



Tuvalu



nems

*National
Environmental
Management
Strategy*



Tuvalu

National Environmental Management Strategy

USP Library Cataloguing-in-Publication data:

Tuvalu: National Environmental Management Strategy.
[Apia, Samoa : SPREP], 1997

xxii, 80p. : 29cm.

"Produced with financial assistance from the United Nations Development Programme (UNDP) and the Australian Agency for International Development (AusAID)".

ISBN 982-04-0095-3

1. Environmental Policy—Tuvalu
2. Environmental Protection—Tuvalu
3. Conservation of Natural Resources—Tuvalu
I. South Pacific Regional Environment Programme

HC79.E5D72 333.716099682

Prepared for publication by the South Pacific Regional Environment Programme, Apia, Samoa, 1995

© South Pacific Regional Environment Programme, 1997

The South Pacific Regional Environment Programme authorises the reproduction of textual material, whole or part, in any form, provided appropriate acknowledgement is given.

Coordinating editor
Suzanne Grano

Editors
Roslyn Sharp and Barbara Henson

Design and production
Peter Evans

Artwork for symbols
Catherine Appleton

Photography
Alefaio Semese and John Lane

Cover design by Peter Evans based on
an original design by Catherine Appleton

Maps supplied by
MAPgraphics Brisbane, Australia

Typeset in New Baskerville and Gill Sans
Printed on 110 gsm Tudor R.P. (100% recycled)
by ABC Printing, Brisbane, Australia

Illustrative material cannot be reproduced without
permission of the photographer or artist.

Produced with financial assistance from the United Nations Development Programme (UNDP) and the Australian Agency for International Development (AusAID)

Cover photograph: Main street, Funafuti. (photo by John Lane)

Tuvalu

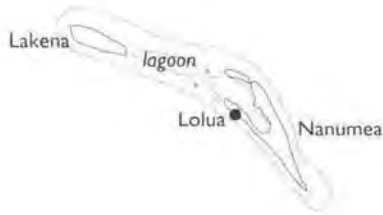
National Environmental Management Strategy

*Produced with financial assistance from the
United Nations Development Programme (UNDP)
and the Australian Agency for International
Development (AusAID)*



Tuvalu

Nanumea



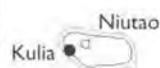
Nanumaga



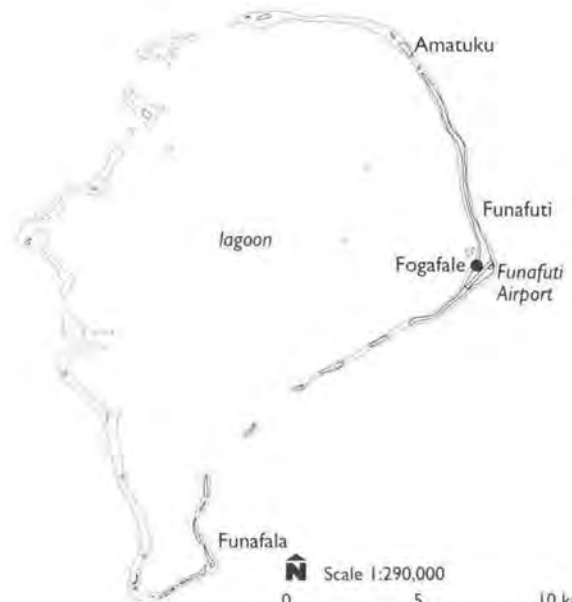
Nui



Niutao



Funafuti



Nukufetau



Vaitupu



Niulakita



Nukulaelae



Foreword

Tuvalu's environmental concerns are typical of most small Pacific Island countries. Global warming and sea-level rise, population growth and distribution and resource over-exploitation are just a few of such concerns. Dealing with these issues will present a substantial challenge for the people and government of Tuvalu.

As Tuvalu's population continues to grow, increased pressure is put on our limited natural resources and on our environment. We know that our resources are limited and we accept that there are no 'quick fix' solutions. We believe that it is now time to deal with our current problems and make plans for tomorrow.

Tuvalu must take real and concrete steps to ensure that it can support its population now and in the future. This will involve the integration of Tuvalu's development aspirations with conservation and resource management principles, to ensure that Tuvalu can accommodate the needs of our growing population, whilst not compromising the needs and aspirations of our children, and their children in time to come. In order for us to realise this goal, the principle of sustainable development must be embraced and observed at every level, from government departments to communities and individuals. This entails a fundamental change in the way we look at the environment, and in the focus of our priorities.

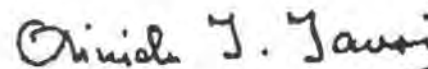
The National Environmental Management Strategy (NEMS) for Tuvalu presents a long-term approach to dealing with areas of environmental concern in our country. The NEMS consists of

management approaches, strategies and programmes in many different areas of the environment, which can serve as initiatives and guidelines in the development of appropriate and sound environmental policy. The aim of the NEMS is to assist Tuvalu in its efforts to achieve sustainable development.

The NEMS and Tuvalu State of the Environment Report (SOE) could not have been formulated without the financial support of the United Nations Development Programme (UNDP) and the Australian Agency for International Development (AusAID). The in-country process of the Tuvalu NEMS was assisted by the South Pacific Regional Environment Programme (SPREP). The Government of Tuvalu extends its sincere thanks to these organisations for their assistance.

The framework for achieving sustainable development has been set in strategies and programmes. The real task ahead, however, is the implementation of these strategies. We realise the difficulties in implementation and welcome the support and assistance of our generous donors and development partners in our efforts to safeguard our environment and our future.

Tuvalu mo te Atua.



Honourable Otinielu Tauteleimalae Tausi
Minister for Natural Resources and Environment

Contents

<i>Map of Tuvalu</i>	<i>iv</i>
<i>Foreword</i>	<i>v</i>
<i>Acknowledgements</i>	<i>xi</i>
<i>Message from UNDP</i>	<i>xii</i>
<i>Message from SPREP</i>	<i>xiii</i>
<i>Acronyms</i>	<i>xiv</i>
<i>Glossary</i>	<i>xv</i>
<i>Executive summary</i>	<i>xviii</i>

Part I The Tuvalu setting *I*

I About the NEMS *2*

- 1.1 Why a National Environmental Management Strategy? *2*
- 1.2 World Conservation Strategy *3*
- 1.3 Scope of the NEMS *4*



2 The Tuvalu setting *5*

- 2.1 Size and location *5*
- 2.2 Climate *6*
- 2.3 Land and coastal resources *6*
 - 2.3.1 Soils *6*
 - 2.3.2 Earth and mineral resources *7*
 - 2.3.3 Land plants *7*
 - 2.3.4 Land animals and birds *8*
 - 2.3.5 Coastal environment *8*
- 2.4 Marine environment *10*
 - 2.4.1 Importance to Tuvaluans *10*
 - 2.4.2 State of fish stocks *10*
 - 2.4.3 Other marine issues *11*
 - 2.4.4 Pelagic resources *11*
- 2.5 Population *11*



- 2.6 Economic framework 12
 - 2.6.1 Structure of the economy 12
 - 2.6.2 Economic development programme 13
- 2.7 Government administration 14
 - 2.7.1 Structure of government 14
 - 2.7.2 Key public agencies 15



3 Major environmental concerns 18

- 3.1 Introduction 18
- 3.2 Global warming and sea-level rise 18
- 3.3 Population growth, densities and distribution 19
- 3.4 Deficiencies in environmental education and public awareness 20
- 3.5 Decline of traditional resource management practices and production systems 21
- 3.6 Unsustainable use of natural resources 21
 - 3.6.1 Terrestrial resources 21
 - 3.6.2 Marine resources 23
- 3.7 Waste management and pollution control 23
 - 3.7.1 Water and sanitation 23
 - 3.7.2 Solid waste and chemical disposal 24
 - 3.7.3 Other pollution concerns 26
 - 3.7.4 Energy dependence 26



4 Institutional issues for resource management and environmental protection 27

- 4.1 Legislation 27
- 4.2 Policy and institutional measures 27
 - 4.2.1 Background 27
 - 4.2.2 Changes in government approach 27
 - 4.2.3 Constraints to change 28
 - 4.2.4 Large-scale projects 28
 - 4.2.5 Cumulative small-scale development 28
 - 4.2.6 Policy tools 29

Part 2 Environmental strategies and programmes 31



5 Integrating environmental considerations into economic development 33

- 5.1 Introduction 33
- 5.2 Adopt an integrated approach to environmental policy and planning 34
 - Programme 5.2.1 Review and recommend appropriate mandates, policies and institutional arrangements for public institutions 34*
 - Programme 5.2.2 Review and upgrade the capacity of the Development Coordinating Committee (DCC) and the Environment Unit 34*

5.3	Submit proposed policies, development programmes and projects to Environmental Impact Assessment (EIA)	35
	<i>Programme 5.3.1 Development and application of standard EIA guidelines</i>	35
5.4	Introduce a comprehensive framework of national and local environmental law, together with means for enforcement which are socially acceptable and culturally sensitive	35
	<i>Programme 5.4.1 Technical assistance for drafting an umbrella national Environment Act</i>	36
	<i>Programme 5.4.2 Review the role of local government in environmental management and investigate options for other technical assistance</i>	36
5.5	Review adequacy of institutional mechanisms and administrative controls and strengthen as necessary	36
5.6	Institute resource pricing in national accounts and other economic policy for achieving sustainability	37

6 Improving environmental awareness and education 38



6.1	Introduction	38
6.2	Review and upgrade the status of environmental education	39
	<i>Programme 6.2.1 Curriculum development in environmental education for primary, secondary and tertiary systems</i>	39
	<i>Programme 6.2.2 In-service training workshops for teachers</i>	39
6.3	Build local government capacity	40
	<i>Programme 6.3.1 Establishment of a focal point for environmental education and information</i>	40
	<i>Programme 6.3.2 Environmental awareness training for government extension officers, planners and enforcement officers</i>	41
6.4	Build community awareness	41
	<i>Programme 6.4.1 Environmental awareness programmes and workshops</i>	41
	<i>Programme 6.4.2 Development of environmental fact sheets, educational resources and visual aids</i>	42
	<i>Programme 6.4.3 Training workshops for NGOs including churches and community groups</i>	42
6.5	Preserve and apply traditional knowledge and management systems	42
	<i>Programme 6.5.1 Documentation and integration of traditional knowledge and management systems into education programmes</i>	42



7 Population policy, balanced development and planned urbanisation 43

- 7.1 Introduction 43
- 7.2 Family planning 43
 - Programme 7.2.1 Population workshops 43*
 - Programme 7.2.2 Improve the institutional capacity of government and community groups to implement a population policy 43*
 - Programme 7.2.3 Integrate population issues into effective environmental planning and management 44*
- 7.3 Controlling in-migration 44
- 7.4 Land-use and development planning 44
 - Programme 7.4.1 Land-use and development plans 45*



8 Improving waste management and pollution control 46

- 8.1 Introduction 46
- 8.2 Education 46
- 8.3 Recycling and reduction of waste 46
- 8.4 Landfill 47
- 8.5 Waste disposal 47
 - 8.5.1 Petroleum waste 47
 - 8.5.2 Hospital waste 47
 - 8.5.3 Chemical waste 47
 - 8.5.4 Sea disposal 47
 - 8.5.5 Sewage 48
 - 8.5.6 Monitoring 48



9 Development and protection of natural resources 49

- 9.1 Introduction 49
- 9.2 Sea-level rise 49
 - Programme 9.2.1 Participation in regional/international climate change monitoring programmes 50*
 - Programme 9.2.2 Anticipating and planning for global warming and sea-level rise 50*
- 9.3 Land and coastal resource protection 51
- 9.4 Marine resources protection 51
 - Programme 9.4.1 Fisheries resources assessment 52*
 - Programme 9.4.2 Development of a marine park at Funafuti 52*
- 9.5 Energy conservation 52



10 Environmental monitoring and reporting 53

- 10.1 Introduction 53
- 10.2 Programme development: important factors 53
- 10.3 Sector monitoring 54
 - 10.3.1 Land 54
 - 10.3.2 Marine environment 55
 - 10.3.3 Climate change 55
 - 10.3.4 Population and health 55
 - 10.3.5 Education and information 55
 - 10.3.6 Development trends 55
- 10.4 Reporting on the environment 55



11 Implementation 56

- 11.1 Implementing arrangements 56

Part 3 Programme profiles 57



References 78

Appendices

- 1 Bird species of Tuvalu 79
- 2 Environmental management and protection laws of Tuvalu 80

Table

- 2.1 Population forecasts from the draft ten-year Water and Sanitation Plan 12

Note All currency amounts are in Australian dollars (\$A) unless otherwise specified.

Acknowledgements

Many people have generously contributed their time and expressed their support in a variety of ways, and it would be impractical to attempt to list all of them here. At the same time, the significant contributions made by a special core of people must be gratefully acknowledged.

The Tuvalu Environment Officer, Alefaio Semese and the Acting Secretary to Government, Feue Tipu deserve special thanks as well as the Attorney-General and staff within the various ministries, departments and councils.

The SPREP Team has been made up of a number of people, both staff members and consultants,

providing specific technical assistance. Our thanks go to Iosefa Maiava, John Lane, Mere Pulea, David Farrier and Ahmet Bektas.



Neva Wendt
Team Leader
National Environmental
Management Strategies (NEMS)
South Pacific Regional Environment Programme

Message from UNDP

UNDP's Environmental Strategy and Action Plan focuses on supporting governments in integrating environmental considerations into their development plans. It provides environmental management guidelines that can be applied to all programmes and project cycles, as part of UNDP's effort to aid governments in their pursuit of sustainable development.

In this regard, UNDP is proud to be associated with the preparation of National Environmental Management Strategies (NEMS) in seven Pacific Island countries. This was carried out through its institutional building project designed to enhance the capacity of the South Pacific Regional Environment Programme (SPREP) to service its mandate from member governments of the South Pacific Commission with regard to environmental assessment and management.

Under this project, UNDP provided SPREP with legal and financial consultants to working groups charged with guiding SPREP to institutional independence, a strategy consultant to formulate its long-term corporate plan, and an environmental management specialist to oversee the development of NEMS in seven countries. UNDP further supported the UNCED process by providing funds not only for Pacific regional workshops but for airfares and subsistence allowances to enable participation by Pacific Island governments and NGOs in the UNCED Preparatory Committee meetings.

UNDP is also undertaking a follow-up programme which will focus on building capacity in fifteen countries of the Pacific region for the implementation and mainstreaming of the NEMS process in national development efforts.

Economic development strategies in any country must be compatible with environmental goals: the challenge is knowing how to do this. It is, however, possible to make choices and decisions that will eventually promote environmentally sound development by understanding how the environment functions, identifying what needs to be done to protect, conserve, enhance and preserve it on a long-term basis, and linking national objectives with environmental management activities.

The National Environmental Management Strategies facilitate the making of such choices and decisions through a participatory process which brings together government departments, non-governmental organisations, and communities in a spirit of inclusiveness and social integration.

UNDP therefore applauds the timely publication of the National Environmental Management Strategy for Tuvalu. This document will undoubtedly provide a further stimulus to the integration of environmental considerations into the national process for the planning and management of development in a sustainable manner.



Anthony R. Patten
Resident Representative
United Nations Development Programme

Message from SPREP

We Pacific Islanders share a common aspiration for economic development and improved living standards for our people. However, we are aware that this development cannot be at the cost of the environment. We have lived in close harmony with our island environment for thousands of years, and we are well aware of its importance to our way of life. We face the complex challenge, in common with many other countries of the world, of achieving economic development in a way which will not significantly affect our environment. This major challenge must be addressed if our Pacific way of life is to survive.

The preparation of National Environmental Management Strategies (NEMS) in several Pacific Island countries has been a major tool in addressing these issues. This undertaking was made possible through the generous financial assistance of the United Nations Development Programme (UNDP). This assistance is gratefully acknowledged.

The Tuvalu National Environmental Management Strategy (NEMS) is a practical document

which aims to identify Tuvalu's major environmental issues and the priority environmental programmes required to address them. The emphasis has been on ownership of the NEMS by the government and people of Tuvalu. The process which has resulted in the preparation of the NEMS has involved many participants comprising relevant government and non-governmental organisations in Tuvalu.

The NEMS process has proved a most useful vehicle for raising awareness of environmental issues. However, the success of the NEMS exercise will ultimately be judged by its implementation. If the NEMS document sits on a shelf and gathers dust, the exercise has failed.

SPREP looks forward to working with Tuvalu and with other regional and international organisations in the implementation of the NEMS.

Mr Tamarii Tutangata

Director

South Pacific Regional Environment Programme

Acronyms

DCC	Development Coordinating Committee
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
IPCC	Intergovernmental Panel on Climate Change
IUCN	World Conservation Union
MFEP	Ministry of Finance and Economic Planning
MHARD	Ministry of Home Affairs and Rural Development
MHHRD	Ministry of Health and Human Resources Development
MNRE	Ministry of Natural Resources and Environment
NAFICOT	National Fishing Corporation of Tuvalu
NEMS	National Environmental Management Strategy
NGO	non-governmental organisation
OPM	Office of the Prime Minister
SOE	State of the Environment Report
SPREP	South Pacific Regional Environment Programme
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WCED	World Commission on Environment and Development
WCS	World Conservation Strategy
WWF	World Wide Fund for Nature

Glossary

Tuvaluan terms

'Bebe' bank	Rock bank thrown up by cyclone.
borrow pit	Pit excavated during World War II to provide landfill for the airstrip.
'pulaka' pit	Pit in which taro is grown when soil conditions are harsh.

General

algae	Non-flowering, stemless water-plant, especially seaweed and phytoplankton.
artisan	Someone skilled in an industrial or applied art; a craftsperson. Adj. artisanal .
avifauna	Birds of a region or country collectively.
biodiversity	The variety of plants and animals in an area. Biodiversity refers not only to the number of different species but to the full range of genetic variation within each species.
cadastral	Relating to the official register of land which shows details of ownership, boundaries, and value for taxation purposes.
conservation	Managing the way people use natural resources so that they give the greatest sustainable benefit today, while keeping their full potential to meet the needs and aspirations of future generations.
corporatisation	Process whereby an activity or enterprise previously operated and owned by government under public funding progressively becomes operated and owned on a private and profit-making basis.
degradation	The result of poor resource use which pollutes, damages or reduces the quality of resources available to future generations.
disturbed	Change in the natural order as the result of human activities or climatic change.
ecology	Branch of biology which deals with the relation of plants and animals to their environment.
economic growth	The increase in the value of goods and services produced in a country, usually measured over a year.
ecosystem	A community of plants and animals and the environment they inhabit.
effluent	A liquid flow.
endangered species	Species that are in danger of disappearing.
endemic	An animal or plant which is found only in one region or country and is not present naturally in any other part of the world.

environment	All the living and non-living things in a particular place or on the earth generally, and the way they interact or work together.
erosion	The wearing away of the earth's surface (for example, soil) by the action of water, wind etc.
fauna	Animals.
feasibility study	A study of the practicability of a proposed project.
flora	Plants.
food-chain	A series of organisms each dependent on the next for food.
geology	The science of the earth, including the composition, structure and origin of its rocks.
geomorphology	The study of the physical features of the earth's surface and their relation to its geological structure.
greenhouse effect	The greenhouse effect is a natural process occurring in the atmosphere. Carbon dioxide and other greenhouse gases trap the sun's heat, warming the earth and allowing life to flourish.
gross domestic product	The money value of all goods and services produced in a country. This value is used to measure a country's national income over a year.
groundwater	Water found in soil or in the pores and crevices in rock.
habitat	The natural home of a plant or animal species.
indigenous	Something that originally occurred in a particular area.
infrastructure	The basic structural foundations of a society or enterprise. Also refers to basic facilities such as roads, airports, electricity and communication systems; typically, their development is costly and is undertaken by governments.
introduced species	A species which does not naturally occur in a particular area but rather has been brought in from outside.
leachate	Water which has percolated through the earth, a rubbish tip, mine waste etc., and hence carries impurities.
natural resource	A naturally occurring stock or supply which can be used to help meet human needs and wants.
nutrient	A substance providing essential nourishment for the maintenance of life.
organic	Relating to plants, animals or other living matter.
pelagic fish	Fish that live in the open ocean rather than close to shore.
pesticide	Chemical that kills unwanted organisms.
private sector	Activities and enterprises run by individuals or groups on a profit-making basis.
public sector	Activities and enterprises run by government.
recycle	To convert something to reusable material instead of throwing it away.
remittance	Money transferred between countries, for example, Tuvaluans abroad sending money to their families at home.
resource	A stock or supply which can be used to help meet human needs and wants.
sediment, sedimentation	Matter which settles to the bottom of a liquid.
sewage	Waste matter, especially from toilets, conveyed in sewers.
species	A scientific name given to each different type of animal or plant.
strategy	A plan to help achieve certain goals.

subsistence	Producing mostly for own consumption, for example, farming which directly supports the farmer's household without producing a significant surplus for trade.
sustainable	Using a resource in such a way that its supply and quality are maintained indefinitely into the future.
toxic	Poisonous.
vegetation community	A commonly occurring grouping of plants and trees.

Executive summary

Background to the NEMS

The consultation process is vital to the development of any management strategy where implementation is dependent on the action of individuals and communities. The process to develop this strategy has been one of consultation and consensus-seeking; it involved a number of steps including reviews of environmental education and legislation in Tuvalu, and the conduct of national seminars (which involved non-governmental organisations, church groups, and other community leaders).

The preparation of the Tuvalu State of the Environment Report (Lane 1994) was an important part of the NEMS exercise in that its purpose was to provide background information for the strategies; indeed, this NEMS document draws very heavily on the State of the Environment Report (Lane 1994). As well, much information on the natural and human environment has been taken from the Tuvalu country report prepared for the United Nations Conference on Environment and Development (UNCED) (Government of Tuvalu 1992a) and the Tuvalu Medium-Term Economic Framework Programme, 1992–1994 (Government of Tuvalu 1992b). This NEMS document has also been thoroughly reviewed by the Development Co-ordinating Committee and has been endorsed by Cabinet for implementation.

The Tuvalu environment: overview

In order to be successful, a National Environmental Management Strategy must be formulated in the context of the overall natural, socio-economic, cultural and political environment of Tuvalu. Chapter 2 provides a brief overview of Tuvalu in

terms of its location and size, climate, land and sea resources, culture and history, people, government, resource ownership and economic development. It is not the intention to reproduce here the detailed information contained in the State of the Environment Report. Chapter 2 simply highlights the key issues which are necessary for an understanding of the discussion of strategies and programmes for addressing major environmental concerns. The key issue highlighted here is that of a resource base which is limited and vulnerable — thus the need for government to lead by example in setting Tuvalu on a more sustainable path to development.

It can probably be suggested that the environmental problems which Tuvalu must deal with in the short term can be solved. In fact, the environmental condition of all the islands other than Funafuti could be considered good. On the other hand, Tuvalu has major environmental concerns which need to be clarified and addressed if the environment is not to be degraded beyond recovery in the long term. These environmental concerns are described and assessed in Chapter 3. They are as follows.

- ◆ Global warming and sea-level rise
- ◆ High population growth and densities, and uneven distribution
- ◆ Deficiencies in environmental education and public awareness
- ◆ Decline of traditional resource management practices and production systems
- ◆ Unsustainable use of natural resources
- ◆ Waste management and pollution control

The matter of institutional arrangements for resource management and environmental protection including legal and policy frameworks is also a significant environmental concern, and this is

discussed in Chapter 4. The Tuvalu government has recognised these problems and constraints, and has begun to set in place a programme for addressing them.

Overall national goals

The main development objectives of the Tuvalu government as set out in its Medium-Term Economic Framework Programme, 1992–1994 (Government of Tuvalu 1992b) highlight the need for sustainable development and include:

- ◆ sustained long-term growth of the economy, without undue corruption of social or cultural values;
- ◆ improvement in the distribution of income by diversifying the economic base, enhancing private sector initiative, improving infrastructure and increasing economic activity, without harming the environment;
- ◆ establishment of sound macro-economic policies and strategies within the public sector to direct and manage financial, economic and social affairs.

The policies and programmes proposed under the environment sector for pursuing the above objectives are:

- ◆ keep the issue of global warming on the international agenda;
- ◆ prepare a National Environmental Management Strategy;
- ◆ recruit an Environment Officer;
- ◆ establish equipment to monitor sea levels;
- ◆ undertake Environmental Impact Assessment (EIA) for future development projects;
- ◆ improve management of waste through implementing the Water and Sanitation Plan, encouraging householders to recycle aluminium cans and plastics, and composting organic waste;
- ◆ undertake a pilot project to fill the Funafuti borrow pits with sediment dredged from the lagoon (subject to EIA);
- ◆ continue the second phase of the coastal protection works project; and
- ◆ further train the Meteorological Division Scientific Officer on forecasting tropical cyclones.

Role of the NEMS

The NEMS document takes these initiatives further and discusses possible strategies to achieve the government goals, particularly the goal of sustained long-term growth. There is some emphasis on biodiversity conservation in these strategies, but clearly the focus is on the sustainable use of species or ecosystems.

Overall, the Tuvalu NEMS is a longer term range of strategies and programmes through which Tuvalu may achieve sustainable development, though in some respects it must also be viewed as a snapshot in time which will be modified by changes in circumstances. Certainly, the number of programmes and actions suggested for government consideration is indicative of the broad range of possible strategies for addressing the goals of the Tuvalu NEMS.

The strategies and programmes presented in this document have been derived from the same consultative process which developed the NEMS. They have been considered and endorsed by the Development Coordinating Committee and Cabinet. However, it must be emphasised that policy decisions on which strategies and programmes should receive priority attention are rightly matters for the Tuvalu government, and any suggestions made in this NEMS document relating to prioritisation should be viewed in that light.

NEMS main objectives

The strategies for attaining sustainable development in Tuvalu are presented in this document under six broad objectives.

- (1) Integrating environmental considerations into economic development (chapter 5)
- (2) Improving environmental awareness and education (chapter 6)
- (3) Population policy, balanced development and planned urbanisation (chapter 7)
- (4) Improving waste management and pollution control (chapter 8)
- (5) Development and protection of natural resources (chapter 9)
- (6) Environmental monitoring and reporting (chapter 10)

Integrating environmental considerations into economic development

To achieve sustainability of resource use and environmental conservation, it is necessary to integrate environmental safeguards into economic decision making. This has been recognised throughout the world and the region, and was a recurring theme at the NEMS seminar held on Funafuti in November 1993. There are a number of steps which can be taken immediately on a national level to ensure such integration, and these could be carried out under five strategies for proper environmental management.

- (1) Adopt an integrated approach to environmental policy and planning.
- (2) Submit proposed policies, development programmes and projects to Environmental Impact Assessment (EIA).
- (3) Introduce a comprehensive framework of national and local environmental law, together with means for enforcement which are socially acceptable and culturally sensitive.
- (4) Review adequacy of institutional mechanisms and administrative controls and strengthen as necessary.
- (5) Institute resource pricing in national accounts and other economic policy for achieving sustainability.

These strategies are described in the document with specific programmes for their implementation.

Improving environmental awareness and education

Effective, long-term environmental management will require an informed and supportive public. This has been a recurring theme in the seminars held during the preparatory phase of the NEMS. The main objective of the awareness and education strategy for Tuvalu is to establish a comprehensive environment education and information programme and have it incorporated into Tuvalu's "Education for Life" policy.

In the formal education sector this means improving environmental content of curricula and developing more appropriate resource materials for schools, as well as improving the ability and confidence of school teachers to use such materials. There is also a need for improving community awareness through workshops/seminars

and other more traditional forms of dialogue, arts and play, which should result in (1) more public support for environmental management activities; (2) more responsible actions; and (3) an ability to make decisions based on an understanding of sustainable development issues.

For such non-formal education/awareness programmes to be effective, there is a need to develop special-purpose educative materials. The awareness/education strategy must also target government, from extension officers to top-level officials and politicians. Further, because of the great relevance of traditional knowledge and practices in efforts to promote sustainable development, there is a need to preserve and integrate these into environmental education and management programmes.

Population policy, balanced development and planned urbanisation

Although the problems of overpopulation, overdevelopment, and uncontrolled urbanisation are most acute on Funafuti, a strategy for maintaining sustainable growth rates would have to incorporate the principles of balanced regional development in order to try to manage the inward migration from outer islands, which is a major source of population pressure on Funafuti.

Overall, to address such problems effectively, three programmes are recommended for action: (1) family planning; (2) controlling in-migration; and (3) urban/land-use planning.

Improving waste management and pollution control

Although Tuvalu does not yet have a serious pollution problem and therefore has the opportunity to address current concerns and prevent future ones from emerging, there are significant concerns on Funafuti relating to: (1) solid waste disposal; (2) petroleum waste management; and (3) water quality monitoring (marine and groundwater). The strategy for addressing these and other pollution concerns in Tuvalu include programmes in education, recycling, proper landfill and adequate waste disposal.

Development and protection of natural resources

With respect to land, Tuvalu's resource base is quite limited and fragile. With respect to the ocean, the

resource base is enormous, but difficult to manage. The maximum but sustainable development of these resources requires programmes to address the following:

- ◆ sea-level rise and its threat to coastal areas and resources;
- ◆ the need to conserve and protect land and coastal resources against excessive and unwise use;
- ◆ protection of marine resources against land-based pollution and unsustainable harvest levels; and
- ◆ energy conservation.

Environmental monitoring and reporting

Perhaps one of the most significant strategies for environmental protection and management is monitoring and reporting. The outcome of such a strategy forms the basis for well-informed, and therefore effective, policies and planning. Its outcome is also the basis for evaluating the success or failure of other strategies. In this respect, monitor-

ing is central to all of the environmental management strategies suggested in this report.

Monitoring could be carried out on the changes with respect to land; the marine environment; weather (important for a vulnerable place like Tuvalu); population and health (which provide some indication of the state of the environment); education and information; and development trends. At the same time, there is a need to ensure that results of monitoring activities are reported in such a way that they can be incorporated into policy making.

Implementation

The most appropriate body to oversee the implementation of the NEMS is the Development Coordinating Committee (DCC). It takes over from the Tuvalu Task Force on the Environment (TTFE) which was originally set up to oversee the preparation of the Tuvalu country report for UNCED.

PART I
The Tuvalu setting





About the NEMS

1.1 Why a National Environmental Management Strategy?

General

Environmental management strategies are the means for promoting sustainable development through the integration of economic development with conservation. According to *Caring for the Earth: A Strategy for Sustainable Living* (IUCN/UNEP/WWF 1991) successful strategies have four components:

- ◆ consultation and consensus-building
- ◆ database development and analysis
- ◆ policy formulation
- ◆ action plans and implementation.

The consultation process is vital to the development of any management strategy where implementation is dependent largely on the actions of individuals and communities. At the end of the consultation process, there must be consensus on what to do and how to do it. Without consensus, strategies will be ineffective, for there will be no sense of ownership, and without ownership, compliance is unlikely to be achieved. The most realistic strategy, therefore, is one derived in part from a wide participatory process of problem recognition, planning and policy formulation.

Information needs

Effective strategies are built on facts (IUCN/UNEP/WWF 1991). In order to formulate policies



Tuvaluan village. (photo: Alefaio Semese)

and action plans, information is needed on the people, the economy, natural resources and the state of the environment, and on institutions, laws and policies which promote or obstruct sustainable development. For such information to be of use, it has to be stored in a form that is both readily accessible and easily updated and used by non-specialists.

There are many gaps in this sort of information in the Pacific. However, given the urgent need for policies to guide development in the region, decisions can still be made on the basis of available information as long as policies and programmes resulting from such decisions can be adjusted as additional information becomes available, and providing the initial decision does not result in irreparable environmental damage.

Strategy basis

The process to develop this National Environmental Management Strategy (NEMS) for Tuvalu has been one of consultation and consensus-seeking. This NEMS strategy is based on an extensive range of studies, consultations, reviews and other efforts instituted through the National Environmental Management Strategies (NEMS) process. In particular, this strategy document is highly indebted to the Tuvalu State of the Environment Report (Lane 1994). As well, the country report prepared for UNCED, the environmental legislation review (Pulea & Farrier 1994) and the environmental education review (Bektas 1992) undertaken as part of the NEMS process, the results of previous national workshops and seminars held in Funafuti, and the contributions of various people and agencies including government departments, non-governmental organisations (NGOs), church groups, etc. have all influenced the drafting of this document. The document has been thoroughly reviewed by the Development Coordinating Committee and endorsed by Cabinet.

Policy issues

The limitations of the Tuvalu NEMS lie primarily in the areas of (1) database and analysis, and (2) existing policy. With regard to the first, facts are few and analysis is limited in many resource areas. On the other hand, enough is known about the state of the environment to warrant a wide range of actions for its protection.

Secondly, although the government has established an Environment Unit within the Ministry of

Natural Resources and Environment, there is currently no umbrella environment legislation and no official national government environment policy statement. Therefore, there is a need for clear directives for environmental management and conservation.

Limited information and lack of formal policy make it difficult to develop appropriate strategies, and it is obvious that strategies should not be formulated in a policy vacuum. Nevertheless, this NEMS exercise has pointed out certain policy directions which the government and people of Tuvalu could take, and the strategies and programmes suggested here are a constructive step along those policy lines. These strategies and programmes can be refined further, and different tactics may also evolve as more information is available and as government formalises its environment policy.

1.2 World Conservation Strategy

Global context

In 1980, the World Conservation Union (IUCN), the United Nations Environment Programme (UNEP), and the World Wildlife Fund (WWF) (now World Wide Fund for Nature) published the World Conservation Strategy (WCS). This stated that conservation could not be achieved globally without efforts to alleviate the poverty and misery of millions of poor people (IUCN/UNEP/WWF 1980). Environmental degradation had brought about poverty which inevitably caused further ecological damage, which in turn led to greater poverty.

The WCS message was very clear: the combined destructive impact of a poor majority struggling to stay alive and an affluent minority consuming most of the world's resources was progressively reducing the planet's life-supporting capacity, and undermining the very means by which all people could survive and flourish. To break this vicious cycle, the WCS promoted the integration of conservation and sustainable development, defining conservation as:

... the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of the future generations (IUCN/UNEP/WWF 1980).

The WCS emphasised three objectives:

- ◆ essential ecological processes and life-support systems must be maintained;
- ◆ genetic diversity must be preserved; and
- ◆ any use of species or ecosystems must be sustainable.

In 1987, the report of the World Commission on Environment and Development (WCED) was released, adding clarity and conviction to the question of global interdependence between economics and environment (World Commission on Environment and Development 1987). The same year saw the groundwork laid for the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in June 1992 and for which Tuvalu prepared a country report (Government of Tuvalu 1992a).

In 1991, IUCN, UNEP and WWF published in partnership *Caring for the Earth: A Strategy for Sustainable Living*. The intention of the document was "to re-state current thinking about conservation and development in a way that will inform and encourage those who believe that people and nature are worth caring about and that their futures are intertwined" (IUCN/UNEP/WWF 1991).

The approach in this strategy document for Tuvalu is premised heavily on the conceptualisation and strategies contained in these two IUCN/UNEP/WWF documents. Indeed, some of

the strategies are directly relevant to the Tuvalu situation and have been adopted or adapted here.

1.3 Scope of the NEMS

The National Environmental Management Strategy (NEMS) is a longer term view of a range of strategies and programmes through which Tuvalu may achieve sustainable development. There is some emphasis on biodiversity conservation, but clearly the focus of the Tuvalu NEMS is on the sustainable use of species or ecosystems.

In some respects, the Tuvalu NEMS must also be viewed as one snapshot in time, which will undoubtedly be modified by changes in circumstances. Certainly, the number of programmes and activities suggested for government consideration is indicative of the broad range of possible strategies for addressing overall country goals.

The specific programmes presented in this document have been derived from the same consultative process which developed the NEMS. They have been considered and endorsed by the Development Coordinating Committee and Cabinet. However, it must be emphasised that policy decisions on which strategies and programmes should receive priority attention are rightly matters for the Tuvalu government, and any suggestions made in this NEMS document relating to prioritisation should be viewed in that light.



The Tuvalu setting

2.1 Size and location

Tuvalu is a small and fragmented land and one of the world's smallest and lowest island nations, with a combined land area of only 25.9 sq km and elevations of generally less than three metres. While it covers an ocean area of some 900,000 sq km, its small land area is split between nine island groups located between 5° and 10° south and 176° and 179° east. This places Tuvalu approximately 1,100 km north of Suva, Fiji, and 250 km south of Kiribati.

In 1991 Tuvalu's population was 9,043, giving it an overall ratio of 353 people per square kilometre of land. However, the spread is quite uneven, with almost 4,000 people or 43 per cent of total population squeezed onto the main islet of Foga-fale, Funafuti, which has an area of only 2.8 sq km (a third of which is uninhabitable because it is used for airfield purposes or contains excavated borrow pits).

Tuvalu is geologically very young, with most of its islands having poorly developed, infertile, sandy or gravel coralline soils. The atolls are also very dynamic. Sediment is constantly being produced by the forces of the sea, and reef growth, where not retarded or stopped by human interference, continues. The islands themselves are subject to continual erosion and deposition, some of this occurring over a relatively long period but some occurring very rapidly as a result of major storms. The rock rampart which developed on the eastern ocean side of Funafuti during Cyclone Bebe in 1972 is testimony to how quickly substantial changes can occur (Lane 1994).

Of the nine island groups that make up Tuvalu, five can be considered true atolls (Nanumea, Nui, Nukufetau, Funafuti and Nukulaelae), three are table reef islands (Nanumaga, Niutao and Niulakita) while Vaitupu (with the largest land area) has composite characteristics of an atoll and a table reef island.



*Funafuti Lagoon. Tuvalu covers an ocean area of some 900,000 sq km—a resource which is vast but difficult to manage.
(photo: John Lane)*

2.2 Climate

Tuvalu's climate is described as tropical and marine. The country is located in the south-east Pacific trade wind belt just south of the dry belt of the equatorial oceanic climate zone. Tuvalu was generally thought to lie outside the southern cyclone belt. However, it suffered significant damage in 1972 from Cyclone Bebe and has experienced an increasing frequency of cyclones since the late 1980s. While some of the apparent increase in the number of cyclones can be attributed to better record keeping, recent cyclone activity has been generally attributed to shifts in weather patterns over a large part of the Pacific. Much of this change is considered to be cyclical, although global warming induced by worldwide human activity may be contributing to an intensification of this natural occurrence.

Winds over 22 knots only occur between 2 and 4 per cent of the time. Gale force winds (over 33 knots) are relatively rare, and mostly occur as west to north-west winds during the cyclone season from November to April. From May to October winds are generally light and from the south-east.

Rainfall varies throughout the island groups, with the southern islands receiving around 3,500 mm per year, decreasing to about 2,700 mm per year in the northern islands. Rainfall variability is generally moderate but significant in the north. Dry spells and droughts are relatively uncommon (though more common in the northern islands). However, as above-ground water storage is limited and potable groundwater unreliable or absent in some islands, even relatively short dry spells can cause significant hardship.

Air temperatures are essentially uniform, with mean daily maximums and minimums of 31°C and 25°C respectively. Temperatures in excess of 34°C occur every two years or so while temperatures below 21°C occur once every three or four years in the south and once every 10 to 15 years in the north.

Sea temperatures (surface) vary little from a mean of 29°C. Nearly all reported waves and swells are under three metres, with most having an easterly direction. Sea surface temperatures are thought to have risen by 0.5–1.0°C since the beginning of the 20th century.

2.3 Land and coastal resources

The land resources of Tuvalu are extremely limited due to its very small mass combined with a very

large foreshore, as well as the poor quality of its soils. These natural characteristics limit the ability of Tuvalu to rely on its land resources. Some of the limitations include the following:

- ◆ soils are coarse, poorly developed and generally of low fertility;
- ◆ agricultural potential is limited in terms of species that can be grown and the volume that can be produced;
- ◆ only limited water supplies can be provided from ground or surface sources (this difficulty is offset by the generally high annual rainfalls received);
- ◆ mineral development prospects on land do not exist apart from small phosphate deposits on some islands;
- ◆ earth materials (sand, gravel and stone) can only be obtained at considerable environmental expense, either because precious land area is made essentially unusable (such as the borrow pits on Funafuti), or because extraction from the foreshore can lead directly to increased erosion and susceptibility to storm impacts.

What follows is a brief description of the main features of Tuvalu's land and coastal resources.

2.3.1 Soils

The atoll soils of Tuvalu are among the most infertile in the world. They are young, shallow, alkaline, coarse-textured and of carbonate mineralogy. Because of their age they are poorly developed and similar to the original coral limestone parent material. They range from 250–1,000 mm in depth and consist of a variable layer of organic material, coral sand and rock fragments overlaying a limestone platform. There is some accumulation of clays and hydrogen sulphide near the centre of islets close to the water table.

The chemical structure of the soils makes the scarce trace elements of iron, manganese, copper and zinc unavailable to plants. Activity of micro-organisms is limited, water-holding capacity is low, and the groundwater is often saline. Plant growth is highly dependent on organic matter for the concentration and recycling of nutrients.

Levels of organic matter can be relatively high in undisturbed soils under natural vegetation. However, in disturbed areas they can decrease dramatically. Mulching of all available leaf and

vegetable material is common practice for the people of Tuvalu. This commonly occurs around banana plantations and in 'pulaka' pits.

Scattered throughout Tuvalu are areas of phosphate-rich soils and phosphate deposits, which originated from guano deposits accumulated over the years under bird rookery sites. In some low-lying areas on the islets, there are poorly developed, but relatively fertile, wet soils. Vaitupu has the most extensive area of fertile soils, possibly related to a better developed fresh-water lens.

2.3.2 Earth and mineral resources

Mineral deposits in Tuvalu are virtually non-existent. Guano deposits were mined in the late 1800s but those that currently exist, if exploited, could supply local agricultural needs only. However, they could assist in expanding Tuvalu's domestic food production which might reduce reliance on imports.

There are limited prospects of finding mineral-rich nodules or crusts (polymetallic manganese and copper) on the ocean beds within Tuvalu's Exclusive Economic Zone (EEZ). Further investigations are necessary but early development of any such minerals would seem unlikely.

Earth materials are relatively abundant but are usually extracted at significant environmental cost (or potential cost). The limited ability of Tuvalu to provide earth resources in an environmentally sound manner could become a key constraint to development projects. This is particularly true of projects such as sea walls, land reclamation works and airstrip construction or extension which may require large volumes of earth materials.

2.3.3 Land plants

Number of species

It is estimated that the total number of plant species of Tuvalu consists of under 200, of which a maximum of 50 could possibly be indigenous. None are endemic. Of the exotics, most are ornamental species, food plants and weeds.

Main vegetation communities

The main vegetation communities consist of coconut woodland in stands of varying age and condition. It has been estimated that on outer islands an average of 67 per cent of the area is occupied by this ecological community. Other communities in-

clude coastal strand vegetation, limited areas of coastal marsh vegetation, and some small remaining areas of indigenous inland broad-leaf woodland, often represented by a few individuals standing together. There are also house yards, village gardens and areas — sometimes relatively large — of open weedy (waste) lands.

Modification of natural systems

Over the years, Tuvalu's natural systems have been greatly modified by agricultural and urban development. Even on uninhabited islets the natural systems have been modified by the planting of food crops such as coconuts. Despite its poor representation and additional modification, there is a strong case for maintaining the biodiversity of the land flora because of their utilitarian uses and to maintain species diversity. Although exotics dominate the species list, it is the indigenous plants which are the most useful for cultural and utilitarian purposes. Existing even in disturbed habitats, they are also ecologically important species. Because of all these aspects, the protection and enhancement of the indigenous species are important.

Value of vegetation

Although vegetation communities are of mixed quality and remaining indigenous vegetation is extensively disturbed, these plants are of critical importance to Tuvalu. Plants remain a major food resource despite the increasing tendency of the population to eat manufactured (generally imported) goods, and vegetation continues to be used for an extensive range of utilitarian and cultural purposes. In an area of extremely high solar radiation, the importance of vegetation in providing shade, particularly around houses and in villages, cannot be overestimated.

In terms of environmental protection, vegetation also plays a critical role. It can provide "soft" protection for foreshores, preventing erosion at a much lower cost than the "hard" protection provided by sea walls, and reducing the impact of storm surges by stabilising coastal zone soils. Vegetation inhibits the penetration of salt spray inland (important in the protection of some food crop species), and in decomposition provides one of the few (and inexpensive) methods of increasing soil nutrient levels. It also improves soil texture and water retention capabilities.

Mangrove communities provide foreshore protection and are of value as a source of raw materials

for construction and handicrafts. They are also essential nursery areas for many important fish and other marine food species. This last point is significant, given the dependence many Tuvaluans have on produce from the sea.

2.3.4 Land animals and birds

There are most likely no indigenous land mammals in Tuvalu, with the Polynesian rat probably being introduced by the earliest inhabitants. The main indigenous land animals consist of birds, insects and some land crabs. Species of lizard and frogs are also present. The main domestic and introduced mammals include dogs, cats, common rats and pigs.

Ten families of birds are present on Tuvalu and 28 species have been reported. These are listed in Appendix 1. With several introduced exceptions, these are mostly sea birds or migratory species. Little data exist on the avifauna of Tuvalu, but the chain of islands probably serves as an important flyway for species feeding on migratory journeys and for those that breed there. There are, of course, a significant number of domestic fowl.

Birds form a dietary supplement for many Tuvaluans, although this may be becoming limited to the outer islands as population pressure on Funafuti restricts significant bird populations to the more remote islets on the western edge of the lagoon. Relative to other places, it is rare to see any birds on Fogafale islet. Despite protected status

under conservation laws, many bird species are commonly eaten.

2.3.5 Coastal environment

General description

For the purposes of this section, the coastal zone is considered the intertidal zone plus the area of foreshore regularly affected by wave action during tidal surges. While variations exist between the islands and on islands (depending on their orientation), a typical atoll ocean foreshore consists of a steep reef slope rising from considerable depths to a low reef crest at the seaward edge of a relatively narrow reef flat. These features are usually covered or, at least, covered at low tide. A small conglomerate platform is sometimes evident above the high-water mark.

The most obvious feature is the steep rubble mound, the top of which is often the highest point on the island. In undisturbed areas, thick coastal species vegetation grows on top of and down the lagoon side of the mound. This mound and its vegetation offer good, natural foreshore protection. The rubble mound is sometimes used as a source of earth material.

Lagoon foreshores are made up of finer, often sandy, material. A reef slope which rises from the shallow lagoon floor to the seaward edge of a broader reef platform is a common feature of a lagoon-side coastal zone. The beach between the tidal extremes is usually made of sand or rock



The uninhabited western islets of Funafuti Atoll provide a haven for fish and birds that are subject to heavy hunting pressure closer to the main settlements. (photo: John Lane)

Crushed rock for construction is excavated from the ocean foreshore, thus reducing the protection offered by the natural "sea wall" built by Cyclone Bebe. (photo: Alefaio Semese)



broken from the reef area. From the high water mark the land rises to a mound which is lower and less steep than the ocean side.

Dynamic processes

The general theory of atoll building is that sediments and beaches erode on the lagoon side, while new sediments (generated from the corals growing on the reef slope) are deposited and build up on the ocean side. Under common climatic conditions, the process of erosion and accretion happens at a relatively slow rate, but during severe storms and tidal surges or as a result of human interference, this process can be rapid and extensive.

Erosion along lagoon shores is often of great concern because of the concentration of village sites near lagoon foreshores. On some islands where there is no lagoon or where urban or infrastructure developments are located beside ocean shores, erosion and depositional activity (particularly during storms) are also of concern.

Coastal land systems are by their very nature dynamic in character. The processes of weathering (sediment production), erosion, and the transport and deposition of rock, gravel and sand are driven by the powerful forces of the sea. Tuvalu, with a coral reef type of foreshore environment, has a large coastline relative to its land area, and its coastal zone is more vulnerable to change than many other types of coastal land systems. The nature of atoll and reef island geology and geomorphology has already been discussed. However, in

considering the coastal environment it is worth emphasising some of these features:

- ◆ atolls and reef islands are geologically young and unconsolidated landforms, and are in a continual process of change;
- ◆ erosion and deposition of foreshore material are natural processes which are often modified by the actions of people through the construction of channels, land reclamation, erosion control and port works.

Implications for human activities

Given the relatively rapid change that occurs to the landform of islands, it is probable that in the past the people of Tuvalu have had to accommodate these changes by moving away from eroding areas or moving onto accreting areas. Anecdotal evidence of this happening on Nanumea is given in Webber (1982).

The coastal zone is Tuvalu's first and last line of defence against the sea. While a naturally dynamic feature, the coast is sensitive to interference. The coastal areas are also the focus of human activities. This potential conflict must be taken into account when coastal development projects or projects which rely on the extraction of resources from this area are being planned. In the light of possible effects caused by climate change and sea-level rise, it would be sobering to cost a project to provide sea wall protection equivalent to that offered naturally by the 'Bebe' bank, now substantially excavated to

provide materials for development projects on Funafuti.

In a natural environment the forces of erosion and deposition will generally balance along a sector of coast. However, Tuvalu's coast has either been modified or human settlement has made sectors of the coast more strategically important (for example, the location of a village or agricultural land adjacent to the foreshore). It is usually considered essential to protect these assets by building coastal defence structures when they are threatened by changes to the coastline. Planning for this situation can prevent future problems. Valuable assets should not be built on vulnerable coastal areas.

2.4 Marine environment

2.4.1 Importance to Tuvaluans

The marine environment is of critical importance to Tuvalu. As one example of this, a 1993 informal household survey conducted in Funafuti by the Fisheries Division found (from a sample of 50 households) that each person eats about 500 g of fish per day; that is, equal to 2,000 kg per day or 730 tons per year across the population of Funafuti. Also, from personal observation, it is reasonable to conclude that the demand for fish is not satisfied in Funafuti. On the outer islands where it is difficult to get other types of food, it can probably be assumed that personal consumption of fish is higher than on Funafuti.

A canoe and small boat survey recently carried out in Funafuti by the Fisheries Division found that the subsistence and semi-commercial group catch was about 300 tons per year. On the other hand, the total catch from the commercial sector (National Fishing Corporation of Tuvalu (NAFICOT)) has been relatively small in recent times, so it could therefore be assumed that the bulk of the remainder of fish eaten in Funafuti (about 430 tons per year) is caught by family and net fishers.

2.4.2 State of fish stocks

For such an essential resource, it is of some concern that so little is known about the sustainable yields of Tuvalu's fisheries. As any adverse impact on fish stocks will presumably be felt first in Funafuti, it is here that we should look closest.

The population growth patterns indicate that because Funafuti is increasing in population at such a significant rate, the pressures being brought on the lagoon and near-shore fisheries must be similarly increasing. In addition, the commercial fishermen fish the same waters as the subsistence operators. By comparison, the population growth rates on the outer islands, in general, are growing slowly, are static, or are declining. Pressure on the fish resource in these areas is unlikely to be increasing significantly.

There is no researched evidence to suggest fish stocks are low in Funafuti or elsewhere. But anecdotal evidence suggests that a lot more effort is being put in for lower returns. There is also limited



Funafuti Town Council representatives examine parts of the uninhabited western islets of Funafuti Atoll which could become some of Tuvalu's first natural resource protection areas. (photo: John Lane)

evidence (from preliminary comments made by the group undertaking environmental monitoring of the Funafuti lagoon dredging programme) that the diversity of species and population levels have declined significantly over the last two years in areas adjacent to the main Funafuti settlement (Vaiaku to the deep-water jetty). It is also reasonable to assume that a resource that was feeding fewer than 1,000 people only twenty years ago but is now feeding four times as many must be under significantly increased pressure.

It is likely in the circumstances that not only are fish stocks declining, but also the diversity of species is being reduced (some species may no longer be present in viable populations). Some species such as clams and turtles are now generally acknowledged as rare. The reasons for this apparent loss of biodiversity are not known but could include population pressure (too many fish being taken), turbidity, high nutrient loads and poor flushing of inshore lagoon waters.

2.4.3 Other marine issues

Other marine resources which are of use but are probably not threatened by over-exploitation at present are shells collected for sale as specimens, and edible seaweeds. The UNCED report suggests that both could form the basis of new sustainable industry in the future (Government of Tuvalu 1992a).

The threat from ciguatera fish poisoning is also a major concern, particularly in Niutao, Funafuti, Nanumea and Nukufetau where outbreaks have been reported. An outbreak of ciguatera occurs following a population explosion of a form of toxic algae which is naturally present in tropical coral reef waters, but usually only in small numbers. The algae is consumed by grazing fish and the toxic effects build up through the food-chain. In humans, poisoning can bring on a range of reactions from mild effects to a fatal illness.

The trigger to the initial population explosion of the organism is not well understood. However, it is believed that disturbances such as storms, channel blasting and dredging or nutrient build-up may be contributing factors. With people so dependent on the lagoon and reef fishery, a significant outbreak of ciguatera would be a disaster.

2.4.4 Pelagic resources

Tuvalu has an enormous oceanic marine area of 900,000 sq km. The pelagic resources are not fished

extensively by Tuvalu. However, a number of licences have been granted to foreign commercial fishing vessels to fish in Tuvalu's Exclusive Economic Zone and it is likely that other unlicensed foreign ships are exploiting this area as well. The government expects to earn on average about \$700,000 each year in licence fees.

Limited surveillance and a lack of enforcement capability makes it difficult to catch unlicensed vessels. Tuvalu is awaiting delivery of a patrol boat (being built in Australia) which will improve its enforcement capability. The South Pacific countries share a strong commitment to work together on fisheries management programmes, particularly those involving international agreements.

Whether the pelagic resource is currently being over-exploited is not known. However, given the increasing exploitation of lagoon and near-shore resources, the pelagic resource may become a very important food resource to Tuvalu in future. In developing a fishing industry strategy, it would seem sensible for the commercial sector to concentrate on the pelagic resource rather than compete with the artisanal/semi-commercial sectors which will continue to fish the lagoon and inshore reef resource.

2.5 Population

Tuvalu's draft ten-year Water and Sanitation Plan deals with the issue of population growth in some detail in an attempt to predict the facilities required to provide these essential services (Reynolds 1993). Tables from that report are reproduced here (Table 2.1) to demonstrate the large increases in population that have been experienced in Tuvalu since 1979 and the forecast growth to 2002 (based on two different assumptions).

The key difference between the two forecasts is not the expected overall population levels in 2002 but the possible distribution between islands. Clearly, the most pessimistic scenario (Two) would see the massive growth rates that have been experienced in Funafuti over the last three years continue. The natural brake on this growth would be the fact that the more unpleasant and difficult life becomes in Funafuti (due to the pressures of over-population), the more attractive life in the other islands will be.

It is wise to be cautious about all predictions of population change (for example, these figures do

Table 2.1 Population forecasts from the draft ten-year Water and Sanitation Plan

Forecast population: Scenario One*						
Island	Actual in year		Forecast for year			
	1979	1985	1991	1995	2000	2002
Nanumea	844	879	818	897	986	1,024
Nanumaga	605	672	644	707	777	807
Niutao	866	904	749	822	904	939
Nui	603	604	608	667	733	761
Vaitupu	1,273	1,231	1,205	1,322	1,453	1,509
Nukufetau	626	694	756	829	911	946
Funafuti	2,120	2,856	3,836	4,209	4,626	4,805
Nukulaelae	347	315	370	406	446	463
Niulakita	65	74	75	82	90	94
Total	7,349	8,229	9,061	9,941	10,926	11,348

* 1985 Economic Plan forecast.

Forecast population: Scenario Two*					
Island	Actual in year		Forecast for year		
	1979	1991	1995	2000	2002
Nanumea	844	818	810	800	796
Nanumaga	605	644	658	675	682
Niutao	866	749	714	672	656
Nui	603	608	610	612	613
Vaitupu	1,273	1,205	1,183	1,156	1,145
Nukufetau	626	756	805	871	899
Funafuti	2,120	3,836	4,674	5,984	6,606
Nukulaelae	347	370	378	388	392
Niulakita	65	75	79	84	86
Total	7,349	9,061	9,911	11,242	11,875

* Change based on 1979/91 actual.

Source: Reynolds 1993

not include almost 1,000 Tuvaluans currently working outside the country). However, there is little evidence to suggest that any current programmes or policies will prevent the large increases forecast. In fact, the current economic development practice and social trends are encouraging continued high rates of population growth in Funafuti.

The critical question is whether the people of Tuvalu want — in under ten years time — a population of more than 6,000 people in Funafuti and the highly degraded environment that (on current practices) will go with it.

2.6 Economic framework

2.6.1 Structure of the economy

The Tuvaluan economy is a mix of subsistence and cash types. The subsistence economy is still dominant in the outer islands, but on Funafuti the cash economy is becoming increasingly important. The Gross Domestic Product (GDP) is estimated to be currently less than \$13 million per annum.

The development of the cash economy is limited by a small land base, a limited internal

"The Fusi", Funafuti's main store. This is where Tuvalu's cash economy is most obvious. (photo: Alefaio Semese)



market and low cash incomes. Export potential is limited to small amounts of copra, clothing and fisheries, with some minor export income from the sale of stamps to collectors and handicrafts to visitors (most of whom are business visitors). The pelagic fish resource offers the best opportunity for an export industry, but the only income from it is derived from the sale of fishing licences to foreign fishing vessels. Tuvalu lacks the capacity to utilise its vast ocean in any other way.

One significant "export" is labour, with the income returning to Tuvalu in the form of remittances. Sailors trained at the Maritime Training School work on foreign merchant ships and a significant group of Tivaluan workers is employed at the Nauru phosphate mine (which is expected to cease operation by the end of the 20th century).

The income from the Tuvalu Trust Fund is also a form of export income and is a critical contribution to the government's recurrent expenditure.

With such a limited resource and capital base, Tuvalu's ability to sustain a cash economy will continue to depend on the support of international aid agencies. Donors are expected to provide around \$26 million in assistance to Tuvalu between 1992 and 1994, which is equivalent to 60 per cent of total capital resources required for the same period (Government of Tuvalu 1992b).

2.6.2 Economic development programme

The government's longer term economic and social development objectives are outlined in its Medium-Term Economic Framework Programme, 1992-1994. These are:



Seamen from the Tuvalu Maritime School train for overseas ships. (photo: Alefaio Semese)

- ◆ sustained long-term growth of the economy, without undue corruption of social or cultural values;
- ◆ improvement in the distribution of income by diversifying the economic base, enhancing private sector initiative, improving infrastructure and increasing economic activity, without harming the environment;
- ◆ establishing of sound macro-economic policies and strategies within the public sector to direct and manage financial, economic and social affairs (Government of Tuvalu 1992b).

To support these objectives, four areas have been identified for strengthening: (1) economic development planning; (2) fiscal policy; (3) foreign and international relations; and (4) environmental conservation and protection.

Specific environmental goals

Within the area of environmental conservation and protection, the following activities were given priority:

- ◆ keep the issue of global warming on the international agenda;
- ◆ prepare a National Environmental Management Strategy;
- ◆ recruit an Environment Officer;
- ◆ establish equipment to monitor sea levels;
- ◆ undertake Environmental Impact Assessment (EIA) for future development projects;
- ◆ improve management of waste through implementing the Water and Sanitation Plan, encouraging householders to recycle aluminium cans and plastics, and composting organic waste;
- ◆ undertake a pilot project to fill the Funafuti borrow pits with sediment dredged from the lagoon (subject to EIA);
- ◆ continue the second phase of the coastal protection works project;
- ◆ further train the Meteorological Division's Scientific Officer on forecasting tropical cyclones.

The Medium-Term Economic Framework Programme thus provides an excellent context for the development of the NEMS, and for the integration of Tuvalu's economic and environmental strategies. Indeed, many of the projects suggested by the Economic Framework document have been already undertaken or are now in the process of

being done. The projects and practices proposed by the NEMS and the Water and Sanitation Plan will continue this very important effort to promote economically and ecologically sustainable development in Tuvalu.

2.7 Government administration

The organisation of government is a significant element in the management and protection of the environment, and government has a central role to perform in environmental management. In Tuvalu, this role can be summarised as being:

- ◆ establishment of environmental policy and coordination of environment programmes;
- ◆ law enactment and enforcement;
- ◆ provision of technical skills and standards;
- ◆ resource allocation among functions;
- ◆ provision of public education and information.

Responsibility for environmental management and protection in any country is spread across a wide spectrum of government agencies. One of the biggest challenges is to coordinate these responsibilities so that environmental management is effective, resources are spent effectively and on agreed priorities, and duplication of effort is eliminated. The principal purpose of the NEMS process is to enable the Tuvalu government to establish its environmental priorities and to provide a basis for the allocation of resources and responsibility across the government sectors.

The purpose of this section is to outline the current structure of government in Tuvalu, identify which groups have responsibility for the different environment sectors, and describe the coordination arrangements between them.

2.7.1 Structure of government

Constitutional and statutory government in Tuvalu operates on two levels. The central government consists of Parliament, the Executive (the Prime Minister and the ministers supported by the public service) and the Judiciary. At the local government level, there are eight island governments, one for each island (except for Niulakita which falls under the responsibility of the Niutao Island Council). These councils are formed under the Local Government Act and therefore have statutory status but not independent constitutional status.

Traditional government is still important in Tuvaluan society, with an island chief playing a major role in determining the pattern of communal activities. This system operates on an informal and non-statutory basis. It is often expressed through the membership of island councils and through the influence of the churches on the lives of most people.

There are 13 administrative units within the central government's administrative structure (including Parliament and the Office of the Governor-General). Most of these organisations have some role in the management and protection of the environment or their programmes have an environmental impact. The approved budget for 1993 for all government agencies is about \$8.1 million funded from the Consolidated Fund (government revenues) and \$7.9 million provided from aid funds (international funds).

In governments around the world, the fragmentation of responsibility throughout separate public agencies makes the integration of environmental management more difficult. Public agencies need to accept that no matter what their primary function, their activities should be assessed for their environmental impact. This seems to be a readily accepted principle in financial management (even environment agencies must be managed according to agreed financial standards) but one not universally accepted with regard to environmental standards. This separation of responsibility also restricts information sharing and transfer between the sectors of government.

2.7.2 Key public agencies

In Tuvalu, the key public agencies and their environment-related functions are the following.

Office of the Prime Minister

This office provides support to the Prime Minister and a number of coordination and support services for other government sectors. In particular, the Office of the Prime Minister provides support to two key government policy and priority setting groups: the Cabinet and the Development Coordinating Committee. Two other functions of relevance in this office are the Training Coordination Section and the Broadcasting and Information Office and Foreign Affairs.

Office of the Attorney General

The Attorney General is the principal legal adviser to government and conducts legal proceedings on its behalf. This office prepares legislation and has significant responsibility in relation to the government entering into international agreements (such as the Convention on Climate Change and the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention)).

Ministry of Finance and Economic Planning

The Ministry of Finance and Economic Planning is responsible for the government's budget and financial management including taxation, excise and tariff policy. This ministry could develop a role in environmental management through the setting of differential taxes and charges in a manner which complement environmental protection policies.

The Statistics Section is responsible for the collection and publication of census and other data. This office could provide a valuable service in the collation of environmental statistical information. Little environmental information is currently available although groups such as the Health Division and the Fisheries Division do collect information of significance to environmental management. The implementation of an environmental monitoring programme would produce a range of information which could provide the basis for an annual report on the environment.

Ministry of Commerce, Trade and Industry

This ministry is responsible for the promotion of commercial private sector development and the corporatisation of public agencies. Specific responsibilities of relevance to the environment sector include tax reform, promotion of tourism and the promotion of import-substituting industry.

Ministry of Labour, Works and Communications

This ministry is responsible for the provision and management of a wide range of infrastructural services. These include telecommunications, meteorology, shipping and civil aviation. Its Public Works Department provides technical advice, project planning, and design and construction services for infrastructure management and development. This includes water and sanitation, the airfield, jetties, boat channels, roads and public buildings.

All of these functions can have an impact on the environment. This ministry should therefore have a critical role in monitoring and protecting the environment and in ensuring that the impact of project proposals is adequately assessed. This role has added importance given the current absence of EIA requirements or an environmental protection agency to carry out this function.

Ministry of Health and Human Resources Development

This ministry is responsible for the government's social services programme covering health and education, and its policies are crucial to providing environmental protection in the long term. In Tuvalu, the two principal causes of environmental degradation are the pressure of population growth and a general lack of knowledge amongst individuals of the impact of their actions. The Health Division is responsible for the government's population policies and the Education Division is responsible for the country's "Education for Life" programme. A wide range of resource material is now available from SPREP to assist teachers in the presentation of environmental education. The introduction of environment protection objectives into both these programmes is essential.

Ministry of Natural Resources and Environment

This ministry is responsible for the development of the fisheries, agriculture and minerals sectors. Clearly, its programmes have an impact on environmental values and are critical to the people of Tuvalu for the provision of the majority of their food needs. This ministry's programmes are oriented more towards resource production than resource conservation.

While this approach is generally common to primary industry organisations all over the world, other countries usually have an environmental protection organisation to provide a balance. Tuvalu would benefit by more attention being paid to environmental research, impact assessment and resource conservation by Tuvalu's resource development agencies. This is particularly so in two areas: the lagoon and reef fish resources and the provision of stone and earth resources for develop-

ment projects. Both issues are of major significance on Funafuti.

The Environment Officer who was previously employed within the Office of the Prime Minister is now located within this ministry. The relocation of this position reflects the importance being placed on integration of resource production and resource conservation in an attempt to undertake development of natural resources on a sustainable basis.

Ministry of Home Affairs and Rural Development

This ministry is responsible for Tuvalu's local government, rural development, community affairs, and lands and survey programmes. These programmes aim to facilitate rural development with the objective of slowing the rate of rural migration to Funafuti. The Lands and Survey Division can play an important role in environmental monitoring and planning as it provides much of the base material and skills necessary for mapping and assessment work.

Police and Prison Services

The Police Service ensures law and order throughout Tuvalu. It can fulfil an environmental law enforcement role, provided officers are educated in the provisions of Tuvalu's environmental laws. At present these laws are limited and not fully enforced.

Local government

The island and town councils of Tuvalu have a legal responsibility for a very wide range of community services. The local government legislation enables, but does not require, councils to undertake environment-related functions such as:

- ◆ activities related to agriculture, livestock and fisheries;
- ◆ building control and land-use planning;
- ◆ education;
- ◆ trees and forestry responsibilities;
- ◆ land protection;
- ◆ famine and drought relief;
- ◆ public health and water supply;
- ◆ communications and public utilities;
- ◆ control of commerce and industry.

With a total annual grant from the government of only \$40,000, limited capacity to raise funds from other sources and almost no staff, local government is much constrained in carrying out these functions and generally does not perform them.

However, they are well placed in the community and are legally empowered to undertake the whole spectrum of environmental protection and land-use planning work.

Major environmental concerns



3.1 Introduction

It can perhaps be suggested that, at present, the environmental problems which Tuvalu must deal with in the short term can be solved. In fact, the environmental condition of all the islands, other than Funafuti, could be considered good. On the other hand, Tuvalu has major environmental concerns which need to be clarified and addressed if the environment is not to be degraded beyond recovery in the long term. These environmental concerns are described and assessed in this chapter.

3.2 Global warming and sea-level rise

General

In its Medium-Term Economic Framework Programme, 1992–1994, the Government of Tuvalu clearly identifies sea-level rise as a major concern:

The principal aim (of the economic plan) with regard to the environment is to keep the issue of global warming on the international agenda. This will be achieved by using international forums to promote the Government's views on the impacts of environmental degradation, especially in the Pacific region (Government of Tuvalu 1992b).

Although the debate is far from conclusive on the level of sea-level rise, there is real concern in Tuvalu that, given its low elevation and long exposed coastlines, even a small rise will have unacceptable consequences. Any rise in sea level will mean loss of land area, which Tuvalu can ill afford. The coastline, which for the most part is the entire country, will become more prone to storm surge and erosion, and coastal infrastructure including ports, airports and causeways will be subject to greater risk, thus making it even harder to attract investment in commercial ventures.

Impact on fresh-water supply

Of more immediate concern in terms of sea-level



Damage from waves at Vaitupu. (photo: Alefaio Semese)

Main street, Funafuti. Vegetation provides valuable protection from sun and wind and helps maintain soil quality. But it is under threat with increasing population pressures. (photo: John Lane)



rise would be a reduction in the size of the fresh-water lens. On small islands there tends to be brackish water interface between the water bodies which can be influenced by tidal change. As sea level rises, therefore, lateral leakage will increase and lenses will become thinner.

There is already much concern about the quantity and quality of fresh water supplies in the country, particularly in the more over-crowded Funafuti with its problems of sewage, chemical residues (fertiliser, pesticides and batteries etc.), and industrial discharges. Further salt-water intrusion is therefore a major issue. Sea-level incursion and sea sprays will also adversely affect agricultural production systems, particularly the production of pit-grown taro.

The government believes that it is a matter of urgency to address the underlying causes of the problem, as well as taking all possible local measures to protect the future habitability of Tuvalu.

Balancing priorities

At the same time, there is legitimate concern that the issue of climate change and sea-level rise has been so prominent that it could overshadow or lead to the neglect of other equally, if not more, important issues such as population growth, pollution, and unplanned development activities.

3.3 Population growth, densities and distribution

Overview

As noted above, Tuvalu has a fast-growing population which on current projections will double

within 35 years. There is also an imbalance in distribution, with about 40 per cent of the population living in Funafuti. The problems associated with such a large and unevenly distributed population in a country like Tuvalu are enormous, given the very limited land resource base. The population on Funafuti has long exceeded the natural carrying capacity of the area and is putting severe pressure on government resources. Overpopulation in Funafuti has contributed to:

- ◆ groundwater depletion and pollution;
- ◆ overfishing of reefs and lagoons, and unsustainable rates of gleaning of intertidal reef flats
- ◆ problems of garbage and sewage disposal;
- ◆ coastal erosion arising from extraction of sand and aggregate for construction;
- ◆ shortage of firewood;
- ◆ loss of knowledge and application of traditional subsistence production systems which effectively conserved resources.

High population densities and overcrowding also put more people at risk of diseases, which must then be managed at great cost to the government and communities.

Some reports including the State of the Environment Report for Tuvalu emphasise the fact that most of the environmental problems in the country are the symptoms of humans putting too much stress on its natural resources. That is to say that, in Tuvalu, the pressure of a rapidly increasing population in an environment that can accommodate only a small total population is a major cause of environmental degradation. The symptoms might emerge as fewer fish in the lagoon, polluted

water and dumped rubbish, but the fundamental problem is that there are now too many people trying to live a lifestyle that requires more and more resources in an environment that is not capable of meeting that demand.

In-migration

There is a need, of course, to separate Funafuti from the other islands when discussing the impact of population growth. Although population growth rates are high across Tuvalu, considerable and continuing migration of people from the outer islands to Funafuti is leading to a situation where it simply will not be possible to house, feed, educate or safeguard the health of the population.

In fact, if current in-migration rates to Funafuti remain constant over the next twenty years, Funafuti's population will have quadrupled by 2016. Population densities are currently over half those of Hong Kong. Unfortunately, unlike that colony, Tuvalu does not have the massive economic power, strategic importance or the large hinterland of a country like mainland China to support the high population levels.

On the basis of its economic and environmental capabilities, Funafuti, and perhaps Tuvalu as a whole, is already beyond a sustainable population level. The adjustments needed to accommodate many more people are either beyond the country's capacity (that is, in terms of technology and economic resources) or unacceptable (in terms of reducing levels of consumption and resource use).

The government in recognition of the problem has responded with a two-tier approach. It is giving high priority to family planning, while providing incentives for people to return to or stay on their own islands.

3.4 Deficiencies in environmental education and public awareness

Overview

Without greater awareness among the public, and hence the decision makers, of the environmental challenges facing the nation and of possible alternative approaches for meeting those challenges, the improvement of environmental management

will be most difficult. Achieving ecologically sustainable development will be similarly difficult.

Indeed, education is the key to improving environmental conditions in Tuvalu. Human actions, mostly carried out in ignorance or without a full understanding of the consequences, are the principal cause of almost all the environmental issues discussed in this report. Undertaking environmental protection programmes which are not backed by public education may solve an issue today but will not prevent its reappearance tomorrow.

"Education for Life" approach

A major concern is that there is currently no formal environmental education programme in place in Tuvalu, although the national education policy (set out in the Medium-Term Economic Framework Programme) has adopted a programme of "Education for Life" which aims to develop the country's human resources, improve the standard of living, and foster greater self-reliance.

To attain this goal, there is a need now to develop an environmental education programme aimed at all levels of school, at the workplace through work and industry-related training programmes, and in the community through community organisations and public information campaigns.

Specific educational issues

During the NEMS seminar in Funafuti in November 1993, other points raised for consideration were that:

- (1) although progress had been made in providing environmental education and in the availability of resource materials, there was a need to improve the ability and confidence of school teachers to use materials effectively;
- (2) the non-inclusion of environmental science as a discrete subject for examination was a disincentive to teaching it;
- (3) there was a lack of appropriate resource materials on environment (that is, materials from and about the Pacific region and Tuvalu);
- (4) there was also a lack of materials including some display materials and other resources on the Pacific environment which could be used for community awareness programmes.

Community involvement

In the areas of non-formal education and raising public awareness of environmental issues, little use has been made of audio-visual materials. Greater efforts are needed in conducting and following up on workshops. There is also a need to make more use of NGOs (including church groups) and island councils in awareness-raising programmes, given their extensive contacts with the communities. The media can also play a very effective role in raising awareness of the environment.

3.5 Decline of traditional resource management practices and production systems

Examples of traditional methods of resource conservation used by the Tuvaluans include restrictions on the type of fishing gear used, and prohibitions on fishing by villagers during the spawning run of flyingfish, bonefish and mullet. Mulching was used extensively for subsistence farming, and many of the trees with cultural and utilitarian values were protected.

Adverse consequences

Unfortunately, the old ways are fast dying out with adverse consequences including the incidence of nutrition-related diseases and increasing dependence on expensive imports. The deterioration of traditional agricultural and subsistence systems is one of the most serious constraints to sustainable development.

On the atolls, the main agricultural and food crops are trees. Household gardens serve as a reserve for medicinal and other useful plants. Most of the trees which provide food, timber, fuel, medicines and serve other important cultural and ecological functions were planted or protected in the past. Today, they are not being replaced or protected by the present generation.

Integrating traditional and modern ways

The influence of modernisation, including education, is blamed for much of the decline in traditional practices and beliefs. Modern education is essential in today's world, but it currently neglects to stress the importance of, and provide training for, traditional resource values and management practices.

Such neglect induces a kind of environmental

insensitivity which fosters an adherence to the prevailing (and environmentally disruptive) development assumptions, and a lack of recognition that some traditional practices may offer better development models. Many of these traditional practices are certainly more environmentally sound and sustainable than some of the modern resource-use practices being introduced. The adherence to some of these traditional practices will also ensure that Tuvaluan culture and identity remain a living phenomenon rather than becoming a mere relic.

3.6 Unsustainable use of natural resources

There are a number of concerns related to the manner in which the environment or natural resources are used by the people, government and business.

3.6.1 Terrestrial resources

Because Tuvalu's terrestrial resources are limited, with land itself the scarcest resource of all, the government and people are conscious of the continued need for resource protection. The government has also initiated many programmes directed towards sound resource conservation and preservation, within the capacity of its resources. Nevertheless, greater effort is needed because of the pressure on some resources caused by increasing vulnerability to climatic conditions, population growth, and changing lifestyles and needs.

Soils

Although many of Tuvalu's food resources are found in the sea and, progressively, more are being found on the shelves of shops, food production from land will remain significant. Indeed, it needs to become more important if sustainable development is to be achieved. Despite the limitations of soil and water, Tuvaluans were traditionally able to develop a sophisticated subsistence agriculture based on coconut, breadfruit, pandanus, native fig and cultivation of taro in pits dug through to the fresh-water lens, and mulched and fertilised with the leaves of highly salt-tolerant coastal plants.

Unfortunately, the traditional, laborious (but effective) techniques of mulching pit-grown taro and other staples are practised less and less as Tuvalu becomes more entrenched in the cash



An area of sensitive ocean foreshore was recently cleared to provide a site for sports facilities. (photo: John Lane)

economy. Yet sustainable development can only be possible if the best soils are protected from urban development, and if knowledge of traditional soil enhancement practices is retained and applied.

Water

Water is another precious commodity in Tuvalu and there is some concern about the pressure being put on both ground and surface sources by humans. There is a need not only to protect our groundwater sources, but also to pay more attention to the conservation and use of our rainwater. Certainly, closer attention to rainwater catchment and storage in Funafuti would reduce the reliance on groundwater supplies.

Earth materials

The uncontrolled extraction of rock, gravel and sand from foreshore areas will leave Tuvalu even more vulnerable to the forces of the ocean and less able to combat the threats caused by climate change or even current climatic conditions. Although seemingly abundant, such materials are often obtained at considerable environmental cost.

In the case of sand mining and the use of dead and living coral from lagoons and fringing reefs, their removal can lead to accelerated coastal erosion and considerable loss of land. With the use of coral (often for house building and sea wall construction), there is considerable disturbance of marine habitats and an associated loss of fisheries resources. The damage could be minimised if these

materials were excavated in an appropriate manner, although the limited and fragile nature of land in Tuvalu makes it extremely difficult to excavate any such materials without significant impacts.

Coastlines

Natural erosion from heavy seas and storm surges is made worse in some areas of Tuvalu through poor management practices, including incorrect use of sea walls, the removal of sand and aggregate for construction purposes, and the cutting of trees along the shorelines. Coastal erosion can threaten valuable human assets. Coastal protection works are expensive and cannot provide protection in all circumstances but vulnerable areas can be identified. Land-use decisions can be made in these areas to prevent the establishment of uses that may require expensive protection schemes at a later time.

Vegetation

The importance of vegetation in the protection of soils and foreshores, and its usefulness as a source of food and for a wide range of cultural and utilitarian purposes, makes its retention and enhancement a priority issue. Unfortunately, its importance does not seem to be widely recognised at present.

For example, anecdotal evidence in Funafuti suggests that many trees have been removed from the village area in the last one to two years, following high winds and storms. This was done without an assessment of the actual danger or potential danger presented by the individual trees, and despite

the important role of trees in reducing wind speeds at ground level. In a further recent example, ocean coastal zone vegetation was removed to provide an area on which sports facilities are to be developed. Vegetation which was providing significant protection in its own right and playing an important role in stabilising soils at this site has been completely stripped back to the top of the rubble mound.

It is reasonable to assume that in both these examples little attention was given to the value of the vegetation's role in environment protection. As pointed out by the UNCED report:

... while floristic degradation in Tuvalu appears to be among the most severe in the Pacific, the vegetation and flora of Tuvalu still constitute a strategic ecological and cultural resource that must be protected. Unfortunately despite the undeniable developmental importance of vegetation protection in Tuvalu, there is still a need for planners and national development plans in Tuvalu to place a high priority on vegetation protection as a basis for sustainable development (Government of Tuvalu 1992a).

Species protection

While both the number and range of land animals and plants are relatively small, Tuvalu is an example of a relatively rare ecosystem and is important for some species of birds. Many indigenous plants and plant communities are under pressure from continued urban and agricultural development. Larger species of trees, traditionally used for canoes and a range of other purposes, are rare in many areas. The maintenance of biodiversity is becoming an important consideration for Tuvalu.

Land-use planning

One of the most effective ways of regulating use of resources and promoting their sustainable development is land-use planning. While development pressure is not so great on the outer islands at present, growth rates on Funafuti and an assessment of current conditions indicate that a land-use plan is long overdue.

3.6.2 Marine resources

Tuvalu's diverse marine food resources, which have helped sustain its people for over three thousand years, constitute a renewable subsistence and commercial resource if managed wisely. The most significant and immediate concern, therefore, is to make sure that the lagoon and reef fishery is not

exploited beyond sustainable levels, particularly in Funafuti. With the limited evidence available on the situation in Funafuti, it is apparent that the inshore fishery resources are already under severe pressure, and that some species such as clams and turtles are now generally regarded as rare.

3.7 Waste management and pollution control

3.7.1 Water and sanitation

General

Since 1978, when Tuvalu became an independent nation, the priority given to the provision of water, sanitation and waste disposal facilities has increased. This is in recognition of the fact that in order to survive, be healthy and lead satisfactory lives, Tuvalu's population requires:

- ◆ an adequate supply of water suitable for drinking, cooking, washing, commerce, industry and agriculture; and
- ◆ suitable methods of disposal for used water and other wastes to prevent the spread of disease through either direct contact with the waste, indirect contact through the use of polluted water, or infection by flies, mosquitoes, rats and similar disease-spreading animals.

Disease outbreaks in 1985 and 1990 showed how the absence of one, or both, led to a life-threatening situation.

Key issues

Water and sanitation programmes have been a feature of each of Tuvalu's economic development plans. A further dedicated water and sanitation plan for the next ten years is currently in draft form and awaiting government approval (Reynolds 1993). The principles of the plan which underlie the recommended programme of works are the following.

- ◆ There are a number of issues related to sewage disposal that need to be considered in the development of the NEMS and the island land-use plans. As discussed earlier, there is a strong possibility that nutrient levels in the inshore lagoon waters adjacent to the village area on Funafuti are already high and increasing. Two factors probably

contribute to this situation: (1) the use of the beach area as a toilet, and (2) the inflow of polluted groundwater caused by the effluent from latrine soakage pits and septic tanks.

- ◆ Increased nutrient levels will damage the marine ecosystem. Changes will take place as coral and the marine animal species which depend on it are displaced by increased algal growth. This will not only reduce the human food supply but could also possibly increase the risk of an outbreak of ciguatera poisoning.
- ◆ Pit latrines will eventually fill and new pits will be required. Where land is limited, such as on Funafuti, this may become a major constraint. Septic tanks in atoll environments, especially in built-up areas such as Funafuti, perform less effectively than in other places because effluent drainage lines are short (due to small allotment sizes), and the nature of the soil combined with a high water table means that nutrient-rich waste quickly enters the groundwater. In addition, sludge from septic tanks must be pumped out periodically. Suitable treatment and disposal arrangements are not currently available.
- ◆ Reliance on a system where sanitation waste is disposed to the ground can effectively make groundwater resources unusable, particularly in built-up areas. This practice may conflict with uses which rely on this resource (such as 'pulaka' pits).
- ◆ The use of the beach as a toilet remains a common practice throughout Tuvalu, even in Funafuti. This traditional method was suitable in past times when population size and densities were low. Given a lack of alternatives, it is still an acceptable practice where such conditions continue to exist and where the ocean beach is used. However, in village areas and especially on Funafuti's lagoon beach, the practice could easily create conditions conducive to the outbreak of disease as well as having an adverse impact on the lagoon ecology. The provision of suitable alternatives (perhaps by requiring two toilets per household) and adequate education are required to address this issue.
- ◆ Animal pens (pigs and chickens) could create significant environmental problems as

more feedlots are established at the same time as human population densities increase, and adequate separation between feedlots and other incompatible uses (such as houses) is not established. Effluent run-off from these activities may already be contributing to water pollution in Funafuti as most feedlots are located on the banks of the borrow pits. In some instances these pits are also used by people to wash in. Animal pens should not be located above groundwater resources which are used by humans, nor should animals (especially pigs) be permitted to "free range" over these areas. Island land-use plans are needed to ensure an adequate separation of incompatible uses.

3.7.2 Solid waste and chemical disposal

General

Although Tuvalu at present does not have a significant or insoluble pollution problem, the rapid changes currently being experienced, including the large growth in population, increased availability of imported consumer products, and an increase in the number of industrial-type activities, means that the potential exists for a very serious problem to develop in the near future. This is especially true for Funafuti, but each island is presently confronting the issue of pollution to some extent.

Solid waste management is perhaps the most obvious environmental concern in Funafuti. Certainly, it is the most visible. It is also likely to become a significant issue in the future on most islands, even if it does not reach the scale of the problem on Funafuti.

Solid and chemical wastes in Tuvalu have many sources and are made up of a range of products including aluminium and steel cans, plastic and paper products, household chemicals including discarded batteries, petroleum products, bleaches, detergents and pesticides. Chemicals can lead to a build-up of contaminants in the environment. Without an adequate method of disposal, particularly in areas of high population density, chemicals such as petroleum products and unwanted pesticides (for example, rat poison) can pose a threat to human health. Even commonly used products such as bleaches and detergents can cause problems if not disposed of properly and later ingested by humans or animals.

With a large number of borrow pits, there is no shortage of places to use as landfills on Funafuti. Sensitive foreshore areas should not be used for indiscriminate dumping of rubbish. (photo: Alefaio Semese)



Household waste

A growing waste management concern is the need to dispose of unwanted or broken household equipment and vehicles. Large numbers of motor vehicles and boats, many of which are second-hand when imported, have been brought into the country in the last few years. Other large household items including refrigerators, washing machines and electronic equipment are also beginning to become common.

The harsh physical environment of atolls means a relatively short life for much of this equipment. These large, bulky and often heavy items mostly pose a physical disposal problem, that is, finding a place where they can be dumped. Some of these items, such as refrigerators and some electronic equipment, also contain small amounts of harmful gases or metals and other chemicals which can build up in the environment.

Agricultural waste

Agricultural production is mostly undertaken on a subsistence basis, generally using traditional management techniques. The tendency to recycle plant and vegetable matter means that this sector does not produce a large volume of solid waste requiring treatment or disposal. The government's economic plan proposes an increase in the volume and variety of agricultural products. Given the infertile nature of most soils in Tuvalu, this objective could possibly lead to an increase in the use of agricultural chemicals, both fertilisers and pesticides. Careful and conservative use of these chemi-

cals can provide many benefits to the community. However, they can cause serious health problems if misused or if unwanted chemicals or their containers are indiscriminately dumped.

Industrial and commercial waste

Industrial and commercial activities are often sources of large volumes of waste (such as paper products and containers), specialised waste (such as petroleum products and other chemicals), unwanted heavy equipment (such as vehicles and engineering plant, electrical transformers etc.) and chemical drums. The operational practices of some industrial activities are already causing pollution of the environment while others are potential sources of pollution (should accidents lead to a discharge of stored material).

There is a need to examine the operations and practices of the major industrial activities in Tuvalu to assess the current and potential threats to the environment and to propose necessary physical works and operational changes. On Funafuti, the operations that should be examined in the short term include:

- ◆ airport operations
- ◆ BP's Funafuti terminal
- ◆ hospital waste disposal arrangements
- ◆ port operations (fuelling, bilge pumping, waste disposal, fish processing etc.)
- ◆ powerhouse operations
- ◆ Tuvalu Cooperative Society waste disposal arrangements.



The Public Works Department depot is one of a small number of industrial plants which should be subject to environmental audit. (photo: Alefaio Semese)

3.7.3 Other pollution concerns

Pollution from vehicles

A growing concern on Funafuti is the pollution of the air from vehicle exhausts, few as they are. Many vehicles are poorly maintained, and exhaust gases contain poisonous gases such as carbon monoxide and other uncombusted hydrocarbons (fuel and oil). When concentrated, such as in village areas where air circulation is limited, these gases are a source of long-term health problems.

The rapid increase in the number of vehicles in recent years (a by-product of a rapidly increasing population and the growth of a cash economy) may lead to air pollution becoming an important future issue in Funafuti. Compulsory vehicle maintenance would alleviate some immediate concerns but limiting the number of vehicles may have to be considered in the long term.

Noise pollution

Noise pollution sources in Tuvalu are limited and noise levels low compared to most other places with similar or even lower population densities. However, the high urban and village population densities mean that noise could become an issue in some circumstances. Noise from industrial processes, vehicles and aircraft is potentially the biggest problem.

On Funafuti vehicle noise is likely to become the biggest source of annoyance to the general public. The rapidly growing number of motor vehicles, many in poor condition, may become an issue of concern but one simply solved by setting and enforcing appropriate vehicle noise limits.

Aircraft noise is high, particularly around Vaiaku, but limited by the infrequent movement of aircraft. However, further residential development should not be encouraged close to the terminal area. Most industrial operations likely to generate noise (the powerhouse, Public Works Department depot and port area) are fortunately located well away from residential and commercial areas. Island land-use and development plans should maintain this separation for new industrial activities.

3.7.4 Energy dependence

Tuvalu is almost totally dependent on imported fossil fuel for its commercial energy requirements. Anything which can be done to reduce the level of the country's consumption of imported fossil fuel would mean significant savings in foreign exchange and release monies for other domestic needs.



Institutional issues for resource management and environmental protection

4.1 Legislation

A review of environmental legislation was undertaken as part of the Tuvalu NEMS process, and its findings published separately (Pulea & Farrier 1994). These are taken into account in this strategy document. However, for the sake of completeness, the main laws of Tuvalu related to environmental management and protection are listed in Appendix 2.

There is a need to improve the environmental laws of Tuvalu and, in particular, ensure application of Environmental Impact Assessment (EIA) to major projects. There may also be a need to modify the Local Government Act since at present the island councils do not have the capacity to exercise the powers available to them under this legislation. The alternative is to provide the councils with the resources to carry out their responsibilities although this may not be cost-effective for the country as a whole.

In general, it does appear that there is plenty of scope under existing legislation for government to require, by policy directives, the adherence of most development to acceptable environmental standards. Law reform or the creation of new laws may be necessary in the long run but is not an immediate priority.

4.2 Policy and institutional measures

4.2.1 Background

It is commonly accepted that the key to effective environmental management, and to sustainable development, is to ensure the integration of economic and environmental planning and pro-

gramme development. As in most Pacific countries, priority has been given to economic development with little emphasis on environmental management. Consequently, Tuvalu has not previously required formal Environmental Impact Assessment (EIA) of major projects. An exception is the EIA conducted in relation to a pilot dredging programme in Funafuti lagoon. In years gone by, a range of infrastructure projects with significant environmental impacts were carried out without EIAs and only limited resources were available for environmental management, resulting in a weak institutional capacity.

4.2.2 Changes in government approach

Over the last few years, the situation has changed. For example, the government requires project proposals prepared by ministries to report on the likely environmental implications of their plans. Coordination and independent assessment of major policy and development proposals currently occur at three stages. Firstly, planning staff in the Economic Planning Section within the Ministry of Finance and Economic Planning assess the proposals; any which they believe to have potential impact on the environment are referred to the Environment Officer. Secondly, the Development Coordinating Committee reviews proposals before they are considered by Cabinet. Once through this process, the proposals are incorporated into the budget-building process or are taken to aid organisations for funding.

Changes are also evident in the way in which government is actively seeking the development of an institutional capacity to manage the environment. One of the most significant commitments in the current economic plan is the preparation of the

NEMS, which is expected to be a key element in environmental management capacity building.

It may be that an adequate framework already exists for effective environmental management. However, what is still needed is a greater environmental awareness among people who manage government responsibilities and make the decisions; a comprehensive government policy statement; and a commitment to implement such a policy. Given the extent to which the public sector dominates the economy in Tuvalu, government commitment and action would alleviate many, if not most, of the problems discussed in this document.

4.2.3 Constraints to change

Firstly, although the policy stated in the Medium-Term Economic Framework Programme identifies the need to promote economic development in an environmentally sustainable manner, the environmental protection programme is, in the main, broad and general. This is understandable given the limited extent to which an environment programme has been developed to date.

In fact, despite emphasis on environmental protection in the new economic policy and the structures of government (including the legislative base and the way in which proposals are developed and executed), more emphasis is still required on institutional processes aimed at sustainable development. In this respect, it is important to note that the NEMS process provides a valuable opportunity to review and change institutional and management arrangements to better reflect the government's current policy.

Secondly, it needs to be emphasised that while the current process of reviewing development proposals is worthwhile, its ultimate success will depend on whether those projects which are considered to have a likely environmental impact are subject to an appropriate degree of environmental assessment before they are finally considered. There are real institutional constraints in the way of undertaking and enforcing EIAs. For example, because of the small size of Tuvalu's economy and the limited number of skilled people available to undertake specialist activities, the government will have to depend on donor agencies for some time.

In addition, the desire to get development projects approved, funded and operational as quickly as possible leads to a temptation to ignore EIA processes. This may be compounded where the

donor country itself, or its aid agencies, do not share a commitment to or accept the importance of EIA. This is a problem in all countries but the lack of legislative power and the fact that assessment processes are new make Tuvalu more vulnerable than many other places.

A third constraint is that, as in most other Pacific Island countries, responsibility for management of the environment in Tuvalu is spread throughout government. While some agencies have direct legislative responsibility for one sector or another, there is no overarching legal basis for coordinating this function, thus making it difficult to address environmental concerns (by nature multi-sectoral) in a comprehensive manner. In recent times the government has begun to address this issue through the appointment of an Environment Officer to the Ministry of Natural Resources and Environment, and by making a commitment to the preparation of a national environmental strategy. However, many changes will have to be made to the present management arrangements, and the Environment Unit will need much more assistance, before any real integration of functions can take place.

4.2.4 Large-scale projects

It is also a fact of life that infrastructure and tourism-related development, with all their impacts on the environment, have been and will continue to be a significant component of economic growth, thus representing an ongoing concern. However, if EIAs are properly carried out and enforced, the impacts of such projects could be managed.

4.2.5 Cumulative small-scale development

On the other hand, development is not just the big, one-off projects but also includes incremental growth in all economic sectors. The increase in the number of motor vehicles, an increase in the volume and standard of construction (for example, houses), the establishment of new businesses, the expansion of existing ones, or a gradual increase in the number of tourists and business visitors are all examples of development. The cumulative effects of these "small" developments are responsible for many of the pollution problems on Funafuti.

Dealing with these incremental changes is perhaps one of the most difficult aspects of environmental management. Because any one of the



Vaiaku Lagi Hotel. Donor-sponsored development such as this will provide a great economic boost to Tuvalu. However, such developments should be subject to Environmental Impact Assessment (EIA) to ensure they meet agreed environmental standards. (photo: Alefaio Semese)

changes in itself has little effect, EIA is out of the question. These situations are also more likely to involve an individual or family trying to improve their own material circumstances. In a small and closely knit society like Tuvalu, it is extremely difficult to regulate such activities.

4.2.6 Policy tools

This problem could be partly addressed through land-use planning. Land-use plans could identify areas for various residential, industrial and agricultural uses so as to minimise conflicts between them, and thus go a long way to minimising pollution.

However, as the State of the Environment Report noted, land-use planning will be no easy task, especially on Funafuti where conflicts between existing uses are already evident, and where land availability is very limited (Lane 1994). This problem is compounded by an increasingly complicated land tenure system, particularly on Funafuti. In fact, while land-use planning remains one of the most effective policy tools in managing development, other tools including pricing policies (taxes and levies) and educational programmes will have to be considered as well.

PART 2

Environmental strategies and programmes



With the publication of the World Conservation Strategy (IUCN/UNEP/WWF 1980) came the clear message that conservation and development must not be regarded as incompatible. Without due regard for conservation, development can only be short-term and cannot be sustained. Since then, and with the growing recognition of the essential interdependence between conservation and development, the term “sustainable development” has become common usage in describing the goal of, and umbrella strategy for, conservation. It is in this manner that the term is being used in this NEMS document.

If there is any difficulty in using the term “sustainable development”, it is due to the fact that it could be interpreted in many different ways. In *Caring for the Earth*, the definition used is: “The use of an organism, ecosystem or other renewable resource at a rate within its capacity for renewal”, or, in a more general way: “Improving the quality of human life while living within the carrying capacity of supporting ecosystems” (IUCN/UNEP/WWF 1991).

In other words, sustainable development is about surviving in the long term. In this respect, sustainable development is something that the Tuvaluans have been expert at for a very long time. Otherwise, they would not have survived on such a limited (fragile) resource base.

The problem today is that the traditional way of life of Tuvaluans, although sustainable, was at a level of material well-being no longer considered adequate by many, especially the people in Funafuti. New types of economic development are required for higher material well-being to be achieved. Unfortunately, the new types of development models being applied in the region and in Tuvalu do not always promote sustainability. The challenge, therefore, is to derive maximum benefits from available resources without jeopardising their capacity for renewal.

To meet this challenge, Tuvalu has organised its environmental concerns under six broad objectives.

- (1) Integrating environmental considerations into economic development (chapter 5)
- (2) Improving environmental awareness and education (chapter 6)
- (3) Population policy, balanced development and planned urbanisation (chapter 7)
- (4) Improving waste management and pollution control (chapter 8)

(5) Development and protection of natural resources (chapter 9)

(6) Environmental monitoring and reporting (chapter 10)

Within these, the following strategies and programmes are directed towards achieving sustainable development and environmental protection in Tuvalu.



Integrating environmental considerations into economic development

5.1 Introduction

As noted already in this document, the key issue in sustainable resource use and environmental protection is to ensure the integration of economic and environmental planning and programme development. This has been recognised throughout the world and the region, and has been one of the key themes in previous reports, including the UNCED and the State of the Environment documents, as well as at the NEMS seminar held in Funafuti in November 1993. There are a number of steps which can be taken immediately on a national level to ensure such integration; these steps could be carried out under five strategies for proper environmental management.

- (1) Adopt an integrated approach to environmental policy and planning.
- (2) Submit proposed policies, development programmes and projects to Environmental Impact Assessment (EIA).
- (3) Introduce a comprehensive framework of national and local environmental law, together with means for enforcement which are socially acceptable and culturally sensitive.
- (4) Review adequacy of institutional mechanisms and administrative controls and strengthen as necessary.
- (5) Institute resource pricing in national accounts and other economic policy for achieving sustainability.



The current practice of excavating rock and sand from the foreshore for development purposes is unsustainable. (photo: Alefajo Semese)

5.2 Adopt an integrated approach to environmental policy and planning

General

Economic and environmental considerations must be integrated if a society is to be sustainable. To this end, government must ensure an effective, integrated approach and provide a national framework of institutions, economic policies, laws and regulations, and an information base. An early area of consideration for the government is how to integrate, both institutionally and procedurally, its policy evaluation, economic planning, physical planning, environmental protection and sectoral development programming activity.

Recent initiatives

The Government of Tuvalu has already indicated that it wishes to address this matter through the development of the NEMS; the creation of an Environment Unit; and the adoption of Environmental Impact Assessment (EIA). This document is a result of such commitment; an Environment Officer has already been appointed; and while a clear policy statement on EIA requirements is still to be formulated, a process is already in place for the assessment of environmental impacts of all major development projects.

Further necessary steps

However, given the constraints discussed in Chapter 4, there is a need to follow through these constructive government initiatives by:

- ◆ formally adopting the principle of sustainability, with the integration of environment and economic considerations built into the terms of reference of government agencies dealing with national economic policy and planning—thus facilitating the reorientation of the development approach to accommodate alternative and more holistic development models;
- ◆ incorporating the principle of sustainable development into the mandates and policies of the sectoral line departments, particularly the key resource development agencies;
- ◆ promoting common approaches to economic and environmental planning both in the public and private sectors;

- ◆ promoting open consultative mechanisms with local communities and pursuing traditional consensus approaches to decision making;
- ◆ strengthening the Development Coordinating Committee (DCC) to be responsible for the integration of economic, environmental and physical planning with the policy evaluation process, and giving it the mandate to examine departmental policy and development or investment proposals before they go to Cabinet; and
- ◆ upgrading the capacity of the Environment Unit to carry out initial screening of project proposals received and to make recommendations to the DCC concerning the need (or otherwise) for Environmental Impact Assessment.

There are two priority programmes which could be carried out under this strategy. Neither need external resources and could be carried out by the government.

Programme 5.2.1

Review and recommend appropriate mandates, policies and institutional arrangements for public institutions

The long-term objective of this programme is to adopt and incorporate the principle of conservation and sustainable development in the mandates, policies and institutional arrangements of all the key public institutions, but particularly those dealing with economic planning and resource development.

Programme 5.2.2

Review and upgrade the capacity of the Development Coordinating Committee (DCC) and the Environment Unit

The long-term objective of this programme is to strengthen these two organisations for the coordination of environmental management initiatives. Of particular interest in this case is the need to spearhead efforts to integrate environmental concerns with development planning.

5.3 Submit proposed policies, development programmes and projects to Environmental Impact Assessment (EIA)

General

Environmental Impact Assessment (EIA) is used to predict the likely economic, social, cultural and biological consequences of a proposed activity (that is, the effect on the environment), and is one of the most effective environmental planning and management tools available to government. It helps identify potential problems and hence aids planning to prevent adverse impacts, or to reduce them to acceptable levels, before investment is committed.

A full EIA is applied only to those development projects which a preliminary screening indicates are likely to have major economic, social, cultural or biological impacts. But all development projects — public and private, foreign and local — must be subjected to an initial screening process. The size of the economic investment in a development proposal is no criterion for the potential magnitude of its environmental impact.

For all projects which (despite not considered to require a full EIA) are likely to have significant environmental impact and are allowed to go ahead:

- (1) an environmental management programme should be included in the project design; and
- (2) the capacity for proper monitoring should be assured (from either internal or external sources), to compare the eventual outcome with the predicted effects, thus permitting adjustment of the planned development process.

Timing and extent

EIA should always be undertaken early in the project cycle. With regard to development assistance agencies, EIA should begin immediately from the country programming mission stage and continue through pre-feasibility and feasibility stages. Subsequently, annual programming mission teams from international agencies such as the Asian Development Bank and World Bank should include a person experienced in environmental appraisal.

EIA must extend beyond development projects to all national and sectoral programmes. Therefore, the institutional EIA capacity should be lo-

cated at the central level of government, where development and sectoral policies, programmes and projects are evaluated. The priority programme under this strategy requires some external assistance for its implementation.

Programme 5.3.1

Development and application of standard EIA guidelines

The need to develop standard EIA guidelines and routinely apply them to all new and existing government and private policies and programmes was recommended by an EIA workshop and the NEMS seminar held in Funafuti in November 1993. The government has also endorsed the need for such a programme in its current development policy. The introduction of EIA guidelines is to be accompanied by detailed administrative procedures for their implementation, and training of responsible officers in EIA.

5.4 Introduce a comprehensive framework of national and local environmental law, together with means for enforcement which are socially acceptable and culturally sensitive

General

In order to achieve harmony between environmental policy and economic decision making at the national level, comprehensive and consistent legislation will need to be introduced. Such legislation would contain a set of clearly defined principles of sustainable use and conservation of the nation's natural and cultural resources, and in this regard it should include provision for mandatory EIA procedures.

The law should also incorporate administrative and enforcement procedures which are likely to engender compliance by the community. This means the incorporation of procedures which are, or have been, part of community life and traditions. In this respect, it is worth noting that the Local Government Act, which provides for a

system of island councils, could be an important instrument for environmental management and protection, although at present there is a prior need to try to match its mandate with the capacity for action.

One of the strategies which Tuvalu has used with relative success has been the use of international fora and agreements (treaties, conventions etc.) to try to influence external forces which have bearing on its environment. Tuvalu is a signatory to, or has acceded to, all regional environment-related conventions, including the Apia and SPREP Conventions, the South Pacific Nuclear Free Zone Treaty (Rarotonga, 1985) and the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific (Wellington, 1989).

Main steps

The implementation of this strategy would entail the following elements:

- ◆ review of existing legislation of relevance to the environment (completed);
- ◆ drafting of an umbrella national Environmental Act reflecting the principle of sustainable development and the role of island councils; and
- ◆ establishing of a new environmental administration structure.

The priority programmes under this strategy require external assistance for their implementation although some of the (research) work could be carried out by a Tuvaluan.

Programme 5.4.1 Technical assistance for drafting an umbrella national Environment Act

This programme involves: (a) drafting an Environment Act and associated administrative policies and structure; (b) guiding it through the process of ratification; and (possibly) (c) assisting in its implementation. It is important to obtain the service of a lawyer who is familiar with and appreciative of the role of customs and traditions in Tuvalu.

Programme 5.4.2 Review the role of local government in environmental management and investigate options for other technical assistance

As the island councils do not have the capacity to exercise their mandate at present, there is a need to review the Local Government Act to identify an alternative approach. For example, the government could take on these responsibilities itself. Alternatively, the government (or donors) could provide the human and financial resources to undertake the planning and enforcement work but use each council as a type of planning and environment commission which would be responsible for decision making. A third approach might involve assistance from a regional planning and environment agency. There are a number of small island states like Tuvalu which do not have the financial capacity, nor the volume of work, to enable them to establish their own expert planning and environment agency.

Given the long history of cooperation amongst the small Pacific countries, it could be appropriate to look to a regional agency, such as SPREP, to provide land-use planning and environmental protection services to member countries; or contract an existing agency from one of the larger regional countries to do the work. Such a proposal would not mean ceding any national sovereignty as each government would remain responsible for making decisions based on the advice of the experts in the regional agency.

5.5 Review adequacy of institutional mechanisms and administrative controls and strengthen as necessary

The aim of such a review is to strengthen the environmental input into government coordination and decision-making systems. Much of the

work could be carried out by the Tuvalu government with its own resources, through the overall NEMS process.

5.6 *Institute resource pricing in national accounts and other economic policy for achieving sustainability*

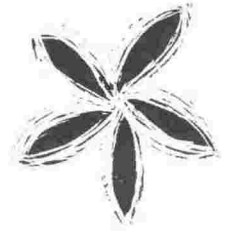
There are many broad economic instruments which countries can apply as flexible and efficient means of promoting sustainable development. In Tuvalu, as in all other Pacific Island nations, there is a need to review existing monetary and fiscal policies for their impact on sustainable resource management and environment protection. Those taxes or subsidies supporting activities which damage ecosystems or resources should be reviewed.

New economic instruments should also be considered as a way of promoting sustainability. For example, where the full cost of a service or resource is not borne by the user, this serves to lessen the interest in conservation. During the course of the Tuvalu NEMS seminar, some participants expressed interest in the introduction of the

“user pays” or “polluter pays” principle as a way of both reducing unnecessary depletion of resources, and providing a strong incentive for pollution control. For example, importers and users of non-biodegradable materials should pay at least part of the costs of collecting and disposing of the materials safely.

Pricing policies and standards can also be used to encourage government, industry and communities to adopt resource-efficient technology. For instance, high prices for imported fossil fuel and for electricity from such imports can promote greater use of solar energy, which for a country like Tuvalu would seem natural. If the Tuvalu government is to take fully into account the effects of its policies, it will need to adopt environmental and resource accounting procedures.

The requirements of this strategy could be met through the two programmes suggested above: Programme 5.2.1 (Review and recommend appropriate mandates, policies, and institutional arrangements for public institutions) and Programme 5.3.1 (Development and application of standard EIA guidelines). Otherwise, the adoption and implementation of pricing/policy instruments could be effectively undertaken by the government itself.



Improving environmental awareness and education

6.1 Introduction

As noted previously, education is the key to improving the environmental conditions in Tuvalu. Human actions, mostly carried out in ignorance or without a full understanding of the consequences, are the principal cause of almost all the environmental problems discussed in this report. Undertaking environmental protection programmes which are not backed by public education may solve an issue today but will not prevent its reappearance tomorrow. In fact, effective long-term environmental management will require an informed and supportive public. This has been a recurring theme in the seminars held during the preparatory phase of the NEMS and is one of the points highlighted in both the UNCED and State of the Environment reports.

It is the resource owners who decide what activities will occur on their land, and it is therefore they who have the greatest effect on the environment. In the case of Tuvalu, the government plays a dominant role in social and economic development, and is therefore seen by many as having the major impact on the environment. Therefore, awareness-raising programmes must not only target individual resource owners, but must also target politicians and government officers. Women must be included, particularly as their daily work always affects the environment. They also have an important role in shaping the attitudes of children.

“Education for Life”

A major concern is that there is currently no formal environmental education programme in place in Tuvalu, although the national education policy (set out in the Medium-Term Economic Framework Programme) has adopted an “Education for Life” programme which aims to develop the country’s

human resources, improve the standard of living and foster greater self-reliance. This must also include developing an environmental education programme for all levels of school, the workplace through work and industry-related training programmes, and the community through community organisations and public information campaigns. This aspect of the NEMS, therefore, aims to establish a comprehensive environment education and information programme and have it incorporated into Tuvalu’s “Education for Life” policy.

With regard to enforcement of environmental legislation, it is assumed that if people are informed about regulation and the reasons for it, they are more likely to comply. Again, this was emphasised in the NEMS seminar with suggestions that environmental legislation and administrative procedures be accompanied by a public education programme.

Spreading the word

Currently, the non-governmental groups (NGOs) and churches have extensive community networks which would make them important channels for conveying environmental messages. The island councils are also well placed for a role in community awareness raising. Other media forms have also been suggested for delivery of environmental messages, including regular radio programmes, newspapers, seminars or workshops by church groups, as well as the more formal education process.

In the area of non-formal education and raising public awareness of environmental issues, little use has been made of visual and audio materials. More efforts are needed in conducting and following up on workshops, and there is also a need to make more use of NGOs (including church groups) and island councils in awareness-raising programmes, given their extensive contacts with



The need to retain significant patches of vegetation such as this will become critical as the population increases and more land is used for urban expansion. (photo: Alefaio Semese)

the communities. The media could also play a much more effective role in raising awareness about the environment. The above goals can be addressed through the following four strategies.

- (1) Review and upgrade the status of environmental education.
- (2) Build local government capacity.
- (3) Build community awareness.
- (4) Preserve and apply traditional knowledge and management systems.

6.2 Review and upgrade the status of environmental education

The main element of this strategy is to review and upgrade the status of formal environmental education in Tuvalu. In fact, such a review has already been carried out under the NEMS process (Bektas 1992), and its findings and conclusions should be considered for action. The two priority programmes under this strategy require external assistance.

Programme 6.2.1 Curriculum development in environmental education for primary, secondary and tertiary systems

This programme aims at extending the current efforts of the South Pacific Regional Environment Programme, the Institute of Education of the University of the South Pacific, and the Tuvalu government to improve the environmental content of the curricula. Some of these environmental materials could also be incorporated into pre-schools.

Programme 6.2.2 In-service training workshops for teachers

As noted during the NEMS workshop in Funafuti, there was a need to improve the ability and confidence of teachers to use environmental science materials. Pre-school teachers could be included in some training workshops.



Niutao community dancing. (photo: Alefaio Semese)

6.3 Build local government capacity

While it is important to establish a sound educational foundation for tomorrow's leaders, it is also important to deal with the here and now. If today's decision makers and managers are not convinced of the need to take action, tomorrow might be too late — thus the need now to build up awareness within government of the importance of proper environmental management. Information on the status of the environment and resources is also needed for decision making. In Tuvalu, the collection and dissemination of such information would have to be done by government. In any case, an environmental information and education plan should be drawn up to indicate how the different requirements could be met. This could be done by the Environment Officer. The priority programmes for this strategy would need some external assistance.

Programme 6.3.1 Establishment of a focal point for environmental education and information

Rather than relying on outside consultancies which often provide a short-term solution to information needs but do not develop an ongoing capability in the country, funding could be more effectively spent in establishing local capacity. Tuvalu's need for information materials (in this case, educative) is ongoing and is shared across other strategies as well.

One of the requirements to consider in establishing a focal point is a secure but accessible environment information and resource library to ensure that the large amount of information currently available is not lost. If the focal point is located outside the Education Division, then close coordination must be maintained with the education sector. This programme could either be a specific one or it could be part of a general capacity-building programme for the Environment Unit.

Programme 6.3.2

**Environmental awareness training for government extension officers,
planners and enforcement officers**

This requirement could be looked at under Programme 5.2.1 (Review and recommend appropriate mandates, policies and institutional arrangements for public institutions). On the other hand, the day-to-day work of extension and planning officers has such immediate impact

on resource use that there is an urgent need for some training on environment management. There is also a need to instruct police and other enforcement officers on environmental and conservation law.

**6.4 Build community
awareness**

As noted previously, a key element for success in environmental management is the participation

and cooperation of the community. The community leaders, being resource owners, are the decision makers of today, and thus are vital. The priority programmes under this strategy require government and donor assistance.

Programme 6.4.1

Environmental awareness programmes and workshops

Special efforts will be needed to ensure that people engaged in subsistence activities in the fishing and agricultural sectors are provided with information about issues of importance to them. Amongst the general population, information programmes need to be developed to raise awareness about issues, educate people to understand the part they play in contributing to environmental degradation, and demonstrate what they can do to improve and protect their environment.

Given their contacts with the communities, non-governmental organisations (NGOs) including church groups and the councils could play the key role of organising such workshops, with the Environment Unit and other government departments providing technical assistance (resource persons and materials) and financial support. These workshops need to reach as wide an audience as possible and should include outer island participants. Some of the community groups should also be used in the organisation and running of workshops but

they, like NGOs and island councils, need some prior training. Such groups include island development committees, village women's groups, youth groups, island community workers etc.

Awareness programmes should not be limited to workshops and should foster other means of spreading the message. Drama/plays in the vernacular have proven a big success in countries like Vanuatu and Papua New Guinea; song, speech and poster competitions are other possibilities. The Environment Unit could also use available media such as radio and newspapers or even newsletters.

Some of these programmes could culminate in an "Environment Week" to be celebrated annually. The finals of competitions could be held during such a week, together with clean-up campaigns, floats, demonstrations (that is, contingency plans for oil spills at sea, mulching, recycling, bio-toilets etc.), and competitions in traditional arts and crafts.

Programme 6.4.2
**Development of environmental
fact sheets, educational resources
and visual aids**

This programme aims at developing information resources for NGOs including church groups and community-based groups, so care must be taken to address them at the right level. A specialist may be required for this particular task. The work could be coordinated through the Ministry of Education or the environmental education focal point but government assistance is certainly needed.

Programme 6.4.3
**Training workshops for NGOs including
churches and community groups**

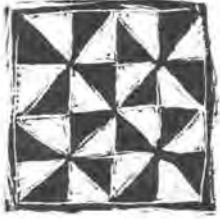
NGOs and community groups need some training in environmental matters before they can be expected to be effective partners in raising awareness of the issues in Tuvalu. This may also serve as a means of encouraging the establishment of a community-based conservation and environment organisation.

6.5 Preserve and apply traditional knowledge and management systems

Given the importance of traditional knowledge and management systems to the sustainable development of Tuvalu, every effort should be made to preserve those elements which enhance the conservation of resources. Perhaps one of the most effective ways of doing this is to integrate aspects of traditional, sustainable resource-use systems for atolls into both formal and informal education programmes. This would certainly rectify one of the shortcomings of the present education system in Tuvalu and the Pacific as a whole, which is the neglect of such materials. The priority programme for this strategy may not need external funding.

Programme 6.5.1
**Documentation and integration of
traditional knowledge and management
systems into education programmes**

It is now clear that traditional knowledge and management practices which ensured sustainable living on Tuvalu for thousands of years are slipping away, and being replaced by modern land management models which are environmentally unproven. Even where traditional resource-use and protection principles may still be adhered to, knowledge of specific practices is being lost. Yet it is this knowledge which is crucial to the development of alternative management systems for today, hence the need to document as much as possible of such knowledge for integration within our school systems.



Population policy, balanced development and planned urbanisation

7.1 Introduction

As the problems of overpopulation, overdevelopment and uncontrolled urbanisation are most acute in Funafuti, remedial actions must focus there. However, the problems in Funafuti must be put in a larger (national) context. It could be suggested, for example, that the immediate cause lies in the movement, since the late 1970s, of people from outer islands to Funafuti.

As has been suggested here and elsewhere, the population growth issue is Tuvalu's most significant and immediate environmental problem. Timely action is needed to change the current trends. The alternative is to experience a continuing downward spiral of environmental degradation and an ever increasing dependence on external economic support. To effectively address such problems three strategies have been developed.

- (1) Family planning
- (2) Controlling in-migration
- (3) Land-use and development planning

7.2 Family planning

The issue of population growth is a sensitive one in most countries. However, it is clear that more effort needs to be put into Tuvalu's current family planning programme. Non-governmental organisations such as the churches and the Family Planning Association are often better placed than government to deal with this sort of social issue. But programmes must be supported by government.

A matter of priority for Tuvalu is to develop and implement a national population management plan to guide programmes and project activities. One of the most important functions of a national

population plan is to ensure the integration of population issues into environmental planning and management. A national population plan should include realistic goals (population growth rates etc.), a time frame, and resource provisions for achieving the goals.

The conduct of population workshops may require some outside funding, but the resource people are available locally. In general, resources are needed to improve the government and non-government capacity in population planning and management, but this does not necessarily have to be in the form of an externally funded project.

Programme 7.2.1 **Population workshops**

These should involve community groups, NGOs and churches, with the government providing resources (finance, logistics and experts). The general aim should be to improve awareness of the benefits (to people and the environment) of smaller families, and the methods and resources for achieving them. The output of such workshops should be a national population plan.

Programme 7.2.2 **Improve the institutional capacity of government and community groups to implement a population policy**

Resources are needed to support family planning initiatives of the Division of Health and NGOs such as the Family Planning Association and churches. Resource materials are also needed for use in school/education programmes on family planning.

Programme 7.2.3
**Integrate population issues into effective
environmental planning and management**

This should follow the development of a national population plan. Its aim is to recognise in a practical manner the centrality of population issues to any efforts to improve the management of the environment and resource base.

7.3 Controlling in-migration

Reducing population growth rates is only one issue. Population levels are already too high on Funafuti and can only be reduced by an active programme of providing incentives for people to stay on, or return to, the outer islands. This will only be achieved by providing some of the attractions of Funafuti on some of the other islands. As the major attraction of Funafuti is paid employment and because the biggest employer by far is government, decentralisation of government activities is likely to be the principal element of any programme. The barriers to a successful programme being achieved are high and establishment costs are also significant. Nevertheless, urgent action is required.

Some external assistance could provide the im-

petus for decentralisation but the Tuvalu government is certainly capable of taking the initiative to promote more balanced development, and indeed it has started to do so already.

7.4 Land-use and development planning

Any programme to reduce or relocate population requires an assessment of the population capacity of the islands involved, what the population targets should be, and where on each island the various land-use activities (urban centres and villages, animal feedlots, agricultural areas, commercial, office and industrial activities, etc.) should be placed. In the outer islands patterns of settlement and land use have largely been determined by tradition. Resettlement, and hence the need to make space for more people, will mean that some activities and structures such as pig or chicken pens will have to be separated from residential areas. Planning for population and land use is an urgent requirement.

The government may have to set building and occupation standards limiting the number of people to be accommodated in houses of different sizes. For example, the building code may determine that the maximum number of residents for a house with two rooms of average size plus a kitchen area and toilet is five or six. The same house with



With rapid population growth land is in short supply. These people are having to build over one of Funafuti's borrow pits. The pit is also used for rubbish and receives animal waste. (photo: Alefaio Semese)

two toilets may be permitted to have eight residents. Such an approach is contrary to traditional Tuvaluan practice where any member of the extended family is welcomed into the house of a relative. However, the physical condition and capacity of Funafuti (and perhaps other islands with large populations in the future) means that some adjustments to current customs may be necessary.

Programme 7.4.1

Land-use and development plans

Given the need to regulate urban spread in Funafuti and to determine the carrying capacity of the islands, a priority would be the preparation of comprehensive and environmentally sensitive land-use and development plans for each of the islands. This will need some outside assistance.



Improving waste management and pollution control

8.1 Introduction

It seems almost inevitable that in most societies, pollution and waste management systems are developed only after serious cases of pollution have become evident. Fortunately, Tuvalu does not yet have a serious pollution problem and has the opportunity to address current concerns and prevent future ones from developing. Even its current concerns are mostly restricted to Funafuti. The key areas requiring immediate attention are:

- ◆ solid waste disposal;
- ◆ petroleum waste management; and
- ◆ water quality monitoring (marine and groundwater).

The NEMS must include a set of integrated programmes to address waste management and pollution mitigation and control. Not all of these will need additional resources. Some may simply require a change of management practice or an attempt to modify community attitudes. The components of an overall waste management strategy are likely to include education; recycling and reduction of waste; adequate landfill; and adequate waste disposal.

8.2 Education

The best method of waste management is by convincing people, through education, to stop disposing of waste indiscriminately, reduce the amount of waste they produce, and recycle wherever possible. This kind of educational programme could be integrated into school, government and community awareness workshops suggested above under the education/awareness strategies.

8.3 Recycling and reduction of waste

Reducing the waste volume is a key factor in making the waste disposal task simpler. Possible actions include:

- ◆ recycling and separation of waste at source, particularly bulky materials such as vegetation and paper products which can be composted (with a wood-chipping service for branches etc.);
- ◆ aluminium cans can be returned for recycling (a scheme has already been shown to work in Funafuti);
- ◆ recycling other products (such as glass and oil) where viable;
- ◆ crushing waste before disposal to reduce its volume;
- ◆ encouraging people (through education) to buy products with a minimum of packaging or to use foods grown or caught rather than bought; and
- ◆ replacing of dry-cell batteries with rechargeable units and a solar-powered recharging unit; this not only helps protect the environment but is more economical in the long run.

Some assistance may be needed in maintaining some of these services, especially if they were to be run by non-government groups.

A range of other measures would also assist. Taxation or container deposit schemes can discourage the purchase of throw-away packaging, ensure its return for proper disposal and provide a revenue source to fund waste management operations. Additional taxation on "environmentally unfriendly" products (such as disposable batteries) or reduced taxation on "friendly" products (such as solar-

powered electrical equipment) can encourage less waste and pollution. A programme to use such economic policy tools in support of environmental management has already been suggested under chapter 5 (section 5.6).

SPREP should be asked for some assistance on recycling materials and operations. Many products (such as plastics) can now be recycled whereas just a few years ago they could not.

8.4 Landfill

The establishment of dedicated, managed and secure landfill site(s) on each island is essential. The sites should be chosen following a full assessment of environmental impacts and the most appropriate funding and management arrangements. On Funafuti a range of borrow pits provides a large number of choices, although dredged sand from the lagoon may be the only source of material to cover the waste. On other islands, pits could be excavated at landfill sites with the soil retained to cover the waste.

The provision of dedicated landfill sites must be backed by a collection scheme to which every household must belong and contribute financially. Such a scheme needs to provide frequent and regular collections and efficient, thorough management. Although legal responsibility for waste management currently lies with island councils under the Local Government Act, they generally have limited financial, technical or managerial ability to undertake this complex task.

Other options which could be investigated are the use of a private contractor or the Public Works Department.

8.5 Waste disposal

8.5.1 Petroleum waste

Petroleum waste should preferably be collected and exported for recycling. However, the feasibility of this proposal would first need to be investigated. In the short term, incineration at a location well away from habitation may provide a better solution than the current ground disposal method.

8.5.2 Hospital waste

The current method of burning medical waste in a pit behind the hospital or dumping it with domestic waste must be replaced by incineration in a plant designed for the purpose.

8.5.3 Chemical waste

Batteries and hazardous chemical waste for which incineration or landfill are not acceptable methods of disposal should be collected and securely stored. For example, batteries can be stored in 200-litre steel drums and left under cover in a secure compound such as the Public Works depot.

8.5.4 Sea disposal

Disposal of waste at sea is commonly practised and often criticised. In many places where waste volumes



Back door of Funafuti Power Station. Oily wastes are simply hosed out the door, and drain away into the groundwater below. Managing oil waste is one of Tuvalu's most urgent pollution problems. (photo: Alefaia Semese)

are huge and land-based disposal options limited, it is used simply because it is seen as the cheapest disposal method. However there are circumstances in which it is the better disposal option. Sea depths around Tuvalu are great. Within a few kilometres of many of the islands the sea is up to 4,000 metres deep. At these depths the water temperature is close to 0°C, water circulation is very limited, and there is very little life. Tuvalu's ocean capacity is much greater than that of its limited land area and may provide a better location for the disposal of some types of waste. Heavy machinery (old vehicles, engineering plant and equipment, old shipping containers etc.) and properly contained chemical wastes may be more appropriately dumped at sea than on land. Chemical waste should first be immobilised by fixing with cement. For example, drummed batteries would first be filled with cement.

8.5.5 Sewage

Given concerns discussed in this document regarding sewage disposal in Funafuti, alternatives may need to be investigated. Composting toilets (which require no water for flushing and produce quality agricultural fertiliser as a by-product) are one possibility. Such systems are being used in many locations in Australia and recently an experimental system was successfully established in Yap State, Federated States of Micronesia.

If population growth continues on Funafuti at the current rate, a reticulated sewage treatment and effluent disposal scheme may become necessary. Given the shortage of fresh water, such a scheme may need to be a salt-water system similar to that operating in Tarawa, Kiribati. Otherwise, the minimum standard of toilet should be the provision of a "pour flush"/soakage pit-type latrine for each household (based on an average occupation rate of six). The use of septic tanks is recommended for households and is suggested as a requirement for commercial and similar developments. Animal waste from feedlots is not to be disposed of indiscriminately and should preferably be used as an agricultural manure.

Groundwater pollution dangers indicate that water supply should be primarily provided by way of catchment tanks with a minimum supply of 50 litres per person per day. Groundwater supplies, where accessible, are not to be used as a primary supply. In the meantime, strict land-use controls should be applied to groundwater reserves used for domestic supply purposes.

8.5.6 Monitoring

As part of an overall environmental monitoring programme, a regular check of critical indicators relating to waste management and pollution should be made and reported on.



Development and protection of natural resources

9.1 Introduction

Tuvalu's resource base is quite limited and fragile (in the case of land), and enormous and difficult to manage (in the case of the ocean). These resources must be managed in a sustainable manner if they are to support the Tuvaluan people into the 21st century. What is discussed in this chapter are the significant issues which relate to Tuvalu's key resources, and the actions and strategies necessary to address them.

9.2 Sea-level rise

General

The key reference for an assessment of the effects of climate change on Tuvalu is Aalbersberg and Hay (1992). This report should be used as the basis

for the development of responses to climate change in the NEMS (Lane 1994).

Although the debate is ongoing, and while there is now general acceptance that global temperatures are increasing, some of the latest findings indicate that early predictions of the impact of the greenhouse effect on global temperatures and consequential sea-level rises are now considered too extreme. Even for low-lying atolls like Tuvalu and Kiribati, it has been suggested that the present situation has not reached a crisis point, and that there is time to monitor, research and plan ahead (Aalbersberg & Hay 1992; Woodroffe & McLean 1992; Lane 1994). Given Tuvalu's concerns, the operative phrase should be "planning ahead". Woodroffe and McLean state that a rise in sea level is likely to be experienced in three ways. These are:

- ◆ changes to the coastal erosion regime;
- ◆ occurrence of more intense and frequent storms; and



Funafuti Lagoon is tranquil here, but the wreck is a reminder of the devastating storms and cyclones which frequently threaten Tuvalu. (photo: John Lane)

- ◆ flooding of low-lying areas caused by a rise in groundwater levels or overwashing of waves.

Recommendations for the short term

Based on their assumption that the threats from sea-level rise are not so immediate as to require precipitate action, Woodroffe and McLean make a number of recommendations for short-term action which are as applicable to Tuvalu as Kiribati. These are the following:

- (1) To collect or consolidate basic environmental data for the whole country. Tuvalu already has a comprehensive land information base (McLean & Hoskings 1991). This report has a country-wide volume plus a separate volume for each island. In addition, information gained from the sea-level monitoring station located on Funafuti wharf can be added. Other resources such as air photos and good topographic and cadastral mapping will be useful. Some of these resources are already available.
- (2) To undertake systematic cross-island environmental surveys to gauge the susceptibility of different areas to inundation under present conditions and possible conditions in the future.
- (3) To run programmes of research about the coastal processes of the islands (sediment production, transport and deposition) and to monitor beach/shoreline profiles in both inhabited and uninhabited areas so that an accurate record of changes can be maintained.
- (4) To undertake a coastal zone mapping programme to identify areas most vulnerable to erosion. The purpose of mapping sensitive areas is to provide a tool to enable land-use decisions (for example, on building setbacks, protection of vegetation, identifying foreshores where the extraction of earth materials should be restricted or prohibited) to be factually based.
- (5) To restrict generally, and prohibit in places close to built-up areas, the collection of reef rock from areas of reef platform; and to restrict the collection of sand and shingle from beaches in areas already known to be vulnerable.

Possible response strategies

The Intergovernmental Panel on Climate Change (IPCC) has prepared a common methodology for the assessment of vulnerability to accelerated sea-level rise. One of the seven steps in this process requires the identification and specification of response strategies: in other words, what a country can do in the face of a rise in sea level. Of the four response strategies identified by the IPCC (do nothing; retreat; protect; accommodate), the first two are either out of the question or impossible. The last one is too passive for a country of Tuvalu's vulnerability, so that leaves the third one (protect) as the only real option.

The priority programmes under a protection strategy against sea-level rise are not necessarily discrete, as the main requirements at this stage are monitoring and planning. Some of these could be met more cost-effectively through either regional/international monitoring programmes or other national programmes. The public discussions necessary for planning purposes could be held within the context of other education/awareness programmes suggested in other areas of the NEMS. Some external funding is required to assist Tuvalu in monitoring and planning.

Programme 9.2.1

Participation in regional/international climate change monitoring programmes

As Tuvalu lacks the resources to monitor the effects of climate change and sea-level rise, maximum information and other benefits should be obtained from regional/international programmes such as the ones coordinated by SPREP, USAID and others.

Programme 9.2.2

Anticipating and planning for global warming and sea-level rise

The goals of such a programme include:

- (a) developing strategies for responding to and mitigating effects of sea-level rise;
- (b) integrating such strategies into development plans; and
- (c) making more effective representations at international fora on global warming and potential sea-level rise.

9.3 Land and coastal resource protection

Given the very small area of habitable land available in Tuvalu and the dynamic nature of the atoll land system, great care should be taken before any works are carried out that may affect the quality of soils and change the foreshore. A strategy for the protection of the limited land base of Tuvalu would need to address all possible threats including the following.

Extraction of beach material

Extracting rock and gravel from foreshores (particularly from the ocean side of islands), blasting channels, building sea walls or dredging from lagoons should all be assessed for their potential impact before works begin, and monitored during and after operations. Given the nature of the geomorphological processes at work and the limited economic resources available to Tuvalu to remedy mistakes, it is reasonable to suggest that as a general rule, works requiring major changes to shorelines should not be permitted.

Devegetation

Given the importance of vegetation and plants in protecting soils and foreshores, there is a need to control the unnecessary cutting down of trees, especially along the foreshore, and to encourage tree planting.

Soil degradation

Poor fertility and limited quantities of soil means that extra care must be taken to protect them from degradation and unproductive and unsustainable use.

Water pollution

Water is such a precious commodity in atolls that its source and quality must be protected at all times against pollution and wastage.

General

Many of these problems could be addressed through other programmes suggested elsewhere in this document. The extraction of earth materials could be controlled through EIA requirements, and land-use planning could regulate many of the activities which threaten the status of natural resources. Laws and regulations could provide the legal basis for many protective actions, and educa-

tional/awareness programmes could go a long way towards encouraging conservation practices, and towards maintaining the support and cooperation of the general public over environmental protection matters.

9.4 Marine resources protection

Tuvalu's marine resources represent the best potential for its economic development, so it is essential to protect them against unsustainable use practices. Nearly all of the threats to the marine resource status, including unsustainable harvests, are from land, so it is important to integrate the strategy for protecting marine resources with those aimed at regulating human and development activities on land. Control of devegetation, dredging, chemical use and sewage disposal, for example, would also greatly benefit marine habitat and life. A range of actions should be taken both to learn more about the fish stocks and to preserve species and populations. These actions could include:

- ◆ requiring the national commercial fishing industry (NAFICOT) to fish the pelagic resource rather than compete with the semi-commercial and family fishers for the lagoon and reef resource;
- ◆ establishing permanent marine protected areas, representing different ecosystems, to give sanctuary to rare species, provide areas for fish breeding and from which restocking can take place (for maintenance of biodiversity);
- ◆ undertaking a fish stock assessment survey (of key indicator species and the foods on which they rely) and an assessment of the threat from ciguatera;
- ◆ instituting a system of resting areas from fishing for various periods to encourage the recovery of marine species. This system has traditionally been used on some islands where island councils close certain waters for specific periods for cultural or management reasons;
- ◆ prohibiting fishing for species acknowledged as rare, such as giant clams and turtles;
- ◆ prohibiting the practice of net fishing in those lagoon areas subject to heaviest fishing pressure (for example, offshore from village areas); and

- ♦ enforcing a ban on destructive fishing methods (dynamiting, poisoning, driftnetting etc.).

In promoting new projects based on marine resources, whether it be specimen shell collection, seaweed harvesting or some other enterprise, the fundamental principles behind their design should be the maintenance of biodiversity, and ensuring that exploitation is kept to sustainable levels. Sustainability is also a key factor in the further development of any commercial pelagic fishery.

As noted above, many of the requirements under this strategy could be integrated with those of other land-based programmes. Some, such as the banning of certain fishing activities and techniques and the encouragement of more traditional (and sustainable) resource management practices, would simply need a clear policy and commitment to action from government and island councils. There are two areas which could be addressed by stand-alone programmes, and for which some external assistance would be needed.

Programme 9.4.1
Fisheries resources assessment

A fisheries stock assessment is needed to determine the status of stock and possible ways of managing it sustainably.

Programme 9.4.2
Development of a marine park at Funafuti

The programme will protect valuable marine habitat and assist in the conservation of certain species such as turtles and clams.

9.5 Energy conservation

Given the enormous costs to the government and public of imported oil, there is a need to conserve fossil fuel for electricity generation through the increased use of alternative renewable forms of energy, particularly solar. Tuvalu may be too small to make any significant impact on international phenomena such as global warming and sea-level rise but, given the magnitude of the problem and Tuvalu's own unenviable position as a low-lying atoll country, a commitment to increased use of renewable forms of energy is important.

A programme on alternative energy will require external assistance, both in terms of funding and technical expertise. Past and current initiatives in alternative energy supplies should be reviewed, with a view to formulating recommendations for government consideration. As the burning of fossil fuel, including wood and even rubber tyres, involves the general public, an important component of any energy conservation project would be education. Pricing policies could also be used to discourage the consumption of fossil fuel and shift the balance in favour of alternative sources of energy. In this respect, some of the requirements for energy conservation could be addressed through other programmes (that is, on public awareness and education and policy) which have been suggested above.



Environmental monitoring and reporting

10.1 Introduction

General

Perhaps one of the most significant aspects of environmental protection and management is monitoring and reporting. Such a strategy forms the basis for well informed, and therefore effective, policy and planning. It also provides a means of evaluating the success or failure of other strategies. In this respect, monitoring is central to all of the environmental management strategies put forward in this report.

Most people conduct some type of monitoring programme in their everyday lives, even if it is not a conscious or planned activity. People monitor their own and their children's health, the level of the water tank, the amount of food in the house, the changing price of common foods or the amount of money left in their pockets. At work and in business, monitoring is a way of life. For instance, levels of stock are checked so that reordering can be done before a product runs out.

Lack of environmental monitoring

However, monitoring of the environment is not such an automatic or common practice. Part of the reason for this is the diversity of environmental issues and the split of responsibility between sectors. Some sectors are monitored well, such as the weather. Others are not monitored at all or not to an adequate degree. Even where monitoring of the environmental sectors is good, the information is rarely brought together, analysed and reported in a comprehensive manner.

Without a monitoring programme it is more difficult for corrective action to be taken to prevent the impacts on people and lifestyle of a degenerating environment. In some sectors, such as the marine environment or water quality, the effect of

degradation is not generally obvious until it is almost too late. For example, by the time people notice that fish from a particular source (such as a lagoon) are no longer being caught in the necessary quantities, the actual population of the fish species in that locality may be lower than that needed to enable it to recover naturally. In general, monitoring is a key tool for the prevention of environmental degradation: *preventing a problem is much better than curing one.*

Special issues for Tuvalu

While monitoring is not commonly conducted in all the environmental sectors in Tuvalu, the nation has a special need to do so, and characteristics which make it a less complex task here than in larger, more diverse places. The special need relates to the limitations of the environment itself and the dependence of Tuvalu's growing population on it. It is the capacity of the environment to continue to provide the basics of food and shelter in a mostly subsistence economy that will determine the material well-being of the people into the future. The characteristics of Tuvalu which make a comprehensive monitoring programme achievable are its small size and the limited number of sectors that need to be examined.

10.2 Programme development: important factors

In developing a monitoring programme a number of factors must be considered.

- ◆ Information needs to be accessible. There has been a lot of information prepared about the environment in Tuvalu in the past, but much of it is scattered, unavailable (in the



*Funafuti wharf is the main storage area for all goods brought into Tuvalu, including chemicals and petroleum products. The wharf is located on a very narrow part of the island, and any liquid spillage will quickly flow into the sea.
(photo: Alefaia Semese)*

country) or in a form which cannot easily be understood.

- ◆ Information collected at a point in time is static, only a “snapshot” of the issue. Monitoring is all about measuring, observing and analysing change. A programme will need to permit the collection of information over time.
- ◆ Collecting, analysing and publishing information can be time-consuming and expensive. To minimise the effort only the critical sectors should be included in the programme. Above all it must be practicable and achievable with the resources available.
- ◆ Some monitoring will require specialist skills and equipment. In some cases, local people can be given the necessary training, but in other cases it is more appropriate to use external expertise. However, monitoring is often simply a matter of observing common activities or situations on a regular basis, recording this information, and looking at the changes.
- ◆ Environmental monitoring is not the job of one person or one sector. However, to be effective the government needs to identify a focal point to edit and publish the information gathered and analysed by others.

10.3 Sector monitoring

10.3.1 Land

There is a range of features relating to land which can indicate the health of the environment. While some

of these require specialised equipment, others can be examined by simple observation. Some key features to monitor would be the following.

Water quality

Water quality relates to surface water, community tanks and groundwater. Water quality testing requires the use of electronic testing equipment. In Tuvalu monitoring of water quality should generally concentrate on signs of contamination by biological, particularly human, wastes. In built-up or industrial areas, signs of petroleum product contamination should be monitored.

Vegetation coverage

Vegetation coverage is a good indicator of change. With limited training an observer can calculate the change in vegetation cover from air photographs. Air photos taken at regular intervals are necessary. At present the Lands and Survey Division has photos taken in 1973–1974 and 1984. A ten-year gap may be too long in Funafuti where change is rapid, but is an adequate time span in much of Tuvalu. An alternative approach is to establish a series of transect lines at various points across an islet. At regular intervals the observer walks the lines recording the number and type of species encountered.

Coastal foreshores

Coastal foreshores are naturally prone to change. Identifying sections of coast vulnerable to erosion and then using either air photos or ground-level photos taken at regular intervals to monitor change is a relatively simple technique.

Solid waste pollution

Solid waste pollution can be monitored by photographing selected sites at regular intervals and comparing the change over time. The changing products that make up the waste can also be monitored.

10.3.2 Marine environment

Fish catch and consumption studies can be carried out by simple survey techniques. Measuring the change in fish catch by time spent fishing can be an indicator of environmental health.

Fish stock and marine habitat surveys are more complex in terms of techniques and analysis. They would only be necessary in heavily fished areas, to monitor a specific feature such as ciguatera, the impact of works undertaken in marine areas, or in similar circumstances.

Water quality and circulation patterns should be monitored in a lagoon like Funafuti's where visual observation shows that human wastes may be polluting the water and the shape of the island may restrict the exchange of the water during changes of tide.

10.3.3 Climate change

Climate is an extremely complex system and change occurs over vast time spans. Tuvalu's weather records and its tide monitoring station contribute, along with information from many places, to establishing the pattern of climate change. The remoteness of Tuvalu from other monitoring stations makes the information gathered here particularly valuable.

10.3.4 Population and health

The collection of population and health information is vital for economic and social service planning. It can also be used to connect changes in the environment to changes in demographics or health. Much of this information is already collected through the census and hospital records.

10.3.5 Education and information

Keeping a record of the education and information programmes undertaken helps determine their effectiveness and identify areas which may require greater effort.

10.3.6 Development trends

Tuvalu does not have industries or utilities which emit effluent requiring complex and technical monitoring equipment. However, regular monitoring of their operations and measurements of their waste products (for example, how much waste oil was produced or the volume of animal waste), together with reviews of waste disposal methods can be useful indicators of the need for action. Other indicators of value might be the volume of petroleum consumed or the number of vehicles registered.

10.4 Reporting on the environment

The purpose of a monitoring programme is to provide early warning of the signs that might indicate that something has changed in the environment. Monitoring on its own serves no purpose. The real objective is to be able to analyse data and publish information that can be used to make planning, policy and operational decisions. For this reason a monitoring programme must include a storage and retrieval information system that is simple, accurate, long-lived and able to survive the inevitable change of staff in any organisation.

The method of reporting also requires thought and planning and an understanding of who the report is directed to. An annual report of key indicators may be appropriate in Tuvalu to ensure that critical sectors of the environment are regularly studied. However, the managers of each sector may need more detail to assist them to plan and set programmes.



Implementation

11.1 Implementing arrangements

Without the will and commitment needed for its implementation, the NEMS is pointless — hence the importance of the selection of a core team who will oversee its implementation, marshalling necessary resources, galvanising into action, coordinating activities and spreading the net of commitment to the sustainable development principle.

At the request of SPREP, the preparation of the UNCED country report and the SOE report was guided by a National Task Force set up for the purpose. The Development Coordinating Committee (DCC) has now taken over the role of the former Task Force, and is the most appropriate body to oversee the implementation of the NEMS.

PART 3
Programme profiles



Detailed programme profiles

Contents list

Profile #1	Development and application of standard EIA guidelines	59
Profile #2	Prepare and guide development of the national Environment Act	60
Profile #3	Review the role of local government in environmental management and investigate options for other technical assistance	61
Profile #4	Curriculum development in environmental education for primary, secondary and tertiary systems	63
Profile #5	In-service training workshops for teachers	64
Profile #6	Establishment of a focal point for environmental education and information	65
Profile #7	Environmental awareness programmes and workshops	66
Profile #8	Documentation and integration of traditional knowledge and management systems into education programmes	68
Profile #9	Development of a population policy and management plan	69
Profile #10	Land-use and development plans	70
Profile #11	Vulnerability assessment and coastal zone protection	71
Profile #12	Fisheries resources assessment	73
Profile #13	Development of a marine park at Funafuti	74
Profile #14	Alternative energy programme	76
Profile #15	Development of an integrated monitoring and reporting system for the environment	77

Note All currency amounts are in United States dollars (\$US).

Profile #1

Development and application of standard EIA guidelines

Background	One of the most powerful policy tools available for the control of the impact of human activities on the environment is Environment Impact Assessment (EIA). In the case of Tuvalu, current legislation does not make mandatory any EIA procedures although the government clearly wishes such issues to be taken into consideration when assessing development project proposals. Only one EIA has been carried out in the past. The current practice for evaluating development proposals would benefit from application of EIA guidelines.										
Aim and scope	To develop a set of standard EIA guidelines to be accompanied by detailed administrative procedures for their implementation, and training of responsible officers in EIA.										
Description	Guidelines would be prepared for the application of the EIA process to all government and private sector development proposals. The preparation of these guidelines requires technical assistance (a technical expert) for a one-month consultation, plus another month to prepare and trial proposed administrative procedures and conduct training.										
Cost estimates	<table border="1"> <tr> <td>Technical expert—2 months</td> <td style="text-align: right;">10,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Publication / dissemination of EIA guidelines and procedures</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Training in EIA</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 20,000</td> </tr> </table> <p>The programme could be implemented quickly if funds could be secured. The South Pacific Regional Environment Programme (SPREP) has already offered assistance in development of EIA guidelines and in training.</p>	Technical expert—2 months	10,000	Travel & accommodation	3,000	Publication / dissemination of EIA guidelines and procedures	2,000	Training in EIA	5,000	Total costs	\$US 20,000
Technical expert—2 months	10,000										
Travel & accommodation	3,000										
Publication / dissemination of EIA guidelines and procedures	2,000										
Training in EIA	5,000										
Total costs	\$US 20,000										
Executing agency	The Office of the Prime Minister (OPM) and the Ministry of Natural Resources and Environment (MNRE), in close consultation with the Ministry of Finance and Economic Planning (MFEP).										
In-kind support	MNRE will provide a national counterpart (Environment Officer) and logistics support, while MFEP will provide the service of a senior economic planner to assist the EIA consultant.										
Duration	2 months										

Profile #2

Prepare and guide development of the national Environment Act

Background	There is no one comprehensive piece of environment legislation for Tuvalu although there are a number of ordinances dealing with various aspects of the environment. Some of these ordinances could be quite useful if and when enforced. However, there is a need to update them and integrate their environmental regulatory content into national umbrella legislation on the environment. Indeed, the development of specific environmental legislation is seen as an urgent priority.								
Aim and scope	To draft an Environment Act and associated administrative policies and structure; and to guide it through the process of approval. Socially acceptable and culturally sensitive penalties for breaches of the Environment Act provisions should also be determined as part of the project.								
Description	The Environment Act would be drafted based on the environmental legislation review (Pulea & Farier 1994) undertaken as part of the NEMS process. The work will be carried out in consultation with both the national government and the local island councils and will take two months. It is important to obtain the services of a lawyer who is familiar with and appreciative of the role of customs and traditions in a place like Tuvalu.								
Cost estimates	<table border="0" style="width: 100%;"> <tr> <td style="padding-left: 20px;">Legal draftsman—2 months</td> <td style="text-align: right;">10,000</td> </tr> <tr> <td style="padding-left: 20px;">Travel & accommodation</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td style="padding-left: 20px;">Workshops</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td style="border-top: 1px solid black; padding-left: 20px;">Total costs</td> <td style="border-top: 1px solid black; text-align: right;">\$US 18,000</td> </tr> </table>	Legal draftsman—2 months	10,000	Travel & accommodation	3,000	Workshops	5,000	Total costs	\$US 18,000
Legal draftsman—2 months	10,000								
Travel & accommodation	3,000								
Workshops	5,000								
Total costs	\$US 18,000								
Executing agency	The Office of the Attorney General in close collaboration with the Ministry of Natural Resources and Environment (MNRE) and the Ministry of Finance and Economic Planning (MFEP).								
In-kind support	The Office of the Attorney General will provide a national counterpart and MFEP will provide logistics support.								
Duration	2 months								

Profile #3

Review the role of local government in environmental management and investigate options for other technical assistance

Background	<p>As the island councils do not have the capacity to exercise their mandate regarding environmental management at present, there is a need to review the Local Government Act with a view to identifying an alternative approach. This situation of limited capacity and resources also extends to the national government of most small island countries, so there is definitely a need to investigate options for improving their capacity for action without putting too much pressure on national budgets.</p>						
Aim and scope	<p>To review the Local Government Act with the view to identifying an alternative approach to local government participation in environmental planning and management. The exercise will extend to the national government in order to review its overall capacity for environmental planning/management, and to recommend cost-effective ways of improving it.</p>						
Description	<p>This review could be undertaken in conjunction with the drafting of an Environment Act (see Profile #2). With regard to the review of the Local Government Act, there are a number of options which could be considered.</p> <p>Firstly, the national government could take on the responsibilities of the island councils. Secondly, the national government (or donors) could provide the human and financial resources to undertake the planning and enforcement work, at the same time utilising each island council as a type of planning and environment commission which would be responsible for decision making. The third option is to enhance the overall capacity of Tuvalu for environmental planning and management through a regional or sub-regional approach. There are a number of small island states like Tuvalu which do not have the financial capacity nor the volume of work to enable them to establish their own expert planning and environment agency.</p> <p>Given the long history of cooperation amongst the small Pacific countries, it could be appropriate to look at a regional agency such as SPREP to provide land-use planning and environment protection services to member countries; or contract an existing agency from one of the larger regional countries to do the work. Such a proposal would not mean the ceding of any national sovereignty as each government would remain responsible for making decisions based on the advice of the experts in the regional agency.</p>						
Cost estimates	<table border="1"> <tr> <td>Technical assistance—2 weeks</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 5,000</td> </tr> </table>	Technical assistance—2 weeks	3,000	Travel & accommodation	2,000	Total costs	\$US 5,000
Technical assistance—2 weeks	3,000						
Travel & accommodation	2,000						
Total costs	\$US 5,000						

Executing agency

The Ministry of Natural Resources and Environment (MNRE) and the Office of the Attorney General.

In-kind support

The Office of the Attorney General will provide some assistance with the review of the Local Government Act while MNRE will assist with logistics.

Duration

2 weeks

Profile #4

**Curriculum development in environmental education
for primary, secondary and tertiary systems**

Background	<p>Tuvalu's national education policy as set out in the Medium-Term Economic Framework, 1992–1994 (Government of Tuvalu 1992b) has adopted a programme of education for life which aims to develop the country's human resources, improve the standard of living, and foster greater self-reliance. To attain this goal, there is a need to develop an environmental education programme aimed at all levels of school, the workplace (through work and industry related training programmes), and the community (through community organisations and public information campaigns).</p> <p>The main objective of the awareness and education strategy for Tuvalu as outlined in its NEMS is to establish a comprehensive environmental education and information programme and have it incorporated into Tuvalu's "Education for Life" policy. A priority requirement under such a programme is the development of an environmental curriculum for primary, secondary and tertiary schools in Tuvalu.</p>										
Aim and scope	To provide technical and other assistance for the development and trialing of curriculum materials on the environment.										
Description	The project will provide resources to extend the current efforts of the South Pacific Regional Environment Programme (SPREP), the Institute of Education of the University of the South Pacific, and the Tuvalu government to improve the environmental content of the curricula. Technical assistance will be provided to assist educators in Tuvalu develop appropriate materials. Funding will also be provided to trial and publish the materials. Some of these environmental materials could also be incorporated into pre-schools.										
Cost estimates	<table border="1"> <tr> <td>Technical assistance—2 months</td> <td style="text-align: right;">10,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Workshops / trials</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Materials</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$U S 23,000</td> </tr> </table>	Technical assistance—2 months	10,000	Travel & accommodation	3,000	Workshops / trials	5,000	Materials	5,000	Total costs	\$U S 23,000
Technical assistance—2 months	10,000										
Travel & accommodation	3,000										
Workshops / trials	5,000										
Materials	5,000										
Total costs	\$U S 23,000										
Executing agency	The Education Division of the Ministry of Health and Human Resources Development (MHHRD) in close collaboration with the Ministry of Natural Resources and Environment (MNRE).										
In-kind support	MHHRD will provide counterparts to assist the environmental curriculum expert as well as logistical support. MNRE will provide resource persons on subject-specific areas.										
Duration	2 months										

Profile #5

In-service training workshops for teachers

Background	<p>Apart from the lack of appropriate educational materials, there is also some concern in Tuvalu about the ability and confidence of school teachers to use the new environmental materials. In fact, as noted during the NEMS seminar held in Funafuti in November 1993, there is a critical need to improve the ability and confidence of teachers to use environmental science materials. Such a need was considered critical because the actual impact of curricula depends on how they are used, or not used, in classrooms. Thus, there is a need for teacher in-service training on using new environmental education materials effectively.</p>										
Aim and scope	<p>To provide assistance in the training of school teachers in the use of environmental science materials.</p>										
Description	<p>The project will provide technical assistance to the Tuvalu government for the training of teachers in the use of environmental science materials. A training instructor will be provided with resources to bring together teachers for training workshops. Pre-school teachers could be included in some training workshops. Local counterparts will assist to ensure that instructions are relevant and clearly understood and appreciated.</p>										
Cost estimates	<table border="0"> <tr> <td>Technical assistance—1 month divided into two 2-week periods</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">4,000</td> </tr> <tr> <td>Training workshops</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Materials</td> <td style="text-align: right;">1,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$U S 15,000</td> </tr> </table>	Technical assistance—1 month divided into two 2-week periods	5,000	Travel & accommodation	4,000	Training workshops	5,000	Materials	1,000	Total costs	\$U S 15,000
Technical assistance—1 month divided into two 2-week periods	5,000										
Travel & accommodation	4,000										
Training workshops	5,000										
Materials	1,000										
Total costs	\$U S 15,000										
Executing agency	<p>The Education Division of the Ministry of Health and Human Resources Development (MHHRD).</p>										
In-kind support	<p>MHHRD will provide local counterparts to assist the training instructor as well as logistical support.</p>										
Duration	<p>1 month</p>										

Profile #6

Establishment of a focal point for environmental education and information

Background	<p>While it is important to establish a sound educational foundation for tomorrow's leaders, it is also important to deal with the issues which are important today. If today's decision makers and managers are not convinced of the need to take action, tomorrow may be too late. Therefore, there is a need to focus on collecting or developing relevant information on Tuvalu's environmental requirements and using such information as tools for decision making. Further, rather than relying on outside consultancies which are often a short-term solution to information needs and do not leave an ongoing capability in the country, funding could be more effectively spent in establishing a local capacity.</p>									
Aim and scope	<p>To develop a local capacity for collecting/developing and storing information on Tuvalu's environment, and for using such information to make informed decisions.</p>									
Description	<p>The project will provide resources for the establishment of an information and education capacity within either the Education Division of the Ministry of Health and Human Resources Development (MHHRD) or the Environment Unit of the Ministry of Natural Resources and Environment (MNRE). One of the information requirements which may need to be considered in establishing a focal point is a secure but accessible environment information and resource library to ensure that the large amount of information currently available is not lost. Also, the need for educative materials is ongoing and is common to many of the other strategies. Therefore, there is a need to locate an information/education capacity in a place that is easily accessible by all the users. If the focal point is located outside the Education Division, there is certainly a need to maintain close coordination with the education sector. If it is to be located within the Environment Unit, this project could also be considered as part of a general capacity-building programme for the Unit.</p>									
Cost estimates	<table border="1"> <tr> <td>Technical assistance—12 months</td> <td style="text-align: right;">15,000</td> </tr> <tr> <td>Equipment—VCR, overhead projector, photocopying, desk-top publishing</td> <td style="text-align: right;">30,000</td> </tr> <tr> <td>Workshop/training</td> <td style="text-align: right;">10,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 55,000</td> </tr> </table>	Technical assistance—12 months	15,000	Equipment—VCR, overhead projector, photocopying, desk-top publishing	30,000	Workshop/training	10,000	Total costs	\$US 55,000	
Technical assistance—12 months	15,000									
Equipment—VCR, overhead projector, photocopying, desk-top publishing	30,000									
Workshop/training	10,000									
Total costs	\$US 55,000									
Executing agency	<p>Either the Education Division of the Ministry of Health and Human Resources Development (MHHRD) or the Environment Unit of the Ministry of Natural Resources and Environment (MNRE) in collaboration with each other.</p>									
In-kind support	<p>The government will provide a local counterpart (education officer) to work with and receive training from the expert on the production and use of education materials. Logistics support will also be provided by the executing agency.</p>									
Duration	<p>12 months</p>									

Profile #7

Environmental awareness programmes and workshops

Background	<p>As noted previously, a key element for success in environmental management is the participation and cooperation of the community. Without community support and cooperation, enforcement and implementation of environmental and conservation programmes are likely to be difficult. Thus, there is a need to engender community participation through effective awareness programmes.</p>
Aim and scope	<p>To raise community awareness of the requirements of the environment and the effects of their actions on it.</p>
Description	<p>The project will provide assistance in developing a special-purpose awareness programme for the communities. Such an awareness programme will have three foci:</p> <ul style="list-style-type: none">(a) the conduct of workshops/seminars and other (more traditional) forms of dialogue and communication;(b) the development and use of special-purpose materials and delivery mechanisms suitable for community programmes; and(c) training of NGOs and other community groups in organisation and conduct of workshops/seminars. <p>Environmental awareness programmes/workshops will aim at raising awareness about issues, educate people to understand the part they play in contributing to environmental degradation, and demonstrate what they can do to improve and protect their environment. These workshops need to reach as wide an audience as possible and should include outer island participants. Awareness programmes should not be limited to workshops but should include the fostering of other means of spreading the message. These may include drama/plays in the vernacular (which have proven a big success in countries like Vanuatu and Papua New Guinea), song, speech, and poster competitions. The Environment Unit should also make greater effort to use available media, like the radio and newspapers or even newsletters.</p> <p>The development of environmental fact sheets, special-purpose educational resources and visual aids is aimed at NGOs including church groups and community-based groups, so care must be taken to pitch them at an appropriate level. A specialist may be required for this particular task. The work could be coordinated through the Education Division or the focal point for environmental education, but government assistance is certainly needed.</p> <p>NGOs and community groups also need some training in environmental matters before they can be expected to be effective partners in raising awareness in Tuvalu. This may also serve as a means of encouraging the establishment of a community-based conservation and environment organisation.</p>

Cost estimates	Technical assistance—1 month	5,000
	Travel & accommodation	3,000
	Awareness workshops	6,000
	Training workshops	2,000
	Materials	10,000
	Total costs	\$US 26,000
Executing agency	The Ministry of Home Affairs and Rural Development (MHARD) in close collaboration with the Ministry of Natural Resources and Environment (MNRE) or vice versa.	
In-kind support	The executing agency will provide counterparts to assist the expert in the development and trialing of materials and also provide logistical support. The executing agency will organise and coordinate training workshops, and NGOs or community groups will organise and coordinate awareness workshops.	
Duration	12 months	

Profile #8

Documentation and integration of traditional knowledge and management systems into education programmes

Background	<p>It is now clear that traditional knowledge and resource management practices which ensured sustainable living on Tuvalu for thousands of years are quickly slipping away, and are being replaced by western land management models which are environmentally untried. Even where traditional principles of resource use and protection may still be adhered to, knowledge of specific practices is being lost. Yet it is this knowledge which is crucial to the development of alternative management systems for today. Therefore, there is a need to document as much as possible of such knowledge for integration in our school systems.</p>											
Aim and scope	<p>To document traditional knowledge and resource management practices and integrate them into educational and awareness programmes.</p>											
Description	<p>The project will provide resources for the conduct of research into traditional resource use and management practices, and to document the findings for incorporation into educational/awareness programmes. The research should be carried out either by a Tuvaluan individual or a local NGO/group. The work will be coordinated through the Ministry of Home Affairs and Rural Development (MHARD) which will also coordinate with the Ministry of Health and Human Resources Development (MHHRD) and the Ministry of Natural Resources and Environment (MNRE) to ensure the integration of findings into educational/awareness programmes.</p>											
Cost estimates	<table border="1"> <tr> <td>Local contract—3 months</td> <td style="text-align: right;">6,000</td> </tr> <tr> <td>Local travel</td> <td style="text-align: right;">500</td> </tr> <tr> <td>Workshops</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Materials</td> <td style="text-align: right;">1,500</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 10,000</td> </tr> </table>	Local contract—3 months	6,000	Local travel	500	Workshops	2,000	Materials	1,500	Total costs	\$US 10,000	
Local contract—3 months	6,000											
Local travel	500											
Workshops	2,000											
Materials	1,500											
Total costs	\$US 10,000											
Executing agency	<p>The Ministry of Home Affairs and Rural Development (MHARD) in close collaboration with the Ministry of Health and Human Resources Development (MHHRD) and the Ministry of Natural Resources and Environment (MNRE).</p>											
In-kind support	<p>MHARD will provide logistical support while MHHRD and MNRE will provide assistance in the integration of materials into educational/awareness programmes.</p>											
Duration	<p>3 months</p>											

Profile #9

Development of a population policy and management plan

Background	As has been suggested here and elsewhere, the population growth issue is Tuvalu's most significant and immediate environmental problem, and decisive action is needed to change the current trends. The alternative, given the unlikelihood of a technological or economic panacea, is to experience a continuing downward spiral of environmental degradation and an ever increasing dependence on external economic support. The government and people of Tuvalu recognise the need to address the problem and have already taken good initiatives in the area of family planning.										
Aim and scope	To develop a population policy and management plan for Tuvalu which takes into account the carrying capacity of the environment.										
Description	<p>The project will provide assistance for the development of a Tuvalu population policy and management plan. A national population plan should include realistic goals (population growth rates etc.), a time frame, and resource provisions for achieving the goals. Community participation will be vital in both developing and implementing a population policy and plan. Therefore, the project will include efforts to involve (through workshops) and empower (through information and technical assistance and funding resources) communities and government agencies.</p> <p>An important function of a national population plan is to ensure the integration of population issues into environmental planning and management. This will ensure that population plans take into account the carrying capacity of the environment, while environmental programmes also take into account the full and/or likely impact of population growth.</p>										
Cost estimates	<table border="1"> <tr> <td>Technical assistance—1 month</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Workshops</td> <td style="text-align: right;">10,000</td> </tr> <tr> <td>Materials</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$U S 20,000</td> </tr> </table>	Technical assistance—1 month	5,000	Travel & accommodation	3,000	Workshops	10,000	Materials	2,000	Total costs	\$U S 20,000
Technical assistance—1 month	5,000										
Travel & accommodation	3,000										
Workshops	10,000										
Materials	2,000										
Total costs	\$U S 20,000										
Executing agency	The Health Division of the Ministry of Health and Human Resources Development (MHHRD) in close collaboration with the Ministry of Natural Resources and Environment (MNRE).										
In-kind support	MHHRD will provide local counterparts to assist in the preparation of a population policy and plan as well as logistical support. MHHRD will coordinate and conduct community workshops while MNRE will assist with the integration of population issues with environmental management and planning.										
Duration	3 months										

Profile #10

Land-use and development plans

Background	Given the need to regulate "urban spread" in Funafuti and determine the carrying capacity of the islands, a priority is the preparation of comprehensive and environmentally sensitive land-use and development plans for each of the islands. Land-use plans could be very effective in regulating the impact of development and population activities on the environment. This is particularly true in the case of Tuvalu where land is limited and where there is a need to accommodate competing uses.										
Aim and scope	To develop land-use plans for each of the main inhabited islands and to use such plans as a basis for development plans.										
Description	<p>The project will provide assistance for the development of land-use plans for the selected islands. Such plans will take into account the carrying capacity of the environment and the competing uses for the resources therein. For example, while the pattern of human use has been set to a large degree by traditional use, the need to make space for more people in Funafuti will mean that some activities, such as pig or chicken pens, may need to be brought together away from residential areas. Such land-use plans need to be well balanced and acceptable to all parties, so there is a need to involve all resource users in workshops as well as resource development agencies including the Ministry of Finance and Economic Planning (MFEP).</p> <p>The government, specifically MFEP, will ensure that land-use plans are used as the basis for formulating development plans for the country and individual islands.</p>										
Cost estimates	<table border="1"> <tr> <td>Technical assistance—3 months</td> <td style="text-align: right;">15,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Workshops</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Materials</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 30,000</td> </tr> </table>	Technical assistance—3 months	15,000	Travel & accommodation	5,000	Workshops	5,000	Materials	5,000	Total costs	\$US 30,000
Technical assistance—3 months	15,000										
Travel & accommodation	5,000										
Workshops	5,000										
Materials	5,000										
Total costs	\$US 30,000										
Executing agency	The Lands and Survey Division in the Ministry of Natural Resources and Environment (MNRE) in close collaboration with the Ministry of Health and Human Resources Development (MHHRD), the Ministry of Natural Resources and Environment (MNRE) and the Ministry of Finance and Economic Planning (MFEP).										
In-kind support	The executing agencies will provide counterparts to assist in the preparation and use (for development planning purposes) of land-use plans.										
Duration	3 months										

Profile #11

Vulnerability assessment and coastal zone protection

Background	<p>While the actual effects of climate change cannot be accurately predicted, and although the time frames may not be immediately urgent, the issue of global warming and sea-level rise and its possible impact on the environment is of utmost importance to the government and people of Tuvalu. Tuvalu is already doing all it can on the international front to keep the issues alive. On the home front, there is felt a need to take actions now to prepare for possible sea-level rise which, as noted in this strategy document, is likely to cause coastal erosion, increased vulnerability to storm surges and wind, and increased salinity of fresh-water lenses. Some preliminary work has been done on the implications of climate change and sea-level rise for Tuvalu (Aalbersberg & Hay 1992). This in addition to other information on land resources will form the basis of further work.</p>												
Aim and scope	<p>(a) To review work already done on Tuvalu's vulnerability to projected sea-level rise, and advance it to a level where it is possible for economic and resource development planners to generate appropriate coastal zone management strategies.</p> <p>(b) To institute early protection measures against coastal erosion through tree and ground cover establishment.</p> <p>The assessment of island vulnerability would include assessment of coastal exposure to greater erosive forces and inundation of land, sea ports and airports, roads and causeways, and fresh-water lenses; salt-water intrusion; and impacts on flora and fauna, agricultural production, sewage disposal, and cultural and historical sites.</p>												
Description	<p>The vulnerability assessment component of the programme would fund an assessment of the potential impacts of sea-level rise on the environment as a whole. It would:</p> <p>(a) review work already done in Tuvalu;</p> <p>(b) reassess and clarify island vulnerability to sea-level rise; and</p> <p>(c) develop island protection strategies, and prioritised programmes for strategy implementation based on that assessment.</p> <p>The coastal revegetation component is a practical measure which would entail the establishment of some nursery capacity and establishment of belts of suitable coastal species to aid the protection of the coastal zone against erosion and the rehabilitation of eroded areas.</p>												
Cost estimates	<table border="1"> <tr> <td>Technical assistance (vulnerability assessment)</td> <td>10,000</td> </tr> <tr> <td>Travel & accommodation</td> <td>4,000</td> </tr> <tr> <td>Workshops</td> <td>4,000</td> </tr> <tr> <td>Local costs (nursery operation)</td> <td>10,000</td> </tr> <tr> <td>Materials</td> <td>1,000</td> </tr> <tr> <td>Total costs</td> <td>\$US 29,000</td> </tr> </table>	Technical assistance (vulnerability assessment)	10,000	Travel & accommodation	4,000	Workshops	4,000	Local costs (nursery operation)	10,000	Materials	1,000	Total costs	\$US 29,000
Technical assistance (vulnerability assessment)	10,000												
Travel & accommodation	4,000												
Workshops	4,000												
Local costs (nursery operation)	10,000												
Materials	1,000												
Total costs	\$US 29,000												

Executing agency	The implementation of the vulnerability assessment component would be through the Environment Unit of the Ministry of Natural Resources and Environment (MNRE) in close consultation with the Lands and Survey Division. The nursery development component would be executed through the Agricultural Division of the Ministry of Natural Resources and Environment (MNRE).
In-kind support	MNRE will provide counterparts to assist the vulnerability expert as well as logistical support.
Duration	12 months

Profile #12

Fisheries resources assessment

Background	<p>With limited land-based resources and a relatively large ocean area, Tuvalu's fisheries resource is of critical importance to the country's development. In fact, it represents the most significant natural resource the country has. It is therefore of some concern that little is known about the sustainable yield levels of such an essential resource. There is, of course, no researched evidence to suggest fish stocks are low in Funafuti or elsewhere. But anecdotal evidence suggests that much more effort is being made for lower returns. There is also limited evidence that the diversity of species and population levels have declined significantly over the last two years in areas adjacent to the main Funafuti settlement. Some species such as clams and turtles are now generally acknowledged as rare. A fisheries stock assessment is therefore needed to determine the status of stock and possible ways of managing it sustainably.</p>								
Aim and scope	To assess fisheries stocks for the purpose of developing and implementing appropriate sustainable management strategies.								
Description	The project will support a programme for assessing the level of fishery stocks. The focus will be on inshore fisheries as it is believed that offshore stocks are healthy and that the focus there should be on maximising economic benefits to Tuvalu. Resources are needed to gather information on the type and size of catches and the time spent on each trip.								
Cost estimates	<table border="1"> <tr> <td>Technical assistance — 6 weeks</td> <td style="text-align: right;">6,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Report preparation</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 13,000</td> </tr> </table>	Technical assistance — 6 weeks	6,000	Travel & accommodation	5,000	Report preparation	2,000	Total costs	\$US 13,000
Technical assistance — 6 weeks	6,000								
Travel & accommodation	5,000								
Report preparation	2,000								
Total costs	\$US 13,000								
Executing agency	Fisheries Division in the Ministry of Natural Resources and Environment (MNRE).								
In-kind support	Fisheries staff and Environment Officer assistance to consultant.								
Duration	3 months (to final report publication stage)								

Profile #13

Development of a marine park at Funafuti

Background	<p>The Funafuti Marine Park proposal has been developed to assist with establishment of a marine protected area within Funafuti Lagoon. The exact location is yet to be determined in consultation with Funafuti Town Council. However, the area being investigated includes the reef flats, channels and islets from south of Tefala Islet to an area to the north of Aualopa Islet along the western edge of Funafuti Lagoon. On 16 May 1994, the Funafuti community agreed to implementation of the Funafuti Marine Park and requested that the activity proceed with close consultation between landowners, Funafuti Town Council and the Funafuti community.</p>												
Aim and scope	<p>The establishment of a marine park aims at protecting valuable marine habitat and assisting in the conservation of certain species such as turtles and clams. The area will consist of a totally protected area surrounded by a buffer zone. The activity will establish Tuvalu's first nature conservation area and demonstrate Tuvalu's commitment to nature conservation and maintenance of biodiversity.</p>												
Description	<p>Within the totally protected area, all marine animals and plants and all indigenous terrestrial animals will be protected. Restrictions will apply to the collection or cutting of terrestrial plants. In the buffer zone, exploitation of marine plants and animals will be permitted only on a restricted basis. Access to this resource would be controlled by the area management authority in consultation with the Funafuti Town Council. A turtle hatchery and sanctuary will be established on an islet within the totally protected area as will giant clam circles to enhance the spawning success of the few remaining individuals. A conservation officer (AVA or similar) will be recruited who will act as ranger, conservation planner and coordinator during the initial stages. A Tuvaluan counterpart (technical officer) and a Tuvaluan assistant (assistant ranger) will support the planned activities and, in time, become fully responsible for management of the area. The project will also include an environmental education and information campaign. To enable effective supervision of the park, a small local house and water tank will be built on an islet. A toilet will also be established to minimise the impact of visitors and staff.</p>												
Cost estimates	<table border="1"> <tr> <td>Salaries (3-year period: AVA ranger, ranger & assistant ranger)</td> <td style="text-align: right;">32,300</td> </tr> <tr> <td>AVA housing allowance and expenses</td> <td style="text-align: right;">2,600</td> </tr> <tr> <td>Education and information campaign</td> <td style="text-align: right;">4,000</td> </tr> <tr> <td>Equipment (including boat, communications radio, uniforms)</td> <td style="text-align: right;">7,600</td> </tr> <tr> <td>Local house on islet for ranger/park toilet facilities</td> <td style="text-align: right;">22,000</td> </tr> <tr> <td>Total costs (3-year period)</td> <td style="text-align: right;">\$U S 68,500</td> </tr> </table>	Salaries (3-year period: AVA ranger, ranger & assistant ranger)	32,300	AVA housing allowance and expenses	2,600	Education and information campaign	4,000	Equipment (including boat, communications radio, uniforms)	7,600	Local house on islet for ranger/park toilet facilities	22,000	Total costs (3-year period)	\$U S 68,500
Salaries (3-year period: AVA ranger, ranger & assistant ranger)	32,300												
AVA housing allowance and expenses	2,600												
Education and information campaign	4,000												
Equipment (including boat, communications radio, uniforms)	7,600												
Local house on islet for ranger/park toilet facilities	22,000												
Total costs (3-year period)	\$U S 68,500												
Executing agencies	<p>Office of the Prime Minister, Fisheries Division of the Ministry of Natural Resources and Environment (MNRE) and Public Works Department.</p>												

In-kind support

Logistical support from Office of the Prime Minister, Fisheries Division and Public Works Department.

Duration

3 years

Profile #14

Alternative energy programme

Background	Tuvalu, like most Pacific Island countries is almost totally dependent on imported fossil fuel for its commercial and household energy. This fuel is imported at very high cost to the country and, in the interests of establishing a more sustainable and appropriate energy supply, an alternative energy programme is required.	
Aim and scope	To develop and implement an alternative energy programme to reduce dependence on imported fossil fuel while establishing a more sustainable energy supply.	
Description	The project will provide resources to review past and current initiatives in alternative energy supplies with a view to formulating recommendations for government consideration. As the burning of fossil fuel including wood and even rubber tyres involves the general public, an important component of any energy conservation project is education. Pricing policies could also be used to discourage the consumption of fossil fuel and shift the balance in favour of alternative sources of energy. In this respect, some of the requirements for energy conservation could be addressed through other projects (that is, on public awareness and education and policy) which have been suggested above.	
Cost estimates	Technical assistance—2 weeks	2,500
	Travel & accommodation	1,500
	Workshops (2, one week each)	1,000
	Total costs	\$US 5,000
Executing agency	Office of the Prime Minister, Ministry of Natural Resources and Environment and Ministry of Labour, Works and Communications.	
In-kind support	Logistical support from Office of the Prime Minister, Ministry of Natural Resources and Environment and Ministry of Labour, Works and Communications.	
Duration	4 weeks	

Profile #15

Development of an integrated monitoring and reporting system for the environment

Background	This is a project which underpins all others being suggested here. Without an effective monitoring system, there is no systematic way of knowing how the environment is coping with human pressure. However, such information is essential if problems are to be addressed while they are still manageable. An effective monitoring system also provides a good indication of how well the strategies and projects being proposed here are working. All the managers of major economic sectors indicate monitoring and reporting to be a high priority and are trying to develop programs to achieve this. The main reason for an integrated approach is to better utilise limited resources.											
Aim and scope	To assist the Tuvalu government establish an integrated monitoring system and a reporting system which allows for the timely use of information in decision making.											
Description	The project will provide technical assistance to develop an integrated monitoring system and establish reporting procedures.											
Cost estimates	<table border="0"> <tr> <td>Technical assistance—1 month</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Travel & accommodation</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Workshop/training</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Trialing</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Total costs</td> <td style="text-align: right;">\$US 12,000</td> </tr> </table>	Technical assistance—1 month	5,000	Travel & accommodation	3,000	Workshop/training	2,000	Trialing	2,000	Total costs	\$US 12,000	
Technical assistance—1 month	5,000											
Travel & accommodation	3,000											
Workshop/training	2,000											
Trialing	2,000											
Total costs	\$US 12,000											
Executing agency	Ministry of Natural Resources and Environment (MNRE).											
In-kind support	MNRE will provide a counterpart to work with and receive training from the environment monitoring expert. MNRE will also provide logistical support.											
Duration	2 months											

References



- Aalbersberg, W. & Hay, J. 1992. Implications of Climate Change and Sea Level Rise for Tuvalu. Report of a Preparatory Mission. South Pacific Regional Environment Programme, Apia, Western Samoa.
- Bektas, A. 1992. Review of Environmental Education—Tuvalu, 1992. South Pacific Regional Environment Programme, Apia, Western Samoa.
- Government of Tuvalu. 1992a. Country Report for UNCED: Tuvalu. Report prepared for the United Nations Conference on Environment and Development by Tausasa Taalaki, Uentabo Neemia and Randy Thaman. South Pacific Regional Environment Programme, Apia, Western Samoa.
- Government of Tuvalu. 1992b. Tuvalu: Medium-Term Economic Framework Programme, 1992–1994. Funafuti, Tuvalu.
- IUCN/UNEP/WWF. 1980. World Conservation Strategy: Living Resources Conservation for Sustainable Development. World Conservation Union, United Nations Environment Programme and World Wildlife Fund. Gland, Switzerland.
- IUCN/UNEP/WWF. 1991. Caring for the Earth: A Strategy for Sustainable Living. Second World Conservation Strategy Project. World Conservation Union, United Nations Environment Programme and World Wide Fund for Nature, Gland, Switzerland.
- Lane, J. 1994. Tuvalu: State of the Environment Report. South Pacific Regional Environment Programme, Apia, Western Samoa.
- McLean, R.F. & Hoskings, P.L. 1991. Tuvalu Land Resources Survey: Country Report. A report prepared for the Food and Agriculture Organization of the United Nations acting as executing agency for the United Nations Development Programme. Department of Geography, University of Auckland, New Zealand, 119 pp.
- Pulea, M. & Farrier, D. 1994. Environmental Legislation Review — Tuvalu, 1994. South Pacific Regional Environment Programme, Apia, Western Samoa.
- Reynolds, C. 1993. Water and Sanitation Plan for Tuvalu for the Period 1993–2002. Draft report to the Government of Tuvalu, Funafuti, Tuvalu.
- Webber, R.B. 1982. Report on the prevention of coastal erosion in Tuvalu. Prepared by Fawcett & Partners for the Government of Tuvalu, Funafuti, Tuvalu.
- Woodroffe, C.D. & McLean, R.F. 1992. Kiribati vulnerability to accelerated sea-level rise: A preliminary study. Unpublished report to Department of Arts, Sports, Environment and Territories, Government of Australia, Canberra, Australia.
- World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press, Oxford, England.

Bird species of Tuvalu

Common name	Scientific name
White-tailed tropicbird	<i>Phaethon lepturus</i>
Red-tailed tropicbird	<i>Phaethon rubricauda</i>
Pacific reef-heron	<i>Egretta sacra</i>
Great crested tern	<i>Sterna bergii</i>
Black-naped tern	<i>Sterna sumatrana</i>
Sooty tern	<i>Sterna fuscata</i>
Spectacled (Gray-backed) tern	<i>Sterna lunata</i>
Common fairy tern	<i>Gygis alba</i>
Brown noddy	<i>Anous stolidus</i>
Black noddy	<i>Anous minutus</i>
Blue-gray noddy	<i>Procelsterna cerulea</i>
Pacific pigeon	<i>Ducula pacifica</i>
Lesser golden-plover	<i>Pluvialis dominica</i>
Wandering tattler	<i>Heteroscelus incanus</i>
Siberian (Gray-tailed) tattler	<i>Heteroscelus brevipes</i>
Bristle-thighed curlew	<i>Numenius tahitiensis</i>
Ruddy turnstone	<i>Arenaria interpres</i>
Sanderling	<i>Calidris alba</i>
Long-tailed cuckoo	<i>Eudynamis taitensis</i>
Christmas shearwater	<i>Puffinus nativitatis</i>
Audubon's shearwater	<i>Puffinus lherminieri</i>
Masked booby	<i>Sula dactylatra</i>
Brown booby	<i>Sula leucogaster</i>
Red-footed booby	<i>Sula sula</i>
Great frigatebird	<i>Fregata minor</i>
Lesser frigatebird	<i>Fregata ariel</i>
Whimbrel	<i>Numenius phaeopus</i>
Banded rail	<i>Rallus philippensis</i>

Environmental management and protection laws of Tuvalu

Land or resource use and management

- ◆ *Closed Districts Act* — declaration of closed areas; commenced 8 December 1936.
- ◆ *Marine Zones (Declarations) Act* — regulation of marine waters including the Exclusive Economic Zone; commenced 1 January 1984.
- ◆ *Mineral Development Licencing Act* — regulation of mineral exploitation; commenced 1 January 1978.
- ◆ *Native Lands Act* — relates to native lands and registration of titles; commenced 14 March 1957.
- ◆ *Neglected Lands Act* — provides for the purchase of neglected land and its sale to others; commenced 25 June 1959.
- ◆ *Prohibited Areas Act* — declaration of certain islands and waters as prohibited areas; commenced 22 March 1957.

Coastal management and protection

- ◆ *Foreshore and Land Reclamation Act* — declaration of ownership of foreshores, and regulates reclamation projects; commenced 10 June 1959.

Conservation of flora and fauna

- ◆ *Fisheries Act* — regulation of fishing and fishing industries and protection for specified fish species; commenced 1 July 1978.
- ◆ *Plants Act* — protection of endangered or culturally important plants; commenced 1 March 1977.
- ◆ *Wildlife Conservation Act* — protection of birds and animals and establishment of

conservation reserves; commenced 29 May 1975.

Water, sanitation and environmental health

- ◆ *Importation of Animals Act* — regulation of the importation of animals; Part III commenced 17 July 1919, Remainder 3 June 1964.
- ◆ *Public Health Act* — maintenance of adequate standards of health; commenced 1 December 1926.
- ◆ *Quarantine Act* — regulation of the importation of products of potential danger to health or industry; commenced 1 January 1931.
- ◆ *Water Supply Act* — provides for the protection of water supplies; commenced 24 July 1967.

Control of environmentally disruptive substances and materials

- ◆ *Merchant Shipping (Oil Pollution) Tuvalu Order 1975* (application of United Kingdom laws) — control of oil pollution incidents; commenced 3 January 1976.
- ◆ *Nuclear Installations Ordinance (Gilbert and Ellice Islands) Order 1972* (application of United Kingdom laws) — control of nuclear installations; commenced 15 March 1972.
- ◆ *Wrecks and Salvage Act* — provides for the rights of wrecks and salvage; commenced 7 February 1966.

Other legislation pertaining to environment management and protection include the *Pesticides Act* (commenced 1 January 1991); *Livestock Diseases Act*, and the *Marine Pollution Act*.

nems

*National
Environmental
Management
Strategy*

About National Environmental Management Strategies — NEMS

Recent times have witnessed increasing threats to Pacific environments, coupled with a growing awareness of the need for action. National Environmental Management Strategies (NEMS) are a measure of this awareness and a positive response to these threats.

NEMS which are being developed in a number of Pacific countries outline the major environmental issues faced by each country, and identify the steps required to address them. They also contain a strong emphasis on the identification of clear, fully costed programmes.

Each NEMS has been developed through a process of extensive in-country consultation and gathering of relevant background information. The end result is a document which "belongs" to the government and people of that country. The involvement of all relevant organisations, as well as a strong commitment by local people, will be essential to the effective implementation of NEMS and the sustainable development of the region over the long term.

