Cook Islands

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state of the environment report

By
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Local RETA Consultant
Cook Islands 1993

SOE

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IUCN
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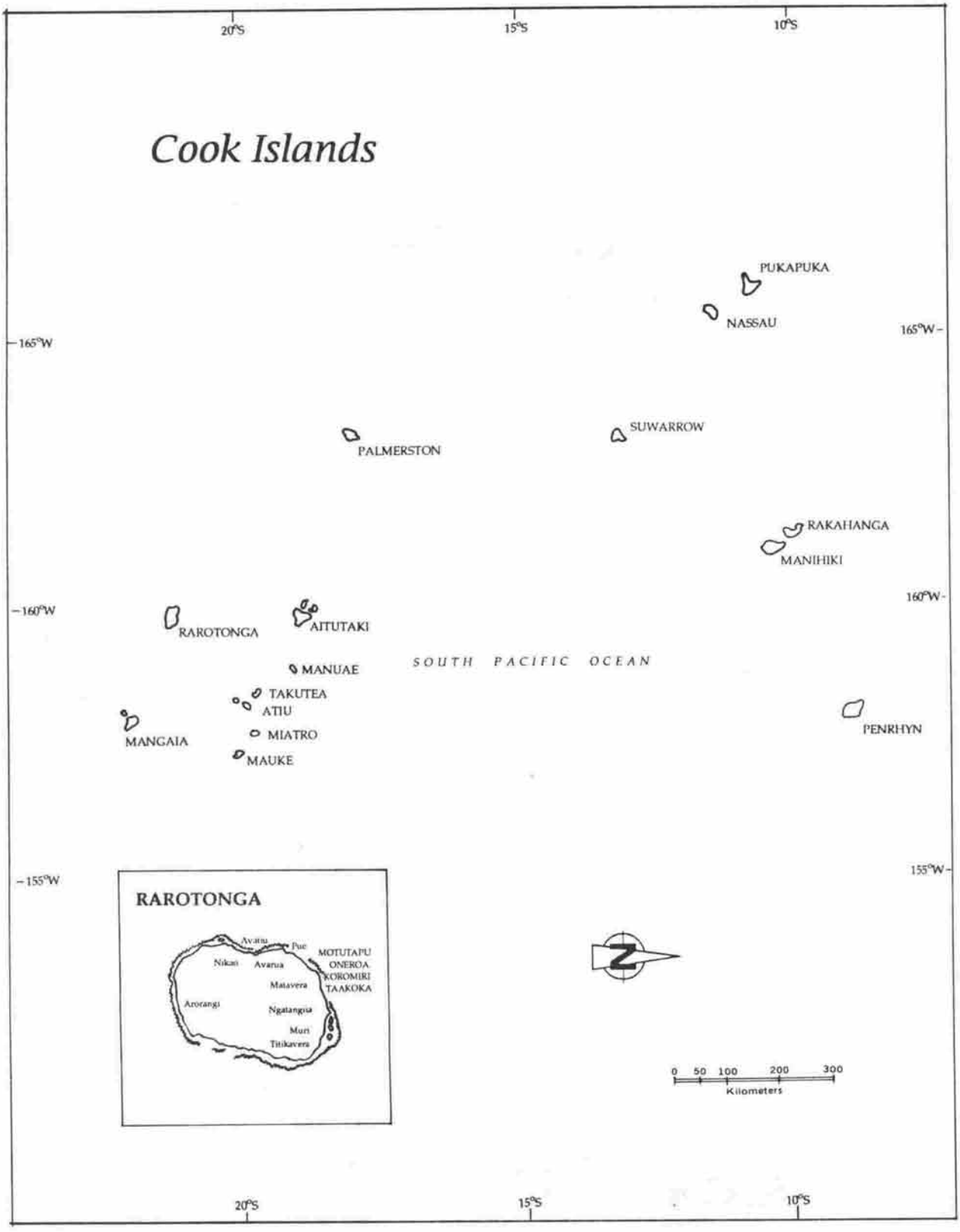
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Foreword

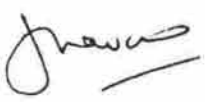
This document represents a concise report on the State of the Environment for the Cook Islands. It was prepared as a major element of the Regional Environment Technical Assistance (RETA) Project, one of the largest environmental projects implemented in the Pacific. The RETA Project has been made possible through the generous financial and technical assistance of the Asian Development Bank and the World Conservation Union. This assistance is gratefully acknowledged.

The main aim of the RETA Project is to develop National Environmental Management Strategies (NEMS) in a number of Pacific countries. The NEMS is a practical document which aims to identify the major environmental issues in the Cook Islands and the priority environmental programmes required to address them. The emphasis has been on ownership of the document by the Government and people of the Cook Islands. The process which has resulted in the preparation of the NEMS has involved many people and has been directed by a Task Force on Environmental Management and Sustainable Development, comprising relevant government and non-governmental organisations in the Cook Islands.

The State of the Environment Report for the Cook Islands was a major background document for the preparation of the NEMS. It summarises the current state of knowledge about the environment of the Cook Islands in areas such as geology, vegetation, fauna and marine resources. It represents a comprehensive reference document which formed the major background paper to the National Environmental Seminar held in Rarotonga in March 1992. The preparation of the State of the Environment Report has also provided an important vehicle for raising awareness at the state and national level of the importance of environmental issues and how they could be integrated into decision-making processes.

I would like to play particular tribute to the work of Teariki Rongo, the RETA Local Consultant for the Cook Islands, who prepared its State of the Environment Report. The comprehensive nature of this report is a tribute to his efforts.

SPREP looks forward to working with the Cook Islands and with other regional and international organisations in tackling the environmental issues identified in this State of the Environment Report.



Vili A. Fuavao
Director

Contents

Map of the Cook Islands *ii*
Foreword *iii*
Preface *viii*
Acknowledgements *ix*
Acronyms *x*
Executive summary *xii*

---

1 The environment

1.1 Physical features *1*
- *1.1.1 Land & distribution 1*
- *1.1.2 Climate 2*
- *1.1.3 Geomorphology 3*
- *1.1.4 Soils 5*
- *1.1.5 Water 6*
- *1.1.6 Energy & fuel 7*
- *1.1.7 Minerals 8*

1.2 Biological features *8*
- *1.2.1 Land 8*
- *1.2.2 Marine 17*

1.3 Cultural features *18*
- *1.3.1 Social culture 18*
- *1.3.2 Material culture 20*
- *1.3.3 Cultural resources at risk 20*

1.4 Demographic features *21*

1.5 Economic features *26*
- *1.5.1 Government development policies 26*
- *1.5.2 Sectoral growth patterns 26*
- *1.5.3 Development trends & issues 30*

2 Environmental issues

2.1 Waste management *35*

2.1.1 Solid waste 35

2.1.2 Liquid waste 36

2.2 Land management *38*

2.2.1 Land ownership 38

2.2.2 Inadequate land 38

2.2.3 Land use practices 39

2.3 Degradation of coastal resources *40*

2.3.1 Siltation 41

2.3.2 Mining 41

2.3.3 Destructive fishing practices 42

2.3.4 Over-fishing 42

2.4 Water supply & usage *43*

2.5 Energy development *44*

2.6 Lack of awareness *44*

2.7 Protected areas development *45*

2.8 International issues *46*

Driftnet fishing 46

Nuclear testing & disposal of toxic waste 46

3 Response to environmental issues

3.1 Government policies *47*

3.2 Laws & conventions *48*

3.2.1 Local laws 48

3.2.2 Traditional Practice 51

3.2.3 International & regional conventions 51

3.3 Institutional developments *52*
3.3.1 Cook Islands Conservation Service 52
3.3.2 Ministry of Marine Resources 53
3.3.3 Ministry of Education: Curriculum Development Unit 54
3.3.4 Ministry of Cultural Development 54
3.3.5 Ministry of Agriculture: Forestry Division 54
3.4 Non-governmental organisations *55*
3.5 Specific programmes & projects *55*
3.5.1 Cook Islands Conservation Service programmes 55
3.5.2 The Coastal Management Units Project 58
3.5.3 The Land Use Capability Project 59
3.5.4 Legislative framework for conservation & restoration in land use 59
3.5.5 Afforestation project 60
3.5.6 Integrated Atoll Development Project 60
3.5.7 Cook Islands Tourist Authority Tourism Master Plan 61
3.5.8 Integrated Pest Management Programme 61
3.5.9 Cook Islands Natural Heritage Project 61
3.5.10 Oil Pollution Management Plan 62

4 Effectiveness of response to environmental issues

4.1 Government policies *63*
4.2 Laws & conventions *63*
4.2.1 The Conservation Act 1986/87 64
4.2.2 Traditional conservation practices 64
4.2.3 International & regional conventions 65
4.3 Institutional developments *65*
4.4 Non-governmental organisations *65*
4.5 Specific programmes & projects *66*

5 Supporting measures for effective response to environmental issues

5.1 Government policies *67*

5.2 Laws, practices & conventions *68*
5.2.1 The Conservation Act 1986/87 68
5.2.2 Traditional practices 68
5.2.3 International & regional conventions 69
5.3 Institutional & administrative measures *69*
5.3.1 Cook Islands Conservation Service 69
5.4 Formal education *71*
5.5 Public education & participation *72*
5.6 Non-governmental organisations *72*
5.7 Specific programme & project needs *73*
5.7.1 Specific programmes 73

6 Conclusions *79*

7 References *80*

APPENDIX 1 *84*

APPENDIX 2 *88*

APPENDIX 3 *89*

Preface

The Regional Environmental Technical Assistance (RETA) Project is a regional programme covering five Pacific Island Developing Countries (PIDCs): the Cook Islands, Federated States of Micronesia, Kingdom of Tonga, Republic of the Marshall Islands, and Solomon Islands.

In the latter part of the 1980s, these PIDCs expressed a common need to strengthen their environmental management capabilities. Consequently during the early part of 1990, the South Pacific Regional Environment Programme (SPREP) requested assistance from the Asian Development Bank (ADB) in order to meet those needs expressed by the PIDCs. As a result the RETA Project was born.

The project is largely funded by the ADB and implemented under the umbrella of the South Pacific Regional Environment Programme (SPREP). The implementation agencies for the project include the International Union for the Conservation of Nature and SPREP.

In the Cook Islands, the main output from the RETA Project is to be the development and implementation of a National Environmental Management Strategy (NEMS). This will strengthen the environmental management capabilities of the Conservation Service, Island Councils and line departments within the public sector, and create public awareness of the environmental issues prevailing in the Cook Islands.

The NEMS will be prepared through a National Seminar which will identify the major environmental issues in the Cook Islands and the project priorities and responses needed to address these issues. Four important documents will provide the basis for the formulation of the NEMS: the State of the Environment Report, Legislative Review Report, Sector Report and an Infrastructural Review Report. Each of these documents will reflect what is needed to strengthen environmental management capabilities within the Cook Islands.

The State Of The Environment Report is compiled on the basis of information available to the consultant, personal experience and observation. It is not intended to cover every aspect of the environment but to offer a clear summary of the resources and environmental issues, and show how the people and Government of the Cook Islands have attempted to address these issues. The report also provides a list of supportive measures to respond to these issues.

Acknowledgements

I wish to acknowledge the assistance given to me in compiling and writing this report by the following people and organisations: the officers of the Conservation Service; members of the Cook Islands Task Force on the Environment and Development; members of the National Advisory Board; the Natural Heritage Project of the Prime Minister's Department; Tai Manuela and Brent Dark of the Ministry of Economic Development and Planning; Kelvin Passfield of the Ministry of Marine Resources; Makiuti Tongia and Kauraka Kauraka of the Ministry of Cultural Development; O'thaniel Tangianau, Chief Forestry Officer; Tony Utanga of the Ministry of Internal Affairs; and any other Government officials who gave their valuable time and input to this report.

I would also like to give a special acknowledgement to my family for their support of this project, especially my wife Julia for her valuable editing skills.

Acronyms

ADB	Asian Development Bank
CC	Conservation Council
CICS	Cook Islands Conservation Service
CID	Cook Islands dollar
CIG	Cook Islands Government
CITA	Cook Islands Tourist Authority
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
FAD	Fish Aggregating Device
FAO	United Nations Food and Agricultural Organization
FFA	South Pacific Forum Fisheries Agency
GDP	Gross Domestic Product
IUCN	International Union for the Conservation of Nature
LDS	Church of Latter Day Saints
MA	Ministry of Agriculture
MCD	Ministry of Cultural Development
MMR	Ministry of Marine Resources
MOPED	Ministry of Planning and Economic Development
NGO	Non-governmental organisation
NZDSIR	New Zealand Department of Scientific and Industrial Research
NZODA	New Zealand Overseas Development Assistance
PSC	Public Service Commission
RETA	Regional Environmental Technical Assistance
SDA	Seventh Day Adventist Church
SOPAC	South Pacific Applied Geoscience Commission

SPC	South Pacific Commission
SPCZ	South Pacific Convergence Zone
SPREP	South Pacific Regional Environment Programme
TLT	Trade, Labour and Transport
UNDP	United Nations Development Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
USAID	United States Agency for International Development
USP	University of the South Pacific
WHO	United Nations World Health Organization

Executive summary

Background

This State of the Environment Report provides a description of the environment covering elements of the Cook Islands' physical and biological features, and demographic and economic features; environmental issues prevailing; responses to those issues; and the effectiveness of those responses. The report also recommends some supporting measures to improve those responses.

It is important to note that this report makes some strong statements on the environment, particularly in regard to the causes of environmental issues, without clarification by hard data. Examples of this are water pollution and contamination; degradation of the coastal zone through over-fishing, destructive fishing practices and mining. Where these statements are made, the need to collect data to provide some measurable comparisons for monitoring and enforcing environmental control measures is also stressed.

The report highlights the need to strengthen national policies on the environment; law enforcement reforms; institutional arrangements including the roles of non-governmental organisations, and the implementation of specific programmes and projects aimed at the protection and conservation of the Cook Islands environment.

The environment

A summary of the topography, reef systems and main environmental features of each island is given in Appendix 1.

Geography

The Cook Islands consist of 15 small islands scattered over some 1.8 million sq km of the South Pacific ocean. The islands are located in an area extending from latitudes 9° and 22° South and longitudes 157° and 166° West. The 15 islands are divided into a Northern Group and a Southern Group. The islands of the Northern Group are: Penrhyn, Manihiki, Pukapuka, Rakahanga, Suwarrow and Nassau. The islands of the Southern Group are: Rarotonga, Mangaia, Atiu, Mitiaro, Mauke, Aitutaki, Manuae, Palmerston and Takutea.

The 15 islands represent five different island systems found in the Pacific basin: atolls like Penrhyn, Manihiki, Pukapuka, Rakahanga, Suwarrow, Manuae and

Palmerston; sand-cays such as Nassau and Takutea; the high volcanic island of Rarotonga; raised makatea islands at Mangaia, Atiu, Mauke and Mitiaro; and the almost-atoll of Aitutaki. Their fragile ecosystems support an increasing population, currently about 18,552 (1991 census). Of its 240 sq km of total land area, over 88 per cent (212.8 sq km) of the land area is in the Southern Group.

Climate

The Cook Islands have a pleasantly warm and sunny climate with an average relative humidity of 84 per cent. On average, there is a total of 2116 sunshine hours per annum and an average monthly rainfall range which falls between 1300 and 1700 mm in the dry season (May-October) and 1500-2500 mm in the wet season (November-April). The temperature range for the Southern Group is slightly lower than that of the Northern Group at 24°C and 27°C respectively. Cyclones are a feature of the islands and are expected during the wet season.

Soils

The soils of the Northern Group are typically atoll soils derived from reef materials with a thin organic top soil. The agricultural value of those soils is restricted to coconut plantations. Attempts have been made to improve the soil quality by composting organic materials. The soils of the Southern Group are derived from the weathering of volcanic rocks and are more diverse and suitable for a wide range of crops. The loss of soil and soil fertility through bad land use practices has resulted in reduced amounts of soil nutrients in the high islands, and has created siltation problems.

Energy

Energy development is an area currently under review in an attempt to seek alternative and cheaper sources of energy. Currently, diesel continues to be a dominant energy source, with solar systems on trial on Pukapuka, Mitiaro and Palmerston. There is a need to further investigate other energy sources, in particular, renewable energy sources.

Fuel

With the changing lifestyle and the availability of modern electrical appliances, cooking is mainly with LPG gas and electrical appliances. Wood and coconut by-products continue to be used for openfire cooking and the traditional earth oven, the **umu**.

Water

Water is readily available on all of the higher islands. On Rarotonga and Mangaia running streams provide a source of water. It has been established that there is a lot of water wastage on both islands, especially as a result of small-scale subsistence and commercial farming activities around homes. This accounts for about 200 litres per day, over three times more than that used by expatriate homes. On the other islands of the Southern Group, water pumping facilities are used to run the water through the islands' reticulation systems. Communal and individual tanks are also used, but they are more common in the Northern Group where water systems are dependent on the weather.

Minerals

The Cook Islands are not rich in land-based minerals but have great potential in deep sea nodule minerals that are rich in cobalt. Scientific expeditions have revealed huge quantities of manganese nodules on the seabeds of the islands north of Rarotonga.

On land the term mineral is used to describe crushed basalts used for construction and the mining of coral beach deposits. The extensive mining of these beach deposits is widely believed to be a major contributor to coastal area retreat on Rarotonga.

Biological features

The islands of the Cook Islands are located on the lower end of a biological diversity gradient which diminishes with distance from the continental land masses and the equator; hence they have little diversity in flora, fauna and marine life in comparison to their northern and eastern neighbours. Within the country, the principal influence on biological diversity is the physical structure of the islands, with some having being shaped by episodic events such as cyclones and storms and/or changing land use patterns.

Land flora

The Cook Islands has an endemism rate of about 10 per cent: 173 flowering plants recorded, of which 18 are endemic. Vegetation communities found in the Cook Islands are atoll communities, makatea communities, coastal ridge communities, wetlands, fernland, and the interior of Rarotonga.

The homalium and cloud forest of Rarotonga are most important because of a wide variety of endemic species found there. While the inland forest supports about 105 native species (10 of these are Polynesian endemics and 15 are unique to Rarotonga), the cloud forest covers less than 3 per cent of the total area of

Rarotonga and supports nine species of flowering plants not found in other communities on Rarotonga. Four of these cloud forest species are not found anywhere else in the world. Twelve ferns are restricted to the cloud forest; two of them are Rarotongan endemic species.

There are many introduced plant species in the Cook Islands, which mainly fall into the food plants and ornamental plant categories. However there are also a large number of plants introduced to improve soil for agricultural production. Other introduced weeds have become a major concern and are considered to be a potential threat to the indigenous forest systems, particularly on Rarotonga.

Grasses are an important feature. There are an estimated 60 species, of which 12 are pre-European (native and aboriginal) and 48 are modern grasses introduced during post-European contact.

There are numerous plant species listed as endangered, mostly found on Rarotonga.

Land fauna

The terrestrial fauna of the Cook Islands is very restricted. The most common species are listed in Appendix 2. Mammals are restricted to domesticated introduced species. The birds of the Cook Islands, particularly the landbirds, are very few. The Rarotonga flycatcher and the Mangaia kingfisher are receiving much attention due to their reduced numbers. Seabirds are protected on Suwarrow Atoll National Park and Takutea, which is a locally protected bird sanctuary.

Other fauna include numerous species of insects and lizards.

Marine fauna

Fringing reefs are common in the Cook Islands, with barrier reefs only being found on Aitutaki. Twenty-four coral genera are known in the Cook Islands, particularly on Aitutaki and Rarotonga. Four genera are known now to have reached their limits. In total, Cook Islands coral fauna is comprised of 58 species in 24 genera (Stoddard & Pillai 1973).

Coral reefs are an important food source for most Cook Islanders. Subsistence harvest of *Tridacna* and the introduced trochus is common, the latter especially on Aitutaki. Other species include the rough turban snail, and the Pacific asphismay found in rubble sand beds. The pearl oyster is also an important food source, apart from being a commercially farmed resource.

The hawksbill turtle found in the Northern Group and the green turtle found in the Southern Group are both considered delicacies as well.

The people

The people of the Cook Islands belong to the Polynesian Maori race and share a bond of history and culture with the indigenous people of French Polynesia and New Zealand. Cook Islanders are citizens of New Zealand. It is a society very much influenced and changed by external religious beliefs, external lifestyles and monetary developments.

The culture of the Cook Islands people, although changing, has maintained its traditional flavour so far through a strong will to preserve some of its customary practices. However it is feared that this could be lost if the Cook Islands Maori language is not passed on to the young children.

Education of young and old in the Cook Islands is very important. This is reflected in the number of schools: twenty primary schools and eight secondary schools. There is also a high proportion of Cook Islanders striving for higher education.

Over 90 per cent of the Cook Islands people belong to the Christian faith.

Population figures show an upward growth trend since 1902. Population growth peaked in 1971 when the population reached 21,323. Since 1976 there has been a decrease in numbers. The 1991 census shows an increase of 5.55 per cent from the 1986 census, bringing the population to 18,552.

The age structure for the Cook Islands population shows an ageing population. An important feature of the population is internal migration. Recent census figures show that the population of Manihiki has increased by more than 30 per cent while the population of Mangaia has decreased.

All of the Cook Islands are inhabited except Manuae, Takutea and Suwarrow.

Economic features

The economy of the Cook Islands is characterised by a very large number of imports and proportionally a very small number of exports. Initially an economy dominated by the primary sector and focusing on agriculture, fisheries and quarrying, there has been a move towards a service-oriented economy to cater to the demands of tourism.

Tourism is the major industry of the Cook Islands with currently over 30,000 visitors.

The pearl industry of the Northern Group has become very important and has picked up since 1985.

Environmental issues

The impact of agricultural activities in the last fifty years on the state of the environment has caused some concern. This does not however stand alone; a changing lifestyle and development, spearheaded by tourism and related activities, also contributed to this impact.

Waste management

Problems of waste, both liquid and solid, are common to all the islands of the Cook Islands. They include garbage disposal; sewage disposal; nutrients and chemicals such as agricultural chemicals (fertilizers, biocides) and oil spills into the environment via major fuel outlets and users.

Garbage disposal is a problem on all islands as a result of high importation of foreign goods and services. The high volume of non-biodegradable garbage is high and the technology to reduce this volume has not yet arrived. With only a small amount of unsuitable land area available, waste disposal is very difficult.

Sewage and other liquid wastes are a major problem, especially on Rarotonga and Aitutaki. With the increasing population, sewage disposal has not been effective. There is an increasing amount of organic material in the streams, and this is indicated by the extensive growth of algae along the streams and the foreshore. Nutrients levels from laundry and agricultural chemicals may also be contributing to the problem.

Land management

The land is owned by the people by heritage, and this has meant a large number of people own a small piece of land. The main land tenure features are described in this report as multiple ownership and absentee ownership.

The inadequate supply of land for developmental purposes has restricted land acquired for purposes such as waste disposal and the protection of environmentally sensitive areas. Absentee ownership has led to small parcels of land being extensively farmed and upland lands excavated, causing serious erosion problems. Some landowners, because of the scarcity of land, have undertaken expensive and ineffective land rehabilitation programmes which have resulted in the degradation of neighbouring properties.

Poor and ineffective use of machinery has not made land management problems any better. The poor construction of roads and house site excavations on steep uplands has caused soil erosion and other related problems.

Coastal degradation

The coastal zone is a very important area of the islands. It provides food, building resources such as sand and coral, shelter and recreation activities. The coastal zones, in particular on the islands of Rarotonga and Aitutaki, are in an unhealthy state. The use of destructive fishing practices (poisoning using plant extract, the use of scuba-diving gear for fishing, gill-net fishing, dynamiting) result in over-fishing and the destruction of these areas' fisheries systems.

The effect of soil erosion through siltation and waste disposal contributes to the degradation of coastal resources. Mining activities for sand and coral aggregate have caused land loss on most of the beaches of Rarotonga.

Water supply & usage

There is much water wastage on Rarotonga, especially due to the subsistence and part-time commercial activities associated with homes. Running taps, piggeries and gardens all contribute to the high level of wastage.

In the Northern Group, water supply is a problem due to low rainfall and the lack of storage systems for a continuous supply of water. The introduction of flush toilets to the north may cause some problems with water supply.

Energy development

Current energy-generating sources such as diesel are expensive and a constant risk to the environment in terms of spillage, fire risk and disposal of waste from major users.

Lack of awareness

Inadequate awareness of environmental issues and appreciation of the environment is a problem. This is mainly attributable to the lack of funds, lack of expertise and lack of acceptance by the Government that the environment is an important consideration in implementation of its programmes.

Protected areas development

The need to protect some areas because of their biological, recreational and educational values is an issue that the Conservation Service is addressing. Land ownership is a major problem.

Other issues

Driftnet fishing, nuclear testing and disposal of toxic waste in the Pacific are issues of which the general public is aware.

Response to environmental issues

Government policies

Conservation and environmental policies are a major feature of the present Government's policy document. Government policy clearly identifies the need to strengthen the Conservation Service through staff training and infrastructural arrangements. The policy document also recognises the environmental aspect in marine resources development, cultural development, beautification and town planning.

Laws & conventions

The Cook Islands have more than 14 pieces of legislation that deal directly with the use of the environment and its resources. The Conservation Act however is the primary legislation which deals directly with the protection and conservation of the environment.

The Cook Islands is a signatory to at least twelve international laws and has ratified about five of these.

Institutional development

The Conservation Service is charged with the primary responsibility of conserving and protecting the environment. Other institutions have also developed in this area. They include the Ministry of Marine Resources, the Curriculum Development Unit of the Ministry of Education, the Ministry of Cultural Development, the Ministry of Health and the Ministry of Agriculture.

Non-governmental organisations

The response of non-governmental organisations to environmental issues has been very recent. A waste management campaign was undertaken under the Chamber of Commerce Environmental Sub-committee. Other NGOs have been instrumental in disseminating environmental messages.

Specific programmes & projects

The programmes of the Conservation Service are specifically designed to address the issues described above. This includes foreshore protection; wildlife and protected areas development; resource management and planning; education training and publicity; and cultural conservation.

Other projects undertaken cover specific problems and these are the coastal management units pilot project; a land use capability study; legislative framework for conservation and land use project; afforestation; island development plans; a tourism master plan; an integrated pest management programme; a natural heritage project and an oil pollution management plan.

Effectiveness of responses to environmental issues

Government policies

Implementation of Government environmental policies has been ineffective. This may be due to the lack of a co-ordinating mechanism within the central Government administration system.

Laws & conventions

Despite the large number of laws which control the environment, enforcement and compliance have been very poor. A feature of outer islands resource management, the **ra'ui**, is a traditional resource management practice that is currently not effective.

Institutional developments

Government support has been very slow, considering the increasing pace of development. There is a lack of technical expertise within the Service and other agencies to cope with the country's environmental technical evaluation and monitoring of development projects.

Non-governmental organisations

NGO activities have not been co-ordinated or monitored, although they are a vehicle for implementing environmental activities in the private sector. However, it is apparent that they could play an important role in implementing environmental protection activities.

Specific programmes & projects

These have created a greater degree of awareness among specific groups, usually at the technical level, and an increasing volume of information in the form of technical reports and publications.

Supporting measures for the effective response to environmental issues

Amongst the numerous supporting measures recommended, priority must be given to an integrated approach to environmental issues through the establishment of a clear policy on sustainable development of resources, and a mechanism whereby the Government's sustainable development policies are properly co-ordinated.

Environmentally related laws must be reviewed to take into account the principle of sustainable development and to promote a community effort in understanding and appreciation of the principle and its application. This should make compliance and enforcement mechanisms more acceptable.

Environmental monitoring procedures are also very important and useful in monitoring specific projects and programmes. Such procedures are also important in the formulation of new policies.

The Conservation Service must take a leading role in any action which calls for action in the short as well as the long term. This will involve strengthening the Service as well as other agencies (Island Councils, line departments), both through legislative and financial support.

chapter 1 ♦

The environment

1.1 Physical features

1.1.1 Land & distribution

The Cook Islands consists of 15 islands scattered over some 1.8 million square kilometres of the South Pacific Ocean between Tonga and Samoa in the west and French Polynesia in the east. The islands are located in an area extending from latitudes 9° and 22° South and longitudes 157° and 166° West.

The 15 islands are divided into a Northern Group of six low-lying islands north of Palmerston, and a Southern Group of nine islands south of Suwarrow.

The islands represent the five different island systems found in the Pacific Basin: high volcanic; low volcanic surrounded by raised reef platform or makatea; volcanic partially submerged with a large atoll type lagoon or almost-atoll; sand-cays; and the atoll systems (see Table 1).

The low-lying islands have a height range, above mean sea level, of between five and nine metres. Rarotonga is the highest island, reaching 652 metres above mean sea level.

The land area of the Cook Islands is 240 sq km, with over 88 per cent (212.8 sq km) of the land area situated in the Southern Group. With the exception of Manuae, Takutea and Suwarrow, all islands are inhabited.

Table 1 **Land, type & altitudes**

Island	*Land area (sq km)*	*Type*	*Max. height metres above m.s.l*
Southern group			
Rarotonga	67.2	High volcanic	652
Mangaia	51.8	Low volcanic (makatea)	169
Atiu	26.9	Low volcanic (makatea)	72
Mitiaro	22.3	Low volcanic (makatea)	15
Mauke	18.4	Low volcanic (makatea)	29
Aitutaki	18.1	Almost-atoll	124
Manuae	6.9	Atoll	10
Palmerston	2.0	Atoll	5*
Takutea	1.2	Sand-cay	5*
Northern group			
Penrhyn	9.8	Atoll	5*
Manihiki	5.4	Atoll	5*
Pukapuka	4.3	Atoll	5*
Rakahanga	4.1	Atoll	5
Nassau	1.2	Sand-cay	9
Suwarrow	0.4	Atoll	5*
Total area	240.0		

* Assumed to be 5 m approximately

Source Map of the Cook Islands (Survey Department Publication)

1.1.2 Climate

The Cook Islands have a pleasantly warm and sunny climate, with an average relative humidity of 84 per cent and with a total of 2116 sunshine hours per annum. Temperature ranges of the Northern Group are fairly uniform, however there is some variation in the temperatures and rainfall patterns of the Southern Group.

The South Pacific Convergence Zone (SPCZ) and its movement between the Northern and Southern Groups is an important phenomena for influencing the weather patterns of the Cook Islands. The SPCZ is a convergence zone of air between the equatorial easterly winds and the south easterly trade-winds. The SPCZ varies from month to month, and the weather in the Southern Group is largely dependent on its position and intensity.

Associated with this movement are the seasonal variations which are much more noticeable in the Southern Group. Between May and October (dry season), the SPCZ is generally to the north of the Group with dry south-easterly winds prevailing, causing cooler temperatures. From November through April (wet season) the SPCZ may lie over the Group, causing unsettled weather and warmer temperatures with higher humidity and heavy rain.

The Northern Group experiences high temperatures averaging 28°C all year round, typical of a tropical maritime climate. The Southern Group, however, is characterised by some inter-seasonal variation in temperatures. The average lowest temperature ever recorded was 21.7°C, recorded on Rarotonga in August. The highest average temperature was recorded on Aitutaki at 27.1°C in March.

The installation of an automatic weather station on Suwarrow earlier this year enhances data coverage for better weather prediction, particularly in regard to monitoring the movement of the SPCZ, which is also associated with cyclones and hurricanes.

Tropical cyclones are widely said to be a major climatic feature of the tropics, however the Northern Cook Islands are seldom affected by them. Between 1940 and the early 1980s there were 11 reported cases of tropical cyclones in the area and only three of these resulted in damage to some of the atolls (Thompson 1986). Gale force winds (34–47 knots) were reported at Penrhyn on only nine occasions over a 34-year period.

The formation of tropical cyclones during the wet season is a major climatic feature of the Southern Cooks. These tropical cyclones develop in low pressure troughs on the SPCZ during the warmer months of the year. The last major cyclone was "Sally" in January 1987.

1.1.3 Geomorphology

The Cook Islands is comprised of an archipelago of 15 islands extending some 1400 kilometres. The islands represent five types of island systems found in the Pacific Basin (see section 1.1; Table 1).

High volcanic islands

Rarotonga is the only true high volcanic island of the Cook Islands. Mangaia and Aitutaki, which are volcanic in origin, are the only other two islands with altitudes above 100 metres.

Rarotonga differs markedly from the other islands. It is a partially collapsed caldera with secondary volcanic cones (e.g. Te Kou), lava flows and differential eroded volcanic plugs dominating the interior skyline as upstanding monoliths (e.g. Te Rua Manga). The high mountainous peaks of Rarotonga and their sharp ridges divide the four main catchment valleys of Takuvaine, Avatiu, Avana and Rutaki.

Raised makatea islands

The makatea islands of the Southern Group are raised volcanic islands resulting in raised coral platforms (makatea) surrounding an apparent interior volcanic plateau. The uplifted makatea rises to more than 60 metres above sea level (a.s.l.) on Mangaia, 20 metres a.s.l. on Atiu and Mauke, and to less than 6 metres a.s.l. on Mitiaro. Mangaia is the oldest of the islands and is severely eroded with a series of concentric cliffs. Mitiaro, on the other hand, is composed of a central volcanic cone submerged with four exposed highly weathered basaltic outcrops. These outcrops are fertile food lands surrounded by a freshwater lake.

Typically, makatea islands are characterised by the presence of limestone caves which are widely explained as the result of dissolution by underground freshwater drainage systems. Previous human settlement and farming activities led to the interiors of Mangaia and Atiu becoming seriously eroded on the slopes and escarpments.

Sand-cays

Sand-cays are small low-lying islands or islets composed of sand and coral fragments. Normally sand-cays are formed on old reef platforms. Of the two sand-cays of the Cook Islands, Nassau is the only one with some human population. Takutea is a seabird sanctuary.

Almost-atoll

Aitutaki, an example of a partially submerged volcanic island, has the features of both a volcanic island and an atoll and is surrounded by a barrier reef.

Atolls

The atoll systems of the Cook Islands are typically low, being only up to 10 metres above mean sea level. Atolls are described as the summit of marine volcanoes (Wood & Hays 1970), and their shape and size is subject to major alterations from cyclones.

Geologically, islets of atolls or **motu** are the result of aggregates of reef materials accumulated during normal high seas but mostly during major storms (Stoddard et al. 1975).

1.1.4 Soils

Northern Group

The soils of the Northern Cook Islands are typically atoll soils derived from reef materials with a thin organic top soil. These soils are inherently infertile and highly porous, capable only of supporting coconut and pandanus and other vegetation types described in section 1.2.1. Selected areas, with adequate quantities of organic soil, usually found in marsh depressions, are mainly used for pulaka (*Spermatoma* spp.) crops. Some attempts have been made to build up soil and soil fertility through composting for home gardening, however the extent of this has not been monitored. With the collapse of the copra industry, little has been gained economically from the atoll soils of the North.

Southern Group

The soils of the Southern Cook Islands are more diverse and more suitable for major agricultural use. With the exception of Rarotonga and Aitutaki, the other islands have large areas of makatea and this has limited the land area available for agricultural use on those islands (see Table 2).

The more fertile soils of the Southern Group are basically derived from the weathering of volcanic materials that form the centre of the islands. (These soils are described in detail in the soil survey reports published by the New Zealand Soil Bureau.) The soils are found in the interior of the islands and over a range of topographical provinces including swamp, escarpments, terraces, foothills, uplands and the makatea of Mangaia, Mauke, Mitiaro and Atiu.

The interiors of Atiu, Mitiaro, and Mauke have deeply weathered clay soil that provides the source for the fertile arable lowlands and the swamplands which support taro crops. On Mangaia and Atiu the lower slopes and escarpments are used for pineapple plantations. On Mitiaro, much of the interior is inundated with the remaining mounds of fertile food lands cultivated for local food crops. Aitutaki and Rarotonga provide the larger areas of arable soil. On Rarotonga, the swamps are located at the toe of the foothill and behind the coastal ridge. On the makatea islands, the swamps extend from the inner foot of the makatea. These swamps are generally planted with taro (*Colocasia esculenta*).

Table 2 **The makatea and arable lands of the Southern Group (%)**

Island	*Makatea*	*Others*	*Arable land*
Rarotonga	nil	87.4	12.6
Mangaia	33.78	59.52	6.7
Atiu	50.09	11.13	26.68
Mauke	76.66	4.34	6.9
Mitiaro	80.00	18.2	1.8

*"Others" includes fern lands and steep country and other lands unsuitable for agriculture

Source Ministry of Agriculture Forestry Division

The steeper uplands of Atiu and Mangaia have been subjected to severe soil erosion as a result of the pineapple industry of the early 70s. Despite the apparent classic erosion prevailing on these low islands, a large proportion of the islands is unaffected. For example, some 89 per cent of Atiu is largely unaffected by soil erosion; the productive volcanic terrace soils of the central lowlands exhibit no evidence of erosion under the present land use regime (NZDSIR 1990). However, where erosion is evident, it is spectacular, in the form of sheet, rill, and gully erosion with some 10.6 per cent (301 ha) of Atiu having lost a great part of its top-soil (NZDSIR 1990). Almost all of this soil erosion has occurred on erosion-susceptible areas and on inherently less fertile soil units, which have been used for pineapple production; or they are fernland slopes which are frequently burned. The extent of loss underlines the need for the application of soil conservation principles and practices.

On Rarotonga, although there are significant areas of eroded soil especially in the upland slopes, in most places there is a fast rate of regrowth which protects the soil from extensive loss of nutrients.

1.1.5 Water

Water quality is generally good.

Northern Group

The Northern Group, being coral atolls, is without surface water and dependent for supplies on the vulnerable freshwater lens which is subject to rapid depletion. Individual homes traditionally depend on rainwater stored in small containers.

However with the introduction of larger tanks, most dwellings now have 1000 gallon (4,500 litres) capacity ferro-cement rainwater tanks, while 10,000 gallon (45,000 litre) communal rainwater tanks are being constructed near or under large public buildings.

Southern Group

The volcanic islands of the Cook Islands are well supplied with good quality drinking water and have no major problems during normal climatic conditions. On Rarotonga and Mangaia, the springs and streams within the catchment valleys provide good running water sources which have already been developed using filtering intake facilities.

On Rarotonga, water from stream catchments is piped into the main reticulation system which serves the majority of households.

The volcanic outer islands of the Southern Group have adequate underground resources. Under the Government water development programme, pumping facilities have been provided. The islands' undulating terrain makes gravity-fed reticulation possible, with pumping systems used to supply settlements on flat or higher grounds.

1.1.6 Energy & fuel

Energy

The Ministry of Energy supplies electricity to most of the inhabited islands. The electric generators are all diesel-powered. Photo-voltaic systems have been introduced to Mitiaro and most recently Pukapuka and Palmerston through external funding. The Government has sought to promote this source of energy and to reduce dependence on imported fuels.

Some attempt was made to introduce the concept of dendrothermal power generation in 1985 but it was not considered viable at the time, due to problems associated with the production of wood-fuel .

Wave and water energy have also been investigated. These efforts have recently been expanded to include SOPAC-funded trials with a small-scale wave energy system and the assessment of the potential of a small hydro-power system.

Fuel

Natural fuel is obtained from firewood and coconut husks/shells which are widely used in the outer islands, and to a lesser extent on Rarotonga, for cooking using traditional ovens or **umu**. Firewood supplies do not constitute a major problem.

1.1.7 Minerals

Land

In the Cook Islands, the term mineral is mainly applied to sand deposits of the beaches or materials from the quarry. Sand deposits around Rarotonga have been mined for building purposes. Mining of beaches and inland sand deposits has been going on for over fifty years. Quarried basalts on Rarotonga, and limestone on Aitutaki and Mangaia, have provided metal for road-building and construction purposes.

Marine

Numerous deep-water surveys have revealed the EEZ of the Cook Islands to be covered with deposits of manganese nodules, particularly to the north of Rarotonga. Since 1974, several scientific vessels have explored the density and nature of these deposits. Tests show a high cobalt content. Japanese explorations estimated that from an area of 105,600 sq km, 7,888,000 tons of cobalt occur, with a value of $NZ 312 billion. Since 1986 Japanese explorations have focused on engineering data collection used to model different and viable methods of mining these resources.

1.2 Biological features

[NB. Not all species have local names; scientific names will only be provided when the species is mentioned for the first time in the text.]

The Cook Islands are remotely located on a biological diversity gradient which diminishes with distance from the continental land masses, and north and south of the equator.

Within the country, the principal influence on biological diversity is the physical structure of the islands, with some shaping from episodic events such as cyclones and storm surge. The other main influence on the biological resources has been the changing pattern of land use since the arrival of European settlers.

1.2.1 Land

Flora

The number of native flowering plants recorded is about 173, of these only about 18 are endemic, giving the islands an endemism rate of about 10 per cent (Whistler 1988).

Vegetation communities vary and their nature depends on the physical structure of the islands. In this report, the following communities are described: atolls, makatea, coastal, wetlands, fernlands and the interior forest of Rarotonga.

Atoll communities

The vegetation of the Northern Group is dominated by typical atoll environment species. These are: pemphis or **ngangie** (*Pemphis acidula*); suriana (*Suriana maritima*); scaveola or **ngahu** (*Scaveola taccada*); sophora or **pohutukava** (*Sophora tomentosa*); the common occurrence of coconut or **'akari** (*Cocos nucifera*); and pandanus or **'ara** (*Pandanus tectorius*); the much used guettarda or **'ano** (*Guettarda speciosa*); some calophyllum or **tamanu** (*Calophyllum inophyllum*); and pisonia or **puka tea** (*Pisonia grandis*). Introduced species, mainly for ornamental and food purposes, are also found.

Makatea communities

The makatea ecological province is of major environmental significance as it is probably the only province whose vegetation pattern has been little altered, due principally to its rugged nature. However, with the introduction of pigs and goats, some species such as herbs and ferns may have been lost. On Mauke and Mitiaro, the exploitation of the alyxia or **maire** (*Alyxia elliptica*) may have had some impact on that species. The four makatea islands of the Cook Islands—Mangaia, Atiu, Mauke and Mitiaro—generally have similar vegetation species.

The vegetation is described in two main categories: the salt-tolerant species of the coastal makatea and the inland species. The coastal makatea is composed of small shrubs and grasses with salt-tolerant pemphis, scaveola, followed in abundance by pandanus, casuarina or **toa** (*Casuarina equisetifolia*), and coconut; and further toward the inland province barringtonia or **'utu** (*Barringtonia asiatica*), and the hernandia or **puka** (*Hernandia peltata*), both common on Mangaia and Mauke.

The inland vegetation has some variation with the elaeocarpus or **karaka** (*Elaeocarpus florindanus*), candlenut or **tuitui** (*Aleurites moluccana*), coconut, pandanus, barringtonia, calophyllum, pisonia, guettarda, hernandia or turina (*Hernandia moerenhoutiana)* growing on Mangaia and the sandlewood or **a'i** (*Santalum insulare*) found on Mitiaro. In areas of significant soil formation, woody plants, herbs, creepers and ferns are well established.

Coastal ridge communities

On Aitutaki and Rarotonga the species are more adapted to free draining, alkaline, and coral sand substrata. Rarotonga in particular has been subjected to extensive alteration, with almost all of the species found to be of secondary and tertiary growth. This is also where a large number of species have been introduced and

become naturalised. Some remains of the original coastal ridge communities may be found on the reef islands or **motu** of the island of Aitutaki and the Muri lagoon on Rarotonga.

The species on the beach are mainly ipomea (*Ipomea pescarprae*), triumfetta (*Triumfetta procumbens*) and vigna (*Vigna marina*), with some grasses and herbs. This is followed in numbers by scaevola, messerschmidia or **tauhinu** (*Messerschmidia argentea*), pemphis, suriana, the legumes leucaena or **nito** (*Leucaena insularum* and *L. utukava*). Other species include morianda or **nono** (*Morinda citrifolia*), pipturus or **orongi** (*Pipturus argenteus*), the dominant hibiscus or **'au** (*Hibiscus tiliaceus*), coconut, barringtonia, pisonia, pandanus (on Aitutaki), guettarda and casuarina.

Outside of the indigenous species, a wide range of introduced weeds, herbs and grasses occur, including the irritating mimosa or **tita pikika'a** (*Mimosa pudica*) and the more prominent spiny lantana or **tataramoa** (*Lantana camara*).

Wetland communities

The wetland communities include species associated with swamplands and marshlands. The latter are those associated with lake environments as found on Mitiaro and the salt marshes of Ngatangiia on Rarotonga and selected areas around Aitutaki and the Northern Cook Islands.

Much of the swamplands are dominated by grasses: echinochloa (*Echinochloa colonum*) and paspalum (*Paspalum orbicul*) are found amongst taro plantations as well as the sedges, which are mainly cyperus (*Cyperus brevifolius, C. ferax*), eleacharis (*Eleacharis geniculata*) and fimristylis (*Fimristylis dichotama*). On all islands water grass (*Commelina diffusa*) is always present. Waterlilies (*Nymphaea* sp.) are common with typhus or **raupo** (*Typhus* sp.). The sedges of Mitiaro are the dominant species on the wetlands of Mitiaro. They are fire-induced.

The salt marshes of Aitutaki and Ngatangiia village on Rarotonga are important areas for fish breeding. It is widely accepted that these marshes provide shelter and hatchery conditions for locally important fish species.

Fernland communities

The fernlands are one of the most important communities on the islands of the Southern Group, particularly Mangaia, Aitu and Rarotonga. Traditionally these areas are found on the lower upper slopes of Rarotonga and in the interior plateaus and slopes of Atiu and Mangaia, as well as the interior escarpments of Mauke. It is believed that fernlands were the result of repeated burning of the original vegetation. Fernlands are frequently subjected to fires induced mainly by activities associated with the clearing of adjacent farmlands or by arsonists.

Fernlands have an important environmental function. They provide physical protection to the poor underlying soil by intercepting and reducing the velocity of rain and retarding surface runoff so that infiltration is improved and runoff reduced. Although burned frequently, fernlands have a fast regrowth rate. The dominant fern species is tangle fern or **tuanu'e** (*Dicranopteris linearis*); there is also the club moss (*Lycopodium cernum*), and patches of casuarina. It is common to find guava or **tuava** (*Psidium guajava*) around the lower borders of the fernlands.

For the past decade the forestry division of the MOA has carried out trials to identify suitable species which could be planted on fernlands and similar land areas, especially those previously used for the pineapple plantations of Mangaia and Atiu. The primary objective is to use soil conservation techniques to improve the nature and value of the soil, particularly in areas previously planted which are now too steep for further cultivation.

The Forestry Division during its 1990/91 year planted 102 hectares, mainly *Pinus caribaea,* with other plantings of *Acacia crassicarpa* and the *Acacia mangium.* Other soil conservation measures involve the mass production of vetiver grass to be used to trap runoff soil into terraces.

Interior forest of Rarotonga

Although much alteration of the island has taken place, the rugged interior of Rarotonga remains intact. The inland area supports about 105 native species and 230 introduced flowering plants. Of the 105 native plants, 10 are Polynesian endemics, and 15 are unique to Rarotonga (Rarotonga endemics). In addition to flowering plants, the mountains support about 88 species of fern, including the giant angiopteris or **ana'e** (*Angiopteris longifolia*) and the Disc filmy-fern (*Trichomanes tahitensis*). Of these, seven are Polynesian endemics, one is a Cook Islands endemic and four are unique to Rarotonga.

The inland community may be divided into two types of communities. The first is the slope forest, dominated by the homalium or **mato** (*Homalium acuminatum*). Other common species include the hibiscus, which is widespread, especially in disturbed areas; Polynesian chestnut; angiopteris; the fagraea or **pu pu'a** (*Fagraea berteriana*) found mainly along the ridges; Rarotonga fitchia or **te neinie** (*Fitchia speciosa*) with its large bright orange flower; pittosporum or **kavakava** (*Pittosporum arborescens*); weinmannia or **kaiatea** (*Weinmannia samoensis*); melastoma or **'ua motukutuku** (*Melastoma denticulatum*); Rarotonga freycinetia or **kiekie** (*Freycinetia wilderi*); and the Pacific metrosideros or **rata** (*Metrosideros collina*) with its spiky bright red flowers.

The slope community also supports a number of introduced species which are strong colonisers, posing a great threat to the indigenous forest. These are described later.

The second type of inland community is the Rarotonga cloud forest. The cloud forest contains the most restricted plant community on Rarotonga, and also contains most species unique to the Cook Islands. This community is situated at and above the altitude of 400 metres. The cloud forest covers less than 3 per cent of the total area of Rarotonga. It supports nine species of flowering plants not found in other communities on Rarotonga. Four of these species are not found anywhere else in the world. Two spectacular-looking species endemic to Rarotonga are the Te Manga cytandra (*Cytandra lillianae*) and the Rarotonga sclerotheca (*Sclerotheca viridiflora*). Twelve ferns are restricted to the cloud forest and two of them are Rarotonga endemics.

Introduced species

There are a large number of introduced species in the Cook Islands, mainly in the food plant and ornamental plant categories. However there are also a large number of plants introduced to improve soil for agricultural production. Such plant species include mimosa, *Desmodium* spp., kudzu (*Pueraria lobata*), the Brazilian lucern (*Stylosanthes guianensis*) and others. These leguminous plants have become widespread, particularly in the Southern Group, and are common along roadsides. Some species, for example the mimosa, have become unpopular weeds due to their prickly nature.

Other introduced weeds however have become a major concern and are considered to be a potential threat to the indigenous forest systems particularly on Rarotonga. The balloon vine (*Cardiospermum halicacabum*), balsam pear (*Momordica charantia*) and red passionfruit (*Passiflora rubra*) are three such weeds that almost always occur together. The balloon vine is found only on Rarotonga. Wilder (1930), in his publication on the flora of the Cook Islands, described the weed as only found in Avarua. Sixty years later this weed is found all over the island and is a feature of old neglected orange plantations. On other islands the balsam pear and red passionfruit are common, especially on old and unattended plantations. The mile-a-minute (*Mikania micrantha*) is another commonly recognised weed which has posed problems for growers.

Another introduced weed from the post-European era is the sorghum or **tarapi** (*Sorghum bicolor*), commonly found on plantations.

Grasses are an important feature. There are an estimated 60 species, of which 12 are pre-European (native and aboriginal) and 48 are modern grasses introduced during post-European contact.

Other invading colonising and introduced tree species are the cecropia or **raumaniota** (*Cecropia palmata*); and the African tulip or **patiti-vai** (*Spathodea campanulata*), which has bright red-orange flowers and is mainly found in the

interior of Rarotonga. The Java plum or **pistat** (*Syzygium cumini*) is widespread throughout the Southern Group. It is a large fast-growing tree.

Other introduced species include the thorny lantana or **tataramoa**; the night-blooming cestrum or **tiare Ariki Vaine**, which has become widespread in the interior and a favourite food source for livestock; the black-berried shrub ardisia or **venevene tinito**; and the strawberry guava or **tuava papaa**.

Species at risk

There are numerous species listed as endangered and they are mostly found on the island of Rarotonga. Table 3 provides a list of the endangered species of the Cook Islands as published by Whistler (1988). The assessment is based on records of the number of specimens found and collected since 1929.

Table 3 **Endangered plant species of the Cook Islands**

Species	*Times collected*	*Last collected*	*Status*	*Island*
Acalypha wilderi	5	1929	E	Rarotonga
Balanophora wilderi	3	1982	E	Rarotonga
Carex graeffeana	4	1980	I/PE/R	Rarotonga
Cenchrus calyculatus	2	ca.1925	I/R	Rarotonga
Chapentiera australis	2	1985	I/PE	Rarotonga
Chloris cheesemani	4	1985	E	Rarotonga
Cytandra lillianae	1	1929	E	Rarotonga
Euodia cf.bracteata	3	1984	I/PE	Rarotonga
Fitchia speciosa	many	1986	E	Rarotonga
Garnotia cheesemani	3	1982	E	Rarotonga
Guioa sp.	1	1985	E	Mk
Habenaria amplifolia	7	1986	E	Rarotonga
Haloragis prostrata	5	1986	I	Mitiaro
Lepidium sp.	3	1982	E	Mitiaro

Table continued over-page

Species	Times collected	Last collected	Status	Island
Liparis clypeolum	1	1989	I/PE	Rarotonga
Nesogenes euphrasioides	4	1986	I/PE	Mk/Mit
Nesoluma polynesicum	1	1986	I/PE	Mk
Operculina sp.	4	1986	I	Mk/Atiu
Pachygone vitiense	1	1986	I/R	Mitiaro
Phaius graefei	2	ca.1975	I/PE/R	Rarotonga
Pilea bisepal	1	1929	E	Rarotonga
Pritchardia vuylstekeana	1	1986	I/PE	Mitiaro
Psychotria sp.	6	1986	I or E	Rarotonga
Scirpus nodosus	1	1982	I/R	Rarotonga
Sclerotheca viridiflora	6	1984	E	Rarotonga
Tetramolopium sylvae	1	1982	I/PE	Mitiaro
Trema cannabina	1	ca.1974	I/R	Mangaia
Ventlago vitiensis	1	ca.1974	I/R	Mangaia
Orchid species undet.	2	1982	I?	Mitiaro

E=Endemic; I=Indigenous; PE=Polynesian endemic; Mk=Mauke; Miti=Mitiaro

Source Adopted from Whistler (1988)

Fauna

Mammals

Terrestrial mammals are restricted to introduced species such as pigs, dogs and cats. The flying fruit bat or **moa kirikiri** (*Pteropus tonganus*) is perhaps the most important terrestrial mammal found in the Cook Islands and is frequently referred to as the Tongan flying fox. The flying fruit bat is only found on Rarotonga and Mangaia and is referred to as a pest feeding on fruit trees such as the coconut and the introduced kapok or **mama'u** (*Cieba pentanndra*) as well as the **rau maniota**.

Although not considered of value, rats are also environmentally significant. Current work on the Rarotonga flycatcher (*Pomare dimidata*) indicates a classic example of the threat to native species which can be posed by rats. There are three species of

rat found in the Cook Islands: the Pacific rat or **kiore** (*Rattus exulans*); ship rat or **kiore toka** (*Rattus rattus*) and the Norway rat or **kiore toka Norue** (*Rattus norvegicus*).

Crabs

The Cook Islands also have a number of crabs, including the butcher land crab or **tupa** (*Cardisoma carnifex*) which is commonly found on Aitutaki and the coconut crab or **unga kaveu** (*Birgus latro*) which is regarded as a delicacy. The coconut crab is the largest of the land crabs and is common on most islands but has become extremely scarce on islands with a significant human population.

An important feature of this animal is its slow growth rate to maturity. It takes about 7–12 years for females to mature sexually and up to 40 years for individuals to be large enough for consumption (McCormack 1991). The **tupa,** on the other hand, has been heavily exploited and it is feared that this local food source may become scarce.

Another threatened species is the banded prawn killer or **varo** (*Lysiosquilla maculata*). It is a burrower, found in the mudflat of Ootu, Aitutaki and is another heavily exploited species.

Seabirds

Takutea and Suwarrow are the two main seabird breeding islands in the Cook Islands. Takutea supports four seabird species which do not breed elsewhere in the Southern Group: the white-capped noddy or **rakia** (*Anous tenuirostris*); red-footed booby or **toroa** (*Sula sula*); great frigate bird or **kota'a nui** (*Fregata minor*); and the brown booby or **kena** (*Sula leucogaster*). In addition Takutea supports the largest colony of red-tailed tropic birds or **tavake** (*Phaethon rubricauda*) in the Cook Islands.

Suwarrow contains the only large colonies of sooty tern or **tara** (*Sterna fuscata*), brown booby and least frigate bird or **kota'a iti** (*Fregata ariel*) within the Cook Islands, in addition to having the second largest colony of red-tailed tropic birds.

The masked booby or **lulu** (*Sula dacrylatra*) are also found nesting in limited numbers. In total there are eleven seabird species found in the Cook Islands, nesting mainly on atolls and sand-cays. Most seabirds, especially those which nest on or near the ground, are very sensitive to human interference. As a result, the uninhabited islands of Takutea and Suwarrow are the most important seabird breeding sites in the Cook Islands.

Land birds

There are four native land birds that are found living and breeding in small numbers in the inland mountains and bluffs of Rarotonga. All these birds are low in

numbers. The Rarotonga starling or **i'oi** (*Aplonis cinerascens*), found in the interior of Rarotonga and commonly seen flying in pairs from ridge to ridge; the Cook Islands fruit-dove or **kukupa** (*Ptilinopis rarotongensis*); the Pacific pigeon or **rupe** (*Dacula pacifica*) and the rarer Rarotonga flycatcher are found only in selected valleys on the south side of Rarotonga.

Other native land birds in the Cook Islands are the Mangaian kingfisher or **tanga'eo** (*Halcyon ruticollaris*) of Mangaia; the Cook Islands warbler or **kerearako** (*Acrocephalus (caffer) kerearako*) found on Mangaia, Mauke, Mitiaro and Atiu; and the Atiu swiftlet or **kopeka** (*Aerodramus (leucophaeus) sawtelli*) which is found only on Atiu. Also living and breeding on Aitutaki is the lorikeet or **kuramo'o** (*Vini peruviana*) (thought to have been introduced from Tahiti). The last of the land birds is found on Mitiaro and is called the Mitiaro warbler or **kaoko**, and is thought to be the same species as the Cook Island warbler.

The Indian mynar or **manu kavamani** (*Acridotheres tristis*), an introduced species, is the dominant land bird on almost all of the islands. It was initially introduced to control stick insects which were damaging coconut plantations during the early 1900s.

There are three other land birds found in the Cook Islands which are mainly migrant species: the golden plover or **torea** (*Pluvialis dominica*), the long-tailed cuckoo or **karavia** (*Eudynanis taitensis*) and the wandering tatler or **kuriri** (*Heterscelus incanus*).

Others

There are numerous species of insects, other crabs, molluscs, and lizards found in the Cook Islands.

The more common lizards are the blue-tailed skink or **moko iku-moana** (*Emoia cyanura*); dandy skink or **moko maunga** (*Emoia trossula*) and the mournful gecko or **moko** (*Lepidodactylus lugubris*). Other common animals are the stick insect or **ee** (*Graeffea cronanii*), found on coconut trees, and two species of freshwater prawns, the thick-hand prawn or **koura-vai** (*Macrobrachium latimanus*) and bracelet prawn or **koura-vai ti'aka** (*Macrobrachium lar*); and the freshwater eels including the endemic species of Mitiaro.

Species at risk

There are a number of species at risk in the Cook Islands. These include endemic species such as the much-publicised Rarotonga flycatcher and the less-known Mangaia kingfisher. Other endemic species such as the Atiu swiftlet and the Rarotonga starling (*Alponi scinerascens*) require urgent protection. The Polynesian introduced flying fox has also declined in numbers over the years and requires

attention. Recent work on the coconut crabs of Suwarrow and Takutea show that there is a need to protect this species as well.

1.2.2 Marine

Reefs & lagoons

All of the Cook Islands feature coral formations, frequently fringing and lagoon reefs. Within the Southern Group islands, windward and leeward atoll reefs are restricted to Palmerston and Manuae, while barrier reefs occur only in Aitutaki.

Twenty-four coral genera are now found in the Cook Islands, particularly on Aitutaki and Rarotonga. Four genera are known now to have reached their limits in the Cook Islands (*Goniastrea, Goniopora, Leptoria,* and *Echinopora*). In total the Cook Islands coral fauna comprises 58 species in 24 genera (Stoddard & Pillai 1973).

Coral reef resources and lagoons provide a very important food source for Cook Islanders, most notably in the Northern Group and, now to a lesser extent, the Southern Group. With the high dependence on imported foods and the change in lifestyle in the Southern Group, not to mention the degraded reef and lagoon environment, particularly on Rarotonga, harvest of reef food is becoming less frequent.

Apart from the subsistence harvest of various varieties of fish and shellfish, tridacna or **paua** (*Tridacna maxima*) is the most popular shellfish, with the introduced trochus (*Trochus niloticus*) becoming increasingly popular as a food with the locals on Aitutaki. Trochus was introduced into the Cook Islands in 1957 and has played an important part in the earnings of Aitutakians in recent years. Trochus has also been established in Palmerston and introduced to Manuae and Suwarrow.

Other harvested species include the rough turban snail or **ariri** (*Turbo sectosus*) found on the reef; the Pacific asphismay or **ka'i** (*Asphis violescens*) found in rubble sand beds, and also various species of sea-urchins, sea cucumbers and sea grapes or **rimu** (*Caulerpa racemosa*). The blacklip pearl oyster or **parau** (*Pinctada margaritifera*) of the Northern Group, particularly Manihiki and Penrhyn, is harvested for food and income.

Two main turtle species are found in the Cook Islands: the hawksbill turtle or **fonu kokorove** (*Eretmochelys imbricata*), found in Manihiki and Pukapuka, and the green turtle or **fonu pokaikai** (*Chelonia mydas*), found in the Northern Group and occasionally around the Southern Group.

No figures are available on the number of fish species found in the lagoons and on the reefs of the Cook Islands. The more common species include reef sharks,

snappers (*Lutjanids*), groupers (*Plectropomus, Epinephalus*), parrotfish (Scaridae), jacks (Caringidae), mullet (Mugilidae), bigeyes (*Priacanthus*) and surgeon fish (Acanthuridae).

Species at risk

There are a number of significant marine species, including the internationally protected turtles, the hawskbill and the green turtles. With the increasing demand for **paua** from the main centre, especially Rarotonga, it would be beneficial if the Island Council by-laws on **ra'ui** could be re-enforced to protect this species. The blacklip oyster also deserves special protection, in view of the increasing farming activities in the Northern Group, to protect the species from disease.

1.3 Cultural features

Culture is always changing. Traditionally the Cook Islands people are culturally sensitive. This is reflected in their daily lifestyle, not so much by their personal appearance but by their customs, artwork and the way they do things. It is a society very much influenced and changed by external religious beliefs, lifestyles and monetary developments. The traditional culture of the Cook Islands people can be regarded as still alive but endangered.

In terms of the environment, there were good traditional practices and bad ones. Good practices include the **ra'ui**. The **ra'ui**, a traditional conservation practice, is a form of resource management (discussed in section 3.2.2) which is still being practised, although to a lesser degree then in the past, in the outer islands. Culturally, it is expected that anything done by a person or a clan must be in harmony with nature.

The following subsection provides a brief description of some important components of the cultural resources of the Cook Islands people.

1.3.1 Social culture

Oral traditions

Oral tradition is a form of recording and passing down information. Normally it involves genealogy in the form of stories, songs and legends. It is a passive form of interpretation where information on events is passed from one to another, or others, in a group. Oral tradition in the form of chants, riddles, songs and similes gives an account of the origin of specific subjects or tribes and major events such as wars, natural disasters and diseases.

Oral tradition is currently used in the land court, investiture ceremonies, funerals and weddings.

Customs

Land boundary demarcation

Traditionally, chestnut trees, streams and ridges were used to show land and district boundaries. It is still very common for old people to site these boundaries to give an idea of bearings, land size and allotments.

Traditional calendar

The traditional calendar is perhaps the most important and still most widely used custom of the Cook Islands people. Based on climatic and weather patterns associated with the lunar cycle, traditional fishing and agriculture are planned and implemented. The traditional calendar is also used for making decisions with regards to family planning, fishing of certain species, and other matters.

Traditional conservation practice (ra'ui)

A description of this practice and its current status is given in section 3.2.2.

Immigration policy (iriiri patai)

Traditionally it is customary for new arrivals to the islands to recite their genealogy to identify themselves to the residents. If they have relatives on the island, this gives them the opportunity to be recognised and therefore easily welcomed to the island. In the Ngaputoru, this is called **iriiri patai**. This is no longer a practice on all Cook Islands.

Disaster preparedness

The people of the Cook Islands traditionally depend on certain signs that indicate a climate-related disaster. The twisting of the banana shoots, especially the mario variety, and the abundance of fruits on the breadfruit tree or **kuru Maori**, both indicate a strong storm is on its way. Frothing on the water surface, or **uka vai**, is normally a sign of an impending flood. The use of these indicators is no longer common. It is also a matter of common knowledge when the hurricane and rainy seasons are and what is normally done to prepare during those times.

Maori medicine

Despite the heavy usage of and high dependency on European medicine, Maori medicine and its practice still prevail. Almost all Maori medicines include the use of herbs and woody plants. Some recipes include animals such as sea urchins, certain crabs and fish species and others. There is a growing concern that much of the

knowledge relating to Maori medicine is being lost, especially the names and locations of certain herbs and tree species.

1.3.2 Material culture

Artefacts

The material culture of the Cook Islands people is reflected in their buildings, crafts, and equipment such as hooks, traps, toys, clothing and ornamental ointments, as well as war equipment like spears, batons, and just about anything made by hand.

The designs on these items show the origin of the item and a great deal about its creator. Normally, the Cook Islands people have designs for any element or part of nature. It may be waves, sky, birds, or a wooden drum, or even the feelings of a person which are reflected in the designs on these materials.

Institutions

Institutional culture covers the structural aspect of the Cook Islands culture. Structures such as the meeting place or **marae**, investiture sites or **koutu**, and the house sites or **paepae** are included here. All three are very important, especially those which were used pre-European contact. The **paepae** has become less important as it is no longer used for any practical purpose. However, the **marae** and the **koutu** are still being used for the investiture of titles.

Most of these marae are regarded as archaeological structures and have become very important tourist, educational and research attractions. Almost all of these structures were destroyed by the missionaries. Currently important meetings which involve the gathering of clans are undertaken in community meeting houses. This means the meeting houses, conference buildings, assembly halls and the court room have become marae of the present. Investiture ceremonies are now undertaken on lands which the family consider to be suitable for the occasion. On these lands the invested person builds his/her own koutu in accordance with traditional architecture.

1.3.3 Cultural resources at risk

Although many of the cultural resources of the Cook Islands are reflected in their social culture, it can be said that the culture of the Cook Islands is at risk. The first step perhaps is to maintain the language of the Cook Islands Maori by re-focusing the school curriculum and school policies, with a change in national policy whereby the national language is Maori and not English. This is very important as it allows social aspects and customs to be passed on to future generations.

In learning the Cook Islands language, one must have a knowledge of the country's history and past culture. Much of the environment is personalised and used by Cook Islanders in their language to give effect to discussions or to clarify a point. This is why the preservation of the material culture of the Cook Islands is very important. It gives insight into the Cook Island Maori language.

Protection and consideration of traditional knowledge of medicinal plants usage is also an important issue.

1.4 Demographic features

The people

The people of the Cook Islands are Maori and share a bond of history and culture with the indigenous people of French Polynesia and New Zealand. Cook Islanders are citizens of New Zealand. The population of Cook Islanders in New Zealand is said to exceed 20,000, greater than the home population. Most Cook Islanders, when migrating abroad, migrate to New Zealand or Australia.

General population trends

In the 1991 census, the population was recorded at 18,552. Of this number, 12.3 per cent lived in the Northern Group and 87.6 per cent in the Southern Group, with 59.2 per cent of these living on Rarotonga.

The population of the Cook Islands experienced steady growth from a population of 8,213 in 1902 until it peaked in 1971 at 21,323. The 1971 census saw an increase of 10.79 per cent in comparison with the previous year, but the population had decreased since 1976.

Census figures of 1991 show, for the first time since 1971, an increase in the population by 5.55 per cent, bringing the current population to 18,552 for the Cook Islands.

Preliminary results of the 1991 census indicates that Manihiki contributed the highest increase followed by Rarotonga, Atiu and Penrhyn. All the remaining islands drew negative movements, with Mangaia and Palmerston both recording a decline in population of more than 20 per cent.

The age distribution of the Cook Islands between 1956 and 1987 is shown in Table 4. The figures indicate a high but decreasing dependency age group sector since 1956, suggesting an ageing population. This decrease is much more noticeable in the 0–14 years age group, and there is an increase in numbers in the 60+ age group. This is reflected in the 1986 census with 36.87 per cent (6,495) of persons being 14 years and under, and 4.71 per cent (830) 60 years old and over.

The economically active age group (15-64) has increased over a period of 30 years and constituted 58.38 per cent (10,283) of the population in 1986. In the case of the islands of Pukapuka and Nassau, there was a constant increase in population between 1966 and 1981, with a slight decline in 1986. The islands of Pukapuka, Mauke, Mitiaro and Penrhyn had the highest dependency ratio in 1986.

Table 4 **Age distribution of population, 1956–1986**

Age groups	Population				Percentage			
	1956	1966	1976	1986	1956	1966	1976	1986
0–14	7598	9983	9022	6456	45.6	51.9	49.6	37.0
15–44	6952	6693	6446	7676	41.0	34.7	33.0	43.9
45–59	1419	1600	1669	2039	7.5	8.4	9.2	11.7
60+	909	971	1090	1292	4.9	5.1	6.0	7.4
All ages	**16680**	**19247**	**18127**	**17463**	**100.0**	**100.0**	**100.0**	**100.0**

Source Cook Islands Statistics Office

With the exception of the 0-14 age group, the figures show an increase in all sectors in comparison to the 1986 census as shown in Table 4.

The population sex distribution for the 1991 census is not yet available, however the 1986 census shows a population of 17,614 for the whole of the Cook Islands; with 52.16 per cent (9,188) males and 47.84 per cent (8,426) females. Of these 55.79 per cent (9,826) were in Rarotonga, 31.46 per cent (5,541) were in the Southern Group, excluding Rarotonga, and 12.76 per cent (2,247) were in the Northern Group, including those at sea at the time of census.

Religion

There are four approved religious organisations operating in the Cook Islands. All belong to the Christian faith. They are the Cook Islands Christian Church (CICC), Roman Catholic Church (RC), Seventh Day Adventist Church (SDA), and the Church of Jesus Christ of Latter-day Saints (LDS). The dominant group is the CICC with 67.07 per cent of the population; they are followed in numbers by the RC at 15.97 per cent.

The Cook Islands people, since the arrival of the missionaries, have strongly involved themselves in the work of the church in various denominations. Church establishments form the nuclei from which individual villages develop church work programmes.

On Rarotonga, this type of development drew people from the interior valleys to the coastal plains where they are still found to this day. It can still be said that there is a strong Christian commitment amongst the Cook Islands people; this commitment is reflected in the community spirit which is the driving force behind community activities.

From an environmental viewpoint, the Church is a very important medium of communication through which environmental messages may be disseminated throughout the various denominations and into the community as a whole.

Migration

Emigration contributes greatly to population loss in the Cook Islands, in particular Rarotonga. Outer islands lose their population through migration to Rarotonga, with a significant number lost through further emigration abroad. This has a major effect on the population age structure. Emigration of the 0-14 age group may be responsible for the marked decline in the population combined with reduced fertility and declining birth and mortality rates. Consequently, this has meant an overall ageing of the population.

Prior to the peak population numbers in 1971 (Table 4) and in 1966, the 0-14 age group accounted for nearly 52 per cent of the national population. In 1986, this percentage had fallen to 37 per cent. In contrast, the 15–44 age group has increased by almost 11 per cent since 1976.

The decline in the 15–44 age group over the 1966-1976 period may have been caused by emigration abroad for reasons such as seeking better education and training opportunities. It is estimated, with regard to these losses, that the figures do not truly reflect losses because of the imbalance caused by internal migration.

Education

The education system in the Cook Islands is not entirely Government-run. Three of the 27 pre-schools, four of the 20 primary schools and one of the eight secondary schools are privately owned.

In an attempt to upgrade the institutional arrangement of the Cook Islands education, the Government reviewed the education system in 1989, addressing various issues thought to be of vital importance. Moves to implement the recommendations of the resulting report are currently being pursued.

An important issue highlighted in that report was the establishment of school committees which would be granted the means to run the affairs of the school. There is also a proposed move to strengthen and improve the capability of Tereora College, to make it a technical training centre for the Cook Islands. Strategically, major primary schools will be improved to be able to support up to New Zealand School Certificate Fifth Form classes. This move has been instigated, with Arorangi Primary School having a Third Form class for the first time in 1992.

Budgetary allocations however have not been high enough to cope with the desired changes to the system. The proportion of the national budget allocated to education has fluctuated between 8.97 per cent in 1985 and 10.33 per cent in 1990.

The system has also suffered a drain in the number of teachers due to low income, the degraded nature of the education system and increasing preferences and challenges offered by other sectors. This trend is particularly noticeable in the Southern Group. Government policy reflects the awareness of this low morale and desire to remedy the situation by reviewing and improving the teachers' salary remunerations system.

From an environmental point of view, Government policy has strongly indicated its preference for teaching environmental control and conservation as a subject at School Certificate level. This is reflected not only in its education policy but also in other sectors such as the CICS and MMR. The recent establishment of a Science Curriculum Section is also supportive of this Government policy. The educational base needs broadening through the introduction of wider arts and science training in the social and biological environment.

Employment

Labour force numbers have fluctuated from 1971 to 1986, as indicated in Table 5 (based on census figures). They fell from 6,269 in 1971 to around 5,384 in 1976. Since then numbers have increased to reach 6,511 in 1986, equivalent to 40 labour entrants per year. Employment opportunities elsewhere, especially in New Zealand, have maintained the unemployment rate at relatively low levels, however numbers have increased in the labour force by 3.1 per cent in 1976 and 5.6 per cent in 1986.

Of the 370 persons registered as unemployed in 1986, nearly half (42 per cent) were living in Rarotonga. Two-thirds of these were born in the outer islands. Unemployment was most marked among new entrants to the labour market, suggesting a clear likelihood of emigration remaining at present levels or even increasing, unless more purposeful employment creation programmes are created.

Unemployment is not considered a major social issue in the Cook Islands, but with an unemployment level of 5.6 per cent in 1986 (Table 5) and reduced employment opportunities in New Zealand and Australia, future migration of the young adult

age group may be reduced and this could cause an increase in the number of unemployed in the Cook Islands.

Table 5 **Labour force & unemployment**

Indicator	*1971*	*1976*	*1981*	*1986*
Labour force	6269	5384	5810	6511
Labour force as % of pop.	29.4	29.7	33.7	39.6
Unemployment rate	6.2	3.1	4.6	5.6

Source Cook Islands Statistics Office

Some significant changes to the structure of the employment sector have occurred in the past 15 years. Particularly significant has been the decline in employment in the primary sector since 1981, and the correspondingly sharp increase in employment in the services sector (Table 6).

The fall in the primary sector appears to have been particularly significant in Rarotonga. Traditionally Cook Islanders have followed a subsistence way of living, however the agricultural labour force has declined since 1971. The fall has been accompanied by major growth in tourism (and related services), the main engine of economic growth in recent years.

Table 6 **Structure of employment (%)**

Sector	*1971*	*1981*	*1986*
Primary	22.7	29.2	16.5
Secondary	22.1	14.8	16.5
Services	55.2	51.7	65.1
Unspecified	----	4.3	5.6

Source Cook Islands Statistics Office

1.5 Economic features

The Cook Islands Government has positive development policies for its infrastructure to ensure sound economic development.

Initially the Cook Islands' economy was dominated by the primary sector, focusing on agriculture, fisheries and quarrying, but this has recently changed towards a service-oriented economy to cater for the demands of tourism.

1.5.1 Government development policies

The first Government Development Plan (1982-85) set the scene for the development of the Cook Islands. The main objective of that plan was for the public sector to set up the infrastructural requirements from which an economy led by the private sector would develop.

With this objective in mind, sea ports and airstrips were built and service facilities such as water supply, energy supply, health services and communication services were established. The import of external technology saw internal and external financial services become highly developed. With this background, the economy has experienced several years of successful growth, led by the private sector.

Present government policy aims to:

i. achieve financial independence in the Cook Islands by promoting a balanced and effective co-operation between the private and public sectors; and

ii. facilitate developmental assistance to the Outer Islands through revenue generation and vigorous initiatives.

A number of policies and programmes have been formulated to achieve this policy. They include the development of an effective public sector management system and the re-direction of financial and human resources from low-priority areas in the budget to areas where improved performance is critical.

Private sector organisations, such as the Chamber of Commerce, are means by which Government can discuss developmental issues and disseminate assistance to the private sector, with a view to achieving fiscal autonomy in the Cook Islands.

1.5.2 Sectoral growth patterns

Tourism

The tourism industry has increased at an enormous rate. Since 1972, visitor numbers have trebled from 10,000 to 32,000 arrivals per annum. Currently over 30,000 people visit Rarotonga each year, remaining on average 10 days each time and spending approximately $NZ 100 per day per person. The tourism industry is

therefore estimated to be worth approximately $NZ 30 million annually to the economy, making tourism the major industry of the Cook Islands in terms of foreign exchange earnings.

The significance of this industry explains the shift in the structure of local employment, as shown in Table 6, from primary industries such as agriculture to the service industries.

The importance of tourism to the future economy will continue to grow, providing that the special features of the Cook Islands which attract tourists are not destroyed. This appeal is derived from a blend of people, scenery, and unspoilt environment.

Agriculture

Due to the limited land area and remoteness of the Cook Islands, the agriculture sector faces grave disadvantages, in comparison with other developing countries of the region, especially in terms of transportation, marketing and economies of scale.

The agricultural sector is characterised by a traditional land system which can restrict full land utilisation (see section 2.2); a high level of part-time activity in agricultural production; limited and expensive inter-island and international shipping and air transport services; limited labour supply; restricted availability of long-term credit; and a high level of Government subsidy for agriculture.

In the past, the main export cash crops were bananas on Aitutaki; pineapples on Mangaia and Atiu; vegetables and root crops from Mauke and Rarotonga; and pawpaw and other fruits from Rarotonga. The pineapple industry is now defunct, and copra, once the largest component of agricultural production, ceased production in the Northern Group in 1987 due mainly to the depressed world market price.

While copra production ceased, commercial production of coconut picked up with the establishment of a coconut cream factory in early 1987.

Banana exports from Aitutaki ceased due mainly to inconsistent quality, irregular shipping, and an inability to compete with imports by New Zealand from other countries. An attempt to revive this industry is now being made.

Citrus continues to be produced on Rarotonga for the local market from an estimated area of 353 acres (1988), but exports to New Zealand of both fresh fruit and juice could not compete with South American produce; export therefore has now ceased.

Agricultural production in 1989 was reported to be down by almost 20 per cent from 1981 and further falls are expected. Although pawpaw production peaked in 1988 at 1000 tonnes and fell to 600 tonnes in 1990, production interests remain

high and the total return to farmers in 1990 was estimated to be at $NZ 1.52 million.

The recent acquisition of a cool store provides a means for improving the quality and transport conditions of pawpaws and other perishable produce. Production levels of beans, eggplants and chilli remain high, with a favourable net estimated return on chilli in 1990 of about $NZ 11.50 per kg.

Export of cash crops has declined markedly, but the indications are that there has been a significant rise in the value of produce sold on the local market. While it is extremely difficult to gather statistics on the domestic market, production of cash crops for the domestic market was estimated by the Ministry of Agriculture to be worth about $NZ 8 million in 1990.

In the outer islands, with the exception of the well-organised production and marketing effort on Mauke, the Ministry of Agriculture is leading a move away from bulk perishable crops to those with long storage life, ease of transport, no quarantine restrictions and more assured markets; such crops are arabica coffee and vanilla. Coffee has been successfully developed on Atiu, and both crops show particular promise for Mauke, Atiu and Mangaia.

Marine resources

Fisheries

There has been only limited harvest of fish resources within the Cook Islands EEZ. There are a number of bilateral fishing agreements and the licences for foreign fishing vessels have made a useful contribution to foreign exchange earnings.

There are only between 8 and 12 full-time commercial fishermen in the Cook Islands (Rarotonga and Aitutaki), with about 40 part-time commercial fishermen on both islands to supply the local market. There is frequently a shortage of fresh fish in Rarotonga, and the expansion of artisanal fishing activity must remain a priority if the increasing numbers of tourists' expectations of fresh seafood are to be met.

Pearl industry

The lucrative and expanding pearl industry has become established in the Northern Group.

The exploitation of pearl oyster shell was a major activity of the Northern Group but declined during the latter part of the 1960s due to declining stock.

Currently focus is now on the farming of pearl oyster for both cultured pearl and shell, particularly on Manihiki, with Penrhyn and Suwarrow currently under investigation. For the past six years, earnings from the pearl shell alone have been

very significant. Export values from 1985–1990 show an increase in the value of the shell per kilogram weight over the period 1985–87 (Table 7).

Table 7 **Cook Islands exports of pearl shells (1985–90)**

Year	*Quantity (kg)*	*Value (CID)*	*Value (kg)**
1985	13,973	90,000	6,441
1986	74,041	641,069	8,658
1987	107,088	1,149,333	10,733
1988	50,227	543,284	10,817
1989	71,404	1,109,681	15,541
1990	43,496	565,946	13,011

* Calculated from data

Source Cook Islands Statistics Office

Cultured pearl has also proven itself to be a highly successful resource development project. A recent auction of cultured pearls fetched CID 4.3 million in 1990 (Table 8). On Manihiki, there are currently 240 licensed farms and approximately 100 of these are active. Some of the licensed farmers operate as family units under more than one licence. The average farm size is approximately one hectare, but currently farmers may operate larger farms depending on capability and management.

Table 8 **Cook Islands exports of cultured pearls**

Year	*Quantity (kg)*	*Value (CID)*
1985	1.00	9,640
1989	26.00	595,780
1990	84.00	4,366,632

Source Cook Islands Statistics Office

Trochus & clams

Other commercial lagoon fisheries include trochus and giant clams in the Aitutaki lagoon. Trochus was first introduced on Aitutaki in 1957 and commercially harvested in 1980. Recent introduction of the giant clam is aimed at improving the economy of Aitutaki and replenishing the natural stock. The Trochus Act of 1985 provides for the management of this resource.

There has however been a growing inability of the public sector to fulfil its role in development projects. In the private sector assistance is needed as well.

1.5.3 Development trends & issues

GDP

The economic growth in the Cook Islands has been volatile but moving in a general upward trend, with per capita income increasing, mainly for residents on Rarotonga.

GDP growth between 1983 and 1990 averaged 6 per cent, with sharp upward or downward surges or drops of between 7 and 11 per cent, illustrating the volatility of the GDP growth rate.

The GDP of different industrial sectors has shown that agriculture and fishing have declined significantly from 25.5 per cent in 1982 to under 18 per cent in 1990 (Table 9). Attributed in part to the offshore financial centre is the large increase in the finance and business services sector from 2.4 per cent in 1982 to 12 per cent in 1990.

Wholesale and retail trade and restaurants and hotels remained relatively steady over the period 1982-1990. Also constant was the contribution from the public sector, which stayed at about 25 per cent of GDP.

Service and related sectors including government activities made up almost 77 per cent of the GDP in 1990 which can be compared to only 65 per cent of the GDP in 1982 from this sector.

Table 9 **Gross Domestic Product at 1990 average prices, by industry, 1982–1990 (per cent)**

Constant 1990 $	*1982*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*
Agri./fishing	25.5	10.8	19.3	16.4	18.6	18.3	17.8
Manufacturing	2.8	4.1	4.7	5.2	4.6	3.3	2.9
Mining	0.3	-	-	-	0.1	-	-
Elec. & water -	0.1	1.1	1.5	1.0	1.0	1.0	
Construction	2.6	2.6	4.1	5.3	4.3	3.5	2.3
Whole/retail trade, hotel/res	25.1	27.5	24.0	24.2	22.4	21.1	22.1
Trans & comm.	9.8	10.2	11.9	11.6	9.6	12.2	11.9
Finance & bus.	2.4	3.7	6.9	6.8	10.4	11.7	12.0
Comm., soc/per	1.4	1.8	1.9	1.4	1.3	1.6	1.8
Public admin.	23.8	23.2	21.4	23.1	24.7	25.1	25.7
Own. of dwel.	6.9	6.7	6.3	6.1	5.5	5.2	5.1

Source Cook Islands Statistics Office

Household expenditure & income

During a family income census carried out in 1987 by the Ministry of Planning and Economic Development, figures showed that, for Rarotonga, 41 per cent of the 3,600 families surveyed fell in the income class below CID 10,000; 38 per cent in the income class CID 16,000-16,999 and 1.4 per cent in the income class of over CID 20,000.

Remittances from Cook Islanders living overseas have for many years made a significant contribution to the economy, raising household expenditure and living standards beyond the level which could otherwise be sustained. For some years remittances passed through the Post Office Bank in the form of money orders have totalled around $NZ 2 million annually, with a peak of $NZ 2.64 million in 1987, the year of cyclone Sally. In 1990 there was a marked slump to about $NZ 1.44 million, possibly as a result of the negative economic circumstances in New Zealand.

International trade

Exports

The Cook Islands is open to and dependent on international price fluctuations, therefore export performance is directly linked to individual enterprises.

This has not, however, stopped exports from increasing steadily from CID 4.2 million to CID 12.0 million between 1982 and 1988.

The export of fruit and vegetables, mainly from Rarotonga and Mauke, has done well in recent years. This area declined in 1987 due to the damage caused by cyclone Sally. In 1990, however, the fruit and vegetable industry showed signs of recovery.

Recognising the limitations of export patterns, the Cook Islands Government has made efforts to diversify marketing opportunities, using niche marketing strategies for exotic fruits. This strategy uses the unique climate and environment of the Cook Islands and outweighs traditional constraints such as high transport costs.

A growth in export value of the cultured pearl shell industry is now evident. In 1988 total export value was over $500,000. Export values per kg show a sudden decrease in 1990 (Table 7). Black pearl exports when tabulated into trade statistics should increase export values.

Imports

New Zealand has accounted for between 50 and 60 per cent of imports since 1978. Nevertheless imports from other nations, particularly those in Asia and to a lesser extent the United States and Fiji, are increasing.

As a percentage of GDP, imports are on the decline from a high of over 84 per cent in 1984, to a low of just over 73 per cent in 1988. Food, manufactured goods, machinery and fuel are the leading import items.

Inflation

Inflation is a very important phenomenon in the Cook Islands economy and is closely linked with inflationary changes in New Zealand. The inflation rate in the Cook Islands is measured by the Rarotonga Retail Price Index (RRPI), Rarotonga being the major port of entry. Between 1982 and 1990, the average rate of inflation was around 9 per cent, which can be compared to the 15 per cent inflation rate of the preceding 10-year period.

As inflation generally parallels that of New Zealand, it is not surprising to see that the figures given correspond to New Zealand price fluctuations. The high rate of inflation for the period 1984-1987, averaging on an annual basis over 11 per cent,

mirrors New Zealand's price changes during that period. The period between 1987 and 1991 showed a 5.7 per cent average rate of inflation.

Government finance

Between 1986 and 1990 total Government revenue grew from $41.8 million in 1986 to $59.6 million in 1990.

This increase is even more significant when one considers that during this period budgetary support from New Zealand fell from 22 per cent to less than 15 per cent.

Total expenditure in the 1990 fiscal year reached over $60 million, with almost half being allocated to personal services. This includes wages and salaries, contractual services and other benefits.

The current level of expenditure on personal costs has raised concern about the Government's ability to increase the quality of its fixed assets and to provide operational and maintenance expenditure.

Increases in the levels of revenue have corresponded to diversification in the sources of taxation. In 1980 there were only two such sources: income tax and import levies and duties. In the early 1980s a turnover tax and a separate company tax were introduced as well as a welfare tax imposed in 1985. As a consequence, the proportional importance of personal income tax as a revenue-earner decreased from 43 per cent in 1980 to 39 per cent in 1990.

Similarly, the contribution of import duties and levies in total tax revenues decreased from 57 per cent to 18 per cent between 1980 and 1990. Total revenues from levies more than doubled over the same period.

Table 10 gives the estimated and actual expenditures for Government for the years 1988–90. Direct expenditure on conservation represents a very small percentage of total expenditure, less than quarter of one per cent. Nevertheless the increasing importance of conservation to the Government is reflected in the budget of the CICS over that three-year period.

Table 10 **CIG & CICS expenditure 1988–90**

Expenditure	CIG ($NZ million)			CICS ($NZ thousands)		
	1988	1989	1990	1988	1989	1990
Revenue	56.9	55.1	60.3	-	-	-
Total expenditure	55.9	57.1	60.1	6.5	99.8	136.0
Recurrent expenditure	45.0	47.4	48.8	33.3	91.2	113.7
Recurrent/total percentage	80.5	83.0	81.2	92.2	91.4	83.6
CICS as percentage of total spending	.065	.175	.226			

Source Cook Islands Conservation Service

External debt

As of June 1991, only six external loans had been negotiated from four different sources: three with the Asian Development Bank (ADB); one with a private bank for the purpose of road improvements and consultancies; one with the New Zealand Government for equity purposes in one of the nation's hotels; and one from the French Government. The total value of these loans is CID 24.6 million.

Given the urgency and insufficient domestic capacity to implement several large infrastructure projects, the Government entered into loan negotiations with the French Government. Tentative agreement was reached on an assistance package aimed at the water supply and energy sectors.

An international four-star hotel for the nation worth an estimated $71 million is to be finished by 1993. Repayment will be the responsibility of a crown corporation. The Government has guaranteed the loan.

The long-term economic benefits derived from these projects financed from external sources are expected to contribute to Government revenues through increased tourism and related activities.

chapter 2 ◆

Environmental issues

2.1 Waste management

2.1.1 Solid waste

The increasing volume of solid waste and its disposal is a major problem in the Cook Islands, attributable to the changing lifestyle. It has been observed that more and more organic rubbish which was previously burnt at home or used for cooking is being disposed of at the public dump. The increasing use of imported technology such as electrical and LPG appliances may have shifted the domestic cooking practice from the traditional **umu** or open fire cooking to the use of gas or electrical appliances.

The problem of acquiring land suitable for waste disposal is described in section 2.2. At present swamplands which are unsuitable for agriculture are being used for solid waste disposal. The landowners in most cases see garbage disposal as a means of site reclamation for housing purposes.

On Rarotonga there are two authorised dumps. On Aitutaki World War II aircraft dispersal bunkers are used and in the Northern Group solid waste is simply dumped onto the foreshore. On the makatea islands of Atiu and Mangaia, rubbish is dumped along the road sides. Normally, the outer island dump sites are the responsibility of the Island Councils.

On the Southern Group islands, rubbish collection is undertaken either by contractors, in the case of Rarotonga, or by Government. Normally these garbage collections are carried out during the working days and hours. Private persons also cart their own rubbish, usually during the weekends and after hours. This practice makes it more difficult to manage rubbish dumps to control the type of material to be dumped. It also aggravates the problems of drainage blockages, water ponds for mosquito breeding and odour.

An effort is made at dump management with the separation of solid wastes, but split responsibilities between Internal Affairs, Ministry of Works and the Health Department fragment the effort. Solid waste disposal sites on all islands are unsuitably located due to the lack of land. This is foreseen as a major problem with the increase in development over the years.

Current methods are normally the use of an excavated area which is covered with topsoil after each day of use. Private contractors on Rarotonga are used for cartage and the Island Councils on the outer islands undertake disposal functions using private or government vehicles. It is estimated that the annual solid waste requiring disposal would currently exceed 9,000 cubic metres per annum.

The Cook Islands must explore alternative methods of dealing with the large volumes of solid waste that it currently produces. The disposal of this waste must be investigated and programmes designed and implemented to find ways to reduce the volume, therefore providing small volumes for landfill. Waste management programmes should also take into account other forms of disposal that reduce or eliminate pollution problems.

2.1.2 Liquid waste

Sewage

The availability of an effective sanitation system is regarded by the Cook Islands Government as one of the main pre-conditions for improving quality of life.

On Rarotonga the majority of households are connected to a system of septic tanks. While coverage is extensive, overall standards have been judged deficient, especially in view of the requirements imposed by future economic growth.

Sewage disposal is currently a problem on Rarotonga. The present practice of sewage disposal on Rarotonga is to spread sludge from septic tanks over orchard lands as fertilizers. With the current increased rate of new housing, particularly on agricultural land, associated problems with this practice will require some attention.

Already there is evidence that sewage contamination of soil in some parts of Avarua is posing a problem for some households.

In the Northern Group, the change from lagoon toilets to flush toilets has had a direct impact on the groundwater resources and the marine environment. This is mainly because of other waste discharging into the septic tank system.

There is a growing concern as to how effective the waste treatment systems are for hotel and motel accommodations around the island. One of the major hotels on Rarotonga has had problems with its waste treatment plant. Health and

Conservation Service officials have monitored the deteriorating status of this treatment plant for the past three years.

The increase in algal growth along the foreshore of Rarotonga gives an indication of an increased level of organic content in that system. The extent of the problem of contamination from sewage on Rarotonga and the possibility of similar problems in the outer islands is simply not known. There is a need to monitor surface and ground water or marine water quality, particularly in the lagoons.

Nutrients & chemicals

In this section, chemicals are discussed as waste entering the ground and the hydrologic system which includes chemicals sprayed on the ground and water surface for a purpose.

No data is available to verify and quantify the damage on the environment as a result of the use, misuse and over-use of fertilizers and biocide. Despite the fact that during the citrus-producing years enormous amounts of chemicals and fertilizers were used on land to enhance production, there have as yet been no hard data linking the use of agricultural chemicals to the degradation of the environment, specifically the impact on living coral, fisheries and human health.

The use of the chemicals Benlate and Malathion on bananas on Aitutaki has raised concern, particularly because of the method of disposal, which is by tipping into the harbour.

It has been widely observed that a large amount of laundry waste is discharged into streams and onto the coastal zone. This is noticeable in the lagoon of Manihiki and the streams of Rarotonga. Although no hard data have been collected to verify the impact of chemical and laundry wastes on the marine and freshwater environment, the growth of algae implies an increase of either organic or chemical nutrients.

Mosquito control chemicals such as DDT used by the Health Department also contribute to the problem through underground runoff. Disposal of these chemicals by local dumping is also a major concern.

There is a need to undertake regular, joint monitoring programmes between CICS, MMR, Public Health, and the Ministry of Agriculture.

Oil spills

The problem of potential major oil spills in the Cook Islands is well recognised by the Conservation Service. Although the Cook Islands has not experienced major spills within its ocean waters, small spills in the main Avatiu harbour and the discharge of used diesel into the main streams of Rarotonga pose some problems

on a small scale. The leakages associated with fuel outlets and major consumers have also become a problem.

In response to major spills, a draft Oil Spill Contingency Plan has been prepared by SPREP and the International Maritime Organisation for the Cook Islands Government to use in addressing the issue.

2.2 Land management

2.2.1 *Land ownership*

Multiple ownership

The lands of the Cook Islands traditionally belong to the native inhabitants of the islands. In accordance with the land court system, lands may be Crown land, acquired by government; customary land, held by natives or the descendants of natives; or freehold land, which is customary land held by individuals through lease, licence, occupation right or court order.

Land administration is carried out through the procedures of the land court for most of the islands, with the lands of Mangaia, Mitiaro and Pukapuka still under customary control.

Customary land is inherited unilaterally by all members of the family; this has resulted in a large number of people having ownership to a small section of land. This multiple ownership has resulted in land titles becoming extremely fragmented.

Freehold land, owned by one or more individuals, has allowed individuals to develop land, however a large number of land developments have been undertaken by the extended families and are mainly of a subsistence nature.

Absentee ownership

With the occupation right system operating, absentee ownership has become a major problem whereby large areas of arable land have been left unused. This has led to extensive cultivation of small parcels of land and the cultivation and alteration of lands on steep country.

2.2.2 *Inadequate land*

Multiple land ownership has made the implementation of any organised land management system very difficult, particularly with respect to the protection of environmentally sensitive lands such as water catchment areas; natural fish breeding areas; the foreshore; habitats of special species; erosion-prone areas;

areas of archaeological, historical and recreational value and areas for the proper disposal of waste.

Normally, land identified as significant for any of the above reasons is preferably acquired for public purposes by warrant or by lease. During the colonial era and the early years of self-government, small areas of land were acquired for public purposes by warrant under the Cook Islands Act of 1915.

The limited land area protected for environmental reasons reflects the potential management problems associated with multiple ownership of land and the value associated with land due to its scarcity. It is believed that the involvement and support of landowners would make establishing areas and enforcing management procedures easier if the intent of the establishment were clearly understood and appreciated.

For this reason, land for waste disposal is restricted to unsuitable land. Currently, the Cook Islands Government is engaged in using solid waste to fill swamplands. Most of these swamplands are used for taro crops. Other than taro cropping, swamplands play an important role in the drainage patterns of lower slopes, particularly on Rarotonga.

Because of the problems described above, Crown lands are used for public purposes other than conservation. There is only one area declared for conservation at the national level in the Cook Islands: Suwarrow atoll. Takutea Reserve under the control of the people of Atiu is another such area, but is locally protected as a seabird sanctuary.

There is a need to acquire adequate land suitable for the aeration and drying of septic tank contents which are normally spread over agricultural lands. The islands of the Northern Group also face the problem of limited land available for waste disposal.

2.2.3 *Land use practices*

Agriculture

Soil erosion is a major land management problem, due in part to multiple and absentee land ownership. Due to occupation right arrangements, some parcels of land are being extensively cultivated, or lands on hill country unsuitable for the purpose are being cultivated using inappropriate techniques, resulting in erosion.

Soil erosion does not only result from poor cultivation and agricultural practices. The preparation of land for house sites or the development of roads to the higher land sections and agricultural areas is a major contributor to erosion. Other factors such as the type of machines and the lack of skilled operators for them has also contributed to the problem.

Land rehabilitation

Land rehabilitation is a major problem in the Cook Islands, more specifically on Rarotonga. The lack of land rehabilitation is mainly due to high costs and the lack of proper planning in the implementation of major land transformation projects. On Rarotonga, huge sand pits are left open near roadsides and backyards and whole hillsides have been removed without proper rehabilitation work, if any at all. Most of these have become safety hazards, illegal rubbish dumps or breeding grounds for undesirable insects. There is very little control in this area.

An increasing number of private individuals are undertaking private land developments, with direct detrimental effects on neighbouring lands and the marine environment through siltation.

Coastal erosion due to the construction of wave-deflecting structures along the foreshore of Rarotonga and Aitutaki built for property rehabilitation and protection has also become a very important issue. Moves by the CICS under the Conservation Act 1986/87 have to some extent caused a reduction in this type of construction along the foreshore. However, Cook Island Government activities on the foreshore, especially through the Ministry of Works, have made it difficult for CICS to enforce the provisions of the Conservation Act. Because of this, compliance by private individuals to CICS guidelines has been low.

It would be true to say that although Government has traditionally been the major cause of such land problems, private developments are an increasing area of concern.

In the Northern Group, evidence of coastal erosion is apparent but this is mainly attributed to natural causes.

2.3 Degradation of coastal resources

Increased organic and nutrient levels; the deposit of acidic soil through siltation, reclamation and land fill; chemical leakages into the coastal environment and the increase of coastal activities — all of these may have been the cause of the apparent degraded nature of the lagoons of Rarotonga and other islands.

Studies on the crown of thorns infestation of the lagoon and reef systems of Rarotonga in the early 1970s indicate a possible natural cyclic occurrence of such infestation and may have largely contributed to the degradation of the coastal resources.

2.3.1 Siltation

Upland erosion, caused by poor land use practices and land management, has resulted in an enormous amount of silt being discharged into the marine environment. This has resulted in the siltation and destruction of corals and lagoon areas in general.

Recent siltation along the Rarotonga International Airport lagoon, resulting from silt pouring into the lagoon during a long wet spell, subjected the coral reef in the area to immense stress. Siltation of lagoon areas over the past 50 years has badly affected lagoon productivity. It is widely accepted that the acidity and clogging nature of the sediment kills coral, the basis of the entire coastal ecosystem. Stringent measures are needed to reduce siltation by control of machines and implementation of appropriate land management practices.

2.3.2 Mining

Traditionally, the making of lime for construction purposes using coral heads was a major community undertaking involving the removal of large amounts of coral from the lagoon and coral rubble beds or **tauna**. However this practice is more frequent in the outer islands and very rarely done on Rarotonga.

With the increasing development of infrastructure and housing to meet the needs of the local population and the fast development growth, removal of sand has resulted in a number of beach areas disappearing in the last 50 years.

Deposits of coral sand along roadsides, swampland and taro plantations are evidence of sand mined over the last 50 years for road metal.

On Rarotonga, other than the port dredging of Avatiu and Avarua, the dredging of the environmentally sensitive Muri lagoon has been a major concern for the CICS. The lagoon not only has its attraction as a local and tourist recreational area but also has ecological significance as a special wetland for the breeding of certain fish species. The lagoon is also very significant for the migration of some species which are fished by locals using traps known as the **pa**. Today an increasing amount of this area along the coastline is slowly being filled for housing developments.

Some dredging has also been undertaken in similar environments in Aitutaki lagoon. Although the activities have been worthwhile, the impact on the local fisheries and coral life has not yet been assessed.

Channel blasting and dredging activities for the development of ports in the Southern Group were major activities in the 1970s and '80s, but no assessments of the impact of these activities have been found.

2.3.3 Destructive fishing practices

Poisoning using plant extract

The use of derris or **'ora papua** roots (*Derris elliptical*) and barringtonia or **'utu** seeds to stun fish is a fishing method widely used by locals wherever these plants are found. Despite the low toxicity of these plants given the low concentration, the toxicity level (especially that of the derris root) can be high enough to kill coral polyps and small fishes which are important within the marine food chain. On some islands by-laws are enforced, with fines of up to $200 imposed on people found using this method of fishing.

Use of scuba gear for fishing

The use of scuba gear for spearfishing has been a major concern for the Conservation Council. This method is a quick way to catch a lot of fish; as a means of satisfying the increasing demand by restaurant owners for reef fish, it could pose a potential threat to reef resources. A means of controlling this type of fishing is needed. On Aitutaki and Manihiki the Island Councils have already banned the use of scuba gear for fishing purposes.

Gill-net fishing

The use of small mesh-size fishing nets is seen by most people as unsuitable. Such mesh sizes catch fish that play an important role in the lagoon food chain. Other dangers come with using a "beat-'n'-chase" method whereby fish are chased into the waiting net. This method engages at least two people beating the water and, in doing so, breaking corals in their path. Control should be imposed on the use of small gill-net sizes; any mesh smaller than 3.5 inches should be banned. The use of fish traps or **pa**, or the coconut frond trap or **rau kikau**, both traditionally practised, should be revived to avoid or minimise coral breakage during "beat-n-chase" gill-net fishing.

Dynamiting

Although very rarely used, dynamiting has been reported in some areas on Rarotonga and to a greater extent on Aitutaki.

2.3.4 Over-fishing

Over-harvesting of fisheries resources, particularly the clams of Aitutaki, is a recognised problem. In 1989 a local by-law passed by the Island Council of Aitutaki prohibited the taking of paua outside of Aitutaki. Trochus, which was introduced to the island in 1957, was initially over-harvested beyond the sustainable level of production. The Fisheries Division quickly introduced controls on maximum and

minimum size and restricted harvest to a number of declared days per year. They also introduced individual catch quotas.

The pearling industry, particularly for pearl shell, has existed in the Northern Group since the 1860s. It lasted until the turn of the century, at which time over-harvesting caused the industry to decline and eventually to be abandoned. It was still alive in the early sixties, but it is widely believed that harvesting had gone beyond the sustainable level of production, thus causing the decline in productivity. Recent work by the MMR suggests that the predation on spats by the large fish population is a contributing factor to a drastic decline of these species, particularly in Suwarrow and Penrhyn.

The destructive fishing practices mentioned above, together with increasing population pressures, will lead to over-fishing and depletion of local fish resources, unless stringent measures and controls are imposed.

2.4 Water supply & usage

Improving water supplies has been a priority for the Cook Islands Government. The availability of good, clear, and clean water in sufficient quantities is required to improve the quality of life of Cook Islanders, as well as to ensure sustainable development in the long term.

Demand for potable water has grown steadily and has exceeded available supplies. The Government's community and household water tank programme for the islands of the Northern Group provides sufficient water both to individual households and the community. Unfortunately, this method of acquiring water is weather-dependent. With the increasingly affluent lifestyle in the North, associated with the growth of the pearl industry, the demand on water has increased. The change from lagoon toilets to flush toilets is one such major change that requires a lot of water. Although the Government programme aims at improving water supply, other developments are placing greater demands on it.

On Rarotonga, water supply is seen as a major issue and attempts have been made to improve it. As Rarotonga is the major centre for development, its demand and supply of water are important for the country's overall assessment.

Although the demands and supplies have changed, Binnie and Partners (1984) estimated that a supply of 10.3 million litres per day was required in 1981, allowing for a 15.5 per cent leakage through the reticulation system. With the mixed lifestyle of the Islanders, the average individual uses 200 litres per day, three times more than an expatriate.

Leakages from the system were also assumed to be a major factor contributing to the high water consumption. However, recent water leakage surveys conducted on

Rarotonga reveal almost 50 per cent of water wastage (as consumed by Cook Islanders) is through running taps, piggeries and agricultural use, thus accounting for the high rate of consumption by local households.

The development of water intake systems on Rarotonga and the outer islands of the Southern Group has also raised concern, particularly in relation to the poorly designed roads to these intakes. The impact on taro plantations has been detrimental in some areas such as Turangi, Rarotonga.

The above factors demonstrate the need for stringent controls on water usage at all levels, through education programmes and regulatory controls. Without these it is quite possible that much water will be lost, posing problems during long periods of drought.

2.5 Energy development

The Cook Islands is totally dependent on imported fuel for its commercial energy supplies. The fuel is transported in small volumes over long distances, resulting in high unit costs, and stored in bulk at fuel depots on Rarotonga. The main users of imported fuels are ground transport, which accounts for around 31 per cent of imports, electricity production 30 per cent, agriculture and commerce 23 per cent and inter-island transport 12 per cent. Imports of diesel fuel, motor spirit and jet fuel together account for more than 90 per cent of all imports. With this amount of fuel imported and used, there is a constant risk to the environment in terms of spillage, fire risks and disposal of waste from the major users.

The main fuel in the non-commercial sector is firewood, which is widely used in the outer islands and to a lesser extent on Rarotonga for cooking in traditional ovens. The availability of firewood supplies does not constitute a major problem.

2.6 Lack of awareness

The Cook Islands media is composed of radio, newspaper and television. The three forms of media communication—news, spot programmes and environment publications—have been used to disseminate and promote environmental protection messages. However due to financial constraints, producing and transmitting these messages has been difficult. This is not unique to the Conservation Service but prevails in all sectors of Government with a responsibility to educate and create awareness of the protection and conservation of natural resources.

The CICS, MOA and MOH have published locally designed posters and other print materials. These materials, although limited, have an enormous impact on the local

people. Other materials produced at the regional level are also being disseminated and promoted locally to assist and complement local programmes. The materials have been produced with the financial assistance of external organisations such as the United Nations, the Food and Agriculture Organization, Unesco and the South Pacific Regional Environment Programme (SPREP).

Conservation is an area which does not command a high priority in the education science programmes. It is approached in a rather piecemeal way, with aspects being covered in different parts of the curriculum. It is seen to be a part of the "Living Things" section but receives only cursory attention in topics such as "What is the environment?"; "Survival in the environment"; "The sea"; "Cycles in nature" and "The chain of life" — topics in Form 3 and Form 4 science programmes. There is no attention to conservation issues at the Lower Fifth Form Level and only passing attention given at the Upper Fifth Form Level. Grades 1 to 6 cover this area as the situation arises in particular units and at times of the year when conservation issues are a focus, for example during Conservation Week.

2.7 Protected areas development

The land tenure problem poses great difficulty for the establishment of protected areas to protect species and recreation opportunities. The CICS has for the past four years made attempts to reserve a number of areas.

The CICS has produced a poster to highlight the importance of the cloud forest and has a proposal to reserve the area. Other work programmes of the CICS, particularly the establishment of the Vai Rakau Maori Reserve, aim to protect medicinally important plant species that are becoming hard to find.

The much-publicised Rarotonga flycatcher (*Pomarea dimidiata*) and the Mangaia kingfisher (*Halcyon ruticollaris*) have received some attention. There are moves by the CICS to establish a nature reserve to protect the flycatcher. Other endemic species such as the Atiu swiftlet and the Rarotonga starling (*Alponi scinerascens*) require urgent protection. The Polynesian introduced flying fox has also declined in numbers over the years and requires some attention. Recent work on the coconut crab of Suwarrow and Takutea shows that there is a need to protect this species as well.

The CICS has attempted to establish a recreational reserve (Pokoinu Recreational Reserve), but has not been able to proceed due to land tenure problems.

2.8 International issues

Driftnet fishing

Although a regional issue, this has caused some local concern. Traditionally, driftnet fishing is practised in deep waters beyond the territorial waters, however it is believed that local fishermen will feel its effects.

Nuclear testing & disposal of toxic waste

Although not an issue within the Cook Islands, nuclear testing in neighbouring French Polynesia has on numerous occasions been the focus of public debate. On the international scene, the Cook Islands supported moves in South Pacific Forum meetings by the countries of the region to have toxic waste disposal systems in the Pacific banned or closely monitored.

chapter 3 ♦

Response to environmental issues

The following subsections briefly describe the responses to the issues described in the previous chapter.

3.1 Government policies

The environmental policy of the Cook Islands Government is stated within the Manifesto of the present ruling Cook Islands Party. This Manifesto (1989) provides the following environment and conservation policies:

i) Establish an Office of the Environment and Conservation which shall be the implementing agent of the Council established under the Conservation Act for the prevention and control of serious environmental and ecological problems. This Office shall be given sufficient authority, finance and staff to do an effective job in the enforcement of the environmental legislation and standards as well as initiating and supporting nationwide the education and promotion of good environmental and conservation practices;

ii) To have environmental control and conservation taught in schools and make it a subject in the Cook Islands School Certificate examination;

iii) To establish offices in the outer islands where appropriate;

iv) Review the existing legislation with particular reference to the 50-metre mean-low-water-mark inland restriction as well as conduct a nationwide educational programme prior to enacting any changes;

v) Instigate a foreshore development programme which shall take into account the need to improve the area functionally and aesthetically and ensure as far as is possible adequate protection for all properties along the foreshore. In this connection urgent attention shall be given to the Avarua downtown area.

vi) To seek the support of landowners in the declaration of prime or suitable areas as public reserves or parks such as, for example the central part of Rarotonga, a motu etc.;

vii) Promote and support any programmes for the preservation of flora and fauna and marine living objects unique to the Cook Islands;

viii) Employ on a short-term basis a herbalist to identify plants used in traditional medicinal concoctions; and

ix) Establish a medicinal herbs farm, especially of those plants which are dying out.

Other Government policies which covered environmental controls and protection are reflected in other sectors under the Manifesto.

- **Marine resources** "In striving for these aims we will pursue a policy of sound economic exploitation, management and conservation."
- **Marine resources** "...maintain strict management and environmental controls over the lagoons to prevent diseases and pollution in these ecologies."
- **Town planning** "...encourage greater awareness of the need to properly utilise our lands, soon to become a very scarce resource, through a nationwide education programme."
- **Town planning** "...work in close co-operation with the office of the Environmental Control and Conservation."
- **Local government** "...beautification programmes, rubbish disposal, public reserve, for recreational purposes."
- **Home affairs** "...a clean and beautiful environment which includes streams and foreshore, provide flowering plant for beautification purposes, landscaping and the establishment of recreational parks etc."
- **Arts & culture** "...restoration and preservation of historic places and customs."

3.2 Laws & conventions

3.2.1 Local laws

Cook Islands Act, 1915

The Cook Islands Act 1915 provides for the taking and reserving of land for public purposes such as recreation reserves, establishing native reserves for the protection of historic sites or areas of scenic interest and water supply sources. The Act also provides for protection of the customary rights of Cook Islanders.

This framework Act provides the basis from which laws are made including laws and by-laws for the protection and management of natural resources.

Conservation Act, 1986/87

The Cook Islands' first separate environmental legislation was introduced in 1975. The 1975 Act covered a broad area of responsibility, however it lacked the powers to prosecute serious offenders.

Although provisions were made to allow regulations to be brought into effect which would support the broader and more general provisions within the Act, no regulations were made to that effect.

The 1975 Act was repealed and replaced by the 1986/87 Conservation Act in 1987. This enactment was carried to give the law some "teeth".

The Act establishes the Conservation Service as a corporation run by a Conservation Council. The five-member Council is appointed by the Minister of the Service under the Act. The Council is responsible for the implementation of the functions of the Service. The Act has the following specific provisions: the establishment and management of parks and reserves; coastal zone protection; litter control; pollution of coastal waters; and marine casualties.

The Conservation Act has recently entered a period of dormancy due to some legal interpretation problems. It is quite clear that the administrative functions of the Act are in force, but the enforcement functions are hanging in the balance for lawyers to argue. The Conservation Council has taken this opportunity to review the Act to take into account important aspects as expressed under the Government's environment and conservation policy. Employees of the Service are currently taking an advisory role.

Outer Islands Local Governments Act, 1987

This Act provides for the following: establish, control and administer parks and reserves, sports and recreation grounds of every kind including beaches; manage and control public places; provide facilities for the disposal of refuse and sewage. The Act also provides by-laws on: trimming of trees; disposal of waste; matters relating to vacant lands; disposal of rubbish on vacant lands; regulating, controlling or prohibiting of fishing, shell fishing, pearl diving, or the use of any fishing net in the lagoon; and animal control.

Crimes Act, 1969

Section 97 provides for the control of activities in regards to the throwing of bottles or glass in public places. A 1981 amendment of the 1969 Act provides for the prohibition of dynamiting and the use of noxious narcotic and toxic substances for fishing.

Re-use of Bottles Act, 1988

This provides for the re-use of glass bottles for commercial purposes.

Land use Act, 1969

This Act provides for the zoning of land with respect to the following: public recreation and enjoyment; tourist accommodation; residential purposes; industrial purposes; commercial purposes; agricultural purposes; and public roads purposes.

The Act also provides for the establishment of a Board whose responsibilities are to hear and determine proposed changes to any zoning order issued under the Act.

Harbour Control Act, 1971

This provides for the control and prevention of pollution in and around the harbour boundaries.

Animal Act, 1975

An Act to provide for animal control (importation) and animal disease.

Plant Act, 1973

An Act to provide for plant control (importation) and plant diseases.

Territorial Sea and Exclusive Economic Zone Act, 1971

This Act relates to the territorial sea of the Cook Islands and establishes an exclusive economic zone of the Cook Islands adjacent to the territorial sea, and in the exercise of the sovereign rights of the Cook Islands to make provision for the exploration and exploitation, and conservation and management, of the resources of the zone; and for matters connected with those purposes.

Public Health Act and Ordinances

There are a number of ordinances under the enforcement of the Public Health Department not specifically mentioned here due to lack of information. However, those that are in force deal with mosquito controls; building alignments; septic tanks; water supplies; and water pollution.

Noise Control Act, 1986

An Act for the abatement of unreasonable or excessive noise.

Marine Resources Act, 1989

This Act provides for sustainable development of fisheries resources, accession to regional conventions, and banning of driftnet fishing in the Cook Islands waters.

Building Control and Standards Act, 1991

This relates to design criteria and the construction of structures. The code provides for safer construction standards.

Comments

The current review of the Conservation Act under the FAO soil conservation project takes into account the provisions of the above laws and covers a comprehensive range of environmental issues. The review also covers land use control, sustainable development and specifically the sustainable use of marine resources, for the strengthening of the management capabilities of Island Councils, ensuring public participation. Under the RETA Project, a legal review will be undertaken of all environmentally related laws, whether directly or indirectly, and recommendations will be made for amendments to give effect to those laws.

3.2.2 *Traditional Practice*

The traditional resource management practice of **ra'ui,** applied by village leaders and enforced by the Island Council, is now only applied on some of the isolated islands of the Northern Group, in particular Pukapuka and Nassau. It is aimed particularly at the conservation of food resources. A **ra'ui** may be used to preserve or restrict access to land, lagoons and reef areas for the conservation of food, coconuts and marine resources. The traditional objective of **ra'ui** was to allow a resource to recover for or after a special event, or to improve its yield.

With the introduction of modern technologies and equipment, traditional practices of agriculture and fishing have often been forgotten.

3.2.3 *International & regional conventions*

The Cook Islands is a signatory to a number of international conventions and agreements. The following are those which have direct relevance to the country's prevailing environmental issues:

- South Pacific Forum Fisheries Agency Convention, signed 10 July 1979
- Canberra Agreement (South Pacific Commission), acceded to 14 October 1980
- Law of the Sea Convention, signed 10 December 1982
- South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty), signed 6 August 1985, ratified 28 October 1985
- United States Forum Island Countries Fishing Agreement, signed 2 April 1987, ratified 17 June 1987

- Convention for the Protection of the Natural Resources and Environment of the Pacific Region:
  - Protocol on the Prevention of Pollution of the South Pacific Region by Dumping
  - Protocol on Co-operation in Combating Pollution, signed 25 November 1986, ratified 9 September 1987
- Convention on the Conservation of Nature in the South Pacific (Apia Convention), acceded to 27 October 1987
- South Pacific Geoscience Commission Agreement, signed 10 October 1990, not yet ratified;
- Driftnet Convention (Wellington Convention), signed 29 November 1989, ratified 24 January 1990
- Forum Secretariat Agreement, signed 29 July 1991, ratified 23 August 1991
- Framework Convention on Climate Change, signed 12 June 1992
- Biodiversity Convention, signed 12 June 1992.

3.3 Institutional developments

3.3.1 Cook Islands Conservation Service

In 1974, realising the potential threat to its environment and in anticipation of a positive trend in economic development, the Government of the Cook Islands, under the Premiership of the late Albert Royale Henry, commissioned an Australian environmental consultant to devise ways to address environmental issues. Protection of the coastal zone, preservation of the interior of Rarotonga and the lagoons and reef islands of Rarotonga and Aitutaki were the main areas of concern highlighted. A management system along the lines of the traditional practice of **ra'ui** was recommended as the most appropriate.

Subsequently, the Conservation Bill of 1975 was prepared and passed. It established the Director of Conservation as responsible for the conservation of natural resources, the protection and preservation of historic places and the establishment of national parks and reserves. The Act was implemented on an *ad hoc* basis, under the administration of the Department of Internal Affairs. No officers were appointed.

With the increasing commercial activities in the Cook Islands, especially as a result of the Government's policy to boost the private sector, increased agricultural production and tourism developments, environmental degradation became

apparent but not serious. The Government decided that the 1975 Act was inadequate and required strengthening.

The contents of the 1986/87 Act have been described in section 3.2.1. Although the environment has been widely identified as a significant issue, the level of financial resource allocation to this area has been very limited.

Between 1987 and 1991, the CICS operated in accordance with the provisions of the Conservation Act, particularly in the enforcement of provisions dealing with protection of the foreshore and littering.

The CICS needs experienced and qualified staff to meet the high standard of environmental protection and control required to cope with the country's increasing development.

3.3.2 Ministry of Marine Resources

Formerly a division of the Ministry of Agriculture and Fisheries, the MMR was established in 1984 under the Ministry of Marine Resources Act (1984). To implement its management functions, MMR, under the 1989 Act, operates as the agency responsible for the management and development of the fisheries resources of the Cook Islands. The Act provides a legal tool, through the Island Councils, with which to manage lagoon resources to ensure their sustainable use.

Under the present Government, the MMR has the following policies ensuring the protection and conservation of fisheries resources:

i) to pursue a policy of sound economic exploitation, management and conservation; and

ii) maintain strict management and environmental controls over lagoons to prevent diseases and pollution.

In response to these policies, the MMR has commissioned a consultant to prepare a national pearl farm management plan for the Northern Group. Pearl shell continues to be a valuable resource, and there is considerable interest in artificially cultivating pearl within the Manihiki and Penrhyn lagoons. There is currently a USAID proposal to set up a research and training facility on Suwarrow for Northern Group pearl farmers. This facility would also provide improved management techniques for better resource management in this industry.

With external assistance, a giant clam hatchery has been established in Aitutaki to restock and recover natural stocks of the clam.

It is believed that sustainable exploitation of trochus is possible through strict enforcement of the Trochus Act 1985. The Fish Aggregating Device programme is another of the MMR programmes formed to assist local fisherman in deep sea

fishing. The Mitiaro Aquaculture project for the development of milkfish, mullet and freshwater prawns in the island's lake adds to the growing list of projects.

The 1989 Marine Resources Act provides for the banning of driftnets in the Exclusive Economic Zone of the Cook Islands.

3.3.3 Ministry of Education: Curriculum Development Unit

Environmental science has always been part of the education system of the Cook Islands. Social science and geography have major environmental components; biology and chemistry focus on plants and animals and their relationships with other elements of nature. However, there is no specific unit on conservation or environmental science.

The Primary School Science Curriculum Development Unit, established in 1989, has introduced environmental studies into the school system. Initially, the unit was set up with the assistance of a curriculum advisor under the New Zealand Supplementation Scheme, and three local counterparts.

3.3.4 Ministry of Cultural Development

The MCD was established in 1990 under the MCD Act of 1990. The Ministry aims to preserve, perpetuate, enhance and maintain the unique cultural national identity of the people of the Cook Islands.

The MCD is pursuing ways to highlight the cultural aspects of the Cook Islands and to preserve local materials required in the making of artefacts. The Ministry has no environmental policy but is aware of the need to preserve local species, especially trees for wood.

The move to join the Unesco World Heritage programme has already been instigated by the MCD and CICS through the Crown Law Office earlier in the year.

3.3.5 Ministry of Agriculture: Forestry Division

The programmes of the Ministry of Agriculture include extension services, research, planning, administration, livestock, quarantine, and forestry. The development of the Forestry Division has been the single most important programme of this Ministry, which aims at soil conservation, land rehabilitation and restoration.

The Forestry Programme was established in 1986. The Programme was initiated in 1984 to undertake species trials on all sorts of land, mainly on Rarotonga, Mangaia and Atiu. Since 1984, the first local trainee has undertaken a degree course, with four more undertaking a two-year forestry technicians' course. In total the Programme has employed four expatriates since its initiation. The Programme

currently employs 24 personnel. Of these, 20 are based in Mangaia, 10 in Atiu and 4 on Rarotonga.

Over the last four years, the programme has established 456.2 hectares (25 per cent of the total fernland area) of forestry on the fernlands of four islands. Of this, 75 per cent was on the fernlands of Mangaia and 18.3 per cent on Atiu. The two islands are the main focus of the forestry programme. There is now a change of focus from conservation forestry to production forestry especially on lower slopes. Good growth, especially of the *Pinus caribaea*, makes the re-focus desirable.

3.4 Non-governmental organisations

Although an important sector for the implementation of developmental projects, NGOs have not been directly approached on environmental strategies. Although few NGOs were established specifically for environmental purposes, some have been instrumental in the dissemination of environmental messages. These include youth groups, cultural groups, church groups, women's groups, traditional leaders and village committees. Others include the Lions and Rotary Clubs.

The Cook Islands Chamber of Commerce was set up in the 1970s, in response to the need for a co-operative approach to development activities, especially in the private sector. The Chamber deals primarily with private sector business and growth. The Chamber recently established an Environmental Sub-committee, primarily to assist the Conservation Service. Although the Sub-committee has not clearly identified its environmental policies and future, it appears to have emphasised waste management and public awareness.

3.5 Specific programmes & projects

3.5.1 Cook Islands Conservation Service programmes

The CICS currently has five programmes other than administration.

Foreshore

Much attention has focused on the main island of Rarotonga, due to the extensive and fast development activities both on the foreshore and in the uplands of Rarotonga. Aitutaki has also been an area of focus and the Act applies to that island.

Although much of the CICS' energy has been directed towards this issue, very little has been achieved. Some of this may be attributable to low budget allocations,

problems of land tenure, lack of proper educational materials and direction, and the lack of transport for law enforcement purposes.

The CICS plans to compile a database on its coastal zone monitoring programmes (1991-1992) to cover corals, fisheries, coastal processes, water catchment activities, upland agriculture and infrastructural activities that contribute to the degradation of the coastal zone. This database will assist the CICS in its efforts to protection and ensure the sustainable use of coastal zone resources.

Wildlife & protected areas

The major activity of the CICS in this area is focused on the Kakerori Recovery Programme, aimed at improving the population of the Rarotonga flycatcher (*Pomare dimidata*).

The CICS has investigated three areas of special biological interest and prepared concept documents for each area: the Kakerori Nature Reserve; the Te Manga Nature Reserve, which aims to highlight the need to protect the cloud forest of Rarotonga; and the Takutea Nature Reserve, which aims to highlight the need to protect the seabirds of Takutea.

At the request of the Aitutaki Island Council, the CICS is preparing a concept document for the establishment of the Ootu Nature Reserve to protect a natural fisheries hatchery.

The CICS, with the financial assistance of SPREP, has published posters on the seabirds of Takutea and Suwarrow, the cloud forest of Rarotonga and a pamphlet on the Kakerori.

Suwarrow atoll is the only officially declared national park in the Cook Islands. With the Government decision to establish a pearl farm and a training and research facility in the lagoon of the Park, it has become necessary for the Director to prepare a Management Plan for the Park. The aim is to achieve total control of the activities within the park, primarily to protect its ecological and intrinsic values.

Other reserve and park development activities include a recreational reserve, the Pokoinu Reserve, and a reserve for the preservation of medicinal plants (Vai Rakau Maori Reserve). Concept documents for these two proposals have been completed.

The main thrust of this programme is to involve landowners in the management of parks and reserves through local committees.

Resource management & planning

Although the CICS has been empowered to prepare management plans for areas requiring careful management, it has not implemented these due to the lack of trained staff, the lack of legal control over marine resources and the need to allow landowners maximum input into the preparation of these plans. Under the

Conservation Act 1986/87. Sections 30-32 provide for management plans to be prepared for national parks and reserves, Cook Islands waters and water resources, coastal zones, indigenous forests, soil erosion, pollution and other areas which in the opinion of the Council will benefit from a management plan.

At the request of the Island Councils of Aitutaki and Mauke, the CICS drafted plans for each island. The Mauke Island Council has recently indicated acceptance of its draft which is ready for formal endorsement by the Government.

With increasing development in the outer islands, particularly tourism and pearl farming in the Northern Cook Islands, Island Management Plans are considered to be an effective tool for conservation and sustainable development on those islands. The CICS priority for 1992 lies with Manihiki and Penrhyn in the North, and Aitutaki, Mauke, Atiu, and Mangaia in the South.

The preparation of these management plans will take into account the developmental objectives and directions developed by the UNDP Integrated Atoll Development Project and the MOPED Outer Island Development Plans.

A Senior Officer was recently appointed under this programme, with a trainee soon to be appointed. Closer contact with MOPED was established by this appointment, and the Service was able to provide a counterpart to the preliminary EIA project carried out on the Government Sheraton hotel project.

Although an EIA provision was part of the initial draft of the Conservation Act 1986/87, it was not included in the final stages submitted to Parliament. It was considered that there was insufficient information, resources and trained personnel to implement and enforce the provision. The CICS has no legislative justification for requesting for an EIA on major projects.

As a member of SPREP, the CICS can request its assistance either to seek outside experts who will undertake an EIA, or to undertake the EIA from its own specialist resources if the CIG considers a project to be of major concern. The preliminary EIA report undertaken on the Sheraton project is an example of this assistance.

The draft Tourism Master Plan highlights the need to evaluate projects in terms of their potential social and ecological effects. It further suggests that the lack of such an evaluation is perhaps the greatest single factor against achieving sustainable development in the Cook Islands.

A draft EIA provision is currently being drafted under the FAO soil conservation project for the Cook Islands. The draft has been prepared as part of the Conservation Council's review of the Conservation Act 1986/87.

Education, training & publicity

This very important aspect of the work programme of the CICS has been poorly funded. Both the Cook Island News and Cook Islands Broadcasting Corporation have expressed their willingness to accommodate CICS programmes on special rates, however, the CICS budget allocation was unable to cover even those. With external assistance the CICS was able to produce two posters and a pamphlet. A NZTV-produced documentary on the Cook Islands environment also assisted as public education and as material for schools with access to video equipment.

In 1991-92, the CICS is planning to set up an environmental education unit to be actively involved with the Education Department Curriculum Unit. It will co-ordinate and produce the educational activities and projects of the CICS. It will also be responsible for providing training programmes for trainee officers and refresher courses for current officers. The CICS will also be appointing an Environmental Education Co-ordinator for the next three years.

Cultural conservation

With the appointment of a herbalist in 1989, the CICS pursued the establishment of a Vai Rakau Maori Reserve for the protection of locally significant plants. Currently the concept document for this reserve has been prepared in consultation with the landowners. Declaration of the Reserve has been delayed by problems associated with the Conservation Act of 1986/87. The primary objective is to preserve and highlight the traditional and medicinal value of these plants.

Already, training in herbarium development has been undertaken with the long-term intention of establishing a herbarium for educational, scientific and information purposes. The New Zealand Overseas Development Assistance Programme made it possible, under an employee exchange scheme, to acquire the expertise of an artist to illustrate some of the more important medicinal plants, for educational purposes. The scheme will run for three years.

3.5.2 The Coastal Management Units Project

This is a pilot project funded under the New Zealand Overseas Development Assistance Programme. The project is a string of separate units aligned along the western coastline of the Rarotonga Resort Hotel, some ten metres from the mean high-water mark. The units are aligned almost parallel to the beach. The principle of this management unit is that it will harness sand while in suspension, as waves loaded with sediments move through the units. The units have designed openings that dissipate and reduce wave energy during the motion of moving through the units. Monitoring of this programme is undertaken by the Lands and Survey Department and Canterbury University of New Zealand.

3.5.3 The Land Use Capability Project

This project, funded under the New Zealand Overseas Development Assistance Programme, commenced in 1989 with Atiu, completed in 1990, as the first case study. The intention of the project was to undertake the study on Atiu, Mangaia, Rarotonga and Mauke as funding became available. The project, implemented by a interdepartmental team of Government employees from the Department of Survey , CICS, Forestry and Agriculture, was co-ordinated by the Chief Surveyor. The team was assisted by NZDSIR personnel who provided the technical input into the programme.

The project data is compiled into a Geographical Information System (GIS) where information on land capability is readily available to farmers or landowners wishing to know the capabilities and limitations of a section of land. In summary the project aims are to:

i) develop a land use capability method from which Cook Islands officials can retrieve information relevant to sustainable land use;

ii) prepare orthophoto map bases;

iii) provide a system which allows physical land resource information to be integrated with agronomic requirements of present and potential crops;

iv) assist in the prevention of soil erosion;

v) identify areas of land requiring protective or preventative action, or which would assist diversification of sustainable agricultural development;

vi) train Cook Island team members to maintain, develop and apply the land use capability system; and

vii) develop a training programme so the system can be used on the other islands by Cook Islands staff.

3.5.4 Legislative framework for conservation & restoration in land use

As a follow-up to the FAO soil erosion report (Sims 1981) and as a result of a request from the Ministry of Agriculture, a soil conservation and land restoration project was undertaken by FAO consultants to assess the legislative aspect of soil erosion and land restoration, and to report on the extent of the problem in the Cook Islands, particularly the Southern Group. The report's recommendations focused on the institutional strengthening of appropriate agencies by improved technical capabilities and legislative back-up.

Under this project and during a second mission, rehabilitation work on the Mauke irrigation dam was initiated.

It was requested that the FAO legal consultant subsequently review the Conservation Act with a strong emphasis on sustainable resource management, including EIA.

3.5.5 Afforestation project

An afforestation programme with exotic tree species was initiated under the NZODA Programme, primarily on Mangaia and Atiu. The main purpose of the afforestation was to control severe erosion on those islands, thereby reducing the rate of erosion and siltation in taro production areas.

Afforestation efforts have concentrated on the eroding uncultivated fernland catchments, as these were considered the immediate direct cause of the siltation of taro planting areas.

On Mangaia much of the runoff comes from old pineapple plantation areas draining into the inner wall of the makatea.

When the pineapple industry collapsed, most, but not all, of the cultivated area rapidly developed a ground cover of weeds, grass and shrubs. However, areas of bad topsoil erosion were not colonised to the same degree as before the pineapple planting and are still actively eroding. The afforestation programme must be extended to those sub-catchment areas with severe erosion on both Atiu and Mangaia.

Similarly, the Rarotonga fernlands are being afforested with the aim of improving the soil's capabilities.

Although erosion on Mauke is much less severe than on Atiu and Mangaia, active erosion is evident. A small afforestation programme has commenced on Mauke.

It should be noted that the afforestation programme aims at soil conservation and the stabilisation of eroded areas using appropriate species and engineering means.

3.5.6 Integrated Atoll Development Project

Under the umbrella of the Ministry of Internal Affairs as implementing agency, the UNDP/Office of Planning and Statistics-funded Integrated Atoll Development Project is being implemented. Its primary objective is to raise the self-reliance of atoll/island communities and promote sustainable development at the grass-roots level. The project advocates community-based participatory development.

In the Cook Islands, the project is involved in strengthening the development planning and management capabilities of Island Councils. A UN volunteer specialist in rural development has been assigned to the Ministry of Internal Affairs to implement the rural capability enhancement programme.

A key activity of this project is to prepare island development profiles with the full participation of local leaders and community members. Through this activity, island communities become more aware of their socio-economic situation as they learn to identify priority problems, assess local resources and grasp development potential and constraints. Hence, the profiling exercise is in itself a social preparation activity towards the formulation of more relevant programmes and projects which are to be implemented and monitored by the people themselves.

Already, the project has proceeded successfully, with the completion of the Mangaia, Manihiki and Penrhyn profiles. This project will facilitate the preparation of the CICS plans.

3.5.7 Cook Islands Tourist Authority Tourism Master Plan

This plan, with the financial assistance of the Asian Development Bank, bridges the link between tourism and conservation. It shows how certain environmental management measures will assist the Cook Islands in pursuing sustainable development in that area. It covers legislative issues, environmental impact assessment processes, education and public awareness, and the establishment of parks and reserves for tourism purposes.

3.5.8 Integrated Pest Management Programme

This is one area the Ministry of Agriculture research station is addressing, particularly in view of the concerns in regard to possible environmental damage through the use of chemicals and fertilizers. The Ministry is promoting measures and alternatives in a bid to reduce the enormous amount of chemicals used and imported. This programme looks at the biological control of pests and the study of the long-term impacts these chemicals may have had on the environment.

3.5.9 Cook Islands Natural Heritage Project

This project, initiated and implemented under the supervision of the Prime Minister's Department, commenced and was formalised in 1990. It is a long-term research project to collect and integrate traditional and scientific information on Cook Islands plants and animals.

The project's output is mainly planned to be publications. Their aim is to preserve traditional information on the environment, and to present the environmental information material to encourage greater awareness of and respect for the fragile biota.

The CICS has published three items produced under this project. Other upcoming work includes a booklet on Rarotonga's Cross-island Walk and a multi-purpose database on the animals and plants of the Cook Islands.

3.5.10 Oil Pollution Management Plan

Hydrocarbon spills in the Cook Islands have not been significant. However, the ongoing leakage of diesel into the Avatiu stream from the electrical powerhouse has been a major concern for the CICS. The recent French-funded energy upgrade project for Rarotonga has taken this problem into account through the recycling and proper storage of waste diesel for recycling.

Ocean pollution from ship-based sources has not been a major issue, although the CICS and CIG have considered the problem. An Oil Spill Contingency Plan drafted in 1981 was reviewed in 1990 by the International Maritime Organisation and SPREP. The plan is to be reviewed and endorsed by the Cook Islands Implementation Agencies Group (IAG), which comprises representatives from CICS, the Police Department, TLT and the oil companies. Once endorsed by the IAG, the plan will be implemented as a Management Plan on Oil Pollution under the provisions of the Conservation Act 1986/87.

chapter 4 ♦

Effectiveness of response to environmental issues

4.1 Government policies

The attempts to address the environmental issues described in Chapter 2 have been fragmented. This may be due to a number of reasons, one being the lack of an efficient mechanism to co-ordinate government policy implementation, especially with regard to natural resource management. Until recently there has been no effort to co-ordinate Government programmes which have an impact on the environment.

Although clearly stated in the environment and conservation policy, promotion of good environmental practices has not been undertaken due to lack of funds and trained personnel to plan and implement educational programmes. Educational programmes are vital to the adherence and practice of good conservation principles. Current sector policies on natural resource development are not based on sustainable development principles.

4.2 Laws & conventions

Despite the large number of laws to control particular aspects of the environment and the high degree of awareness across all sectors of the need to maintain a quality lifestyle, the Cook Islands still has major problems in managing its environment.

Close kinship ties may make enforcing laws which impose fines and penalties very difficult. This has led to inconsistent enforcement of the laws.

It may be argued that a long and effective educational process is required, however it is very difficult to implement this if funds and human resources are not available. Despite this, the Cook Islands people have a high degree of understanding of the

issues and would be willing to abide by any laws if it were clear that these were to their advantage.

4.2.1 The Conservation Act 1986/87

Land tenure problems relating to land ownership have been a major issue. The consultation process has always been a one-way affair—usually the landowners will only look for advice and guidelines after a mistake has been made or when high monetary costs are involved.

Between 1987 and 1991, 89 applications for approval of work as required under the Act were considered by the Conservation Council. Of these, 84 per cent dealt with the foreshore. The Council considered and discussed a total of 255 issues, of which 35 per cent were applications. There has been a downturn in the number of issues and applications discussed and considered by Council; this may be attributed to the effectiveness of the awareness programmes initiated by the CICS in the initial years of its establishment, and the ongoing consultation process by CICS officers.

However, the number of environmentally detrimental activities continues, due mainly to the lack of officers trained to supervise and monitor the increasing number of activities and follow proper law enforcement procedures. Although it may seem that the work of the Council is decreasing, this is not an indication of the effectiveness of the CICS.

Although CICS officers have been active in both the educational and consultative processes, no survey has been carried out to determine the effectiveness or weaknesses of these efforts.

4.2.2 Traditional conservation practices

The traditional resource management practice of **ra'ui** is not being effectively practised in the Outer Islands. This may be attributed to the breakdown in the power system of the traditional leaders and, perhaps to a larger extent, the changing lifestyle from a subsistence nature to a part- or full-time commercial lifestyle.

The traditional management system should be strengthened by providing the Island Council with the means to enforce stringent measures and ensure serious observance of the ra'ui. There is also a need, especially in the rural outer islands, to re-enforce good traditional fishing practices. Local herbal medicine, taro irrigation methods, composting, and the removal and planting of trees need to be revived.

4.2.3 International & regional conventions

Through regional conventions and agreements, some of the projects of the CICS, Public Health and the Ministry of Marine Resources (Surveillance) have been implemented. This was done through technical assistance programmes, overseas training courses, participation in workshops and seminars, purchase of capital items and funding of local programmes and projects. A major component of project costs is the financial resources allocated for outside technical assistance.

The Cook Islands' participation in these conventions and agreements has been beneficial. For reasons of trade benefits, funding arrangements of projects, sharing of information with neighbouring countries, international co-operation in territory surveillance with regards to fishing agreements, pollution and others, to name but a few, the Cook Islands should continue to participate in the negotiation of treaties and conventions. The recent signing of the Rio Conventions, namely the Framework Convention on Climate Change and the Biodiversity Convention with the ratification process in motion, should give the Cook Islands the opportunity to partake in the meeting of parties where important decisions will be made about the global environment. The Cook Islands will also have the opportunity to raise issues concerning national benefits. Its Government should therefore maintain this momentum by sending personnel to participate in these meetings.

4.3 Institutional developments

The Conservation Service is not the only agency that can manage and protect the environment. Other line agencies as described in section 3.3 contribute to the effective management of the environment. The effectiveness of their responses to environmental issues have not been assessed in this report.

4.4 Non-governmental organisations

The efforts of the various NGOs will not be assessed here. NGOs are the main vehicle by which the environmental awareness activities of the CICS and Public Health have been highlighted. In most cases efforts are normally not effective because of the lack of ongoing programmes to re-enforce and monitor long-term activities. World Environment Day, for example, is a case where a message on the environment is promoted only during a single week. There is a need for on-going support for activities, especially those geared for community and non-business organisations.

4.5 Specific programmes & projects

The specific programmes and projects described in Chapter 3 cover a wide area. They have all created a greater degree of awareness amongst specific communities and an increasing level of information in the form of technical reports and publications.

chapter 5 ◆

Supporting measures for effective response to environmental issues

Although responses to environmental issues must take an integrated and comprehensive approach, with both immediate and long-term action, the CICS must take a leading role. Institutional changes and greater commitment of financial resources by the CIG are key factors in any responses to the issues previously discussed. The following sections outline proposed components of supporting measures.

5.1 Government policies

Policy on sustainable development

A clear policy on sustainable development of resources, including a definition of goals, is needed in the Cook Islands. This policy should be the main focus of any other sectors which aim at the exploitation of environment resources.

Co-ordinating mechanism

The Cook Islands Government needs to formulate a co-ordinating mechanism whereby development policies are properly implemented and consistent. This may be achieved through policy directives from the executive Government promoting integration and inter-departmental co-operation. The Ministry of Economic Planning and Development may be used as a vehicle to execute such policy directives. This may also be achieved through legislation.

5.2 Laws, practices & conventions

5.2.1 The Conservation Act 1986/87

Considering the status of the current Conservation Act, and in view of the increasing number of environmentally detrimental activities taking place, first priority should go towards bringing the 1986/87 Conservation Act out of dormancy and having it applied to all of the Cook Islands. Moves must be taken to review the Act to incorporate the following:

i) a Sustainable Development Section that employs community support and participation, through the preparation of management plans and environmental notices, and the enforcement of an environmental impact assessment process;

ii) re-defining of the foreshore to suit each island;

iii) an extended definition of the environment to include the marine environment and the sustainable management of the resources therein;

iv) broader membership of the Council; and

v) extension of the application of the Act to the entire nation.

The revision of the Act must also take into account the provisions of all local laws currently existing which have an environmental component.

Under the FAO project described in Chapter 3, the policy documents for a revised act were drawn up and used as the basis for a draft Sustainable Development of the Environment Bill, called the Environment Bill.

When the new Act comes into force, the CICS will need trained staff to implement its provisions. This may include the appointment of other public servants such as constables, building inspectors, health officers, quarantine officers, post office officers, general licensing authority inspectors and honorary officers to have specified powers under the Act to assist in its enforcement.

All officers appointed will need to be thoroughly trained in law enforcement procedures which are effective and locally appropriate.

5.2.2 Traditional practices

Re-enforcing of traditional resource management systems and good traditional practices requires a system of cultural education. This may include a re-evaluation and re-enforcement of the roles of traditional leaders in the community.

5.2.3 International & regional conventions

The Cook Islands must participate in the negotiation and enforcement of international conventions to promote and maintain international co-operation, especially in attempts to monitor its EEZ with regards to international fisheries activities, pollution and other global issues.

Resources of technical organisations should be made use of for staff training and for obtaining assistance on various environmental issues.

Local expertise should be used where possible under technical assistance projects to the Cook Islands. This will, where possible, strengthen local capabilities to effectively manage the environment.

5.3 Institutional & administrative measures

The effectiveness of environmental responses is currently inadequately monitored. Although numerous responses have been cited, their effectiveness has not been measured. The collection of environmental indicator statistics would be of great benefit in measuring trends. Such statistics would be useful in justifying the financial resources being allocated from the national pocket and by outside agencies through the various institutions.

5.3.1 Cook Islands Conservation Service

Organisation & staffing of the CICS

Under the present Conservation Act 1986/87, the Service is a corporation under the control of a Conservation Council which is comprised of community, government, and private sector representation. CICS staff, through the Director, are responsible to the Council.

The CICS is technically unable to cope with current responsibilities. It is suggested here that the Service be restructured, identifying those areas of programmes with staffing and training needs. The programmes identified should be implemented by experienced officers with expertise in the areas concerned. Since all programmes overlap, there will always be a "team approach" to all issues.

As the leading agency for environmental protection, the Service must be seen to play a facilitating role to ensure sustainable development of natural resources, whether this involves hotel resort developments, lagoon fisheries development, pearl farming or sand mining and dredging. The Service must implement programmes that promote community participation, and involve landowners in its decision-making process.

The Service, in addressing Outer Island concerns, must involve Island Councils; this is seen to be effectively addressed through Outer Island Environmental Management Plans. Such plans will be the product of consultation with the Island Councils and will be enforced by each island's Council and its Conservation Officer.

Finally, the Service must maintain its independence in order to advocate its role of an honest broker in development and environmental issues.

The composition of the current staff is described in Chapter 3 and above. There is an urgent need to structure the Service to enable it to function properly and effectively. A proposal for a programme list and the staffing needs for the CICS is given in Appendix 3.

Additional staffing is needed within the next five years. This assumes that Cook Islanders, currently either at home or in New Zealand, with the appropriate background and motivation will be attracted to fill these positions.

The Service, through the Australia Volunteer Abroad scheme, has now employed an Educational Co-ordinator to establish its environmental education programme. This is seen as the Service's most important programme and the Government must give its full support.

Documents have been prepared under an FAO project, described in section 3.5.4, outlining the requirements for establishing a Soil Conservation Unit. They provide for such a unit to be set up by an experienced trainer, qualified in the area of soil conservation and related land rehabilitation works. It is proposed that local counterparts be employed at the same time to undertake training. Trainee positions are planned for the 1993 financial year. It is recommended that Government give this its full support.

CICS facilities

The Service's current facilities are inadequate to fulfil its huge responsibilities. Its office accommodation is about 60 sq m which accommodates eight officers, a kitchen, Council meeting room, library, toilet and small air-conditioned computer room. With the current move to employ more staff and also with the extension of the work programmes, the office facilities must be extended and upgraded.

Transport and communication facilities also have to meet the daily demands of the field activities of the Service. In this respect, two four-wheel-drive vehicles are required. Each vehicle must be fitted with a VH communication system. This will ensure an effective communication system between officers and the main office, enhancing law enforcement procedures.

Office facilities are required — a computer database to enable the Service to run wildlife database systems, a foreshore database system and any other database

systems. Other facilities required include desktop publishing accessories such as laser printers and report production facilities.

Budgetary support

The CICS budget over the last four years has been very limited. Although the Government budget allocation has been increasing, most of it has only covered salaries, leaving limited operational funds. This has kept the Service from implementing real conservation projects such as land restoration, national park establishment, production of educational materials, implementation of waste management strategies and resource monitoring activities.

If environmental action is to be taken and maintained locally, the Service will need additional financial support. The concept of resource pricing may be implemented, considering that the Cook Islands environment is what the tourists come to see. The "user pays" concept may be applied to the inland tracks of Rarotonga, the lagoon tours of Aitutaki and the prime coastline areas of Aitutaki and Rarotonga used by hotel accommodation. This system may be implemented through an environmental tax charge on top of tourist room bills. Under its cultural conservation programme, a cultural tour could also be an avenue for acquiring funds.

With the above approach, and other local fundraising, the CICS's programmes must have a certain degree of internal funding. The CICS, to initiate such efforts, must seek the opportunity to control its own financial resources and have an accountability mechanism in place. This would not only enhance the Service's budgetary support but also ensure timely and effective release of funds. This should also attract external funding from donor organisations for environmental purposes.

The CICS under the NZODA and in association with the Department of Conservation of New Zealand will engage the expertise of a corporate funding planner to assist the CICS in achieving a sustainable financial status.

5.4 Formal education

Environmental Studies needs to be introduced into the school curriculum so that conservation is covered in conjunction with scientific principles. This would require an examination of the total school programme to see how such an area could be developed from Grade 1 through to Upper Fifth Form, looking particularly at geography and social science subjects, and any others which might have a contribution to make.

To produce units as "gap fillers" for programmes, such as the Cook Islands School Certificate science programme, would be inadequate to express the importance of environmental conservation. Such an investigation will require the expertise of conservation personnel, educators and others in the area of Environmental Studies. This could include the Med, MOA, MMR and the MOH (Department of Public Health). Such a programme should not only include the general principles of environmental control, maintenance and development, but also an approach which considers the diverse nature of the Cook Islands environment. In other words, it would have to be flexible enough to be applied locally within the framework of each island's needs.

5.5 Public education & participation

Environmental issues in the Cook Islands have a wide public appeal. This has been a mixed blessing. The CICS has been seen by some people as anti-development and has been branded as a "foreshore act", or a group of "litter inspectors" and the "saviour of the Rarotonga flycatcher".

However, recently there has been some change as a result of outside organisation (aid donors) development policies and the high profile that the international media is giving the environment. There has also been a move by the private sector to form an environment sub-committee. Interest has been shown by women's groups as well as other organisations such as Rotary and the Lions Club which gives a good indication of a wider public awareness and willingness to participate.

As expressed throughout this report, the need to promote and encourage community participation in environmental activities either through business or individual efforts is important.

5.6 Non-governmental organisations

It is apparent that NGOs could be most influential in conveying environmental messages to the community. The role of women and women's organisations must be recognised as an important vehicle in promoting environmental awareness, providing practical support through families, schools and the community as a whole.

5.7 Specific programme & project needs

National and sectoral programmes and projects (environmental response projects or environmental resource development projects) need to be co-ordinated, with a

means of co-ordination and awareness amongst those sectors responsible. This promotes awareness of individual roles and how projects and programmes may be implemented in a sustainable way.

There is a need to monitor these programmes through the identification of indicators and their regular update and comparison to measure their effectiveness.

There is a need to publish information and reports of those projects in a manner attractive to the public. This should allow all sectors to become aware of the projects and avoid repetition of efforts.

5.7.1 Specific programmes

Urban planning for Rarotonga & Aitutaki

The main business centre on Rarotonga is found in the Avarua area. Business activity is however scattered around the perimeter of Rarotonga in a unplanned way and mixed in with urban housing or agricultural activity.

Electricity, sewage, rubbish collection and other communal services are becoming more difficult and costly because of this sprawl. The application of proper town planning principles for the central business area would seem to be the first task, but this can not be sensibly undertaken in the absence of comprehensive land use planning and a zoning plan for Rarotonga as a whole.

Urban planning for Aitutaki is basic to the efficient expansion of the tourist trade, and many of the problems which now confront Rarotonga can still be avoided or reduced.

Soil conservation

The main environmental problem of the agricultural sector is erosion. This is fully recognised within the Cook Islands, in particular the Southern Group, but erosion control actions are very expensive.

Erosion control will require a combination of actions, from conservation engineering works to afforestation. The fundamental need is for greater attention to the factors which produced the erosion in the first place. If landowners intend to continue cropping their lands intensively and still expect to pass on a valuable resource to their children, they will have to change their perception of what practices are or are not environmentally acceptable.

Increased training on appropriate mechanised cultivation practices will be required; some islands may need to reduce their use of fire in land preparation.

In the area of infrastructural developments, such as roads and inland water development projects, trained personnel are needed to operate any machinery so

that proper excavation is carried out and soil wash kept to a minimum. This may be achieved through a licensing system whereby only authorised personnel are allowed to operate specialised earth-moving machines. This licence will only be issued after an operator has successfully completed a course designed for that purpose.

Under the NZODA, the CIG through the Forestry Division of MOA is addressing this erosion problem, with the initial emphasis on reforestation to rehabilitate damaged areas. This programme is confined to the islands of Rarotonga, Mangaia and Atiu. While erosion is not evident on Mauke, the potential there for erosion suggests the need for re-afforestation action. Other actions taken to address the problem were initiated under the FAO soil conservation project which provides the legislative framework for soil conservation, and rehabilitation work on Mauke on the ADB irrigation dam project. It is important that the community where these actions are being implemented learn to appreciate these efforts and co-operate in their protection and maintenance.

Material for construction

Construction grade sand and aggregate is vital for the Cook Islands' development. The beach was the main source of sand. Other inland sources within the coastal zone are also used. The problems associated with the mining of sand from this area are described in Chapter 2. The responses to these problems have been difficult and it seems clear that unless an alternative source of this resource is found, any controls imposed will not be accepted.

There is a rock-crushing plant on Rarotonga. Aitutaki and Mangaia have similar but smaller plants. The Rarotonga plant has been upgraded to provide high-quality aggregate and some fines. But it can supply only a small portion of the material needed. Urgent attempts to locate a viable alternative source have to be made. The only possibility, other than mining environmentally sensitive sand and gravel sources, is the ocean outfall of passages in the fringing reef.

A feasibility study and environmental impact study are required to show the economic and financial viability of recapturing these sand deposits.

National parks & reserve development

There would seem to be a major opportunity, because of the emphasis on tourism as the future mainstay of the Cook Islands economy, to protect the remnant biological diversity by establishing terrestrial and marine reserves. This "eco-tourism" or "nature tourism" is one of the main themes of the recently completed Tourism Master Plan for the Cook Islands.

The management of such reserves must of course remain with the people and Island Councils, with the CICS assisting as required.

Energy

Steam generation could play a much larger role in Cook Islands' fuel supply than is the case today. The main renewable source of fuel is firewood and coconut shell/husks.

The prospect of steam generation was considered three years ago but rejected on wood resource, maintenance and cost grounds. With recent new designs for both biomass combustion and auto-regulating steam engines, small-scale electricity generation for small outer island communities is a real and relatively cheap prospect compared with diesel generation.

However steam generation requires a continuous supply of large volumes of high calorific firewood and reliable labour to harvest the wood, run and maintain the equipment. None of these are available. The establishment of fuelwood plantations as part of the reforestation programmes for rehabilitating eroded areas on Mangaia and Atiu, and as wind-break around exposed garden areas, should receive closer attention.

Solar energy in combination with diesel generation is proving a viable option in remote areas to supply electric power needs, with significant cost reductions over normal stand-alone diesel generators. On its own, solar energy is a proven way of providing solar lighting, water pumping, and hot water for small communities or individual households.

The Cook Islands' experience with photo-voltaic lighting has yet to be assessed; windmills for water pumping, wind-powered DC electricity generation, and roof-mounted, black-bag hot water production are well known, or in some cases, remembered.

The incineration of waste to generate energy is another possibility worth considering. However, a lot of investigation work on its viability needs to be done. Although used in some countries in the Pacific, waste-to-energy generation has its problems, mostly in terms of pollution.

As there are a significant number of generators available to communities in the outer islands, it would be quite wasteful of existing capital investment if they were to be abandoned. The systems described above could be developed to complement existing diesel generators, reducing fuel costs as mentioned above.

This would be an attractive opportunity for development assistance from donor organisations for the conducting of field trials.

Waste management

Clearly there is an urgent need for a plan of action to address this problem.

Solid waste

The main immediate opportunity to reduce the solid waste disposal problem is to reduce the volume of rubbish, especially the non-biodegradable component.

Efforts to promote recycling of aluminium cans and glass bottles need to be stepped up. But experience elsewhere suggests that commercial recycling exercises will only be profitable if can or bottle collection is subsidised by government.

An alternative approach is to minimise collection costs by imposing a large deposit on the container at point of sale, for example 10-20 cents. Another approach is to require, by law, that beer and soft drinks be packaged in biodegradable containers (i.e. steel cans), or in recyclable containers (i.e. glass bottles). With glass beverage bottles however, their sale should be permitted only on islands where recycling is practical, that is, only Rarotonga.

Government packaging policy should also discourage plastic containers, bags or wrapping, opting instead for renewable products of cardboard and paper. Separate organic waste should be composted, not burnt, to provide essential humus to help sustain horticulture production. Proper garbage dumps should be designated in those outer islands which have not already done so, with Island Councils providing two drums at a small price. One of these should be designated for organic and the other for non-organic waste, with regular collection undertaken by truck or by tractor and trailer. Proper management and siting of rubbish dumps must be a priority and must be authorised by health and engineering experts.

Sewage

Sewage disposal is a problem in the Cook Islands as elsewhere in the Pacific. With the growing tourist industry, there is an urgent need, on Rarotonga at least, to design and install a sewage collection and treatment system. The major hotels have their own treatment systems but these are not always satisfactory. There is a need to investigate systems suitable for the island environment. Past plans for the construction of a sewage treatment system for the main business and tourist area on Rarotonga need to be reviewed to include the whole of the island.

Environmental monitoring

The need for monitoring systems and regular programmes with trained staff is a matter discussed within the report. This concerns not only the CICS but also the MA and Public Health. Not one has the current capacity to police the registration, storage, sale, safe use and disposal of agricultural chemicals nor to monitor the

impact on soil, water, and food of the use of agricultural chemicals, including fertilizers and biocides, and veterinary drugs.

Boosting this capacity requires upgrading of the present laboratory analytical capacity, including training of field staff for taking soil, plant and food samples, and of specialised laboratory technicians. Any strengthening of the system must include the capacity to trace back instances of chemical residues exceeding safe maximum limits and to take corrective actions. Recurrent cost implication in such monitoring activities may be high and therefore a cost-benefit analysis must be done to determine what tests are realistic for the Cook Islands and which ones should be sent overseas.

Water monitoring

The Cook Islands need to institute a programme of regular monitoring of the quality of both underground water and marine water of the lagoons. Quality monitoring would include the regular collection of water samples for laboratory analysis for organic chemical contamination, for bacterial pollution from faeces and, in the case of groundwater, for salt content.

Regular sampling should be undertaken, but analysis will be too expensive if all samples are sent to New Zealand. However for a full analysis (or even routine basic analysis) to be undertaken in the Cook Islands, significant improvement of the analytical capability of the Public Health Department laboratories may be required.

Resource pricing policy

The CICS considers that there is little real appreciation of the true worth to the community of the nation's natural resources. Although supportive of a quality lifestyle and healthy living conditions, the people of the Cook Islands are inclined to take their natural assets for granted.

There are possible ways of valuing the resources in order to place real prices on all natural resources and charge for their use according to their scarcity. The latter may be referred to as the "user pays" concept or the "polluter pays" concept. With the CIG being one of the principal destroyers of the natural resources it may be approached differently through the CIG financial system. There should always be cost-benefit assessment of projects that deal with natural resource development to ensure that additional costs, for resource recovery and rehabilitation programmes carried out by other sectors as a result of the project, are taken into account.

Implementation of such policy should have a major educational component.

chapter 6 ♦

Conclusions

The environmental issues described in this report highlight the fact that the environment of the Cook Islands is not healthy and requires urgent attention. The degree of health varies from island to island. The more accessible an island is to the outside world, the more degraded its environment.

The problem of waste and waste management is an important issue to all the Cook Islands. It is clear that the problem of waste is felt throughout the system by way of pollution and contamination of the coast and marine life which are valuable resources of the people.

The responses to these issues are extensive, covering policy issues; legal issues; management issues; institutional development issues; financial support issues; education and the implementation of projects. Despite all these efforts, the problems are not under control.

Some consolation should be taken from the fact that these efforts have only been made recently; however, with the current increasing rate of development that the country is experiencing, these efforts should be sped up to accommodate the change. The main problems with these responses are primarily due to a fragmented approach and the lack of data to define the problems and the best responses to them.

It is therefore recommended that the implementation of those measures described in Chapter 5 be among the priority issues addressed by Government.

chapter 7 ♦

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APPENDIX I

Summary of topography & environmental features

Islands	*Topographic & environmental features*
SOUTHERN GROUP	
Rarotonga	**Topography** High volcanic (652 m); collapsed caldera; prominent monoliths in the interior; steeply dissected valleys with ridges separating four main valleys (Takuvaine, Avatiu, Avana & Rutaki); 4 sand-cay islets, 3 located on the eastern side, the other on the northern side; 1 volcanic islet; storm rubble prominent on the north & north-east coast with finer coral sand & wider beaches on the south & south-east coastline
	Reefs Fringing reefs with varying widths from 400–800 m on the south coast to 50–100 m on the windward east coast
	Environmental features Coastal zone; Ngatangiia lagoon & wetland; cloud forest; fernlands; water catchments; swamplands & wetlands; habitat for the kakerori (Rarotonga flycatcher) & the i'oi (Rarotonga starling)
Mangaia	**Topography** Low volcanic (169 m) surrounded by high makatea; uplifted island; concentric cliffs up to 80 m; volcanic plateau; swamplands at the edge of inner makatea; limestone caves
	Reefs Fringing reef, narrow reef flat
	Environmental features Classic erosion feature of infertile fernlands & former pineapple production areas; siltation banks of makatea outlets around taro plantations; concentric limestone cliffs & caves; swamplands; makatea wildlife; habitat for the tanga'eo (Mangaian kingfisher)

Islands	*Topographic & environmental features*

SOUTHERN GROUP

Atiu	**Topography** Low volcanic (72 m) surrounded by makatea; raised island; volcanic plateau; limestone caves & cliffs; swamplands on the lower inland slopes
	Reefs Fringing reef, narrow reef flat
	Environmental features Classic erosion features similar to Mangaia; limestone cliffs & caves; swamplands; makatea wildlife; habitat for the kopeka (Atiu swiftlet)
Mitiaro	**Topography** Low volcanic (15 m) surrounded by makatea; raised island; freshwater lake with fertile outcrop mounds
	Reefs Fringing reef with narrow reef flat
	Environmental features Freshwater lake with freshwater eels; habitat for the Kerearako (Cook Islands warbler); some of the few remaining sandlewood trees.
Mauke	**Topography** Low volcanic (29 m) surrounded by makatea; interior escarpment forming interior catchment area; an uplifted island
	Reefs Surrounded by a fringing reef with a narrow reef flat
	Environmental features Interior escarpments; limestone cliffs & caves; swamplands & a makatea wildlife
Aitutaki	**Topography** Almost-atoll (124 m) cone partially submerged rising from about 4,000 m depth
	Reefs Barrier reef; large lagoon 66 sq km; 10 sq km reef flat plus 12 motu, with 2 volcanic islets
	Environmental features Coastal zone; lagoon; the habitat for the kuramo'o (lorikeet)
Manuae	**Topography** Atoll, about 10 metres in altitude; 2 islets & a shallow closed lagoon.
	Reefs Fringing reef with a single boat passage
	Environmental features Lagoon; turtle nesting site

Islands	*Topographic & environmental features*

SOUTHERN GROUP

Palmerston	**Topography** Atoll, up to 5 metres in altitude; 8 main islets
	Reefs Fringing reef
	Environmental features Coastal zone; major nesting ground for green turtles; lagoon
Takutea	**Topography** Low lying sand-cay up to 5 metres in altitude, elongated
	Reefs Fringing reef
	Environmental features Major seabird breeding ground; turtle nesting site

NORTHERN GROUP

Manihiki	**Topography** Atoll, up to 5 metres in altitude; pentagonal shape with 2 large islets **Environmental features** Coastal zone, seabird breeding ground, turtle nesting; lagoon; stocks of blacklip oyster
Pukapuka	**Topography** Atoll, up to 5 metres in altitude
	Reefs Closed reef with artificial passage
	Environmental features Green & hawksbill turtle nesting site; blacklip pearl oyster; lagoon; trochus introduced
Rakahanga	**Topography** Atoll, 5 metres in altitude; rectangle shape
	Reefs Closed reef
	Environmental features Green turtle nesting site; lagoon
Penrhyn	**Topography**: Atoll, up to 5 metres in altitude
	Reefs 3 natural passages, largest lagoon
	Environmental features Coastal zone; lagoon; green & hawksbill turtle nesting site; natural stocks of blacklip oyster
Nassau	**Topography**: Sand-cay, up to 9 metres in altitude; a few dunes; narrow reef flat

Islands	*Topographic & environmental features*
NORTHERN GROUP	
Suwarrow	**Topography** Atoll, up to 5 metres in altitude **Reefs** Algal ridge; broad reef flat (100-800 m); active lagoon flushing; one natural passage **Environmental features** Major seabird breeding area, a National Park, turtle nesting site; lagoon; natural stocks of blacklip oyster

Source Conservation Service Office

APPENDIX 2

Summary of selected fauna

Fauna	*Description*
Mammals	**Terrestrial mammals** Introduced species such as pigs, dogs & cats; flying fruit bat; Pacific rat; ship rat & the Norway rat
Crabs	Butcher land crab; coconut crab; banded prawn-killer
Seabirds	White-capped noddy; red-footed booby; great frigate bird; brown booby; tropic birds; sooty tern; brown booby; least frigate bird; masked booby.
Landbirds	Rarotonga starling; Cook Islands fruit-dove; the Pacific pigeon; Rarotonga flycatcher; Mangaian kingfisher; the Cook Islands warbler (found on Mangaia, Mauke, Mitiaro & Atiu); Atiu swiftlet; lorikeet of Aitutaki; Indian mynar; golden plover; migratory long-tailed cuckoo; wandering tatler

Source Conservation Service Office

APPENDIX 3

Cook Islands Conservation Service : Recommended programmes & staffing

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Recommended programmes

Management Unit: Administration & Environmental Planning

Implementation Unit:Awareness & Training

Natural Heritage: Wildlife

Cultural

Research

Waste & Pollution Control

Staffing needs

Management Unit

Chief of Management
Senior Administration Officer
Secretary
Computer Operator
Outer Island Officers (Mangaia; Atiu; Aitutaki; Mauke; Manihiki; Penrhyn)
Senior Planning Officer
EIA Officer

Implementation Unit

Chief of Implementation
Senior Education Officer
Publicity Officer
Information Officer

Natural Heritage

Senior Wildlife Officer
Wildlife Officer (Fisheries)

Wildlife Officer (Botanist)
Park Ranger
Senior Coastal Zone Management Officer
Soil Conservation Officer

Cultural

Senior Cultural Officer
Cultural Officer (Herbal)
Cultural Officer (Archaeologist)

Research

Research Co-ordinator

Waste & Pollution Control

Waste Control Officer

Currently, the Service has employed a total of six trainees to fill some of the positions above in Wildlife (General); Wildlife (Fisheries); Wildlife (Botanist), Education (Overall); the remaining two are still to be designated.

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