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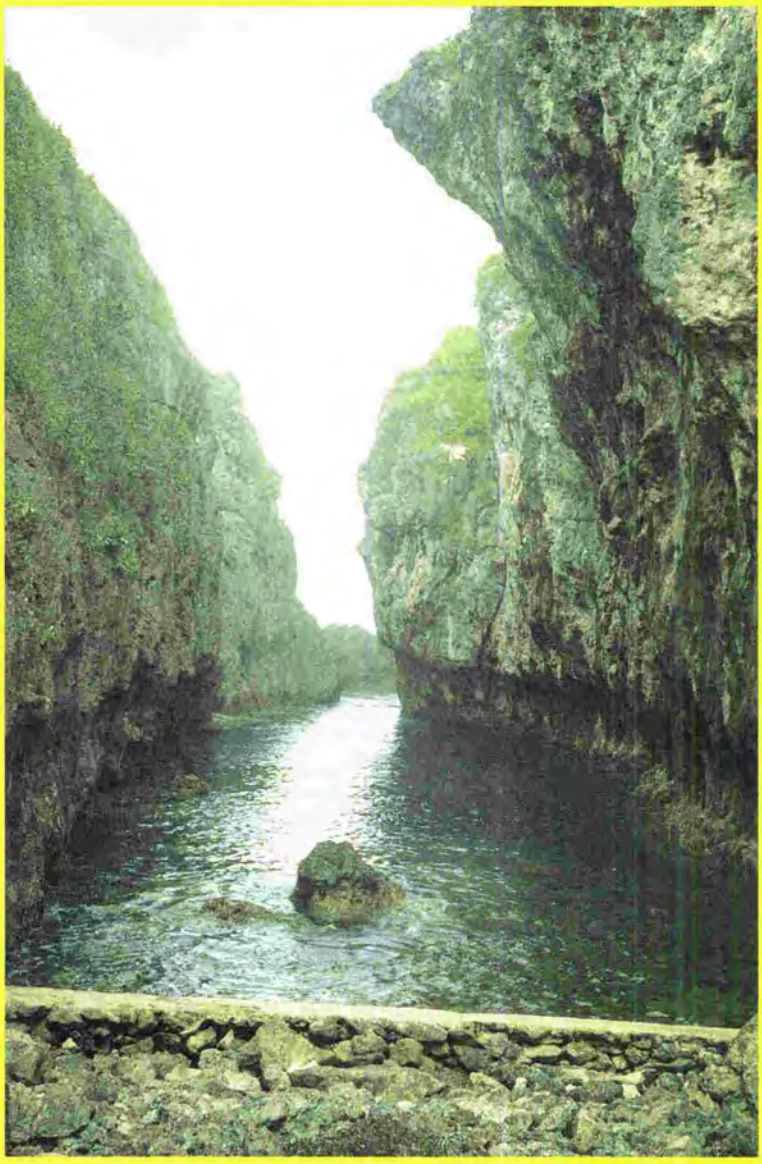
State
Of the
Environment
Report

Niue



Niue

***S**tate*
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1993

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Cover photograph: Matafpa Chasm is one of the many scenic features of Niue's environment that makes the island so attractive to locals and visitors alike.

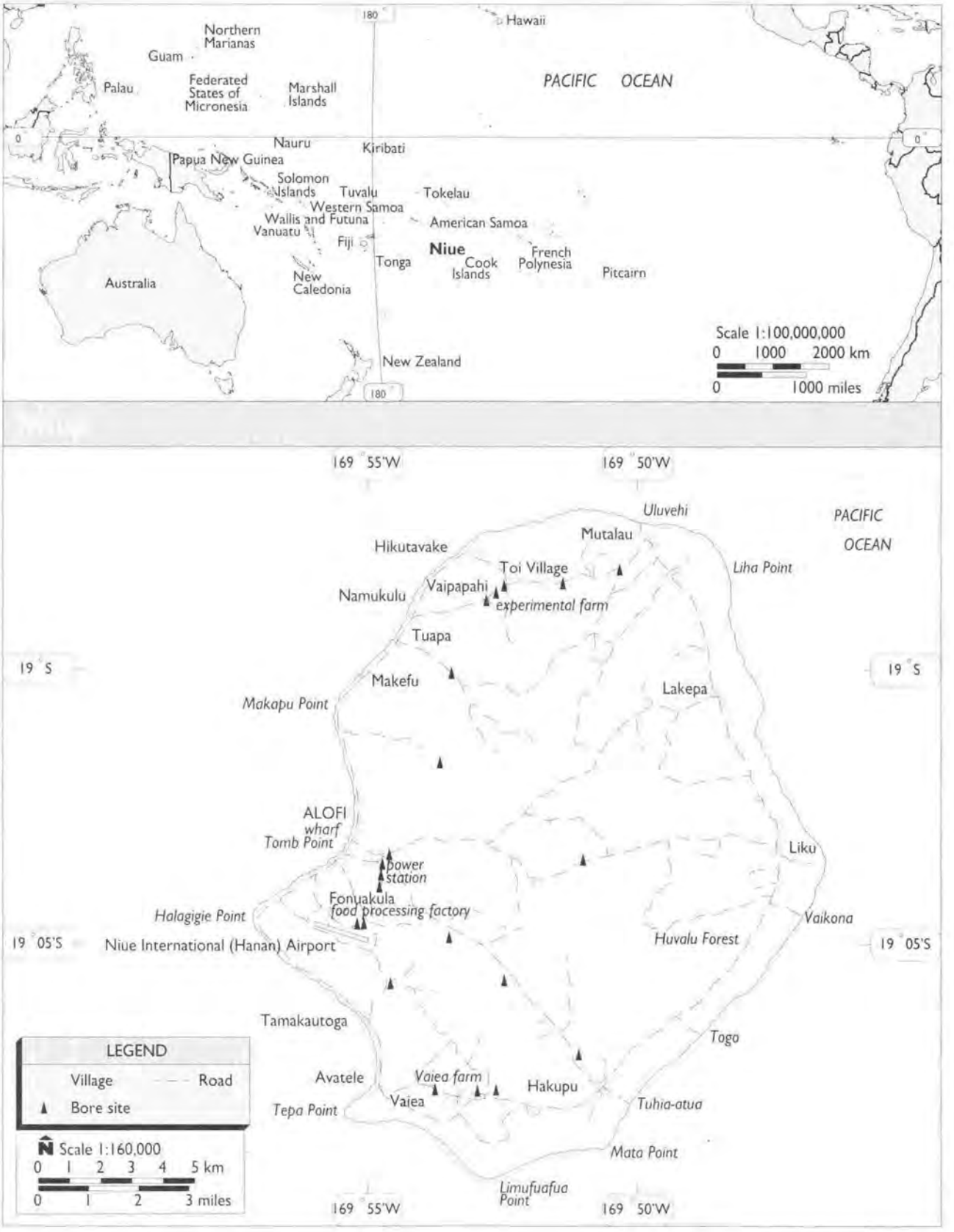
Niue

State Of the Environment Report 1993

Prepared by John Lane

Report for the South Pacific Regional Environment Programme as documentation in support of the Niue National Environmental Management Strategy (NEMS)

Produced with financial assistance from the United Nations Development Programme (UNDP)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Foreword

This document represents a concise report on the State of the Environment for Niue. It was prepared as a component of the National Environmental Management Strategies (NEMS) Project. The NEMS Project was instigated to address sustainable environmental development and planning issues in a number of Pacific Island countries, namely, Kiribati, Nauru, Niue, Palau, Tokelau, Tuvalu and Western Samoa. It has been funded by the United Nations Development Programme (UNDP) and implemented through the South Pacific Regional Environment Programme (SPREP) as part of a broader UNDP assistance programme called PMI: Planning and Implementation of Pacific Regional Environment Programme which concentrates on regional and in-country institutional strengthening and training of environmental managers.

The State of the Environment Report for Niue is a comprehensive reference document on the current status of the environment of Niue which should act as a benchmark against which changes to the environment can be gauged. The report summarises the current state of knowledge about the environment of Niue in areas such as terrestrial environment, marine resources, cultural and archaeological resources, and socio-economic environment, and outlines environmental challenges facing Niue. The State of the Environment Report also provides an important vehicle for raising awareness within the community about the importance of environmental issues and how these should be integrated into future decision-making processes.

I would like to thank John Lane for his work in preparing this State of the Environment Report. SPREP looks forward to working with the people of Niue and with other regional and international organisations in tackling the environmental issues identified in this report.

Vili A. Fuavao
Director
South Pacific Regional
Environment Programme

Preface

Having read this report, I am convinced that Niue urgently needs a "National Environmental Management Strategy (NEMS)" that it can implement immediately. This State of the Environment Report will serve as a basis for Niue's future development.

Our ability to survive with dignity and without total reliance on our Pacific neighbours is at stake. Our economic environment and future development rely on Niue having an intact environment. I ask you all to examine this document carefully, as the custodians of our heritage and natural resources.

If it were not for the National Environmental Management Strategy initiatives, we could possibly have overlooked the need to change our environmental management in Niue. The Government of Niue and the community have a daunting task ahead of them if they are to alter their current environmental practices.

In Niue, we want the best environmental planning possible, and we want it translated into action before further damage is done to our delicate environment. We must act now. We have the capability, and we also have many of the solutions.

We owe a sincere thanks to SPREP, UNDP and the New Zealand Representative (Niue) for this initiative and for their continuing financial support. Without such help, it would not be possible for us to attain sound environmental management and sustainable development throughout the Pacific region.

I look forward to a change in development attitudes, a change that will bring about a greater awareness of the 'Moui Faka-Niue' and its relationship to our natural resources and the beautiful environment of Niue.

The Honourable Frank Fakaotimanava Lui
Premier of Niue

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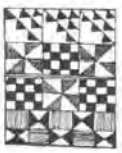


Notes The currency of Niue is the New Zealand dollar. All monetary amounts are in $NZ.
A financial year spans the period 1 July to 30 June.

Acronyms

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DAFF	Department of Agriculture, Forestry and Fisheries (Niue)
DSIR	Department of Scientific and Industrial Research
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
FFA	(South Pacific) Forum Fisheries Agency, Honiara, Solomon Islands
IAEA	International Atomic Energy Agency, Vienna, Austria
IPCC	Intergovernmental Panel on Climate Change, Geneva, Switzerland
NEMS	National Environmental Management Strategy
NVCO	Niue Village Council(s) Ordinance 1967
NZ	New Zealand
PMI	Pacific Multi Island
PWD	Public Works Department (Niue)
SOPAC	South Pacific Applied Geoscience Commission, Suva, Fiji
SPC	South Pacific Commission, Noumea, New Caledonia
SPREP	South Pacific Regional Environment Programme, Apia, Western Samoa
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
USP	University of the South Pacific

Glossary

Niuean words

fono	Prohibition placed on an area (land or sea) to protect it and its crops or resources (e.g. coconut leaves tied around fruit trees indicate both trespass and the taking of crops are forbidden).
Fono	Government Assembly.
leveki magafaoa	Trustee/s or guardian/s of the land on behalf of all the members of the family with an interest in the land.
lupe	Pacific pigeon.
magafaoa	Extended families.
Moui Faka-Niue	Niue way of life.
peka	Fruit bat, flying fox.
tapu	Forbidden, protected, placed under taboo.

General

aquaculture	The farming of marine or freshwater plants and animals.
biodiversity	The variety of plants and animals in an area. Biodiversity refers not only to the number of different species but to the full range of genetic variation within each species.
cadastral	Relating to the official register of land which shows details of ownership, boundaries and value for taxation purposes.
conservation	Managing the way people use natural resources so that they give the greatest sustainable benefit today, while keeping their full potential to meet the needs and aspirations of future generations.
degradation	The result of poor resource use which pollutes, damages or reduces the quality of resources available to future generations.
development	The introduction of new ways to use natural resources to meet human needs and wants.
ecology	Branch of biology which deals with the relation of plants and animals to their environment.
endangered species	Species that are in danger of disappearing.
environment	All the living and non-living things in a particular place or on the earth generally, and the way they interact or work together.

erosion	The wearing away of the earth's surface (for example, soil) by the action of water, wind etc.
fauna	Animals.
geology	The science of the earth, including the composition, structure and origin of its rocks.
geomorphology	The study of the physical features of the earth's surface and their relation to its geological structure.
habitat	The natural home of a plant or animal species.
indigenous	Something that originally occurred in a particular area.
introduced species	A species which does not naturally occur in a particular area but rather has been brought in from outside.
leachate	Water or other liquid which has seeped through the earth, a rubbish tip, mine waste etc., and hence carries impurities.
natural resource	A naturally occurring stock or supply which can be used to help meet human needs and wants.
nutrient	A substance providing essential nourishment for the maintenance of life.
pelagic fish	Fish that live in the open ocean rather than close to shore.
planning	Developing a detailed method by which something is to be done.
productive, productivity	The capacity to produce something of benefit, for example, crops, goods, services, craft, art etc.
public sector	Activities and enterprises run by government.
recycle	To convert something to reusable material instead of throwing it away.
remittance	Money transferred between countries, for example, Niueans abroad sending money to their families at home.
resource	A stock or supply which can be used to help meet human needs and wants.
species	A scientific name given to each different type of animal or plant.
strategy	A plan to help achieve certain goals.
subsistence	Producing mostly for own consumption, for example, farming which directly supports the farmer's household without producing a significant surplus for trade.
sustainable	Using a resource in such a way that its supply and quality are maintained indefinitely into the future.
terrestrial	Relating to the earth.
toxic	Poisonous.

Executive summary

The State of the Environment Report for Niue was commissioned by the Government of Niue and sponsored by the South Pacific Regional Environment Programme as part of the process of developing a National Environmental Management Strategy (NEMS) for the island. This Strategy will form the basis of the government's ongoing environmental policy and project work and will set priorities for resource allocation in the future.

The State of the Environment Report will provide basic background information on Niue's various environmental sectors and in this way will support the development of the NEMS. In addition, it is a source of general and educational information about features of Niue's environment and issues that need addressing. One critical issue that has limited the scope of this report is the inadequate level and availability of data to support environmental planning and policy. This report is a "desk" study based on the limited information provided by available references and comments on the programmes and priorities of government agencies. The need for maintaining and publishing important environmental information is an issue that should be addressed in the NEMS.

The purpose of this executive summary is to highlight the identified issues in relation to the different environmental sectors covered later in the report.

Geomorphology

The coral atoll origins of Niue have left it with spectacularly scenic coastal areas but with soils limited in depth and fertility. Thirty to forty per cent of Niue is unsuitable for agriculture. However, the land and seascapes, provided they are not damaged or destroyed, are very positive features upon which to base tourism. Mineral and earth materials are limited to the provision of rock and sand for domestic construction needs. The physical structure of the island has led to the existence of an extensive subterranean fresh water lens which supplies nearly all Niue's domestic and stock needs. This water needs protection from contamination caused by inadequate disposal of human and animal wastes and the application of agricultural chemicals. Water quality is also affected by extensive clearing of forest areas for agricultural production, and monitoring for a range of likely pollutants needs to become a priority.

Climate

Niue's tropical marine climate provides relatively constant climatic conditions throughout the year. The island is subject to both tropical cyclones, which have caused substantial damage in the past, and occasional droughts. Climate change may lead to more frequent and severe storms which will have significant land use planning implications in terms of structural design and location of facilities close to the edge of the island's sea cliffs.

Flora and fauna

Niue was originally covered in dense tropical rainforest. Much of this forest has now been replaced by extensive areas of fern-dominated shrubland and regenerating forest. While Niuean plant species have been researched and documented, there has been no recent work done on the relative abundance and distribution of species. Between 1966 and 1981 the area of quality forest was reduced by about 42 per cent as a result of clearing

for agriculture. Vegetation clearance and maintenance of plant biodiversity are important issues requiring attention.

Naturally occurring fauna on Niue is limited in species variety, and the abundance of most species is unknown. The coconut crab, important as a food species, is known to be under pressure from over-exploitation and habitat loss. The fruit bat (flying fox or 'peka') is one of two naturally occurring mammals which is hunted and likely to have only a small population. Of the 25 bird species, the Pacific pigeon ('lupe') has also been hunted to the extent where it is now considered uncommon.

A flora and fauna management programme is needed to ensure remaining species continue to thrive. Agricultural and forestry programmes should be designed to protect and enhance remaining natural environmental values.

Marine environment

Niue's inshore fishing resources are relatively limited and boat access is very restricted. The country has some potential offshore resources on distant reefs but there is currently no capacity to fish these areas. Fishing is essentially carried out on a subsistence basis except by foreign vessels under licence. The potential to over-exploit limited resources is increased by the gradual change from the use of traditional craft and equipment to motor boats and modern equipment.

Population

The population of Niue is small and has declined substantially since the mid-1960s when many people chose to live in New Zealand. Niue's major population issue is the maintenance of a viable "living" community. Programmes to encourage people to stay, or return, need to be based on an assessment of the population capacity of the island's resources and the economic capacity to maintain desired standards of living.

Economic management

Niue's economy is substantially dependent on overseas aid principally provided by New Zealand. Recent substantial reductions in aid levels have led to reductions in employment and greater reliance on the subsistence sector. The government has only a very limited capacity to fund environmental protection projects, and the key issue is to ensure that traditional family and village social structures are used to help implement environmental programmes.

Environmental management

Responsibility for environmental management is split between a number of agencies. The government's Environment Unit comprises one staff member who has only a coordinating role. The effectiveness of this arrangement and responsibility for implementing the NEMS programme needs consideration. An important role the Environment Officer could undertake is the development and implementation of an environmental monitoring programme which draws on information collected by other agencies and establishes monitoring systems in those sectors where none currently exist.

Waste management and pollution

Management of solid and chemical waste and guarding against pollution, particularly contamination of groundwater and oil spills in the marine environment, are major concerns in this sector. Niue has a good domestic waste collection system which includes a can recycling programme. Better management of waste disposal areas is necessary together with facilitation of waste reduction and recycling of a wider range of waste products. Both hospital wastes and waste oil are managed in an unsatisfactory way at present.

Water and sanitation

The water supply is dependent upon the groundwater lens. This source is currently subject to possible contamination through a number of land use practices and requires a reliable electrically powered pumping system to make it accessible. Greater use could be made of rainwater by re-establishing the village catchment system and setting the objective of each house having its own catchment tank.

Sanitation is maintained by the use of septic tanks and water sealed pit latrines, although in some cases pit toilets are still used. Niue needs to establish a programme to ensure effluent from the sanitation system does not contaminate groundwater.

Education and information

Niue has begun to incorporate environmental themes into school and community awareness programmes. Public awareness of many environmental issues is already relatively high. The importance that education plays in achieving environmental objectives cannot be overstated, and a targeted programme is needed to gain public acceptance of NEMS priorities.

Environmental law

The laws of Niue are currently inadequate to deal with a number of important environmental issues. In particular, legislation relating to pollution, vegetation management and land use planning (including Environmental Impact Assessment) needs to be prepared. A new Environment Management Bill is currently in draft form and this should be closely examined to ensure it provides all powers necessary for dealing with Niue's environmental concerns.

Chapter 1

Introduction

It is not surprising that people in the South Pacific are aware of critical environmental issues. People who live in larger countries are more able to insulate themselves from the effects of environmental degradation and have a tendency to delay resolving existing problems. On a small island such as Niue, people are more directly dependent on their environment to provide life's essentials and they are, therefore, more attuned to the need to protect natural resources and environmental values that support their cultural and economic needs. Therefore, when something goes wrong it usually becomes obvious in a short time and the impact is quickly felt. There is, however, a limited understanding of the implications of some environmental issues, and adequate public education is essential to bring about a better understanding of these issues.

Many of the environmental issues that Niue needs to deal with are a direct result of a rapid move to a consumer lifestyle and the use of modern equipment and techniques to undertake traditional activities such as fishing, agriculture and forestry. The effects of these changes (which have brought some positive benefits in terms of living standards) include the unsustainable use of Niue's natural resources, difficulties in disposing of a wide range of hard-to-manage wastes, the prevalence of

Niue's rugged and attractive coast is a great asset and one that needs to be protected for present and future generations.

a range of "lifestyle" diseases, and pressure to change cultural values and practices. The adoption of this consumer-oriented and technological lifestyle has occurred without any preplanning or assessment of its likely impact. The economic and developmental changes, although rapid, have been incremental and it is impossible to say at which point the problems arose. There is now recognition that an action strategy is needed to address the most pressing issues and to avoid others which may arise as economic development progresses.

The Government, with the assistance of the South Pacific Regional Environment Programme (SPREP), has decided to prepare a National Environmental Management Strategy (NEMS) which will be the priority action plan for addressing Niue's environmental problems. The process of preparing the NEMS includes an identification of environmental values requiring protection and a statement of what is currently known about the environment of Niue. This is the purpose of a state of the environment report and this report, together with the community consultation which has already occurred, will provide a base for preparation of the NEMS.

It would be best if knowledge of the environment was complete before planning and development decisions are made. Unfortunately this is a luxury no one can afford. The best that can be achieved is a thorough examination of available data and taking every opportunity to increase the level of knowledge. This report is limited in scope for the reason that it is essentially a "desk" study which has consolidated information previously reported and, in addition, it includes information provided by the Government of Niue and private organisations through direct discussions and sector reports prepared for the NEMS Seminar held in May 1993. The base source document used is the report prepared by the Government of Niue for the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in June 1992 (Government of Niue 1991). Additional texts, where they exist, are quoted in each relevant section and are included in the References. These sources should be referred to for a more detailed review of various sectors.

PART I
Natural environment

Chapter 2

Niue's place in the world

2.1 Geography

Niue is part of Polynesia and is located in the south-west Pacific Ocean at approximate coordinates of 19° south and 169° west. It is approximately 480 km east of Tonga, 930 km west of Rarotonga (Cook Islands) and 660 km south-east of Western Samoa. Niue is known as the largest and highest coral atoll in the world with a land area of 259 sq km. Its Exclusive Economic Zone (EEZ) covers approximately 390,000 sq km.

2.2 Government

Niue is an independent, self-governing state in free association with New Zealand. The General Assembly of the United Nations recognised Niue's act of self-determination on 13 December 1974. Niue is a parliamentary democracy and its government consists of a 'Fono' (Assembly) of 20 members, a Premier (elected by the Fono), a Cabinet (Executive) made up of the Premier and three ministers (whom the Premier selects from amongst the members of the Fono), and a Judiciary. The Fono is Niue's supreme law-making authority. Elections are held every three years under a system of universal suffrage.

2.3 Economy

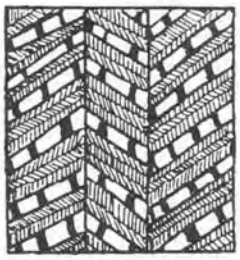
Niue has a mixed subsistence and cash economy. The cash economy is characterised by a very wide gap between domestic production and goods and services demands, making the country heavily dependent on foreign aid which is provided, in the main, by New Zealand. The official currency of Niue is the New Zealand dollar.

2.4 Population

The population was estimated at 2,443 in June 1993 although about 15,000 Niueans live in New Zealand or other places. The modern resident population of Niue has fallen from a high of about 5,194 people in 1966. Under the agreement of free association with New Zealand, all Niue citizens are also citizens of New Zealand.

Chapter 3

Geomorphology

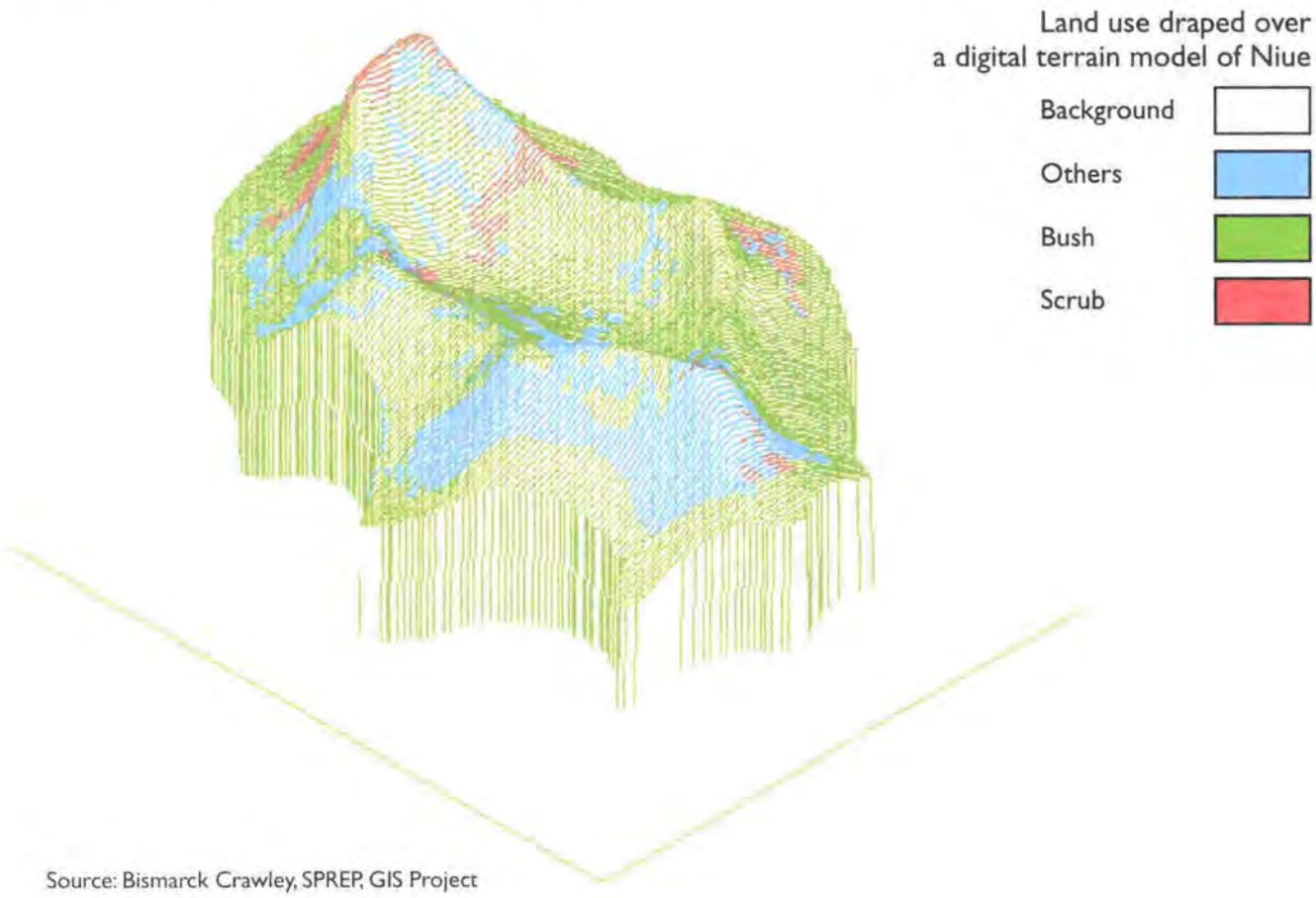


3.1 Island formation and geology

Geology

Niue comprises a single up-thrust coral atoll which, over geological time, has emerged in stages out of the ocean. Two theories have been put forward to explain this occurrence. The first suggests the forces derived from internal volcanic activity, while the second suggests the up-lift was caused by buckling of the Pacific tectonic plate prior to its subduction into the Tongan trench. Changing sea levels would also have altered the relative level of the shoreline over time. The atoll has three terraces, with the rim of the lower terrace averaging 28 metres above sea level while the upper terrace averages 69 metres above sea level. Below the current sea level are two further terraces indicating previous shorelines. The former atoll would have

Figure 3.1 Three-dimensional view of Niue



Source: Bismarck Crawley, SPREP, GIS Project

Wharf at Alofi. Niue's rugged coastline makes this one of the few places for ships to offload cargo.

contained a shallow lagoon in its centre and the slight depression found in the centre of the island is what remains of this lagoon. Surface geology consists of highly eroded and fissured coral limestone. This karst (limestone) landscape features jagged rocks and boulders with many crevices and holes, and, apart from short, sharp rises between the terraces, the island can generally be described as flat. The limestone making up the core of the atoll is thought to be of the Pliocene age (geologically young) and has been drilled to a depth of 200 metres.

Coastline

The island's coastline is spectacularly rugged and rocky. The top of the first terrace rises directly from the sea, and the resulting cliffs, which virtually encircle the island, contain many caves, chasms and blowholes. Access to the shoreline is generally limited to walking tracks (sea tracks) although in three places vehicles can be driven near to the water's edge. One of these places is at Alofi where a small concrete wharf has been built. A channel has been constructed through the narrow, fringing coral reef surrounding the island to service the wharf but it is not navigable by larger ships which must stand offshore and unload cargo by barge or launch. Bulk liquids are transferred by floating pipe.

The coastal scenery and coral reefs of Niue constitute an attractive and valuable resource for a small but increasingly important tourist industry. Protecting and managing this resource (particularly the coral, and cave decorations which can be easily damaged) is a major issue and, in this regard, much can be achieved through educating visitors and residents.

3.2 Minerals and extractive materials

Minerals

Owing to the young coral limestone that makes up the cap of Niue, it is unlikely that minerals of any economic consequence are to be found. While the volcanic geology that underlies the limestone may be more prospective, exploiting any resource by open-cut, underground or solution mining would be technically difficult in the extreme, and, almost certainly, uneconomic.

Quarries provide earth materials for construction but too many small pits can lead to an inefficient use of resources, resulting in greater areas of land being unavailable for other uses.

Anomalous levels of the radioactive elements radon and uranium have been detected in groundwater and soil samples but at levels below those acceptable by health authorities for drinking water. In recent times these anomalies have been investigated by a private mining company which conducted a drilling programme in 1979 and by a consultant geologist from the International Atomic Energy Agency (IAEA), also in 1979.

The IAEA report concluded:

> Measurable quantities of both uranium and radon are present in the fresh water lens of the island. These can be related to the leaching of radioactive elements from the surface soils by rain water and their downward percolation through the rocks. The quantities of these elements, while unusually high for a coral island, are low in terms of absolute abundance, are entirely natural and should present no hazard to the water supply in the fresh water lens. (IAEA 1979)

From the interpretation of the geological processes at work the IAEA consultant also concluded that the presence of any uranium deposits was "extremely doubtful".

As Niue sits upon a seamount and the ocean depths surrounding it are as much as 4,000 metres, scientists from the South Pacific Applied Geoscience Commission (SOPAC) estimate that there is little likelihood of finding minerals within the EEZ as sedimentation rates are not rapid enough (Government of Niue 1991, p. 18).

Extractive minerals

Extractive materials are taken for construction and road-making purposes from a number of pits and quarries around the island. The main issue with regard to extractive materials is the unnecessary number of small pits. In part this is caused by individual landowners establishing pits on their land rather than obtaining earth material supplies from a smaller number of larger pits. Old pits are not generally rehabilitated and this tends to sterilise these areas in terms of their future use as agricultural land.

Future quarries should be subject to a development approval process which would include an assessment of their environmental impact, and rehabilitation made a requirement.

3.3 Soils and land capability

Soil, in general, is limited in availability, often too alkaline for many agricultural plants, porous, and low in some chemical elements critical to soil fertility (particularly nitrogen, potassium and the trace element zinc) and, as such, is typical of most coral islands. A combination of large areas of exposed rock (boulders and pinnacles) and poor quality soils means that about 30 to 40 per cent of Niue is unsuitable for agriculture. Broad scale agricultural production is limited, although good quality forests and typical Pacific food plants are successfully grown.

Soil improvement, usually through mulching of plant material (to keep the level of organic material in the soil high), is required to support horticultural use. Under the traditional slash and burn agricultural techniques (still the usual farming practice), cropped areas must be left for up to ten years before being reused. Use of chemical fertiliser is encouraging shorter rotation periods.

Soil information is well documented and is proposed to be accessed through the computerised land information system of the Department of Lands and Survey. The report of the Niue Soil and Land Use Seminar held in October 1979 (with papers published in 1980 by the New Zealand Department of Scientific and Industrial Research [Miller 1980]) provides a detailed discussion of soil structure, fertility and location. This report contains a "one inch to the mile" map of soil types in Niue.

3.4 Groundwater system

Niue relies heavily on its extensive groundwater resource as a source of water for domestic and agricultural purposes. There is no surface water on the island. The groundwater resource consists of a "lens" which, because of chemical and physical differences between salt and fresh water, floats on the sea water which surrounds and lies underneath Niue. The volume of fresh water is such that it can displace the salt water it sits on, allowing fresh groundwater to extend below mean sea level. Less porous limestone on the outer edge of the island restricts lateral flows of fresh water into the sea.

The groundwater resource has been well surveyed on at least six occasions since 1959, with an extensive survey being undertaken in 1985. The UNCED report (Government of Niue 1991) provides a discussion and summary of these surveys. The resource is limited and over-pumping could lead to salt water intrusion although pumping is at present well below the theoretical capacity of the resource. All pumping sites have been mapped and are included on the land information system operated by the Lands and Survey Department.

Water quality

The water quality of the lens is naturally suitable for drinking and is currently piped untreated to all villages. However, owing to the porous nature of the overlying geology, the resource is susceptible to pollution from wastes disposed into the ground. A 1991 test identified coliform bacteria in some samples, prompting the issue of a warning to users to boil all drinking water. Most houses have a septic tank or water sealed pit latrine, although unsealed pit latrines (sometimes utilising natural sinkholes) still exist. Effluent from these facilities could pollute water supplies.

The impact of vegetation clearance on the groundwater system is unknown, but it is likely to increase the inflow rates and reduce quality.

The use of weedicides and fertilisers in the agricultural sector is of immediate concern. The possibility of hazardous chemicals infiltrating the water supply is not to be taken lightly. The government has expressed concern over this issue and has

Niue's domestic water is pumped from the groundwater lens into storage tanks before being reticulated to the villages.

established a Pesticides Committee to monitor the importation and use of agricultural chemicals. It is vital that there is adequate public education about both the dangers that such chemicals pose to health and the importance of strictly observing the manufacturer's instructions for the use of agricultural chemicals.

The key issue in relation to Niue's water resource is water quality. Regular monitoring and reporting will provide a warning if quality drops below acceptable standards, and, over time, it will also provide valuable information to aid land use decisions. Monitoring should aim to determine:

- biological content, in view of the sanitation methods in use;
- chemical content, given the possible infiltration of agricultural chemicals;
- salinity, in view of the possibility that over-pumping could disturb the sea and fresh water balance; and
- radioactivity, given the anomalous readings previously discussed.

Climate

4.1 Climate description

Niue is located on the edge of the southern tropical cyclone belt and in the zone of the south-east trade winds. The island has been subject to severe cyclones on an average of one every ten years. Cyclone Ofa in February 1990 was the most recent and caused widespread damage to crops and houses as well as to the wharf at Alofi and a number of sea tracks. The corals surrounding Niue were also extensively damaged. There are two distinct seasons in Niue, the hot wet season from November to March, characterised by high temperatures and humidity, and the cool dry season from April to November. Most rainfall occurs during the wet season, often in torrential downpours and this is also the cyclone season. Niue's weather patterns are fully described in Kreft (1986).

Temperatures

Temperatures in Niue do not vary a great deal and this is a typical feature of the modifying influence of the sea on a small low-lying island. At the height of the wet season the mean daily maximum air temperature is 30°C (January/February) with a mean daily minimum of 23°C. The maximum temperature ever recorded was 34°C. In the dry season the lowest mean daily maximum is 26°C (July) with a mean daily minimum of 19°C. Sea surface temperature varies between 24°C and 28°C, winter to summer.

Relative humidity

Relative humidity is a measure of the moisture content of the atmosphere. The average monthly relative humidity at 7.20 a.m. varies from 85 to 90 per cent throughout the year. The variation is greater during the day with the relative humidity being some 10 per cent lower early in the afternoon compared with the morning.

Rainfall

Rainfall is moderate for a tropical area, with an average annual fall of around 2,000 mm. However, variability is large from year to year, with an annual range of between 839 mm and 3,300 mm. While rainfall is concentrated in the wet season (68 per cent of rain falls during this time), the annual pattern is erratic, with very dry or very wet months possible at any time of year.

Wind

Wind blows predominantly from the north-east to south-east sector consistent with Niue's location in the south-east trade winds belt. The strongest winds usually come from the north-west/north-east sector, particularly in the first four months of the year, coinciding with the wet season tropical storms that pass to the north of Niue.

4.2 Climate change

The impact of the greenhouse effect and possible sea-level rise is of major concern to people of the South Pacific. While Niue does not share the same concerns about sea-level rise as the (true) atoll countries or those places heavily dependent on low-lying coastal plains, it will be affected by other predicted consequences of climate change. The predicted increase in frequency and severity of tropical storms and cyclones is of particular concern.

Early predictions of the impact of the greenhouse effect on global temperatures, and consequential sea-level rises and changed weather patterns are now considered to be too extreme.

The most respected current estimates are those of the Intergovernmental Panel on Climate Change (IPCC) in 1990, updated in 1992, which suggest an approximate rise in global temperature of 2°C by the year 2050 and a sea-level rise of about 0.36 metres by the same year. IPCC tempers these figures by suggesting possible variations of ± 0.15°C for temperature and ± 0.3 metres for sea-level rise predictions.

There now appears to be general acceptance that global temperatures are increasing; however, there is still a considerable degree of debate over how much they are rising, the cause (human activity or a natural cycle), and the likely impact any changes might have on weather patterns or global sea levels. In addition, there is also a limited understanding of the implications of these predicted global changes in regional areas such as the Pacific.

Most observers agree that the threat of climate change is not so imminent as to require precipitous action; however, it is important to begin planning for possible impacts. In Niue, the most likely detrimental impacts that could be expected are:

- changes in the performance of the water lens;
- increased frequency and severity of storms and cyclones; and
- greater levels of coastal erosion and increased storm damage to infrastructure, particularly that located near the cliff edges.

IPCC has prepared a common methodology for the assessment of vulnerability to climate change. One of the seven steps in this process requires the identification and specification of response strategies, or possible measures a country can take in the face of climate change. The four response strategies identified by IPCC are:

(1) do nothing;
(2) retreat;
(3) protect; and
(4) accommodate.

Relative to many other South Pacific countries Niue has more choices in responding to the threat of climate change. Planning for change is the action required in the short term.

Chapter 5

Flora and fauna

5.1 Flora

5.1.1 General

The isolation of Niue from other land masses, together with its soil quality, has limited the variety of naturally occurring flora. Introduced species are also limited, owing to the few places from which the original Niueans came and (until recent times when plant quarantine restrictions have been put in place) the relatively few visitors. A botanical survey of Niue was carried out in 1965 and reported by W. R. Sykes (1970) in a publication by the New Zealand Department of Scientific and Industrial Research. This research is the best guide to plants in Niue.

5.1.2 Vegetation cover

A series of surveys to determine vegetation cover were carried out under the Niue forestry programme using air photos taken in 1966 and 1981. The purpose of the surveys was to assess the extent and quantity of potentially merchantable timber on the island. Table 5.1 shows the change in cover under four vegetation types between the two survey periods. The 1981 areas have been mapped at a scale of 1:50,000. The main merchantable species consist of Kafika (*Eugenia inophylloides*) and Kolivao (*Eugenia richii*).

Niue contains some splendid forest areas but this is a resource which is under threat from clearance for agricultural production.

Table 5.1 Niue vegetation types by area, 1966 and 1981

Vegetation type	1966 (ha)	1981 (ha)	% change
Open areas	3,200	7,800	+144%
Coastal forest	2,500	3,000	+ 20%
Light forest	14,000	12,000	– 14%
Merchantable forest	5,500	3,200	– 42%

Source: Government of Niue 1990

The surveys clearly show that the area of quality forest is concentrated in the triangular area of the island contained by the villages of Alofi, Lakepa and Hakupu. The largest block is the Huvalu Forest between Hakupu and Liku. Apart from a solid coastal belt of vegetation, where the surface geology makes access very difficult, the majority of Niue is vegetated with regenerating forests and large areas of shrub and fern lands.

Open areas

Open areas are those with no continuous canopy cover of scrub or forest vegetation.

Coastal forest

Coastal forest includes those areas between 200 and 800 metres from the coast with generally good cover and species composition but vegetation is usually stunted from salt exposure. Ground access is difficult.

Light forest

Light forest includes those areas that have previously been used for cultivation but have reverted to forest, and predominantly cultivated areas in various stages of reversion.

Merchantable forest

Merchantable forest includes those areas which contain commercially millable forests. It includes areas of low volume timber (which border or include old garden areas) and old growth forest with mature trees.

The period over which Niue's population rapidly declined (peaking at approximately 5,000 in 1966) was, surprisingly, the same period over which the large reduction of quality forest took place. No data exist to demonstrate changes in the last ten years; however, it is likely that the establishment of an export taro programme has led to further clearing. It is estimated that only about 250 hectares have been cleared for forestry purposes, and the bulk of land has been cleared for agriculture.

Continued monitoring of the vegetation cover is required. It is possible that a satellite mapping project will be undertaken shortly which will complement the vegetation surveys previously mentioned. In addition to these broad surveys, there is a need for more detailed baseline surveys to determine species composition and extent. The Forest Survey (Government of Niue 1990) did limited population counts for some species.

5.1.3 Vegetation management

Vegetation management is at present limited to either agricultural or forestry production. Current information does not exist on vegetation cover or species range and distribution. However, extensive clearing over the last 30 years has substantially reduced the area of forest. This has been assisted by the use of bulldozers in clearing operations.

It is reasonable to suggest that there is already more than sufficient cleared land available for agricultural or forestry production to support Niue's needs and any export industry that may develop in the future. Given the nature conservation values of the remaining areas of quality forest and the importance of the remaining forest areas to the tourism industry, these areas should be managed for

The walk into Togo Chasm shows the variety of plant communities in Niue. From dense forests and coastal scrublands, visitors soon find themselves in a coconut grove deep within this narrow limestone chasm.

more than just their timber or potential agricultural values. The issue of land clearance is one that needs to be urgently addressed.

5.2 Fauna

5.2.1 Birds

From the study undertaken by Kinsky and Yaldwyn (1981) it is known that there are 25 confirmed species of birds found on Niue (see Appendix 2). Given that Niue is of recent geologic age and was formed in isolation from other land masses, all resident birds must have reached the island over water. All these birds are of western Polynesian origin and most would have originated in Tonga or Samoa.

The Polynesian triller and Polynesian starling have evolved into distinctive subspecies on Niue but all other birds are found elsewhere in the Indo-Pacific region. The Pacific pigeon is hunted during a set season (December to March) and there is concern about its population levels. In the Kinsky and Yaldwyn report the pigeon was considered "not very common", and the blue crowned lory and the spotless crake (or sooty rail) are considered uncommon or rare.

A new survey of Niue's birds is to be undertaken shortly and this will demonstrate the impact of changes to bird habitat which have occurred since the earlier survey work.

5.2.2 Mammals

There appears to be very little information about mammals and other land vertebrates on Niue. A 1969 report by Wodzicki and the 1902 recordings of Smith fill some of the gaps in knowledge. The fruit bat and the Polynesian rat are likely to be the only indigenous mammals but both appear to have small remaining populations. There is a range of introduced mammals, mostly domesticated, but some have become feral. Of these, cats and rats are having a significant impact on the populations of other animals including birds, reptiles and crabs, and feral pigs are having an impact on vegetated areas. Niue's rugged landscape will make any control measures very difficult. A cat-trapping programme is likely to be part of the proposed bird survey project.

The fruit bat, like the Pacific pigeon, is hunted for food. The bat shares the same hunting season as the pigeon. There is considerable concern about the population levels of the bat and it will be included in the proposed bird survey.

5.2.3 Reptiles, amphibians, land crabs and insects

The reptile and insect fauna of Niue have not been well reported. A butterfly study was undertaken by Miller and Miller in 1993 in Tonga, Niue and the Cook Islands, and six species of reptile were described by Wodzicki in his 1969 report. Various skinks and geckos are commonly seen, but little other information appears to be available.

The coconut crab was surveyed in detail by Schiller (1992). This crab is an important food source for the people of Niue and there is concern about its population levels. Clearing of its preferred forest habitat, over-hunting for internal, tourist and export use, and the impact of dogs have added to this concern. Schiller's report revealed that the population is quite small, estimated at less than 200,000 individuals predominantly comprising small specimens. The long life cycle of the crab, the relatively long period before females reach sexual maturity (about six years), and low repopulation rate make this species very susceptible to over-exploitation. A public awareness campaign was conducted in 1992–93 using posters, a video, crab-sizing gauges and other means to raise awareness about the declining crab population. A number of management actions have been proposed to conserve the coconut crab including;

- breeding females to be left alone;
- crabs taken to have a minimum thoracic length of 50 mm;
- exports to be banned;
- the breeding season to be closed for hunting, and dogs should not be used in hunting;
- crab sanctuaries to be established and habitat protected; and
- a monitoring programme to be maintained.

Chapter 6

Marine environment

6.1 Reef and foreshore resources

6.1.1 General

Niue is situated on a relatively barren seamount with limited access to deep-sea resources. Its inshore fishing grounds are not particularly fertile as there is little sediment and nutrient run-off. Fishing is also made more difficult by the fact that the rugged nature of the coastline restricts boat and foot access to only a few places. Despite this impediment fishing remains an important activity and marine resources make up a significant part of the diet of most people on Niue. However, these factors mean that it is unlikely any significant marine-based export industry could develop although more efforts could lead to a reduction in the importation of fish and fish products.

6.1.2 Fish (ciguatera) poisoning

Ciguatera poisoning is apparently rare in Niue although its symptoms, especially in mild form, may often be misdiagnosed as some other illness.

Ciguatera is a common organism that feeds on algae that grow on coral reefs. Reef fish take in the ciguatera organism when they graze these plants, and bigger fish, in their turn, accumulate ciguatera from preying on the smaller reef fish. The organism builds up through the food chain and when humans eat the larger predator fish they also take in the toxins.

Ciguatera is always present in low numbers on coral reefs, and health problems do not arise with fish or their predators when ciguatera populations are low. Owing to environmental circumstances that are not well understood, the ciguatera organism sometimes experiences explosive population growth and when this happens grazing fish take in many times the usual numbers of organisms, as do the predators (including humans at the top of the food chain). This is when quite serious illness can occur.

Disturbances to the reef environment are thought to be a trigger to ciguatera population explosions. Looking after the reef environment by not damaging the reef and preventing nutrient pollution of reef waters are actions that may assist in the prevention of ciguatera outbreaks. Ciguatera outbreaks can be a result of natural changes to the reef (such as storm damage).

6.2 Offshore resources

6.2.1 General

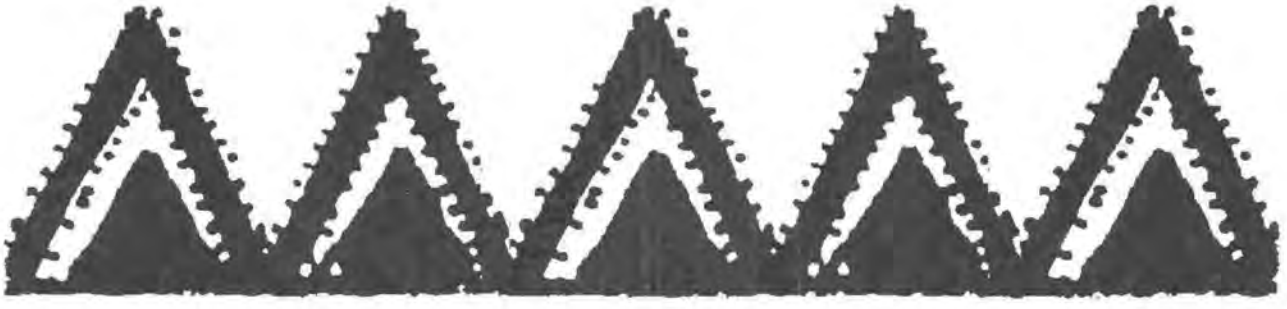
There are three distant reef systems within Niue's territory. Little is known about the resources of Antiope and Harran's Reefs and only a limited assessment has been made of Beveridge Reef which is located about 200 km to the south west. Indications are that there are extensive resources of clams and crayfish. The isolation of the reef and its exposure to the ocean are major constraints to their utilisation. More information is required to determine the sustainable level of catch from these sources.

6.2.2 Exclusive Economic Zone

Niue is not well equipped to control fishing in its extensive EEZ. It does not have a long-range fishing fleet and has only a limited capability to police fishing by foreign vessels. The main role Niue plays in this regard is as a participant with other South Pacific countries in a joint fishing agreement with the United States of America (Multilateral Fisheries Treaty) (Pacific Island States 1987). The ex-

tent to which foreign vessels illegally fish Niue's EEZ is unknown.

Little is also known of the pelagic resource in this area. It has been suggested that the only practical way to utilise this resource would be to examine research reports from vessels that have used the area in the past. If a resource is present the opportunity exists to seek foreign tenders for fishing licences which could incorporate conditions relating to reporting, monitoring and enforcement. An effective surveillance and enforcement capability is necessary for such a programme to be effective.



PART 2
Human environment

Chapter 7

Population

7.1 General

Information about population characteristics of the people of Niue and of Niueans in New Zealand was published in detail in the 1991 census report produced by the Department of Administrative Services (Government of Niue, n.d.). It is from that publication that the following information has been obtained.

7.2 History

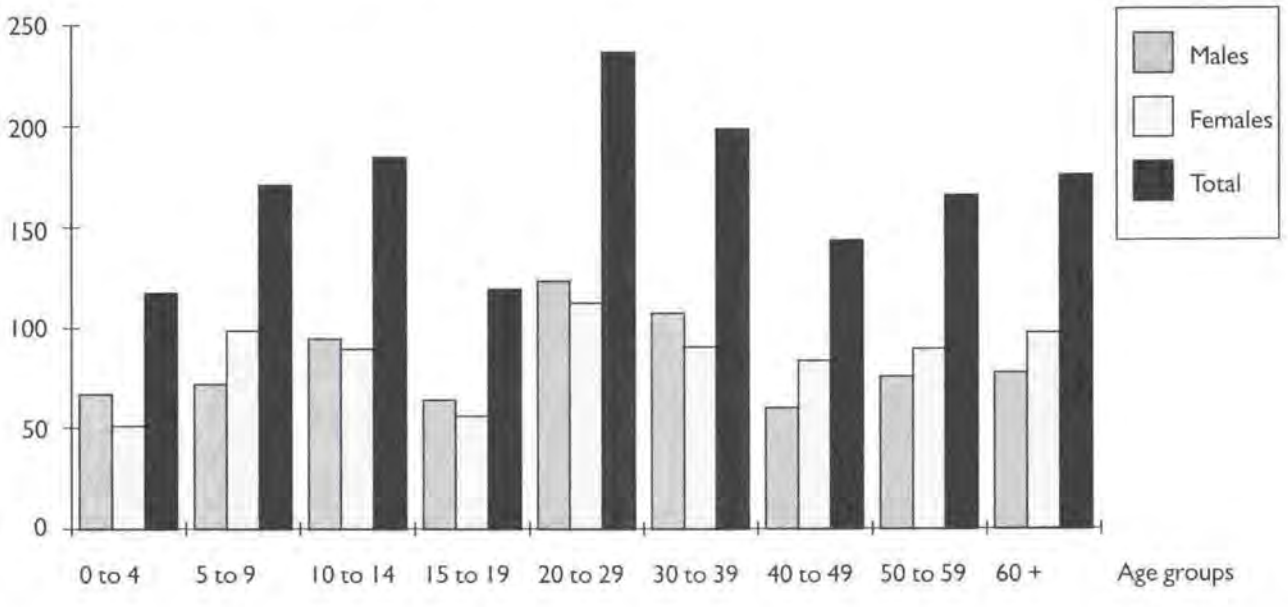
Niue is thought to have been inhabited for about 1,000 years. The first settlers probably arrived from the neighbouring Polynesian islands of Samoa, Tonga and Pukapuka in the Cook Islands. There is also a more recent Melanesian influence, especially in the southern part of the island. There appears to have been little contact between Niue and its neighbours over this time.

Niue's recorded history dates only from the mid-18th century and the period of European exploration in the Pacific. Captain Cook, on one of his three voyages to the Pacific, visited Niue in 1774. However, it was not until 1846 that the London Missionary Society established itself on Niue. The establishment of missions and more frequent visits by outsiders from the mid-19th century led to reporting of population levels.

7.3 Population structure

Population figures suggest that during the 1860s the number of people rose from around 4,300 to about

Figure 7.1 Sex–age data from 1991 census



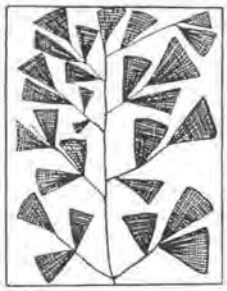
Many empty houses in villages all over Niue clearly show the decline in population levels that the island has experienced in the last three decades.

5,000 and population changes were not large for the remainder of the century. By the turn of the century the population numbered 4,015. This reduction has been put down to a combination of disease and migration (both forced and voluntary). Population figures remained static until the mid-1940s but increased to a peak of 5,194 in 1966 and since then have declined steadily as the granting of New Zealand citizenship, improved travel opportunities and better economic conditions have encouraged outward migration. In 1989 the population was recorded as 2,267. The 1991 census found a total population of 2,239 people (1,134 males and 1,105 females). This total includes 277 people who are not of Niuean descent. The New Zealand 1991 census estimates that 14,556 people of Niuean descent currently reside in New Zealand. The June 1993 population for Niue is estimated to be 2,443.

The effects of fertility, mortality and migration rates are reflected in the age–sex structure of the population. Migration has most effect on the 10 to 24 year age band. The fertility rate, or number of children a woman of childbearing age can be expected to have, has dropped from 5 (1986 census) to 3.5 (1991 census).

7.4 Population decline

Population decline is a key issue in Niue and one which the government hopes to reverse by developing the economy, social structures and infrastructure to encourage Niueans to return from overseas. The impact of population growth on the environment is not yet an issue. The resources of the island are limited, however, particularly if they are to provide the high standard of living many people now enjoy. Population planning should take into account the capacity of the environment to support the desired increase. Population impacts are now greater than they would have been only 10 or 20 years ago. Improved economic circumstances and the associated increase in consumption ensure that individuals, through everyday actions, will now have a greater impact on the environment and consume more of Niue's natural resources.



Chapter 8

Government administration

8.1 Introduction

The following sections outline the Government of Niue's administrative arrangements and describe the responsibilities of various agencies involved in environmental management. The sector analysis also highlights the environmental issues associated with the policies, programmes and projects of the agencies. Information has been drawn primarily from sector reports prepared from information provided by most departments as part of the NEMS development process. In some cases these reports included contributions by relevant business sectors and other non-governmental organisations.

8.2 Government and the private sector

Government dominates the economic and, to a large extent, social structures of Niue. The private sector is small, although of much greater significance if the subsistence sector is added to the business sector. The government's influence is considerable. It employs the vast majority of those in paid work, provides education, health and community services and funds the major development works in Niue. The Government of Niue has a policy to facilitate development of the private sector and in recent years has substantially reduced the number of its employees. Part of this action was required to reduce expenditure in the wake of reduced aid from New Zealand and part was an attempt to encourage the private sector to provide services both to the government and the public.

8.3 Other social institutions

Despite the apparent dominance of government, the role of other social institutions also has a big effect on the public. Family and village life, communal landownership and the influence of the churches determine what most people do on a day-to-day basis. In considering environmental issues and developing responses to environmental problems, there is a basic need to obtain community agreement and acceptance of proposed actions. It is not possible for government or any other group to impose unacceptable policies in a close-knit society such as that found in Niue. The role of public information and education is vital if current detrimental environmental practices are to change.

Chapter 9

Economic planning and management

9.1 General

Aid from New Zealand has raised Niue's living standards well above a level that could be sustained by the local economy alone. There have been occasional mini-booms in commodity production and manufacturing such as fruits, honey, coconut and taro (fresh and processed), handicrafts and the assembling of soccer balls, but these have tended to be short-lived. Production costs in Niue are too expensive and the volume of production too low to overcome high transportation costs and remoteness from markets. The current standard of living is maintained through aid from New Zealand and other countries, a small export sector, tourism, and remittances from Niueans living overseas.

As a backstop Niue can rely on its family and village subsistence economy. While there is little likelihood of Niue achieving economic self-sufficiency (except perhaps in the very long term), its subsistence sector provides an ability for the country to sustain itself should overseas aid be substantially reduced at some point in the future. Maintaining traditional social structures and the subsistence economy is therefore an important continuing economic objective. The subsistence sector relies entirely on a healthy environment. It is an economic necessity for all places, but particularly Niue, to protect and conserve its environmental resources.

9.2 Objectives

Niue does not have a current economic plan. A National Development Plan was prepared for the period 1980 to 1985 and the Niue Concerted Action Plan was prepared for the period 1988 to 1990 and extended to June 1991 following the need for urgent activities after Cyclone Ofa. The two plans recognised the need for continued overseas aid but aimed to strengthen Niuean society, maintain a living community and give people a sense of their productive value. The programmes associated with these plans aimed to:

- increase support for village life and rural development;
- emphasise the importance of people being active in village projects;
- strengthen village responsibilities in community activities;
- increase rural production for local and export markets; and
- develop crafts for sale and for cultural satisfaction.

Since these plans were prepared the government has had to adjust to a greatly reduced level of aid from New Zealand. Since the 1991/1992 financial year, total aid from New Zealand has fallen from $9.5 million to the 1993/1994 value of $7.0 million. Niue's total expenditure for the 1993/1994 financial year is estimated to be $13.8 million. The Government of Niue's current economic objectives are to:

(1) become independent of external aid in the long term;
(2) substantially reduce government costs (public service staff levels have been reduced from 600 to 300 over the last two years);
(3) build up a significant tourist industry;
(4) improve agricultural production to replace imports and develop specialised export produce (for example, lime production);
(5) improve returns from foreign fishing exploiting Niue's EEZ;
(6) establish a plantation forestry industry aimed primarily for export; and

(7) develop alternative energy sources to reduce reliance on diesel-powered electrical generation.

The environment is also a critical factor in the achievement of goals being set for the market or cash economy. Tourism, in particular, will depend on the maintenance of environmental values critical to that industry. Economic development and environmental protection are closely interlinked and mutually dependent. A significant issue for consideration in the development of both NEMS and the next economic plan is how to integrate the objectives and programmes of both.

Chapter 10

Community affairs

10.1 Community affairs objectives

The community affairs sector (which includes all government and non-government community groups) covers a broad range of issues aimed at maintaining a living community in Niue. The activities undertaken to promote community affairs clearly demonstrate the connection and interrelationship between culture, economy and the environment.

The objectives of the community affairs sector are to:

(1) foster national pride and retain the cultural identity of Niueans;
(2) retain traditional art skills, both visual and performing;
(3) protect sites of cultural, archaeological and historical significance;
(4) strengthen the role of women in society by promoting self-sufficiency;
(5) improve community education and training for all village groups;
(6) identify business opportunities, provide basic enterprise skills, and encourage implementation of income-generating projects;
(7) promote healthy living; and
(8) improve environmental planning and management of Niue's limited and vulnerable natural resources.

10.2 Social environment

To support these wide-ranging objectives the Community Affairs Department is responsible for a number of programmes aimed at providing social welfare and financial support to the aged, and at increasing cultural awareness in the tourist industry, through school and village programmes and the establishment of the Huanaki Cultural Centre. These activities have renewed interest in Niuean culture and traditional skills.

In addressing social environmental issues, greatest priority needs to be given to promoting self-sufficiency in terms of utilising the benefits and support provided by the extended family system. Government will not be able to afford increasing welfare expenditure and social service benefits. In this light, priority will be given to strengthening the role of women's groups and ensuring that education for women attracts greater support.

Emphasis is also being placed on home economics and family health. Such projects as the Home Gardening and Drum Oven Projects have markedly benefited village women. The Niuean Council of Women is presently encouraging the women's committees in each village to increase proficiency and production of traditional handicrafts, and the handicraft centres are also being updated.

10.3 Environmental management

10.3.1 Environment Unit

The Community Affairs Department has responsibility for coordinating environmental management in Niue, and the department includes Niue's Environment Unit. With responsibility for on-the-ground environmental management split between a number of agencies (and landowners), the key role of the unit is to prepare policy and programmes for implementation by others. With only one externally funded position, and no supporting legislation and no project budget, the unit is

limited in the work it can do. At present the work of the unit is directed at the completion of the NEMS Project. This task is supported by a NEMS Task Force made up of departmental managers of those agencies that have direct responsibility for management of the different sectors of the environment.

10.3.2 Draft environmental legislation

Draft environmental management legislation (Government of Niue 1992) has been prepared, proposing the establishment of a Conservation Service and Management Board. The legislation attempts to cover the spectrum of the physical environment including protected areas, coastal management, wildlife management and pollution control. A number of important issues need to be resolved before the current legislation can be successfully implemented. Among these are:

(1) resourcing the new administration;
(2) division of responsibility between the proposed Conservation Service and the agencies that currently manage different sectors of the physical environment;
(3) establishment of protected areas (such as national parks) over Niuean land (private and communally owned) and the need to use traditional 'tapu' and 'fono' techniques to protect the environment;
(4) the need to deal more comprehensively with land, groundwater, air and noise pollution;
(5) ability to control importation or production of substances hazardous to the environment;
(6) the need to incorporate Environmental Impact Assessment provisions into the legislation; and
(7) the need to balance the exercise of traditional and customary rights and practices with the impact they may have on the environment (particularly where modern tools are used).

10.4 Environmental monitoring and reporting

10.4.1 General

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

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

Without a monitoring and reporting programme it is more difficult for corrective action to be taken to prevent the impacts that a degenerating environment may have. In some sectors, such as the marine environment or water quality, the effect of degradation is generally not obvious until it is almost too late. For example, by the time people notice that fish are no longer being caught in the usual quantities, the actual population of the fish species in that locality may be less than is needed to enable it to recover naturally.

Monitoring is the tool that assists in prevention of environmental degradation.

10.4.2 A monitoring programme

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

(1) Information needs to be accessible. A lot of environmental information is scattered in unpublished or unavailable reports or is in a form which cannot be easily understood.
(2) Information collected at a point in time is static and only a "snapshot" of the issue. Monitoring is about measuring, observing and analysing change. A programme will be needed to permit collection of information over time.
(3) Collecting, analysing and publishing information can be time consuming and expensive. To minimise effort, only critical sectors should be included in a programme. Above all, it must be practicable and achievable with the available resources.
(4) Some monitoring will require specialist skills

and equipment. In some cases local people will be able to be given the necessary training, but in other cases it will be cost effective to use external expertise. Much monitoring is simply a matter of observing common activities or situations on a regular basis, recording the information and looking at changes over time.

(5) Environmental monitoring is not a job for one person or one sector. To be effective the government needs to identify a focal point for editing and publishing information gathered and analysed by all relevant sectors.

One of the key issues for Niue to deal with, and a fundamental task of the Environment Unit, is to establish an environmental monitoring and reporting programme. At its most basic, this may simply involve collecting information from sectors where data are already gathered, and publishing it annually. Identifying sectors not currently monitored and establishing a suitable programme of collection and reporting would increase the worth of a monitoring programme.

Chapter 11

Health

11.1 Health objectives

The health sector plays a vital role in environmental management in Niue. In addition to providing public health services, it carries prime responsibility for waste management, pollution control and monitoring the quality of the water supply.

The objectives of the health sector are to ensure that Niueans benefit from good health and long productive lives by:

(1) providing and maintaining essential health services;

(2) maintaining community health care by working with individual families and the community, with special emphasis on the welfare of mothers and children, the elderly and the disabled;

(3) improving waste management and doing everything possible to reduce pollution levels, locally and globally.

11.2 Waste management

11.2.1 Domestic waste

With a continual shift towards a cash economy and consequent reliance on purchased and packaged goods, it is not unexpected that the volume of domestic waste continues to grow. Managing this ever-growing pile of rubbish can consume a large proportion of a small community's resources.

The Department of Health is responsible for the effective collection and disposal of domestic waste. Collection of waste has been contracted out privately and is paid for by the government. No separate charge is levied on householders for this service, either directly or by property tax. Waste is collected from each village on a regular basis and the service provided is very good. There is an average of one rubbish dump per village and these generally comprise cleared areas within 500 metres of the coast to avoid contamination of the groundwater lens.

The Department of Health would like to reduce the number of tips by having shared sites between villages. Tips are managed directly by the Department of Health. Rubbish is bulldozed in an attempt to cover it and sites are regularly sprayed and bait laid to keep pest numbers down. Despite these actions tips remain breeding grounds for a range of animal and insect pests, most of which are capable of being disease vectors. More active management of household rubbish is needed.

There are a number of issues associated with the collection and disposal of domestic waste which need some thought in policy preparation and day-to-day management. These include:

(1) the need to reduce the amount of rubbish produced by households and industry through education and taxation mechanisms (let the polluter pay);

(2) the importance of separating out those components of the waste stream that can be recycled, composted or are too dangerous to be simply dumped in a landfill;

(3) putting restrictions on the type of products that cannot be easily recycled where alternatives exist (such as using aluminium or paper containers instead of glass, steel and plastic);

(4) finding the best location for dumps to avoid pollution (particularly of the groundwater and marine environment) and nuisance to neighbours;

This rubbish dump near Alofi presents a number of health and environmental hazards. More active management of Niue's dumps is necessary.

(5) ensuring the best possible management of dump sites; and
(6) educating the community against dumping rubbish on roadsides, in sinkholes, over cliffs or in the bush.

Large dimension waste

There is also a growing problem with non-hazardous but "difficult" waste such as old cars and trucks, rusted shipping containers and similar large dimension metal products. Some of these products, such as refrigerators, contain small quantities of chemicals dangerous to both the environment and people should they find their way into the food chain, the drinking water or the atmosphere. Vehicles, refrigerators, stoves, electrical and electronic equipment all have a relatively short life span in Niue's warm and salty climate. As more of these products are acquired the problem of their disposal will also grow. Although land is not in short supply in Niue, finding places to dispose of waste and transportation of waste will become major issues.

11.2.2 Recycling

Reusing rubbish or converting it to another product is one of the best ways of dealing with waste (the best way is not to produce it in the first place). Niue has established a recycling scheme for aluminium cans. This high-profile project was instigated and is run by the Catholic Church with funding assistance from the South Pacific Regional Environment Programme (SPREP). Can bins have been put in many places around the island and are regularly collected by Father Glover and his band of willing helpers. The collected cans are then crushed into small blocks and shipped overseas for smelting into new aluminium products. While Niue's roadsides and tip sites still contain many aluminium cans, it is evident that a large proportion of cans imported into Niue are later recycled.

These bins are found throughout every village in Niue and are evidence of the success of the Catholic Church's recycling programme.

More benefits could be achieved through recycling. Two of the largest components of the waste stream are vegetable matter and paper. Once reduced through composting, this waste can become valuable mulch for gardens and agricultural areas. Not only does mulch reduce the evaporation rate of water from the soil (helping to keep plants alive during dry spells), the composting material adds valuable nutrients to the soil, fertilising plants, building up and improving soil quality, and suppresses weed growth. This is a much better approach than using chemical fertilisers or weedicides. Large dimension waste such as tree branches may need to be chipped first, and paper will require shredding. This may necessitate the acquisition of appropriate machinery but any initial outlay in this regard is more than compensated by the long-term environmental savings.

Paper is recycled directly into new paper products in many places. However, it is unlikely that this would be economic in Niue. Other products should be investigated to determine their recycling viability. Glass, metal and oil may have sufficient value to enable them to be exported for recycling.

11.2.3 Hospital waste

Disposal of hospital waste poses a threat to the environment. The Department of Health has no effective means of disposing of the hazardous wastes produced by the hospital. These wastes include expired medications, surgical wastes, infected bandages, swabs, needles and scalpels, amongst other things. A properly constructed medium-to-high temperature incinerator is necessary to properly destroy many of these wastes. At present, waste is burnt at low temperatures in an area behind the hospital.

11.2.4 Chemical and hazardous wastes

Agricultural chemicals

There is a range of chemical and hazardous wastes that cannot be safely disposed of in Niue. High on this list are old agricultural chemicals and their containers, especially biocides (plant and animal poisons). These chemicals can be extremely hazardous to humans, particularly in their concentrated form, and also when people are exposed to small amounts over a long period. Unfortunately, these chemicals are now being used to replace traditional agricultural practices.

Old chemicals and their containers make up the bulk of chemical wastes and must be either kept in safe storage or shipped overseas for disposal. The Department of Agriculture, Forestry and Fisheries has stored some of this waste until a disposal method can be devised; however, it is likely that some wastes are finding their way into the landfills where they continue to cause a threat to human health either through direct contact or by entering the food chain or water supply.

Batteries

Other chemical products that are difficult to deal with include batteries (lead-acid, disposable dry cell and small batteries that power cameras and some electronic equipment — a number of these latter types contain the extremely poisonous metal, mercury). Batteries must not be disposed of in landfills as the chemicals they contain can leach out and enter the underground water system.

Early in 1993 a project was run on Tarawa, the capital atoll of Kiribati, to collect old batteries which were being disposed of in rubbish tips or just thrown on the ground. A reward of two cents per battery was offered to all those who brought batteries into a central disposal place. In a few short weeks, over 60,000 old batteries were collected. They are now being kept in sealed 200-litre drums until some suitable method of disposal can be found.

A switch to rechargeable batteries is one way to reduce the problem of battery disposal. Initially there is a larger cost for the purchase of a charger (which could be solar powered) and rechargeable batteries, but this is offset by having to purchase fewer batteries in the future, and there is also a saving for the environment.

Waste oil

Waste oil is another chemical product that is difficult to dispose of. The power house in Niue produces about 200 litres of waste oil each month and has no adequate method of disposal. Most of the oil is currently stored at the power station awaiting disposal. Previously it was simply dumped. Some of this oil is now used by the community for marking sports fields.

Export for recycling is the best solution if at all possible. Incineration in a purpose-built, properly constructed incinerator which burns at medium temperature is another alternative. There are a number of simple designs for waste oil incinerators that can be built with local materials. With a grow-

The bulk fuel store at Alofi is not only vulnerable to cyclones but its position means that any accidents lead to a high likelihood of petroleum being spilt into the sea.

ing number of vehicles and other machinery, each producing a few litres of waste oil each time they are serviced, it will not be long before Niue has a significant problem. It will be an even bigger problem if most of the waste oil ends up dumped onto the ground from where it can leach into the groundwater or the reef environment.

11.2.5 Oil spills

The major threat of oil contamination is at the Alofi wharf where the bulk fuel store is located and liquid petroleum products are shipped ashore. Fuel tanks at the storage depot are surrounded by concrete walls (or bunds) which are designed to trap any spillage and prevent it draining into the sea. Spillage at sea would be much more difficult to clean up. Spills could come either directly from the tanker which stands offshore or from the floating line that transfers bulk liquid petroleum products to the storage tanks.

An Oil Spill Contingency Plan has been prepared and it is the responsibility of Public Works to implement it. At present the equipment required to put the plan into effect has not been obtained and the Public Works Department (PWD) is therefore in no position to effectively deal with a large marine oil spill.

11.3 Water supply

11.3.1 Groundwater system

Water is well supplied in Niue. It is pumped from the underground water lens from fifteen bores into header tanks or reservoirs and then reticulated untreated to houses in each village. Pumping, reticulation and maintenance of the water supply system are undertaken by the Public Works Department, and the Department of Health is responsible for testing water quality. PWD recently prepared a water system development plan for the next six years which provides details and specifications of the current system and necessary upgrading works.

While abnormally high in some minerals and radioactive elements, groundwater is considered fit for human consumption. However, a number of agricultural practices, in particular the use of

Pumps like this are used to extract water from the groundwater lens. Areas surrounding pumps should be protected to maintain water quality.

chemicals (biocides and fertilisers) and the keeping of livestock pens close to where water is extracted, are a threat to quality. Re-establishment of forest around the areas where water bores are situated is the best form of land use. Not only do the forests mean other harmful land use practices are not carried out near where water is collected, the plants also act as natural nutrient filters.

11.3.2 Water quality

Human waste threatens the quality of the water supply. While most households use a septic tank or similar for treatment and disposal of human waste, the effluent from tanks is generally not filtered (through sand filters) and is sometimes piped directly into rock fissures and drops. In addition, not all systems are well constructed or in good repair and these leak untreated human waste into the groundwater. A further concern is the use of pit and "long drop" toilets near areas from which water is extracted. Simple precautions and a small amount of routine maintenance can protect underground water supplies from contamination.

The water testing programme carried out by the Department of Health provides a warning system on water quality. Water from the fifteen water bores used for domestic water supply is tested every three months. Agricultural bores are not regularly tested. This domestic water testing programme has been upgraded with the acquisition of testing equipment funded by SPREP. The tests are bacteriological and primarily concerned with faecal coliform contamination. Coliform counts in five of the bores were unacceptably high when measurements first began in 1992. Following a number of actions (such as relocating a piggery away from one bore), more recent counts have been lower, although still unsatisfactory. The Department of Health warns that drinking water should be boiled before use.

Testing for other contaminants is undertaken by the Public Works Department when new bores are being put in. Water is tested for salinity and chemical contaminants. In only one case (at the Department of Agriculture's experimental farm) was a high chemical content measured. The chemicals found were nitrates which are likely to have come from fertilisers. Domestic water bores are not regularly tested for anything other than bacteriological contamination.

The long-term solution for protecting groundwater supplies is adequate land use management of catchments. In theory, the whole of Niue functions as a catchment. Special precautions need to be taken within 500 metres of each bore. Many bores are on private land and as draft water quality regulations have not yet been passed, the Health and Public Works departments have difficulty in maintaining a high quality water supply.

11.3.3 Rainwater

Another water supply option is rainwater. Niue once had a system of rainwater collection tanks to provide fresh drinking water. This was a safe alternative to groundwater which is not only subject to contamination but is also affected by droughts and power failures. Remains of this rainwater catchment system can be seen at many points around the island. Some of the tanks are still in good condition

Collecting rainwater in these community catchment systems was common in Niue. Reliance on groundwater, which is piped to individual houses, has led to this older system being mostly abandoned.

but the catchment systems require extensive repair or replacement.

The vast proportion of rain which falls on Niue is allowed to run off unused. To ensure top quality drinking water, a mosquito- and vermin-proof rainwater catchment tank system should be re-established.

11.4 Sanitation

11.4.1 Sanitation system

Niue does not have a reticulated sewerage system. All dwellings and commercial establishments use septic tanks (about 60 per cent) or water sealed pit latrines (about 40 per cent). Pit and long drop latrines are still occasionally used as well. Both the septic and water sealed systems must be pumped out at regular intervals, and sludge presently collected in this way is dumped in a thin layer and covered with sand at a site near the airport. The impact of this practice should be examined and alternative disposal methods investigated. Well constructed and maintained septic tanks, with sand-filtered effluent lines that are kept away from water collection areas, provide an adequate treatment system if sludge disposal is properly managed. There are also other alternatives that can be looked at.

11.4.2 Alternative methods

Composting toilets are now commonly used around the world. Recent trials of this type of system have been undertaken in the Federated States of Micronesia and are commonly used in national parks in Australia where pressure from large numbers of visitors threatens fragile natural environments. Composting toilets require no water and minimal maintenance. They produce no liquid effluent and the resulting compost (which has the texture of fine, dry top soil) is an ideal fertiliser for garden and agricultural use.

Another alternative requires the collection of sewage and its transport to a central composting or treatment facility. The products of this process are methane gas, which could be used in industrial applications (such as power generation), and high-grade fertiliser for agricultural or home garden use. In this system, toilet wastes are flushed into a holding tank which is regularly pumped into a tanker for transport to the treatment facility. In more densely built-up areas, waste can be piped from buildings directly to the treatment facility.

Whether the septic tank system remains the mainstay of sanitation in Niue or an alternative is adopted, it is essential that high standard facilities and regular monitoring are maintained for environmental protection and human health.

11.5 Community health

11.5.1 Lifestyle diseases

From a health perspective the traditional Niuean lifestyle had many advantages. It was an active lifestyle and the food was wholesome and nutritious. The modern lifestyle, where exercise is limited, processed food is consumed, and a range of drugs

such as tobacco and alcohol are used, has led to a range of debilitating and entirely avoidable illnesses. Apart from the impact illness has on individuals, the whole community must share the cost of looking after these people.

Establishing a food and nutrition policy, discouraging smoking and overuse of alcohol or other drugs, together with a thorough community health awareness campaign, are important ways of overcoming these lifestyle diseases.

11.5.2 Disease vectors

A significant issue in tropical countries is the spread of disease through insects, vermin and polluted water. Fortunately, Niue's geology means that water does not sit on the ground for long and thereby create breeding grounds for disease vectors. Rubbish tips and discarded containers can, however, all become a habitat for pests. Ensuring proper disposal of wastes reduces the chances of the spread of diseases.

11.6 Air and noise pollution

Air pollution

With no significant industry, generally dispersed population and good winds, Niue is unlikely to suffer other than very localised air pollution. The most likely causes of air pollution are smoke from agricultural burning, cooking fires and tip fires, and vehicle emissions. People working or living near tips and others breathing in woodsmoke are regularly heightening their chances of contracting respiratory diseases, eye disorders and other illnesses. Burning wastes, particularly some plastics and many chemicals, give off toxic gases.

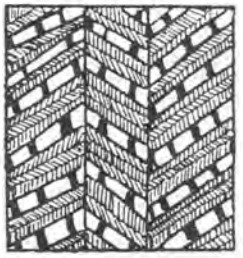
Motor vehicles, which are rapidly increasing in number, could become a source of pollution. Unless they are maintained to an adequate standard they produce noxious gases poisonous to people.

Noise pollution

In Niue, cars, trucks, motorbikes and heavy machinery are a greater problem for the noise they produce. Poorly maintained vehicles and some heavy vehicles, originally designed only for industrial areas, cause a significant nuisance to people living close to the main road, particularly in the Alofi area. As the number of vehicles increases, this nuisance is likely to become more of an issue.

Other noise sources are localised and intermittent and generally pose few problems. The powerhouse is the only facility that needs to be examined on noise grounds as it runs 24 hours per day and is located relatively close to housing.

Chapter 12



Education and information

12.1 Community education

Community education is the key to improving environmental conditions in Niue. Human actions, carried out mainly in ignorance or without a full understanding of consequences, are the principal cause of almost all environmental issues discussed in this report. Environmental protection programmes need to be supported by the community and backed by public education to solve problems in the long term.

A review of environmental education was undertaken in 1992 by Cliff Benson (USP) and a community awareness report was prepared by Herman Tagaloailuga (SPREP) at the same time (Benson & Tagaloailuga 1992). These reviews, undertaken as part of the NEMS Project, detail activities and opportunities available to Niue in environmental education. The thrust of their findings is included here.

While school-based programmes are important, environmental education is not simply an issue for schools. Environmental education must also provide for education and information throughout the community, that is, in the workplace, through work- and industry-related training programmes, community organisations and public information campaigns.

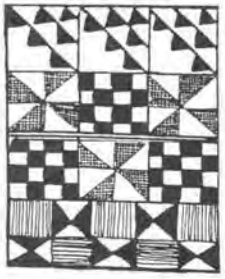
12.1.1 Integrating environmental issues

The environment, by definition, includes everything in one's life. It is not a subject that can be isolated and "taught". At school, environmental issues can be integrated into science and maths classes, social studies or other humanities subjects and also into religious instruction. To a degree this is already happening in Niue. To assist this process further, there are now environment-related teacher manuals and resource materials available from SPREP.

At work and in industry, programmes are required which show the effect of work practices on the environment and demonstrate ways in which the adverse impacts of work activities can be reduced. Special effort is needed to ensure that people engaged in subsistence activities in the fishing and agricultural sectors are provided with information about issues of importance to them.

Amongst the general population, information programmes need to be developed: first, to raise awareness about issues; second, to educate people to understand the part they play in contributing to environmental degradation; and, third, to demonstrate what can be done to improve and protect the environment. Specific points requiring consideration are:

(1) preparation of an environmental information and education plan targeted at special groups in the community;
(2) the need for information to be published in Niuean;
(3) broadcasting of environmental programmes on radio and television;
(4) the need to establish a secure but accessible environmental information and resource library so that the large amount of information currently available is not lost or inaccessible;
(5) emphasis to be given to environmental law enforcement, such as special training for police; and
(6) encouragement to be given to the establishment of a community-based conservation and environment organisation.



Chapter 13

Tourism

13.1 General

Tourism is a relatively small but increasingly important industry in Niue. It is considered one of the bright spots for future economic growth. This is not surprising given Niue's obvious attractions of natural beauty, climate, safety and friendly Polynesian lifestyle, together with modern services and conveniences. As air transport links improve and more tourist accommodation is provided, the chance to attract more visitors will increase.

The tourism industry can be an economic and environmental asset provided it develops in a manner that protects Niue's natural resources and the Niuean way of life. The link between tourist growth and environmental and community protection is clear—these are the best things that Niue can offer visitors. Maintaining a quality environment, looking after the water supply, properly disposing of waste, developing good sanitation practices, protecting forests, reefs, animals and scenic sites, will encourage visitors to stay.

13.2 Tourism issues

Unplanned and over-developed tourism will bring unmanageable pressure on both community values and environmental assets. The first step in addressing this issue is to determine the number of visitors Niue can accommodate before the environment and lifestyle become overtaxed.

The next concern is to plan where tourist accommodation developments would be best located and what features should be developed and promoted. Recent developments have been established in an ad hoc manner. This is not the best way for the physical infrastructure to expand.

Other significant issues include the capacity of Niue's servicing infrastructure to cope with the additional load. Suggestions have been made that, over time, a tourist population of between 5,000 and 20,000 each year should be planned for. At the lower figure, and assuming tourists arrive in even numbers across the whole year and each stays an average of seven days, this represents an increase in the permanent population of about 100 people; at the higher figure a permanent population increase of about 400 is projected.

Matapa Chasm is one of the many scenic features of Niue's environment that makes the island so attractive to locals and visitors alike.

13.3 Tourism Office

The Tourism Office is responsible for planning and marketing tourism in Niue and is well aware of the need to strike the right balance between development and environmental protection. Its initial aim is to prepare a ten-year tourism development plan. Other goals it believes need to be achieved include:

(1) ensuring the natural beauty and natural resources of Niue are protected for residents and visitors alike;
(2) enhancing cultural viability by promoting and preserving the Niuean lifestyle; and
(3) ensuring that a regular, reliable, cheap and accredited airline carrier can adequately deliver the tourist volume that Niue requires.

Commerce and industry

14.1 General

Niue has little in the way of industry and commerce outside the tourist industry and the essentially subsistence agricultural and fisheries sectors. Government is by far the biggest sector, although recent trends to reduce the number of public servants and meet government service needs from the private sector have given the private sector a boost.

14.2 Private sector

The private sector is essentially made up of retail and service industry including imports, shipping and transport. Manufacturing is limited to the handicraft business and some food processing such as honey and lime juice production. Production of agricultural products for export has dropped significantly over the last ten years. Only a very small number of people are employed in the private sector (6.7 per cent of the workforce in the 1989 agricultural census). This figure will certainly be higher now.

While the private sector is not large it can have a considerable impact on the environment. Containers and packaging that hold imported food and other products constitute a significant component of the waste stream. Some materials (paper and aluminium) are easier to recycle than others (glass and plastic). The disposal of chemical waste, particularly petroleum products, will become an issue as the number of private vehicles increases.

As the private sector expands, issues relating to the location of commercial and industrial activities will have to be addressed. Land use planning can be a valuable technique to prevent problems that might arise in the future.

The sawmill owned by the government is currently closed. It could be used to support an environmentally sensitive, import-replacement timber industry.

Chapter 15

Land tenure and information

15.1 Land tenure

By law all land in Niue is either Crown land or Niuean land. Crown land is considered to be land that has become vested in the Crown (through acquisition by the government) and is free from customary ownership. It appears not to include land leased by the government. Crown land makes up only a small percentage of all land in Niue.

Niuean land is land used and occupied by Niuean people according to traditional customs and includes land that may have been granted in fee simple (freehold or private ownership) at some time in the past to Niuean people. The legal situation is made more complex because the Crown has vested in itself all Niuean land held under customary arrangements. This vesting does not remove traditional rights to use and own land, and the Crown acts like a trustee in such cases.

Most land in Niue stays in the ownership of extended families (the 'magafaoa') and is managed on behalf of the family by the 'leveki magafaoa' (trustee/s or guardian/s of the land on behalf of all the members of the family with an interest in the land). Disputes are dealt with by the Land Court which has exclusive jurisdiction over all land matters. This includes issues of ownership, possession, occupation, use, rights to proceeds from sale or lease, and boundary disputes.

Land ownership and land use rights are complex in Niue. Owners have significant rights over what they do with their land. Government intervention is generally limited to acquisition for public purposes. The tradition of leaving land management to the discretion of the 'leveki magafaoa' may create difficulties for the government in any attempts it may make to manage or protect the environment. This will be particularly true of any attempts to establish national parks or similarly protected areas. Clearly a high degree of agreement with landowners will be necessary to successfully implement a number of environmental policies.

15.2 Land information

Land and resource information is an important tool in environmental planning and management. The Department of Lands and Survey of Niue is responsible for collecting and storing cadastral and topographic information and is currently developing a computer-based geographic information system for its land information. This system currently shows roads and villages, location of boreholes, and land allotments that have been identified. Soils information has been mapped but has yet to be added to the data base.

The current major land information project is the survey and recording of land parcels in Niue. Establishing correct ownership details is a slow but valuable job because much land is communally owned by extended families, and in some cases by villages. This information is also being progressively added to the data base.

The usefulness of environmental information is limited by the age of available data. The last series of air photographs were taken in 1981; current estimates of vegetation cover and quality as well as changes to the built environment are therefore impossible to obtain. The topographical map is based on even earlier data. No current information is available on the location of various plant and animal habitats.

Agriculture, forestry and fisheries

16.1 General

The agriculture, forestry and fisheries sector is responsible for the sustainable use of Niue's natural resources. As these resources are limited, their wise use is of prime importance to a developing nation like Niue. There is already concern being expressed about the over-exploitation of soils, forests and fishing grounds. In order for Niue to attain ecologically sustainable development this sector needs to:

(1) determine acceptable and sustainable levels at which natural resources can be exploited;
(2) aim to use natural resources wisely to produce goods that can replace imports;
(3) encourage forest conservation and replanting while discouraging the practice of clearing large areas for taro production;
(4) use more environmentally "friendly" methods of agriculture and avoid overuse of dangerous chemicals;
(5) reafforest disturbed areas with indigenous species;
(6) restrict the development of sea tracks and bush roads which results in invasion of previously inaccessible coastal forest vital for the protection of crabs and other wildlife;
(7) maintain the use of the 'tapu' and 'fono' as protective mechanisms to prevent over-exploitation, and to rest specific areas and resources;
(8) ensure sustainable fishing of inshore areas and discourage the use of destructive fishing techniques so local needs can be met; and
(9) use regional fisheries forums to fight against damaging fishing methods within Niue's EEZ.

16.2 Agricultural development

16.2.1 Taro growing

Throughout the Pacific the expansion of agriculture is one of the chief causes of deforestation. This is a fact in Niue as well. One of the key agricultural programmes in Niue at present is the taro planting scheme where encouragement is being given to landowners to grow taro for export. The clearing methods being used result in large areas of forest being destroyed and use of significant volumes of chemicals for fertilisation and weed suppression. Any short-term profits this scheme may have will be paid for later with polluted groundwater, unproductive soils and a reduction in wildlife populations.

16.2.2 Agricultural chemicals

A dependency on expensive, imported and often dangerous chemicals to support agricultural production has resulted in environmental degradation and poses a threat to the health of the people handling them. The government currently has a stockpile of old chemicals and containers for which there are no safe disposal methods available in Niue.

The use of chemical fertiliser is no substitute for proper soil management practices. Soil fertility is already a limiting factor to successful agriculture. Many existing crop preparation practices, such as slash and burn or bulldozing, where soils are left exposed to bake in the sun, can also do irreparable damage to this valuable resource and lead to a dependence on agricultural chemicals.

16.2.3 Livestock management

Keeping livestock pens or permitting livestock to

Use of bulldozers for clearing forested areas and inappropriate application of agricultural chemicals may cause environmental degradation that is much more costly to Niue than the value of the taro crops.

graze close to areas where water is extracted has resulted in biological contamination of water supplies. These areas should be kept free of use and replanted. Livestock should also be managed to prevent escape. Feral animals, particularly pigs and goats, have a great capacity to cause serious damage to forest areas.

One of the major difficulties associated with this project revolves around entering into agreements with landowners. The system of traditional landownership makes it very difficult to identify landowners. Plot acquisition generally follows behind the land titling project, which is being

16.3 Forestry development

The naturally available species suitable for timber cutting in Niue's forests can be used for only limited applications, although they have traditionally been used to meet most domestic construction and craft needs. At present, most timber for construction purposes is imported and there is no logging of existing forest. The "best picture" of the current timber resource estimates that about 8,000 cubic metres per year is available. Niue's only sawmill is currently idle. Timber imports run in the order of 500 to 600 cubic metres annually. The Forestry Project has immense potential for export earning as well as in-country downstream processing. Only the natural forests are suitable for import substitution (and limited export orientation).

The government is currently undertaking a forestry plantation project using exotic timbers (mahogany and Australian red cedar). Consideration should perhaps be given to using native species as well. This project, which is worth about $300,000 per year, aims to achieve a plantation development rate of 100 hectares per year over a 40-year period. To date, about 120 hectares have been planted.

This plantation is part of DAFF's forestry programme and is located on previously cleared land.

undertaken by the Department of Lands and Survey. This project aims to clarify ownership and registered landowners. To date, land has been leased with the owners benefiting, in addition to receiving rent, by being given the opportunity to undertake employment establishing and maintaining the plantation. The project also provides for joint ventures with landowners.

Today, very little land clearance activity in Niue can be attributed to forestry. Land clearing is mainly directed towards providing agricultural land. However, given the present availability of cleared and degraded land, all forestry schemes should be aimed at replanting areas rather than logging remaining sectors of high quality forest.

16.4 Fisheries

16.4.1 Overuse of inshore resource

As the use of traditional fishing methods has declined and the use of aluminium boats, outboard motors, nets, torches, spearguns, scuba equipment, poisons etc. has increased, local fish catches (which most families rely on as a food source) are also thought to have declined. It is estimated that on average about 0.5 tonnes of fish are taken each month. Overfishing could be a reason for the apparent drop in catches, although some fishermen suggest that the cost of fishing is such that it is now cheaper to buy imported products. Changing weather patterns and resource exploitation by foreign fishing vessels may also be contributing factors.

The 'fono' has been used in the past to successfully rebuild fish stocks, but, once lifted, overexploitation has tended to continue. This is especially true for clams and crayfish. The 'fono' system is a very useful traditional means of controlling modern exploitative fishing techniques. The 'fono' could perhaps be used more in the future to ensure sustainable development of this vital natural resource.

16.4.2 EEZ licences

In 1993 a new licence came into operation which allows up to 30 Taiwanese fishing vessels to fish within the EEZ of Niue, Tonga and the Cook Islands. The licence fees for Niue are $US 45,000 per year. Records provided from fishing vessels indicate that about five to eight tonnes of albacore tuna and one to two tonnes of other species are caught each month. These other species include types of tuna, shark, wahoo and mackerel. Licence conditions are to be reviewed with a view to reducing the number of boats permitted to operate. Under the South Pacific Forum Fisheries Agreement with the United States of America, to which Niue is a signatory, American boats are also permitted to fish Niuean waters. It is thought, however, that they do not operate in these waters.

Fishing licences to utilise the resources of the EEZ should be issued to foreign vessels only on the basis of scientific advice and information from fisheries databases of regional agencies such as the South Pacific Commission (SPC) and the Forum Fisheries Agency (FFA). Cabinet has sole legal responsibility for granting fishing licences, but general community concern about the impact that large-scale industrial fishing appears to be having on inshore resources means that more discussion is needed before future licences are issued.

In a number of villages, access for boat launching is by narrow and steep sea tracks. Launching boats across the reef flat into seas which can often be rough is a major challenge to inshore fishing.

Niue does not have the capacity to patrol its EEZ or the capability to enforce licence conditions and may need to seek assistance from neighbours with this capability (such as Tonga) or obtain help from New Zealand or Australia.

16.4.3 Aquaculture

Two experimental aquaculture projects are being undertaken in Niue. A trochus-seeding project began in 1992 with the importation of about 200 individuals from Fiji. They have been placed in three areas along the south-east sector of the coast where environmental conditions are thought to be best. It is intended to seed another 400 in the short term. These will take about four to six years to mature. Trochus is not naturally found in Niue.

A second project involves establishing clam aquaculture. A feasibility study has been undertaken by FFA and the project now awaits funding and final approval.

Care must be taken when introducing exotic animal species into coastal waters. Proper planning and environmental assessment should precede the implementation of any aquaculture projects. Aid donors should be made aware of this requirement.

Public works and infrastructure

17.1 General

The public works sector is of critical importance to the development and operation of Niue's essential services and infrastructure. The Public Works Department (PWD) carries out most heavy engineering works in Niue although, as a result of the government's privatisation policy, a number of its functions will in future be undertaken by the private sector. The objectives of the Public Works Department are to:

(1) enforce building codes;
(2) meet the energy needs of Niue;
(3) maintain transport services;
(4) support the Department of Health in waste management;
(5) supply sufficient quality and quantity of drinking water; and
(6) assist the government with implementation of its privatisation policy.

17.2 Building and planning

Building control and land use planning are two techniques that can be used to protect environmental values. For example, all occupied buildings in Niue should be serviced by a properly constructed septic tank with an outlet some distance from any water bore which is used for human consumption. At present, PWD has a policy that septic tanks should not be within 200 metres of such places. Regular inspections are needed to ensure environmental health standards are being met.

Other aspects of building control relate to the strength of buildings and in particular their ability to withstand cyclonic winds, a critical factor in Niue. There are, however, broader considerations to take into account beyond the structure and servicing of individual buildings. Land use planning involves setting standards for the use and development of land. In determining where uses are best located the objective is to protect environmental values and avoid conflict between incompatible uses (such as houses close to the airport or intensive agriculture near water bores).

Because of low population pressure and a lack of industrialisation, there has been minimal need to actively plan land use on Niue, and development has simply progressed on sites traditionally used for settlements. Planning issues do arise though. Recently PWD required the removal of a piggery from an area near the airport where water is pumped for human consumption. PWD is also concerned about the location of buildings, especially houses and essential services, close to cliff edges. The height of waves during Cyclone Ofa in 1990 demonstrated the vulnerability of these locations.

Location of commercial buildings, controlling development and land use near water bores in areas of conservation significance or scenic beauty, keeping areas that contain the best soil available for agriculture, and keeping incompatible uses separate can all be the outcomes of land use planning. The planning process can also be used to undertake a full assessment of proposed developments, including their environmental effects. Niue needs to consider whether its current planning arrangements are adequate or if a more formal system is needed.

17.3 Energy

Diesel power

Niue's electrical power is provided by five diesel-powered generators. Two of these must be operating continuously to meet the island's base load

power demands. In addition, a small experimental solar system has been operating in Namukulu village running a freezer and two lights.

Diesel-powered electrical generation is expensive and requires the storage of relatively large quantities of petroleum product (the bulk fuel depot in Alofi is located in a position by the wharf where it is susceptible to damage from cyclones). Burning fossil fuel releases greenhouse gases, adding in a small way to a problem which all South Pacific countries are actively campaigning against. Fossil fuels are a finite resource and will become more scarce and expensive in the long term. About 200 litres of waste oil are produced each month from the power station. It is used by the community to mark playing fields. There is no adequate disposal method currently available in Niue.

Alternative energy sources

Although diesel-powered generators are likely to remain the most significant power source into the future, Niue needs to pay close attention to alternative and renewable energy sources. The small experiment with solar power at Namukulu village demonstrates other possibilities. For example, on the outer islands of Tuvalu where reticulated power is not available, a co-operative solar electric power company has been established which provides equipment and technical service to its customers. Solar power is used for most domestic applications, with small petrol generators kept in reserve to power high demand tools. Many of Niue's electrical needs are for lighting, and solar energy can cater well for this type of application. Solar hot water systems are already popular but could be used more. Wind may be another power source that could be used to produce electrical power or run water pumps.

Transport

Niue's transport fleet consists of private vehicles. While convenient to the people with access to them, a reliance on private vehicles wastes energy and makes transportation difficult for those who do not have access to a motor vehicle. Bicycles are a quiet, inexpensive, energy-saving form of private transport on Niue. Public transport is also a cost-effective way of both providing transportation opportunities to everybody and saving energy.

Appliances

In an attempt to use less power, PWD discourages the use of air-conditioners and other unnecessary appliances. Audits of power usage at the power house and the domestic and commercial level can mean large savings. If everybody reduces their power demands by only a small amount the whole country saves.

17.4 Major impact developments

The Public Works Department is generally responsible for major works undertaken in Niue. Many of these have a significant environmental impact. Current activities including quarrying, road construction and vegetation clearance should be examined to determine their environmental effects. Proposed new projects such as extensions to the port and airport clearly need an Environmental Impact Assessment. Smaller scale projects also have significant impacts and should equally be subject to review. To ensure a minimum of environmental damage, all projects should be subject to a review process, and those projects which (on first assessment) are considered likely to have a significant impact should be subject to a full Environmental Impact Assessment (EIA).

Chapter 18

Environmental law

18.1 Law

18.1.1 General

Niue's formal body of law has been developed along British and New Zealand lines. It is made up of English common law and various statutes passed by the Niue 'Fono' (Assembly) since independence, a range of Niuean laws passed by the New Zealand Parliament (which predate independence and still apply), and some New Zealand laws that, by specific request of the 'Fono', also apply to Niue. In addition to the formal body of law, there are many strong Niuean traditions and customs which govern the lives of the people. While without a formal or statutory basis, these "laws" are a real part of the system of law and government in Niue.

As with many places, Niue's environmental laws are spread through a range of sector- specific legislation, and a number of sectors are either dealt with inadequately or not at all. A draft Environment Management Bill (Government of Niue 1992) has been prepared and is intended to create a consolidated, and in some cases establish a new, body of environmental law. The Bill is scheduled to be dealt with by the 'Fono' in early 1994.

SPREP and the Government of Niue have undertaken a full review of the laws of Niue as part of the NEMS development process (Peteru 1993). This report is the main source of information about the existing body of law as it relates to the environment and the new Environment Management Bill. The State of the Environment Report will therefore only provide a brief overview of the environmental laws of Niue.

18.1.2 Environment Management Bill

The current draft of the Environment Management Bill deals with the following issues:

(1) establishment of a Conservation Council, a Conservation Service and Conservation Officers;
(2) establishment of national parks and protected areas;
(3) preparation of management plans relating to area management (such as protected areas) and a range of environmental issues (such as soil erosion, pollution, wildlife);
(4) coastal zone management;
(5) pollution of seas and waters; and
(6) litter control.

18.1.3 Sector-specific legislation

Forestry

The *Niue Village Council(s) Ordinance 1967* (NVCO) gives councils the power to take action to improve forestry standards. The current forestry programme is undertaken by the Executive (through DAFF) in cooperation with landowners. Traditional 'tapu' controls have been extended over forested areas and these have provided protection to what are becoming remnant areas of undisturbed natural forest.

Agriculture

The NVCO provides councils with the power to take action to improve agriculture, and the *Pesticides Act 1991* deals with the importation and sale of agricultural chemicals but does not regulate their usage.

Mining and minerals

The function of the *Mining Act 1977* is to control exploration and mining development. It was passed to regulate the exploration programme of a mining company investigating anomalous radioactivity (see Chapter 3).

Talava Arches is an area of outstanding scenic beauty. At present, environmental attributes are not adequately protected by law. The proposed Environment Management Bill will provide a framework for legal protection.

Biodiversity conservation

There is little statutory law dealing with the protection of biodiversity although both the *Niue Fish Protection Ordinance 1965* and the *Wildlife Ordinance 1972* could be used in this regard. The NVCO provides councils with some powers in regard to conservation. The *Agriculture Quarantine Act 1984* provides protection against invasion of foreign pest species.

The traditional resource controls of the 'tapu' and 'fono' are still used (the 'fono' particularly with regard to fishing controls). The Fish Protection Ordinance gives some statutory backing to the 'fono'.

Pollution control

A range of legislation can be relied on to deal with different types of pollution. These include:

- *Agriculture Quarantine Act 1984* which provides regulations to ensure proper management of rubbish tips to minimise animal access;
- *Marine Pollution Act 1974 (NZ)* and the *Wreck and Salvage Ordinance 1968* which cover pollution at sea;
- *Mosquito Control Act 1980* which can be used to prevent littering which creates breeding places for mosquitoes;
- *Niue Public Health Ordinance 1965* which provides for the sanitation of buildings and dwellings; and
- *Niue Village Council(s) Ordinance 1967* which has provisions relating to village cleanliness in addition to dealing with health, sanitation and public nuisance issues.

Water quality

The *Niue Public Health Ordinance 1965* and the *Niue Act 1966 (NZ)* have provisions regarding the quality of the water supply. Provisions of the NVCO also apply to water supply issues.

Fisheries

The *Niue Fish Protection Ordinance 1965* deals generally with fishing matters and can be used to con-

trol the use of firearms, explosives or poisons to catch fish in the narrow area of "Niuean Waters" — within one mile (1.5 km) of the outer edge of the reef. As described earlier, the Ordinance can also be used to declare a 'fono' over fishing in selected areas for specified times. The NVCO and the *Sunday Fishing Prohibition Act 1980* also have provisions which can be used to restrict fishing.

The *Territorial Sea and Exclusive Economic Zone Act 1978* allows Cabinet to determine the total allowable catch within the EEZ and issue licences to foreign fishing vessels using Niue's EEZ.

Tourism

The *Tourist Board Ordinance 1970* has provisions to promote tourism and regulate the use and development of tourist attractions and recreational facilities, and the NVCO has provisions relating to parks, gardens and recreational facilities.

Cultural heritage

The *Niue Cultural Council Act 1986* provides for the promotion and protection of all aspects of Niuean culture, including conservation of sites of cultural significance.

18.1.4 International treaties

The situation with regard to international treaties is a little confused, owing to the fact that New Zealand acts on Niue's behalf in all foreign affairs matters. However, New Zealand can only enter into international agreements for Niue on request. It is not clear how many of the numerous environmental treaties which New Zealand has entered into also bind Niue.

Environmental treaties to which Niue is known to be a party include:

- *Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973*, Washington (CITES);
- *Convention on Conservation of Nature in the South Pacific, 1976*, Apia (Apia Convention);
- *United Nations Convention on the Law of the Sea, 1982*, Montego Bay;
- *South Pacific Nuclear Free Zone Treaty, 1985*, Rarotonga;
- *Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, 1986*, Noumea (SPREP Convention);
- *Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America, 1987*, Port Moresby;
- *Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific, 1989*, Wellington (Wellington Convention).

18.2 Law enforcement

Use of the law to protect the environment has limitations. This is particularly true when traditional practices or customary uses are restricted for conservation purposes. There are many laws in many countries that are not enforced because they are either inappropriate to the circumstances or because the people breaking the laws (and/or the people enforcing the laws) do not believe in or understand the need for the restrictions. Niue is no exception to this fact.

The police in Niue are almost exclusively responsible for the enforcement of all laws. Their numbers are limited, and individual knowledge of many of the less well-known laws is not perfect. It is not surprising that many actions and offences are not prosecuted. Consolidating and updating environmental legislation will help make things easier for the police and others who might be given enforcement powers, although legislation and enforcement will never replace the need for public education as to why restrictions are necessary to protect the environment. Providing this information to the public is an effective and positive way to achieve environmental protection objectives.

The strong Polynesian traditions that exist on Niue provide what is probably a more effective form of social control over the behaviour and practices of individuals. The authority of the family, village and churches offers an alternative to the western model of law enforcement typified by legislation and courts. It is important to use traditional social structures to achieve environmental objectives. This will happen only if family, village and church elders as well as younger members of the community are given the opportunity to learn how the use of modern tools to undertake traditional practices can have an adverse impact on the environment.

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Appendix I

People consulted

The following people from the Government of Niue were consulted:

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Birds of Niue

English name	Niuean name	Scientific name	Comments
Giant petrel		*Macronectes* sp.	Rare vagrant
Wedge-tailed shearwater	Kalangi	*Puffinus pacificus chlororhynchus*	Resident breeder
White-tailed tropicbird	Tuaki or Tavake	*Phaethon lepturus dorotheae*	Common resident
Great frigatebird	Manu folau or Kota	*Fregata minor*	Uncommon visitor
Feral fowl	Moa	*Gallus gallus*	Introduced
Banded rail	Veka	*Rallus philippensis goodsoni*	Common resident
Spotless crake (Sooty rail)	Moho	*Porzana tabuensis tabuensis*	Rare resident
Purple swamphen	Kale	*Porphyrio porphyrio samoensis*	Fairly common resident
Pacific golden-plover	Kiu	*Pluvialis dominica fulva*	Common migrant
Far Eastern curlew		*Numenius arquata orientalis*	Accidental visitor
Bristle-thighed curlew	Kiu-vouvou or Motuku	*Numenius tahitiensis*	Uncommon migrant
Eastern bar-tailed godwit		*Limosa lapponica baueri*	Accidental visitor
Wandering tattler	Kiu-tahi	*Heteroscelus incanus*	Common migrant
Ruddy turnstone		*Arenaria interpres interpres*	Uncommon migrant
Pectoral sandpiper		*Calidris melanotos*	Accidental visitor
Common noddy	Ngongo	*Anous stolidis pileatus*	Common visitor
White tern	Takatake	*Gygis alba candida*	Common resident
Pacific pigeon	Lupe	*Ducula pacifica pacifica*	Not very common resident
Purple-capped fruit-dove	Kulukulu	*Ptilinopus porphyraceus*	Common resident
Blue-crowned lory	Henga	*Vini australis*	Uncommon resident
Long-tailed cuckoo	Kalue	*Eudynamis taitensis*	Rare migrant
Barn owl	Lulu	*Tyto alba lulu*	Common resident
White-rumped swiftlet	Pekapeka	*Aerodramus spodiopygius*	Common resident
Polynesian triller	Heahea	*Lalage maculosa whitmeei*	Common resident
Polynesian starling	Miti	*Aplonis tabuensis brunnescens*	Common resident

Source: Kinsky & Yaldwyn 1981

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