to monitor policies, and the capacity to enforce supporting legislation. Melanesia faces a number of constraints in this regard.

Since independence from their former colonial powers, there has been a major increase in government expenditure on its bureaucratic support in an attempt to establish an institutional structure which would meet the people’s expectations for services. However, such expectations are sometimes based on those observed in more developed nations, and not necessarily appropriate to the lesser-developed Melanesian nations. The countries simply cannot afford the luxury of some public services, such as old age pensions, and unemployment benefits, and all clearly recognise the need to curb existing expenditure and strive for greater effectiveness within a smaller institutional framework. As a result, all countries place great stock on training to improve capability and efficiency.

However, the environmental sector of government within Melanesia has never been provided with the institutional framework, staff numbers and training which would give it the capacity to support sustainable development and enforce environmental legislation. Papua New Guinea and Fiji have made some advance towards developing that capacity, but in Vanuatu and Solomon Islands environmental units are grossly under-resourced, are accorded a very low status within government, and not infrequently ignored altogether.

Environmental responsibility is not the sole prerogative of environmental units, but resource-based departments have made no real effort to identify and rectify environmental problems which stem from their own developmental activities, let alone attempt to counter damage caused by poor environmental practices of the private sector in their use of resources for which individual government departments have been given a specific administrative charter. Natural resource departments in every Melanesian country grossly lack the capacity to monitor resource controls and conservation measures. Monitoring staff are few and special groups, such as timber control units, exist only because of heavy support by aid programs. Too often the easy way out is taken by resource departments which
dump the environmental concerns arising from poorly-planned and executed development on to these tiny environment units, abrogating their own responsibility to act in concert with those units. But such action, by resource departments and environmental units alike, often requires additional resources of staff and funds.

Melanesian governments are therefore faced with a potential institutional imbalance. While an effort is being made to reduce the number of bureaucrats and lower government expenditure on public service generally, at the same time governments are being urged to strengthen the institutional capacity of the natural resource and environmental sectors on which the future prosperity of each country is predicated.

Another major constraint to increased recognition of the need for greater expenditure on environment-related and resource control matters is that the subject of environment does not loom large in the minds of Melanesian people generally. Perceptions are starting to change but some of the social issues arising as a result of rapid population growth and rampant urbanisation are so pressing, that concern for wider environmental issues is often put aside in the fight to tackle what are seen by politicians and the bulk of the population alike as the immediate problems. It is, therefore, easy for governments to restrict spending on environmental management and, in some cases actually reduce expenditure levels.

At the same time these countries need to create the economic surpluses in order to support both economic development and better environmental management. Environmental protection and preservation come at a price. In the industrialised, democratic world voters have signalled their willingness to bear this cost because the environment is seen to be of immense worth to the human race, and should be protected and preserved.

This is a luxury which Melanesian and other less developed countries are less able to afford, and the trade-offs between environmental preservation and development are more starkly contrasted. Economic activity is required to create the surpluses needed to support environmental management, yet inappropriate use, or over-use, of the environment will mitigate against long-term surplus creation.
unless successful investments are made in substitutes and/or in the enhancement of natural assets.

Recent environmental reviews, particularly the national reports to the 1992 Earth Summit (United Nations Conference on Environment and Development) and the National Environmental Management Strategies (or their equivalent) all stress the lack of expertise available to governments in the areas of environmental assessment, management and policy development. Even if governments decide to give the environment higher priority and allocate additional funds accordingly, this expertise will take time to build. Indeed there is little encouragement within Melanesian high schools for top students to consider a career in the sciences, and especially in natural resource, biological or environmental fields.

The communal land tenure systems common to Melanesia require different approaches to resource management and environmental conservation than might be expected under systems supporting individual land ownership rights. The Melanesian land systems are not a constraint to sustainable development, as is often stated in the literature, but they require fresh approaches to land management and great sensitivity by governments in trying to apply national or regional policies for resource development. With many resources being held as common property in Melanesian society, the development of an institutional structure to govern resource use is difficult.

In countries such as Australia or the United States, one policy frequently proposed is to base environmental management on well-defined property rights. In Melanesia, property rights are neither well-defined nor codified in the sense understood by policymakers of western nations. Kopp (1992) argued that property held in common does not provide the incentives for optimal investments in natural assets. It is important, however, to assess whether the Melanesian form of resource ownership can be turned to advantage. For example, it may be possible to establish a system of protected areas, using international grant aid, if landowner groups can see long-term financial benefits in the establishment of such areas; one such area has recently been established on Erromango in Vanuatu to protect a remnant stand of Kauri forest. For this, traditional owners must be
involved in the management of those areas, continue to have traditional rights of use—such as in subsistence agriculture—and be able to secure financial returns through such measures as charging entry fees, employment of 'rangers', and/or an annual management fee for the area in question.

In such cases, communal or common ownership may become the best ally of sustainable management of scarce natural resources.

**The policy framework—summing up**

Some policy initiatives will be simpler to implement than others, while all rely on governments recognising natural resources management as being central to the future of Melanesian nations. Changes to taxation systems, building institutional capacity and systems, developing resource management skills through education and training, and investing in natural capital are all policy matters which can be attended to in the short to medium-term. With some support from aid donors, particularly in the area of technical assistance, governments are in a position to at least begin action on these policy issues immediately. Conversely, changing the system of national accounts, even though a well accepted idea relies on the development of new systems internationally. However, with the considerable international effort presently underway, changes to the accounting system are likely to occur within the next five to ten years.

**Endnotes**

1 Daly (1994) overviews research into economic aspects of sustainable development over the preceding five years and his suggestions (particularly the first two) synthesise various viewpoints put forward by a many researchers. Rather than directly reviewing that body of research for this study and its relevance to the Melanesian situation, it was decided to draw on Daly's summary of the key issues, and consequently frequent reference is made to his work in this section. Those readers who would prefer to review the original literature are referred especially to Repetto et al. 1989, 1992; Peskin 1989; El Serafy and Lutz 1990; and Bartelmus 1992.
2 GNP is the value of all final goods and services produced by domestically owned factors of production within a given time period. (The alternative measure of national income often reported as gross domestic product (GDP). The difference between GNP and GDP is that the latter is the value of final goods and services produced within the country, whereas part of GNP is likely to be earned abroad.)

3 Data from Fiji Forestry Department’s Utilisation Division reports, and Fiji Forest Industries.

4 Marketing Newsletter, International Trade Center UNCTAD/GATT.
General strategies

A conceptual framework for the development process in Pacific island economies has been put forward by Thistlethwaite and Votaw (1992). As part of that framework a series of possible strategies for sustainable development was described. The following material draws partially on that work, complementing the policy framework presented in Chapter 8.

**Raising productivity**

Sustainable development requires an increase in productivity through time, a national output which increases and improves in quality more rapidly than its population and, thus, an increasing value per capita in available goods and services. Thistlethwaite and Votaw (1992, Appendix c-5:319) defined a developing economy as ‘...one in which the output available in any specified time period is increasing relative to the number of people supported by or participating in that economy’. That is, productivity per capita is increasing and individuals are becoming better off materially from one year to the next.

However, this definition relates to a specified time period. The challenge is to ensure that such improvements are sustainable. It
would, for example, be easy to increase economic growth (as conventionally measured) in the short term simply by increasing the rate of exploitation of non-renewable resources; by exploiting renewable natural resources at an unsustainable rate; or by short-term increases in government expenditure, funded by the proceeds of natural asset sales or foreign loans. It is for this reason that Repetto (1992), Daly (1994) and others have emphasised the need for national accounts which distinguish between sustainable and unsustainable activities.

How might productivity be increased in a sustainable fashion? Thistlethwaite and Votaw (1992) identified four general strategies for increasing

- access to more or better natural resources
- improved technology
- improved know-how
- shifting a greater percentage of the population into production activities.

In Melanesia, considerable gains might come from making better use of those resources currently being used. For example, the adoption of more intensive farming systems involving mixed subsistence and cash cropping would save farmers the time and effort involved in clearing new areas and, in theory, raise productivity per unit area per unit time by concentrating farming activity on a smaller parcel of land. Agricultural land would be improved through better management and improved agricultural techniques; and less land would be cleared for shifting cultivation—an investment in land maintenance, forest protection and conservation of biological diversity.
But such farming systems would require new management approaches improved technology (crop varieties, fertilisers, and so on) and a further move into the cash economy (with more of the population in production activities).

Productivity increases are both possible and necessary in Melanesia if sustainable economic growth and development are to be achieved. If resources are being depleted and population growth is exceeding growth in output then sustainable development simply will not be achievable.

**Resource investment and savings**

Investing in natural resources and increasing national savings are important strategies in the quest for sustainable development in Melanesia. But not all production activity is intended to deliver outputs for immediate consumption. To ensure that productivity increases over time, it is essential to direct some proportion of current production to capital creation—to creating outputs that themselves will lead to further output increases. That is, it is essential that national saving, broadly defined, is increased through time.

The development process requires that current outputs sufficiently exceed current consumption to allow both for the maintenance and repair of accumulated capital stocks and for the provision of additional productivity enhancing goods and services. Three criteria must be considered in assessing a nation’s prospects for development.

- Its propensity to save—to put aside some current outputs for deferred usage and investment in productivity enhancing assets.

- Its capacity to absorb investment goods—to build and manage productivity enhancing structures or to absorb valuable new concepts. (Its own savings may well be augmented by donations or loans from overseas savers.)

- The efficacy of its investment decisions, with consideration of matters such as employment creation, energy efficiency and the conservation of natural resources (Thistlethwaite and Votaw (1992)).
Under these criteria Papua New Guinea, Solomon Islands and Vanuatu generally have a poor track record and their current prospects for future sustainable development are poor. Fiji’s prospects are somewhat brighter, in a relative sense.

It must also be acknowledged that aid agencies have not been particularly helpful in strengthening Melanesian (or other) countries to meet those criteria. Such agencies have their own political and bureaucratic objectives, and their own views about development processes and the specific needs of a particular country. They tend to see development as a series of individual projects, each with its own very focused aims and objectives. It is incumbent on the Melanesian nations to develop a sound policy framework and ensure that aid programs are accepted and implemented within the confines of that framework.

Specialisation and diversification One strategy often advocated for increasing productivity is specialisation among producers. It is a feature of the economic development process that producers become more specialised, and trade what they produce for the goods and services they need. The encouragement of specialisation, at either the national or individual level, however, brings with it certain risks. Specialised producers are more vulnerable to market fluctuations, especially important in the agricultural sector where seasonal gluts and changes in demand patterns may bring about a severe decline in prices. At the national level, a reliance on export commodities opens up the economy to the vagaries of international markets. This may be very significant to small trading nations. Conversely, diversification of economic activity spreads the risks of market variability, although it may mean giving up some short-term advantages.

For Melanesia, a sound strategy will be limited diversification. Too much specialisation brings too great a risk for these small economies but, at the same time, the economies are neither sufficiently large nor robust to spread their production activities too widely. However, while they maintain a preferred trading status in certain markets, Melanesian countries have the opportunity to diversify into new areas and to reduce their reliance on commodity exports. Fiji, with its export
tourism and garment industries provides an example of a limited diversification strategy.

While it has been argued that population growth per se is not a major issue generally for Melanesia, it is an important issue for sustainable resource use and the achievement of sustainable income. Continual productivity gains are required, as populations increase, to maintain per capita income levels. The structure of populations in Melanesia, with large numbers in the under-15 year cohort, means that productivity gains per worker must exceed population growth rates. For most of Melanesia this is presently possible because, in general, the complementary resources of arable land and near-shore fisheries still exist in sufficient abundance to support continued productivity growth. The relatively low level of technology in most agricultural systems also means that there is considerable scope for productivity gains in the short to medium-term future.

However, maintenance of these gains in the longer term will require increased national savings, capital formation, and investment in natural resources. Concomitantly, Melanesian governments will be faced with ever-larger challenges of finding ways to productively employ the growing workforce.

Country-specific strategies

This section draws out the policy issues and options identified in the analysis, comments on these from the cultural, economic and political aspects and then, as far as practicable, assesses how these policy options can be made to work.

Papua New Guinea There are many strategies that the Government of Papua New Guinea could adopt to address some of the resource use and management issues which arise. Some strategies have already been put in place or foreshadowed such as improved forest management following the preparation of a National Forestry and Conservation Action Plan in
1989. The foreshadowed intention to use earnings from mineral exploitation to support rural development is further evidence of the recognition of the finiteness of non-renewable resources and the need to invest the proceeds on sustainable activities.

The Department of Environment and Conservation has commented

The economic development strategy of the Government will see the further development of large enclave projects such as the Porgera Gold Mine and oil field at Kutubu. The Government recognises the non-renewable nature of such activities and their limited contribution to local employment. Part of the Government's strategy is to see that the economic benefits of developing its non-renewable resources are used constructively for the sustainable development of renewable resources such as agricultural land, fisheries and forests (1992:4).

The following strategies are suggested for Papua New Guinea.

1. The prime development strategy has been for the exploitation of mineral and oil wealth to finance formal sector development. While it is too early to make any judgement whether this strategy is succeeding, the country's enormous natural wealth does present a clear opportunity to pursue such a strategy. However, many of the benefits of this exploitation appear to have gone offshore with only limited benefit to the country. There is also criticism that the benefits are not equitably distributed. The exploitation of non-renewable resources will need wise management and monitoring to ensure the people derive maximum benefit with minimal environmental consequences. The proceeds from mineral exploitation must be converted into national savings rather than spent on the recurrent budget; otherwise the benefits of these non-renewable resources will be frittered away.

2. The potential for success is heightened by generally low population densities. Therefore, a key strategy for sustainable resource use and development is to attempt to minimise population growth through education and appropriate family planning policies. However, unless this education policy is accompanied by concrete moves towards an appropriate form of government-funded community support for the elderly, then the prospect for a real reduction in the natural birth rate by
2010 among the rural population is poor. Social service benefits may not be such an economic luxury if they are a necessary step to reduced population growth and a more readily achievable national goal of sustainable development.

3. In the agricultural sector, a strategy of commercial agricultural development has been pursued with a certain measure of success. Considerable effort has been directed towards the diversification of the agricultural base. However, for the strategy to produce development which is sustainable, greater attention will need to be paid to environmental issues. For example, concerns have been raised concerning the expanding coffee industry that cropping is moving on to ever-steepier slopes, with the available evidence indicating this has led to increased erosion and siltation of rivers; dumping of coffee pulp has also increased levels of organic matter in streams.

4. Limited evidence indicates that fallow periods are shortening as more good quality land is converted to cash cropping, but without any measures to help compensate for the increased drain on soil fertility. The trend to gardening on steeper slopes and on land of marginal fertility is also pronounced in areas, such as Chimbu Province, as a result of population growth. New, efficient cropping systems are required to cope with intensified subsistence production—systems which are firmly founded on traditional practice but incorporate low-cost, practical measures for multiple cropping and sustained fertility. In order to implement this strategy more resources will need to be focused on agricultural research and extension in the subsistence sector. If this is to be undertaken without a reduction in the effort directed to commercial agricultural development, additional resources will need to be directed towards research and extension. Additional financial resources might be sourced from the proceeds of the exploitation of mineral resources.

5. New forest management practices set out in the National Forestry Development Guidelines (Papua New Guinea, Minister of Forestry 1993) aim to steer forestry towards sustainable forest use. While the total annual cut is close to the sustainable national forest yield, the allowable cuts for export log operations in some areas are greatly in excess of the sustainable yield. Some operations may better be described as
a forest liquidation. Because of the nature of log export operations, generally from remote locations with limited inspectorial control, Papua New Guinea has foregone considerable revenue due, for example, to under-reporting of export log volumes and prices, and avoidance of customs duties (Duncan 1994)\(^1\).

It is by no means as easy to understate royalty payments to landowners and manipulate government revenue when logs are processed into sawn timber for further local processing into high-value end products, such as furniture. With its enormous mineral and oil wealth, Papua New Guinea is not forced to liquidate its forests through economic necessity. The time would seem overdue for a new strategy to rapidly phase out the export of lower-value, unprocessed logs, with increased emphasis on (and support for) investment in value-adding processes. At the same time, some of the proceeds from timber utilisation and from mineral exploitation should be directed to the post-logging regeneration and management of native forest, together with a re-invigorated program for plantation establishment in joint ventures with landowner groups and land corporations.

6. Sustainable development will require a sustained educational effort to raise the level of community awareness on environmental and resource management issues. An environmental education strategy would include specific campaigns directed, for example, against the environmental damaging practice of repeated firing of grassed areas, cropping excessively steep slopes, and the like. But the main effort should be directed towards countering a popular view that the environment is only an issue when it has an immediate impact on personal livelihood and lifestyle. To a certain extent this low priority may be bound up with the day-to-day struggle of simple existence, but overlaying this is a viewpoint that as there is abundant land and ample resources to serve the population, conservation is not a concern. An intensive environmental education program is needed now,\(^2\) not at some future date when the need for a conservation ethic is thrust upon the nation through dire necessity.

With the correct mix of policy responses Papua New Guinea is well placed to take advantage of its rich natural resource endowment, coupled and of its generally low levels of population pressure.
However, this potential will only be realised if government is prepared to focus more purposefully on the long-term sustainable use of resources as well as the delivery of goods right now.

**Solomon Islands**

There is little doubt that population growth in areas of Solomon Islands is placing increasing pressure on the country’s limited natural resource base (compared to Papua New Guinea). This pressure is exacerbated by the need to generate foreign exchange and has led to over-harvesting of the rainforest.

Initiatives which Solomon Islands could take of its own volition include the following.

1. Development and implementation of environmental education and public awareness campaigns, particularly through support for the efforts of indigenous non-government organisations to disseminate information on environmental issues and the urgent need for conservation steps.

2. Continued donor support to strengthen the nation’s commitment and capability to control logging activities to reduce environmental vandalism and to capture an equitable return to both landowner and government for the harvest of the growth increment of the nation’s forests.

3. A concerted effort to add value to forest products in-country, where this is economically viable and internationally competitive, rather than continuing to rely heavily on the export of lower-value, unprocessed logs. Where a ban on the export of all logs is not immediately tenable economically, very high export taxes should be applied to the export of logs of high-valued, cabinet-wood species in world demand to conserve these for the time when local industry is capable of maximum value-added processing.

4. The implementation of a national population policy and improved public awareness of the benefits of family planning. The comments made concerning this educational process in Papua New Guinea on social security also apply here.

5. Agricultural research, development and extension programs focused on making more intensive use of lands which have already been cleared, and placing traditional agriculture on a...
sustainable basis. Coupled with this activity should be efforts to devise and apply a meaningful land use planning process.

6. Research leading to a greater understanding of the natural resources (both terrestrial and marine) of the nation to lay a sound base for the design of appropriate management regimes. Coastal zone management should be a key component of resource management in Solomon Islands, but these coastal resources are poorly charted and understood.

7. The lengthy effort to produce workable environmental legislation, within the context of coordinated umbrella resource legislation should be brought to conclusion as a matter of urgency. With this legislation must go the financial and human resources necessary to monitor the provisions of such legislation through the offices of the provincial governments. A fundamental precursor would be institutional strengthening of the Environment Division of the Ministry of Natural Resources.

In conclusion, a problem confronting Solomon Islands is that the Ministry of Natural Resources has been forced into a ‘maintenance mode’ even though senior officers have sought a more active resource management role. Because of limited resources within the Ministry, little medium or long-term planning for the management of natural resources is feasible. It is to be hoped that the National Environmental Management Strategy which emerged from very extensive consultation at both area, provincial and national levels will now be implemented; in doing so the Ministry, with full support from government, will be able to shift its mode of operation from the reactive to the more pro-active.

Vanuatu

Vanuatu currently considers it has few environmental problems, but this stems more from the low level of development and quite low population density (except for islands such as Epi and Paama), rather than from any pro-active sustainable development policy.

1. With proposed expansion of beef production, tree crops, forestry, tourism, and fisheries industries, it is inevitable that soil erosion, water pollution and loss of biodiversity will ensue if a course is not carefully charted towards a goal of sustainable
resource management. The national institutional capacity is wholly inadequate to the task of environmental planning, monitoring and enforcement necessary to ensure such expansion programs are truly sustainable.

2. The status of the government's environmental unit needs to be raised, appropriately staffed and adequately funded. Continued donor support to strengthen environmental planning, monitoring and enforcement will be required for the next decade at least, well beyond the planned life of existing donor-funded land use/forestry control projects.

3. Continued and increased donor support is needed to expand the rate of establishment of forest plantations of fast growing, high value, native species in the main, but not excluding exotic species (such as mahogany) which may offer even superior value, provided they exhibit equal ability to withstand cyclones, and resistance to disease.

4. The efforts of the private forestry sector to establish its own plantations to ensure longer-term resource security should be encouraged by government, and indeed made a mandatory requirement of timber licences, with offsetting reductions in taxes and duties applicable to plantation establishment activity.

5. The government has a set of sustainable forest yields on an island by island basis. The national need is to ensure these sustainable yield levels of the natural forest are not exceeded in timber licences without due public debate, and substitution for the resource loss through plantation establishment. The government would also be concerned to conserve the remnant primary forest through land use planning measures which would seek, wherever possible, to contain land clearing for agricultural activity to secondary regrowth areas, while recognising the constitutional right of the custom landowner to use land as seen.

6. As with Solomon Islands, agricultural research programs need to focus on more intensive use of lands which have already been cleared, adapting traditional subsistence agriculture to more intensive production on a sustainable basis. Complementary forestry research must focus on agro-forestry practices, small-holder forest plantation establishment and management, and forestry extension systems.
7. Village-based development should receive as much, if not more attention than export industries. There is considerable scope for closer integration of land-based industries at the village level, focussing particularly on fruit and nut production, timber production, and beef production, together with subsistence cropping. This builds on existing practice in some areas of Vanuatu of blending the production of trees to supply village housing needs with fruit and nuts production and horticulture.

8. There are two potential larger-scale, tree-based activities which would be appropriate for village-based industry development. These are the production of burao (Hibiscus tiliaceus) for its fibre, and the production of treated roundwood poles for house construction.

9. Vanuatu’s burao thickets make up almost one third of the vegetative cover (mostly in northern Vanuatu). Although this species is regarded as a weed by some people, its heartwood is used extensively for house construction, firewood and as live fences. However, it is the bark which is traditionally the most valuable part of the stem, the bark fibre being used throughout the tropics for making rope, nets, ‘grass’ skirts, woven bags and the like. Burao is a major untapped resource of wood fibre, which may have a multiplicity of uses. The resource may offer villagers a simple, but financially rewarding village-based pulpwood industry, and should the bark fibre prove suitable for cloth manufacture (similar to flax), there is a potential to feed a processing industry which would generate considerable rural employment. The commercial possibilities for burao seem realistic, particularly for Espiritu Santo where port facilities, roads and other infrastructure exists.

A number of technical and economic studies are required before this prospect could be shaped into an economically viable proposal, including volume estimation, pulping tests for bark and wood for size classes ranging from finger-sized regeneration to saplings, and for the main burao varieties which are known to occur. Other studies would include roadside pulpwood collection systems, chip storage, transportation (shipping), and marketing.

10. Greater attention should also be paid to the prospect of village supply of treated roundwood poles for the construction of
houses and of such public structures as markets, bus shelters and nakamals (traditional men’s meeting houses). For this prospect to become reality, the Building Code would need to give specific attention to roundwood structures, coupled with the development of simple, gangnail fastening systems for roundwood poles. Roundwood poles would be produced as part of the traditional gardening system, and treated with preservatives at a communal plant, like copra.

11. Land and resource capability studies are needed to determine the level at which more intensive resource use systems can be safely instituted before environmental problems emerge. Donor support for the development and application of land use planning systems hold particular promise for effective, sustainable land management practices. Such donor support should be extended to a revamping of the village-based land court systems for resolving land boundary disputes which plague land use planning and management.

12. The implementation of sustainable resource management practices will be severely constrained if long-delayed draft environmental legislation is not enacted, and other resource-based legislation is not reviewed and amended to bring their provisions fully into line with the concept of sustainable development.

13. Vanuatu does not enjoy a marine resource as extensive as that of its Melanesian neighbours. Current commercial exploitation is small scale with limited capital investment and small vessels. Marine resources would appear to be under-utilised and there is clear scope for greater local participation in the harvest of marine resources, given the right encouragement for investment in offshore fishing capability, in artisanal reef fishing enterprises, and in fish marketing.

14. Tourism will undoubtedly grow and earn increasing revenue for Vanuatu, providing the country’s ambience which attracts tourists in the first place remains strong. However, there should be greater support for the development of exciting tourist destinations outside of Efate and Tanna. Vanuatu has a wide range of potential attractions, especially for the eco-tourist, and, with careful management, these can be used to advantage in Vanuatu’s push for sustainable economic development.
Vanuatu is in a position where pro-active choices can be made about the management and use of the nation's natural resources. The fact that significant steps are now being taken to establish a land use planning capability is evidence of a certain level of commitment by government to longer-term resource sustainability.

Fiji

Fiji has a major head-start compared to many other countries in the Pacific—there is a solid economic, social and environmental database, and a great deal of sophisticated thinking has already gone into planning both the future economic strategies (for example, *Opportunities for Growth*, Fiji Government 1993a) and future environmental strategies (*National Environmental Strategy*, Fiji Government 1993b). The challenges at this stage may be to ensure the correspondence or integration between the two, and to further develop the institutional capability to put the new sustainable development initiatives into operation.

1. The principal concern about natural resources and the environment in Fiji's future is not for depletion of renewable or non-renewable resources, and certainly not as a result of population pressure. Rather, concerns are likely to be for the environmental and social impacts of resource-based developments, and how these developments can be managed to minimise any undesirable consequences. Furthermore, unlike the other independent Melanesian countries, the principle 'driving force' is not population growth, but the quest for higher living standards and the need to generate export earnings.

2. Government should concentrate more on considering the relative costs of 'greenfield' new industries, compared to marginal additions to existing facilities, and on the costs of provision of services (sewerage, water supply and electricity) to municipalities.

3. For forests, fishing and mining, there are choices to be made about the scale and capital intensity of operations. One approach for Fiji is to focus on a small number of large, export-oriented and hopefully profitable operations, which may have large impacts but which tend to be visible, professionally managed and relatively easy for government to regulate. The alternative, of many small, decentralised, labour-intensive units...
may provide more jobs, but more comprehensive institutional arrangements may be required to ensure their environmental and economic sustainability (Byron and Waugh 1988).

4. Fiji has an export-led strategy for the agricultural sector and has fostered agricultural intensification, deregulation and sound commercial practice. There is scope for further intensification of research into niche markets for those crops for which Fiji has a peculiar climatic, geographic or other market advantage. Fiji’s ability to provide off-season fresh produce to the northern hemisphere could possibly be further exploited.

5. The switch from agricultural self-sufficiency in protected domestic markets, to an export-led strategy, with intensification, deregulation and a strong commercial orientation. This will have implications for land use planning, and land-management practices including soil conservation.

6. Through its foresight in establishing softwood and hardwood plantations, the Fiji forestry sector has great potential for value-added processing, employment, and foreign exchange earnings which will peak from 2010. Fiji has the opportunity to use some of the earnings together with continued donor support for further plantation establishment, which will confirm its position as the premier Pacific island supplier of processed timber products.

7. Fiji should press for environmental certification of its timber which will give it a marketing advantage over those Melanesian neighbours (and other timber suppliers in the Asia Pacific region) for whom certification is not a real prospect in the short to mid-term. Because of its plantation establishment program, Fiji is in a position to phase out commercial logging operations in its rainforests by about 2000.

8. If Fiji is to derive maximum benefit from its offshore fisheries, considerable investment is required in extensive infrastructure development and repair. This investment will come from the private sector, particularly those foreign companies which have a major interest in supplying the Japanese sashimi market and other lucrative markets. The government would ensure that maximum benefits come onshore through expanded local processing facilities and fleet servicing.
9. While the offshore fisheries offer considerable potential for expansion of exports, it is a common view that the inshore fisheries which provide the bulk of domestic fish are approaching their maximum sustainable yields, and several inshore sedentary resources are already overfished. Chape and Watling's (1991) strategies for solving the inshore sedentary resource problem are supported, including a reduction in fishing effort, introduction of management measures such as the rotation of harvesting areas and creation of breeding reserves, and better marketing to maximise the value of the existing resource.

10. For Fiji's thriving tourism industry, the sky would seem the limit literally. Fiji looks for increasing numbers of international flights to bring the tourists which will feed the existing resorts and support continued expansion. By the careful location of resort facilities, Fiji has tried to contain the undesirable impacts of tourism, especially on cultural and social values. Eco-tourism is increasingly attractive as a tourist drawcard, especially to the more remote localities and islands. This trend will offer gainful employment in areas which would otherwise have a limited capacity to generate new cash jobs and should be more actively pursued, but again, the concern will be to reach an acceptable compromise between economic development and the protection of social and environmental values.

Endnotes
1 Duncan (1994) estimated that revenue foregone by landowners and the government in Papua New Guinea in one year (1993) was 193 million kina.

2 The medium to be used for education is an important consideration. Radio appears to be the medium with best potential given the dispersed nature of the population (for example, talkback radio is in operation in Port Moresby, with issues such as the environment being aired).

3 As thicket falls outside the technical description of a 'forest', all thickets, including burao, were excluded from volume estimations in the National Forest Resource Survey, although VANRIS does provide estimates of thicket areas.


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Index

agriculture, 44–47, 59, 76, 60, 92, 159, 162, 164, 167
aid (development assistance), 120, 156
reliance on, 8, 128
biodiversity
  Fiji, 27
  Papua New Guinea, 27, 49
  population growth and, 28
  Solomon Islands, 27
technology and, 28
Vanuatu, 25
capital bequests, 3
cash crops, 46, 159
earthquakes, 30
economic development
definition, 4, 155
economic incentives, 146, 147
environment and, 199, 123–126
impact, 132
institutional structure, 34, 147–149,
internal markets, 147
national income accounts, 135–140
social welfare and, 4, 104–106
society and, 123–126
sustainable development and, 10
technology, 118
environment
damage, 6, 8, 113, 114
education, 11, 34, 160, 161
impact assessment, 123
management, 32, 33
pollution, 37
environmental legislation, 21, 23, 33
  Papua New Guinea, 22, 50, 56
  Solomon Islands, 24, 162
  Vanuatu, 24, 165
exports, 52, 70, 78, 88, 97–99
Fiji
  agriculture, 92, 167
  biodiversity, 27
  economy, 97, 100–102
  exports, 97–99
  fish and fisheries, 94, 95, 167, 168
food crops, 92
forests and forestry, 9, 92–94, 167, 168
geography, 90
land use, 91
mining, 96, 97, 167
population, 9, 90, 91
tourism, 168, 169
traditional fishing rights, 96
fish and fisheries, 5, 50, 51, 66–68, 84–86, 94, 95, 166–168
informal sector, 45
land tenure, 12, 24, 42, 86, 150, 151
land use, 45, 60, 61, 91
marine environment
damage, 26, 27, 28
migration, 109, 117
mineral resources, 5, 8, 14, 112
mining, 51–55, 68, 69, 86, 96, 97, 167
national parks
Papua New Guinea, 26
Solomon Islands, 26
Vanuatu, 24, 26
national plans, 119, 127
natural resources
consumption, 135, 136, 139
resource use, 128
sustainable development and, 128
traditional use, 114, 115, 124
Papua New Guinea
agriculture, 44, 45, 46, 47, 159
biodiversity, 27, 49
cash cropping, 46, 159
economy, 55
exports, 52
fisheries, 50, 51
forests and forestry, 9, 44, 48, 49, 50, 159, 160
informal sector, 45
land tenure, 42
land use, 45
mining, 51, 52, 53, 54, 55
oil and natural gas, 53
pollution, 47
population, 41, 42, 43, 44
poverty, 42
resources, 41
sustainable development, 56
traditional practices, 47, 48
population, 106, 107, 109, 111, 157
density, 108, 109, 117
economic growth and, 107, 108
environmental damage and, 14, 108, 115–119
family planning and, 106
migration and, 109, 110, 117
pressure on land, 116
population growth, 13, 37, 103, 104
biodiversity and, 28
resources (renewable), 144
resource accounting, 11, 12
resource information systems, 26, 63, 139
resource taxes, 13
soil fertility, 30, 31
soil erosion, 32
Solomon Islands
agriculture, 59, 60, 162
biodiversity, 27
cyclones, 57
economy, 69, 70, 71
exports, 70
fish and fisheries, 66, 67, 68
food production, 60, 61
forests and forestry, 5, 58, 62–66, 161
government, 63
land use, 60, 61
mining, 68, 69
population growth, 58, 59, 60, 65, 68, 161
sustainable development, 61, 71
women, 61
<table>
<thead>
<tr>
<th>Term</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Pacific Forum</td>
<td>4</td>
</tr>
<tr>
<td>sustainability</td>
<td></td>
</tr>
<tr>
<td>definition</td>
<td>2, 4, 7</td>
</tr>
<tr>
<td>self-reliance</td>
<td>110, 111</td>
</tr>
<tr>
<td>sustainable development</td>
<td></td>
</tr>
<tr>
<td>activities</td>
<td>7</td>
</tr>
<tr>
<td>economic development and</td>
<td>4</td>
</tr>
<tr>
<td>policy</td>
<td>9, 10, 13, 120, 121, 123, 127-129, 134, 135, 140, 151, 157</td>
</tr>
<tr>
<td>precautionary principle</td>
<td>129-131</td>
</tr>
<tr>
<td>productivity</td>
<td>153-157</td>
</tr>
<tr>
<td>resource accounting</td>
<td>11, 12, 26, 131, 132, 137-140</td>
</tr>
<tr>
<td>resource investment</td>
<td>133, 134, 142-145, 155</td>
</tr>
<tr>
<td>resource knowledge</td>
<td>20, 21</td>
</tr>
<tr>
<td>resource taxes</td>
<td>13, 141, 143, 146</td>
</tr>
<tr>
<td>social welfare and</td>
<td>4</td>
</tr>
<tr>
<td>strategies</td>
<td>153</td>
</tr>
<tr>
<td>technology</td>
<td>118</td>
</tr>
<tr>
<td>biodiversity and</td>
<td>28</td>
</tr>
<tr>
<td>timber</td>
<td>38</td>
</tr>
<tr>
<td>technology and</td>
<td>119</td>
</tr>
<tr>
<td>tourism</td>
<td>38, 39, 40, 88, 112, 129, 166, 168, 169</td>
</tr>
<tr>
<td>urbanisation</td>
<td>35, 36, 117</td>
</tr>
<tr>
<td>Vanuatu</td>
<td></td>
</tr>
<tr>
<td>agriculture</td>
<td>76, 164</td>
</tr>
<tr>
<td>beef</td>
<td>78</td>
</tr>
<tr>
<td>biodiversity</td>
<td>25</td>
</tr>
<tr>
<td>climate</td>
<td>73</td>
</tr>
<tr>
<td>economy</td>
<td>87</td>
</tr>
<tr>
<td>exports</td>
<td>78, 88</td>
</tr>
<tr>
<td>fish and fisheries</td>
<td>84-86, 166</td>
</tr>
<tr>
<td>forestry and forests</td>
<td>78, 79, 80, 163-165</td>
</tr>
<tr>
<td>geography</td>
<td>72</td>
</tr>
<tr>
<td>grasslands</td>
<td>80</td>
</tr>
<tr>
<td>institutional capacity</td>
<td>163</td>
</tr>
<tr>
<td>migration</td>
<td>74</td>
</tr>
<tr>
<td>mining</td>
<td>86</td>
</tr>
<tr>
<td>population growth</td>
<td>9, 74, 75</td>
</tr>
<tr>
<td>resources</td>
<td>19</td>
</tr>
<tr>
<td>soil</td>
<td>73</td>
</tr>
<tr>
<td>standard of living</td>
<td>73</td>
</tr>
<tr>
<td>tenure</td>
<td>86</td>
</tr>
<tr>
<td>timber</td>
<td>81-84</td>
</tr>
<tr>
<td>tourism</td>
<td>88, 166</td>
</tr>
<tr>
<td>volcanoes</td>
<td>72</td>
</tr>
<tr>
<td>volcanoes</td>
<td>30, 31</td>
</tr>
<tr>
<td>water quality</td>
<td>29</td>
</tr>
<tr>
<td>water quantity</td>
<td>29, 30</td>
</tr>
</tbody>
</table>
The countries of Melanesia have reached a cross-roads in their development. Melanesia is resource rich, but the long-term economic viability of the region depends on the governments of those countries recognising the immediate necessity of planning their natural resource use with a view to sustainable development. The Pacific 2010 series has been influential in forcing Melanesian policymakers to confront the big questions about the future of their islands.

This book presents a comprehensive view of the challenges faced in establishing economy-wide policy guidelines for sustainable resource use and presents recommendations for action.

Bob Thistlethwaite is a consultant in forestry and environmental policy in the Pacific region. Derrin Davis is also a consultant and teaches in the Faculty of Resource Science and Management at the Southern Cross University.