

# Country Report for UNCED

## Kiribati

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National Reports to the United Nations Conference on Environment and Development (UNCED) were prepared under the direction of the National Task Forces in 12 Pacific island countries with the financial and technical assistance of the Asian Development Bank and United Nations Development Programme. This assistance was coordinated by Gerald Miles through the South Pacific Regional Environment Programme (SPREP). For Kiribati, this report was drafted by Nakibae Teuatobo, Ventabo Neemia and Randy Tharman, and endorsed by their government for presentation to the United Nations.



June 1992

South Pacific Regional Environment Programme (SPREP)  
Apia, Western Samoa

## FOREWORD

There is increasing global, regional, national and local recognition that environmental degradation and associated human ecological problems, in their various forms (e.g., deforestation, soil erosion, pollution, waste disposal, global warming, overexploitation of marine resources, loss of biodiversity, overpopulation, poverty and malnutrition), are among the major constraints to sustainable development. Because of this recognition, on 22 December 1989, the 44th Session of the United Nations General Assembly adopted a resolution to convene a two-week United Nations Conference on Environment and Development (UNCED) or "Earth Summit" to coincide with both the twentieth anniversary of the United Nations Conference on the Human Environment held in Stockholm, Sweden in 1972 and with World Environment Day, 5 June 1992. The General Assembly accepted the offer of the Government of Brazil to host the conference in Rio de Janeiro in June 1992.

The purpose of UNCED is to set the international agenda and priorities for the implementation of environmentally sound and sustainable development. Because of the importance and the scope of the decisions to be taken at UNCED, the General Assembly also established, by the same resolution, a Preparatory Committee (PrepCom), open to all member States at the Heads of State or Government level, to prepare for the conference. The UNCED, the "Earth Summit", is expected to be the largest summit-level conference ever held.

At the Third Intergovernmental Meeting of the South Pacific Regional Environment Programme (SPREP) held in Noumea from 24 to 28 September 1990, the 27 member countries reached a strong consensus on the critical importance of UNCED to the Pacific Islands, particularly since no Pacific Island states were represented at the 1972 Stockholm Conference. In order to ensure that the priorities and concerns of Pacific Island Developing Countries (PIDCs), in relation to the promotion of sustainable development, are clearly represented in Brazil and incorporated into a global strategy for sustainable development, SPREP, with funding from the Asian Development Bank (ADB) and the United Nations Development Programme (UNDP), is coordinating, in cooperation with National Task Forces, the preparation of National Reports by PIDCs for presentation at UNCED.

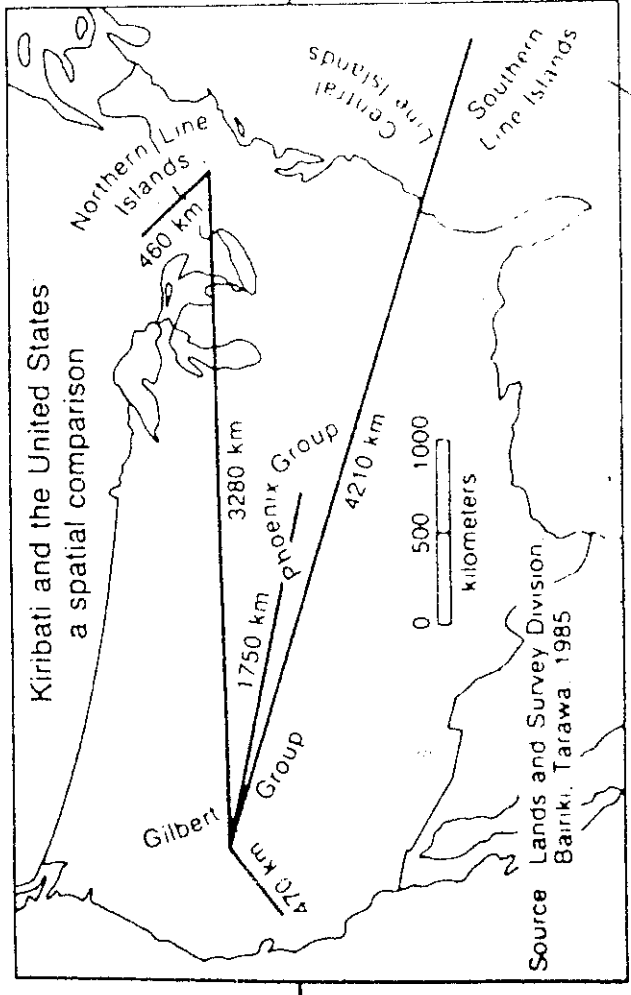
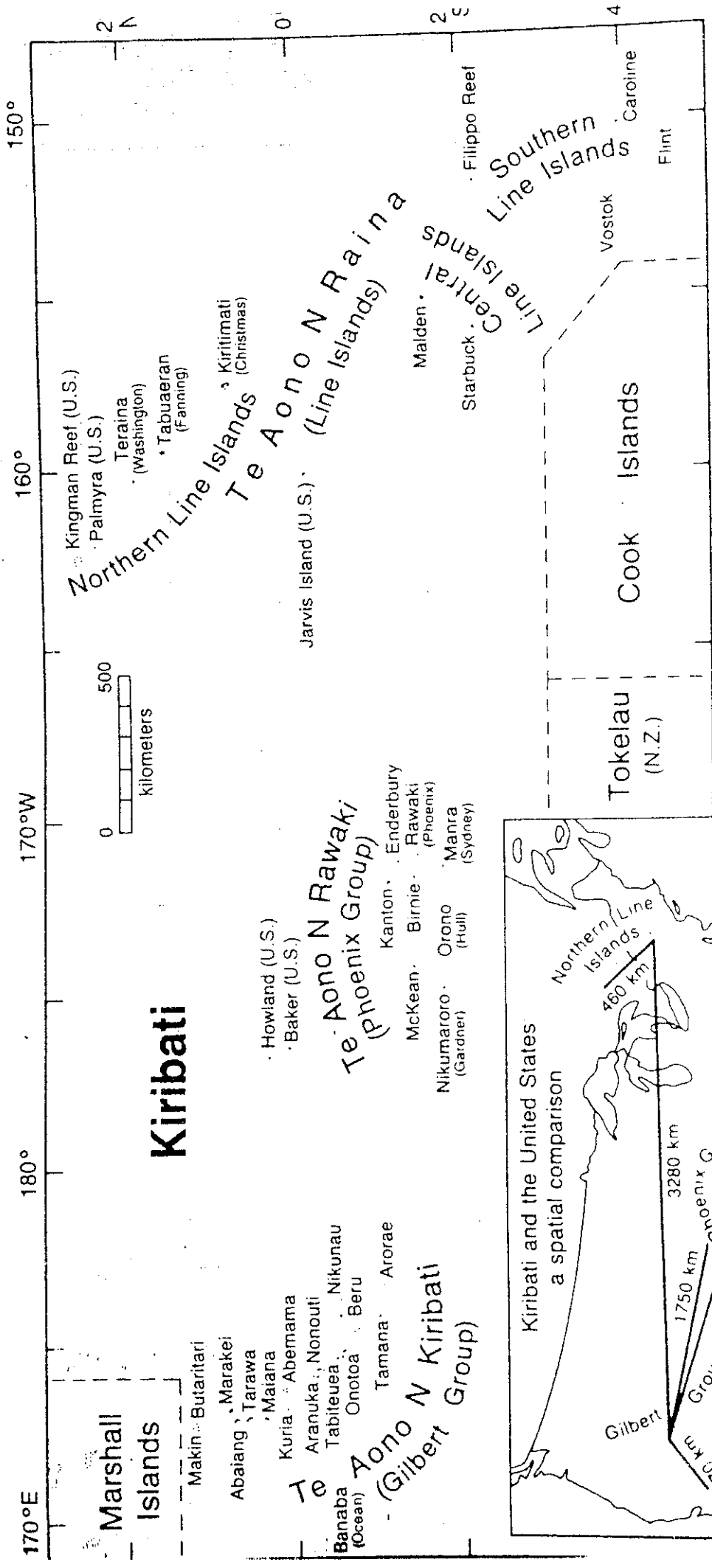
The following is the National Reports for submission by The Republic of Kiribati to UNCED. The report is based on a review of the available literature and documents and consultations with governmental officials, public servants, aid agencies, NGO representatives, community leaders and other persons with relevant knowledge. Particular thanks are given to SPREP, ADB and UNDP for their support in producing the report, those persons who contributed their time and expertise, the Kiribati Task Force on the Environment (KTFE) for its work in reviewing and strengthening the report, and in particular the SPREP Consultants, Uentabo Neemia and Professor Randy Thaman of the

Institute of Pacific Studies and the Geography Department of the School of Social and Economic Development of The University of the South Pacific, respectively, for their assistance in producing the Report. Because of the breadth of information required to adequately assess constraints and opportunities for sustainable development in the atoll environment, the report is necessarily general in its coverage, although detailed information in Appendices and a Bibliography of relevant sources are provided. It is hoped that the report accurately expresses the diverse concerns of the Republic of Kiribati in relation to its stated commitment to environmentally and culturally sustainable development in the atoll environment.

Through this National Report, the Government and people of the Republic of Kiribati express their strongest support for the principles and objectives of the United Nations Conference on Environment and Development (UNCED) and the promotion of environmentally and culturally sustainable development, globally, regionally and in the atoll Republic of Kiribati. Through this Report we also express our hopes that the deliberations of UNCED will be fruitful and will foster a return to more sustainable lifestyles that will ensure that future generations will be able to live out of the some resources that we currently have at our disposal.

Te mauri, te raoi, ao te tabemoa

The Honourable Ieremia Tabai, G.C.M.G.  
Minister for the Environment and  
Natural Resources Development, and  
Former President of Kiribati (1979-91)



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## LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AIDAB	Australian International Development Assistance Bureau
EEC	European Community
EEZ	Exclusive (Extended) (200-mile) Economic Zone
ENSO	El Nino (Ninyo) Southern Oscillation
ESCAP	Economic and Social Commission for Asia and the Pacific
FFA	Forum Fisheries Agency
FSP	Foundation for the Peoples of the South Pacific
KTFE	Kiribati Task Force on the Environment
NDP	National Development Plan
NGO	Non-Governmental Organisation
NOAA	US National Oceanic and Atmospheric Administration
PEDP	UNDP Pacific Energy Development Programme
PIDC	Pacific Island Developing Countries
SOPAC	South Pacific Applied Geoscience Commission
SPACHEE	South Pacific Action Committee for Human Ecology and the Environment
SPC	South Pacific Commission
SPREP	South Pacific Regional Environment Programme
TOGA	Tropical Oceanic Global Atmosphere Programme
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNICEF	United Nations Childrens Fund
USAID	United States Aid in Development
USP	University of the South Pacific

## EXECUTIVE SUMMARY

### SUSTAINABLE DEVELOPMENT AS A PRIORITY

As stressed in the September 1991 "Policy Statement" of the Ministry of Environment and Natural Resources Development: "the incorporation of 'Environment' in the new name of this Ministry expresses the serious concerns that this Government has over a number of environmental issues and particularly over the potential dangers of 'sea-level rise'." In stressing the need to take into account environmental considerations in its development planning efforts it was stated:

Our aim is to achieve what is normally referred to as an environmentally sustainable development, means that the present generation will be able to earn its living without compromising the ability of future generations to live out of the same natural resources.

Former President of the Republic of Kiribati, current Minister for the Environment and Natural Resources Development, and recently elected Secretary General of the Forum Secretariat, The Honourable Ieremia Tabai, puts it more succinctly in saying:

For the people and Government of the Republic of Kiribati the object of the exercise of 'sustainable development' is to survive on the atolls forever . . . until the end of the world! . . . Sustainability is the idea that we can survive from day to day and ever after."

It is stressed that, although the I-Kiribati (people of Kiribati) have lived a relatively sustainable way of life for thousands of years in the atoll environment, this was at a relatively low level of material wellbeing, a level which is no longer considered adequate. The level of wellbeing is observed not only to vary from place to place but also in terms of people's perspectives of their own wellbeing. Our people desire some of the more appropriate modern technologies and social services that will make their life easier, safer, healthier and more enjoyable in today's world. This requires increased cash incomes and foreign exchange and changes in lifestyles which, if NOT pursued in the right manner, could undermine the cultural and traditional resource-use systems which have promoted sustainability in the past. This is the difficulty, in terms of promoting sustainable development, which faces the people and Government of the Republic of Kiribati.

### GEOGRAPHY

As a nation, the Republic of Kiribati is mostly ocean. Its 33 islands, which are divided into three main groups, have a land area of only 823 square kilometres within an

equatorial EEZ of some 3.55 million square kilometres and spanning a total ocean area of some 13 million km<sup>2</sup> - an area larger than the continental United States of America. Its ratio of sea to land of 4000:1 reflects the extreme isolation and fragmentation of Kiribati and the associated difficulties and high costs of the management and sustainable development of such a large area.

The westernmost group, the Gilbert Islands, comprises 13 true atolls and three limestone islands, including the atoll of Tarawa, the capital and main urban centre, where one-third of the estimated total population of 72,298 lives. Population densities in urbanised South Tarawa are extremely high, at 1,596 persons per square kilometre, and 4167 persons per square kilometre on Betio Islet -- a density which is expected to rival that of Hong Kong by the late 1990s.

The Phoenix Group of eight atolls lies to the east of the Gilberts. They are largely uninhabited. In the far east, and some 3000 km from the main Gilbert Group, lies the Line Group, another eight atolls including Kiritimati (Christmas) Island, which contains over half the land area of Kiribati. In the extreme west, 400 square kilometres to the south-west of Tarawa, lies Banaba (Ocean) Island, an uplifted phosphatic limestone island encircled by a narrow coastal plain. The mining of Banaba's phosphate deposits was the main source of foreign exchange for almost 70 years until 1979, when, on the eve of Kiribati's independence, deposits were exhausted. While Banaba rises to a maximum elevation of about 78 metres, the other 32 island atolls are rarely more than three metres above mean sea level. The country is, thus, exceptionally vulnerable to the high spring tides, storm surge, seismic sea waves and the projected sea level rise resulting from global warming.

Some atolls have passages into the central lagoons which provide secure anchorage for vessels. Others have no passages or, as in the case of limestone islets, offer few safe anchorages. Teraina (Washington) Island in the Line Group has offshore anchorage useable only during calm weather.

All the atolls and table reef islets have some fringing reef and reef slope resources. These are of critical importance for subsistence and also support some commercial fishing, particularly for deep-water snapper. The pelagic tuna resources of the extensive EEZ are a major source of foreign exchange.

Climatically, Kiribati lies in the dry belt of the equatorial oceanic climate zone, with the average annual rainfall in the Gilbert group varying from 1000 mm per year for drier islands south of the equator (e.g. Arorae and Tamana) to 3000 mm for Butaritari in the far north. The annual average for Tarawa is 1550 mm. Rainfall in the Line and Phoenix groups ranges from 700 mm to 4000 mm in good years. Severe prolonged droughts with as little as 200 mm of rainfall per year are common in the central and southern Gilberts, on Banaba, the Phoenix Islands and on Kiritimati. Such droughts are a major determinant in the survival of both cultivated and wild plants, including major food species such as breadfruit, with mortality occurring due to severe soil moisture stress, depleted groundwater and increased salinity. Although commonly thought to lie outside the tropical cyclone belt, Kiribati has recently been effected by destructive tropical cyclones, which bring increased rainfall to the Gilbert group.



Such recent shifts in weather patterns over a large part of the Pacific, in the forms of increased incidence of tropical cyclones and increased rainfall in some areas and prolonged drought in others, have been associated with the occurrence the El Nino (pronounced Ninyo) Southern Oscillation (ENSO) conditions and associated increasing atmospheric instability over the central equatorial Pacific due to cyclical warming of the eastern Pacific Ocean. ENSO conditions seem to have intensified in recent years, thus possibly reinforcing the potential negative impacts of projected sea level rise due to Global Warming.

## NATURAL RESOURCES AND PRODUCTION SYSTEMS

The natural resources of the Republic of Kiribati are either extremely limited, in the case of terrestrial, lagoonal and near-shore resources, or extremely vast and difficult to utilise and manage in the case of its oceanic marine resources within its extended exclusive economic zone (EEZ).

### Water and Soil

Apart from a freshwater lake at the eastern end of Teraina, there is no surface freshwater. The only permanent natural sources of potable water are limited groundwater in the form of freshwater "lenses" "floating" on the higher density seawater beneath the atolls. Because of water shortage, some of the Phoenix and Line Islands have historically been uninhabitable.

As with all atolls, the limited soil resources of Kiribati are among the most infertile in the world. Derived from coral limestone, atoll soils are shallow, alkaline, coarse textured and lack most nutrients required for plant growth. Plant nutrition is highly dependent on the humus cycle and the maintenance of the vegetation cover. Scattered throughout Kiribati are pockets of phosphate rich soils, which are believed to originate from guano deposits accumulated over long periods of time under groves of *Pisonia grandis*, a favoured seabird rookery species.

### Minerals

While the mining of rock phosphate on Banaba ceased in 1979 and other smaller deposits of fossilised sea-bird guano have been exhausted, there are still a few deposits thought to be promising as sources of fertiliser for use in local food production.

Kiribati has occurrences of cobalt-rich crusts and polymetallic manganese-nodules in the EEZ, with some potential for future exploitation. However, these deposits are not as extensive or economically attractive as those found in the neighbouring Pacific states, and their economic exploitation will not take place in the foreseeable future.

Sand, gravel, limestone rock aggregate and reef coral are relatively abundant, and their exploitation has been increasing for infrastructural development (e.g., causeways,

seawalls and buildings). These materials are often obtained at considerable environmental cost to limited land resources and to productive reef areas; negative impacts could be minimised by more careful selection of extraction areas.

## Flora

The indigenous flora of the atolls is extremely poor, with terrestrial associations limited to coastal strand vegetation, small areas of mangroves and coastal marsh, relict stands of inland forest, and on Banaba limestone escarpment vegetation. Of a total of 306 species present, only 83 (27.1%) are possibly indigenous. There are no reported endemics. Of the 83 indigenous species, 40 are severely restricted in distribution, endangered, or possibly extinct, due to removal and severe habitat modification, widespread destruction in World War II, monocultural expansion of coconut palms, and, in the case of Banaba, 70 years of open-cast phosphate mining.

## Terrestrial Fauna

Kiribati illustrates well the marked attenuation in the diversity of terrestrial and marine fauna which occurs with distance from Indonesia/Papua New Guinea eastwards into the Pacific. There are no endemic terrestrial species reported for Kiribati. The only terrestrial mammal (possibly an aboriginal introduction) is the Polynesian rat (*Rattus exulans*). In terms of numbers, the avifauna of Kiribati is considerable, but consists of mostly sea birds and migratory species. The bird populations of the Phoenix Group, although numbering in the millions, are comprised of less than a dozen families. Rare species include the Line Islands reed warbler (*Acrocephalus aequinoctialis*) and the red-tailed tropic bird (*Phaethon rubricanda*).

## Marine Resources and Mariculture

Kiribati's marine fauna is richer with an estimated 300 to 400 species of finfish. Marine resources now represent the sole opportunity for substantial commercial economic development. Industrial fishing makes an important contribution to the national economy (mainly through licensing revenues from foreign fishing vessels), while small-scale fishing is important nutritionally and for cash income.

There is considerable potential for further development of the pelagic and deepwater demersal fisheries within Kiribati's EEZ. Pelagic species of increasing local commercial or export potential are tuna (skipjack, yellowfin and dogtooth), big-eye scad, queenfish, rainbow runner, wahoo and mahimahi. The skipjack tuna resource is especially important. Deep sea demersal species of increasing importance include the snappers and jobfish. Important non-fish marine species include turtles, crabs, prawns, lobsters and other crustaceans, shellfish (both bivalves and gastropods) and seaslugs (holothurians). Species of particular nutritional and cultural importance, but which have come under increasing pressure from overexploitation, include bonefish (*Albula vulpes*), giant clams (*Tridacna* spp. and *Hippopus hippopus*), and an endemic cockle (*Anadara maculosa*).

Shell collecting could have increasing importance because the range of shell species, often with a high degree of colouration. Sea shells are in great demand for their ornamental value and for local handicraft production. They will continue to form the basis of a promising but limited trade as long as the resource is not over-exploited. Seaslugs, one of the first exports after European contact, still offer some potential for commercial development, although the small localised habitat of the more valuable species is a limiting factor. Seaweed culture has considerable commercial potential as a village industry, and the export value of the cultivated exotic eucheuma seaweed (*Eucheuma cottonii*) recently surpassed that of copra. There is also the increasing export of blue reef coral and some possibility for the export of aquarium fish and deepwater corals. The extent of these resources and the environmental impacts of these activities still need investigation.

Maricultural production of milkfish (*Chanos chanos*) on Kiritimati, originally for baitfish production for the pole-and-line tuna industry, but now for export and local consumption, is an important activity. On Tarawa, where there are extensive networks of recently constructed fishponds, production has been constrained by competition from the introduced Malayan mosquito fish or tilapia (*Oreochromis* spp.).

### Agriculture and Subsistence Production

Despite limitations of soil and water, the I-Kiribati have developed a sophisticated subsistence agriculture based on coconut, breadfruit, pandanus, native fig (*Ficus tinctoria*) and the cultivation of 'te babai', the giant swamp taro (*Cyrtosperma chamissonis*) in pits dug through to the freshwater lens and mulched and fertilised with the leaves of highly salt-tolerant coastal plants. Other important staple foodcrops, such as breadfruit, pandanus and coconut palms are also given similar care to ensure their survival in the atoll environment. Due to the increasing salinity of the groundwater, infestation by the Papua taro beetle (on Tarawa) and the declining importance of te babai relative to copra production, cash employment and imported food, a large proportion of the pits have been abandoned on some islands. Babai, however, still remains of great cultural importance as a ceremonial food in Kiribati.

There are currently a number of projects encouraging the cultivation of short-term vegetables and appropriate food trees and to promote increased production of pigs and poultry to widen the local nutritional base, especially in rapidly urbanising South Tarawa.

Commercial export cropping is restricted to the coconut palm for the production of copra, the world price of which continues to fall relative to the cost of imported goods. Whereas 15 years ago a tonne of copra bought Kiribati 100 barrels of oil, it now buys only 10, a reality imposed on Kiribati and other developing countries by the unchanging nature of world trade relationships. Despite decades of coconut replanting and rehabilitation programmes to replace senile palms and to expand plantations, copra production continues to fall.

There is virtually no forestry activity, although casuarina, eucalyptus, leucaena (*Leucaena leucocephala*) and a number of other species have been introduced for

windbreaks, fuelwood production and soil improvement. There is considerable interest in mounting appropriate coastal reforestation, agroforestry and forest protection programmes, both for their ecological and cultural value and their role in ameliorating the potential impact of global warming and sea level rise.

A particularly important role of the agricultural system, in addition to food and export production, is the production of a wide range of other useful products such as medicines, beverages, animal feed, fuelwood, fertiliser, tools, fishing equipment, handicrafts, construction materials, canoes, fencing, fibre and cordage, dyes, oils, perfumes, body ornamentation and toys, the value of which, when added to the value of subsistence fishing, is estimated to constitute between 20 to 80 per cent of the real incomes of Kiribati's rural, outer island communities. The protection of this time-tested subsistence production system is seen as a priority for sustainable development because of the limited opportunities for cash income in Kiribati and because the replacement of these products with imported substitutes would either be impossible or extremely expensive and subject to the same deterioration in terms of trade and inflationary pressures affecting all imports.

## DEMOGRAPHIC TRENDS

Ethnically the I-Kiribati are Micronesians although there is some Polynesian influence due to long contact, particularly with Tuvalu to the South. The 1990 population of 72,298 is grossly unevenly distributed with 96 per cent living in the Gilbert Islands Group and one-third of these on the tiny islets of urbanised South Tarawa, where population densities and pressure on scarce terrestrial and lagoon resources are extremely high.

The age-sex population structure is broad at the base with 40 per cent younger than 15 years, and a median age of 20 years. Of the four atoll nations of the Pacific (Kiribati, Marshall Islands, Tokelau and Tuvalu), Kiribati is reported to have the highest rate of infant mortality (i.e., 82 per 1000 live births) and an average life expectancy at birth of only 53 years.

The average annual rate of natural population increase is 2.4 per cent. However, emigration is estimated at 0.3 per cent, which results in a net annual population growth rate of 2.1 per cent, (i.e., with a doubling of the population in 35 years). Reliable figures on internal migration do not exist, but considerable migration can be observed from the outer islands to urban South Tarawa. Of the emigrants about 1000 are working in the phosphate mine on Nauru and a few hundred others are engaged as merchant seamen. With the projected return of people from Nauru with the cessation of phosphate mining early next century, population pressure on resources in both urban and rural areas in Kiribati is expected to increase.

## ECONOMIC STRUCTURE

For more than 70 years the cash economy of Kiribati (then the Gilbert Islands within the British Colony of the Gilbert and Ellice Islands) was dominated by phosphate mining on Banaba. This industry contributed about 85 per cent of export earnings, 45 per cent of GDP and 50 per cent of government revenue. The mining turned Banaba into an almost unrecognisable moonscape of almost no developmental potential. The original inhabitants were resettled on Rabi Island in Fiji. On the eve of Kiribati's independence in 1979, the phosphate mining ceased which immediately cut foreign earnings and government revenues in half.

Kiribati has limited natural resources of economic importance except for fish, primarily tuna (currently the major non-aid source of foreign exchange by value) and some future possibility of mining sea-bed minerals. Coconut products, mainly copra, have been the second most important export by value and the sole agricultural export, although the export of *Eucheuma* seaweed which is used in food processing has recently surpassed copra exports in value.

Outside of Tarawa and Kiritimati there is little infrastructural or other economic development. Most paid employment is in the public sector, with only 11,142 people reportedly in cash employment. Since 1956 Kiribati has accumulated royalties on phosphate exports in a Revenue Equalisation Reserve Fund (RERF) and avoided drawing down that capital, except for its purchase of Teraina (Washington Island) and Tabuaeran (Fanning Island) in the Line Group. In 1985 Kiribati managed to do away with budgetary support from Great Britain. The trade deficit is met primarily through the fishing licence fees paid by foreign vessels fishing in its EEZ, through grant aid and through significant levels of remittances from I-Kiribati working overseas.

Tourism development is minimal, although there is some promise of expanding a specialised tourist industry on Kiritimati, based on avifauna and game-fishing. Because of Kiritimati's large size, small population and government ownership of land, there are plans for the resettlement of Gilbert Islands people there, and on Teraina and Tabuaeran, and for further development of the Line Islands coconut industry.

## ENVIRONMENTAL ISSUES

Two main sets of environmental issues are the primary focus of Kiribati attention. One set concerns those issues arising from the impacts of population growth, urbanisation and modernisation on isolated, resource-poor atoll islets, particularly on urbanised South Tarawa. The second, broader set includes: the consequences for Kiribati of global warming and any resulting rise in sea-level; the dangers associated with nuclear pollution and the disposal of hazardous waste by industrial nations in the shared oceanic environment; the need for improved management of Kiribati's EEZ; resource development problems, in terms of cash generation (e.g., viable artisanal fisheries development), in the 'Outer Islands' --- that is, all islands outside of South Tarawa; and a range of problems related to strengthening environmental education and other institutions needed to promote environmentally sustainable development.

## Population Growth and Urbanisation Impact

High population densities and rapid urbanisation, particularly in overcrowded South Tarawa have led to problems of: (a) groundwater depletion and pollution through percolation of sewage or effluent from domestic animals; (b) contamination of shellfish by micro-organisms from human excrement; (c) overfishing of reefs and lagoons; (d) garbage and sewage disposal; (e) coastal erosion and sedimentation attributed principally to extraction of foreshore materials and construction of causeways between islets; (f) the shortage of firewood for cooking; and (g) breakdown of traditional food and subsistence production systems and knowledge, and associated problems of increasing economic dependency and incidence of malnutrition and nutrition-related non-communicable diseases such as heart disease, stroke and diabetes.

With a high incidence of diarrhoeal disease as a major cause of mortality, a recent history of cholera (in the late 1970s), and increasing nutrition-related health problems, health and sanitation are among the major concerns arising from urbanisation. The underlying problem to be addressed is the rapid growth and imbalanced distribution of population. There are simply too many people on the islets of urbanised South Tarawa; the population already far exceeds the carrying capacity of the natural resource base. In response the Kiribati Government is giving priority to family planning and actions designed to make it attractive to settle in less populated areas. At the same time government programmes address urgent environmental, social and health issues, such as housing, waste management and water resource conservation resulting from overpopulation, both in South Tarawa and on other islands.

## Global Warming and Sea-level Rise

There is grave concern that the atolls of Kiribati will become uninhabitable as a result of global warming and associated sea level rise. This has caused serious concern at all levels in the community, and threatens the very existence of atoll societies. There is uncertainty as to the amount and rate of sea level rise; but IPCC predictions are from 12 to 40 cm by the year 2030 and 30 to 100 cm by the end of the next century. Although evidence from El Nino phenomena shows that the sea-level near Kiribati has risen from time to time as much as 40 cm higher than its current average level, there is doubt as to whether Kiribati could cope with a similar El Nino rise superimposed on higher average levels associated with global warming.

While issues of climatic change should not be overdramatised, it is clear that the likelihood of sea-level rise must be given priority consideration in planning for sustainable development in Kiribati. Even if protective coral reefs continue to grow upwards at a rate greater than that of rising sea levels, the coastline will become more prone to tsunamis, storm surge and erosion; freshwater resources and agricultural and subsistence production systems will be subject to increased saltwater incursion and seaspray; engineering structures will be threatened; and the construction of new infrastructure near the shore subject to greater risk.

Kiribati, thus, views the problem of Global Warming (Climate Change) and associated sea level rise with grave concern and believes there is great urgency to address the problem immediately. Kiribati is actively involved in global efforts to monitor climatic change and rising sea levels through the NOAA administered TOGA programme. It will also participate in the South Pacific Forum network of sea-level monitoring stations.

### **The EEZ**

Given its desire for economic self-reliance, a growing population and extremely limited terrestrial resources, Kiribati is heavily dependent on its ability to exploit, on a sustainable basis, and serve as a custodian for its enormous 3.55 million square kilometre EEZ. Present indications are that the resource is currently underutilised, with considerable scope for increasing its own national tuna-fishery fleet (4-5 pole and line vessels), and for permitting further fishing by foreign vessels, provided that suitable licensing arrangements and fee structures are adopted.

Ensuring that the resource is exploited fully but sustainably requires close monitoring and continued surveillance of all fishing activities. For this Kiribati must rely on the assistance of the Forum Secretariat, FFA, SPC, SPREP, other regional agencies and larger regional countries such as New Zealand and Australia, with the cooperation of distant water fishing nations.

### **Nuclear Pollution and Hazardous Waste Disposal**

Kiribati is concerned over the long term impact of nuclear weapons testing and nuclear pollution on the peoples of Kiribati, their island environments (in particular Kiritimati Island, where atmospheric tests were conducted by the Americans and the British), and on other peoples of the Pacific and the shared oceanic environment. Some evidence indicates that there may be levels of residual radioactivity on Kiritimati which constitute a danger to human health.

There is similar concern over the negative impacts of the disposal of hazardous and military wastes by industrialised countries in neighbouring island groups and in the oceanic environment, and the inability of Kiribati to control such actions.

### **In-shore Fisheries**

Over-exploitation of in-shore fisheries stocks and reef resources is most serious in Tarawa Lagoon and on South Tarawa reefs. Elsewhere, there is some evidence of overexploitation of giant clam, cockle or *te bun* (*Anadara maculosa*), bonefish, flying fish and some other finfish species, although the impact on the outer islands is limited by the inadequacy of suitable storage and transport. These limitations are being actively addressed by the government, with external technical and financial support. As a result there is greater availability of fish in local markets and an apparent decline in imports of

tinned fish per capita. Attempts at outer island fisheries development have, however, been seriously constrained by fuel costs for fishing vessels and transportation of catch.

### **Breakdown of the Traditional Food and Subsistence Production System**

Infant malnutrition, iron-deficiency anaemia and vitamin A deficiency-induced night blindness among children and nutrition-related non-communicable diseases, such as heart disease, stroke and diabetes, among adults are increasingly serious health problems in Kiribati. The main causal factor is a shift from a traditional diet to a diet of imported foods which are high in sugar, salt, alcohol and animal fat, and low in vitamins, minerals and fibre. This shift is due in part to the breakdown in the traditional food system and a change to a sedentary lifestyle, particularly in South Tarawa.

The breakdown in the traditional food and subsistence production system not only affects health. It also undermines the provision of fuel, medicines, handicrafts and many other products, the loss of which has made Kiribati very dependent on expensive imported products at considerable expense in scarce foreign exchange, and, thus, constitutes a major constraint to sustainable development.

### **Sanitation and Health**

Many of the health problems in Kiribati are due to the contamination or shortage of water supplies. Recent studies have shown that the southern portion of Tarawa Lagoon is still contaminated due, in part, to people continuing to use the beach rather than toilet blocks for defecation. Other problems arise from frequent blockages of the public toilet facilities, too few connections to the system by private owners, system leakage, and the discharge of sullage on the ground. As part of efforts to improve sanitation on South Tarawa, a salt-water sewerage system has been installed which discharges into the open ocean beyond the reef and not into the lagoon.

### **Water supply**

A major project for a Tarawa Water Supply System commenced in 1983 and has now entered its second stage, involving the identification of potential new water reserve areas in rural North Tarawa. Outside Tarawa, the Outer Island Water Supply Unit aims to provide safe drinking water on the basis of one handpump well for every ten households. Groundwater resources are monitored and analysed for total coliform, faecal coliform and dysentery bacteria counts, but only routinely on South Tarawa. The supply and monitoring issues raise the question of the wisdom of using reticulated water supply systems which draw on fragile groundwater resources to supply drinking water. Use of contaminated or overdrawn water reserves has been suspended and programmes to increase rainwater catchment capabilities have been implemented.



## **Solid waste disposal**

Solid waste disposal is a major problem given the susceptibility of groundwater and marine resources to pollution and increasing pressure from metropolitan powers to dispose of hazardous waste in atoll and oceanic environments. There is uncertainty regarding the availability of land for safe landfill sites; a lack of disposal facilities for hazardous waste; increasing dependence on imported non-biodegradable products and packaging; a lack of information on the nature and origin of waste and its environmental impacts; and a lack of legislation controlling toxic and non-biodegradable waste. Inability to stop use of neighbouring islands and oceanic areas as waste disposal/reduction sites is also a major concern.

## **Energy**

Kiribati is almost totally dependent on imported fossil fuel for its commercial energy. Almost all electricity generation depends on diesel fuel, and motor vehicle, aviation and marine vessel fuels are imported at very high cost to the country. An exception is the promotion of solar photovoltaic technology for outer islands where there is no power supply or regular supply of fuel for generators. The Solar Energy Corporation was established in 1985 and provides infrastructural and technical services for importing, retailing and servicing photovoltaic equipment. The Energy Planning Unit is also investigating alternative sources of renewable energy.

In terms of domestic energy, fuelwood is used for 90 per cent of cooking in the outer islands and also by most families in South Tarawa. Overexploitation of fuelwood in South Tarawa, as well as the increased population and the high cost of kerosene and other fuelwood substitutes have resulted in the reduction of fuelwood as a source of fuel for domestic cooking.

## **Causeways and marine management**

The Kiribati Government has initiated a number of environmental programmes. Studies have evaluated the environmental impacts of existing and proposed causeways linking atoll islets, with an aim of improving the location and design of any existing and proposed causeways to minimise negative environmental impacts. A complementary applied atoll ecological study addresses issues of marine resource management and environmental protection for atoll communities.

## **Training, education and public awareness**

Considerable effort is required to improve environmental education in primary and secondary schools. At the primary school level no course focuses on environmental change and human impact, although there is a general nature-oriented Environmental Studies course. At the secondary level there is no formal study of the environment beyond topics addressed in the context of traditional geography, chemistry and biology

curricula. However, the geography component of the Kiribati Seventh Form High School programme (a preparatory year before tertiary studies) includes a major emphasis on sustainable development issues in the Pacific Islands. So far Kiribati has not utilised the courses offered by the USP leading to a Bachelor of Science in Environmental Studies and a Diploma in Environmental Education, although these courses are in demand in other countries of the region.

In the area of public awareness of environmental issues, little use has been made of visual and audio media. There is no regular radio programme on environmental topics although there is a programme for health education and a major programme to promote water conservation.

### **Legislation**

Although Kiribati does not have a comprehensive national environmental policy, there are a number of sectorally related ordinances which provide regulations for coastal protection, the conservation and protection of fish, the protection of specified birds, and for endangered or culturally important plants. These ordinances need updating, and their environmental regulatory content integrated into national umbrella legislation on the environment. New legislation should also include provision for mandatory EIA procedures.

The Local Government Act 1984, which provides for a system of Island Councils, is a particularly important instrument for environmental management and protection. Several Island Councils have adopted by-laws prohibiting destructive or wasteful fishing methods with the view to conserving stocks and ensuring that the resource provides a more equitable benefit to all members of the community.

On the international scene, Kiribati is a signatory to or has acceded to all environmental-related conventions of the South Pacific, including the Apia and SPREP Conventions, the Rarotonga Treaty and the Tarawa Declaration on oceanic driftnetting.

### **Institutional**

While individual government departments retain day-to-day functional responsibility for environmental concerns relevant to their own sectors, the Government has shown a priority concern for addressing environmental issues and promoting sustainable development by: giving the newly created Ministry of the Environment and Natural Resources Development a central role in environmental planning and management; establishing a Kiribati Task Force on the Environment (KTFE); and appointing an Environment Coordinator. A Technical Adviser is being sought through SPREP to assist an Environment Unit.

The Environmental Unit will be expected to formulate and implement a multi-sectoral programme of environmental planning and management. The work of this unit

would be greatly strengthened by the formation of a cross-sectoral Advisory Committee, representing all ministries and other government bodies as well as the private sector and non-government organisations.

## OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT

The environmental issue of top priority for Kiribati citizens is the prospect of a significant rise in sea level as a result of global warming. The area of utmost concern in relation to future economic development is the sustainability of production of the key marine resources of its lagoons, reefs and EEZ, the capital inheritance on which I-Kiribati can subsist and earn the cash to purchase the other commodities needed by a society seeking to improve its standard of living.

The sustainability of the resource, if managed wisely, is evidenced by the fact that it is still possible, even in South Tarawa and other densely populated areas, for families to harvest their daily protein needs from the intertidal and fringing reef areas, despite thousands of years of fishing activities. This could change if proper management practices are not adopted. Kiribati's 3.55 million square mile EEZ has the greatest development potential in terms of its currently underexploited pelagic and demersal fisheries potential. It is here that the Republic of Kiribati proposes to focus even greater attention in order to achieve that measure of economic self-dependence to which it aspires.

On shore, the over-riding concern will continue to be issues arising from overpopulation and the impact of urbanisation on a limited terrestrial resource base, particularly in South Tarawa. Related to this is the accelerating breakdown of the traditional subsistence production system which has, for hundreds of generations, given Kiribati's people resilience and insulation against natural and economic factors beyond their control. The Government's decentralisation efforts and resettlement programme aim to reduce high population densities in the Gilbert Group and to develop the Northern Line Islands by resettling people from South Tarawa and other islands in the Gilbert Group to the Line Islands. The success of these policies will depend in large measure on the economic opportunities and quality of life offered to the new Line Islands communities. The programme will require a significant long-term funding commitment, and feasibility studies have already commenced.

The promotion of culturally acceptable birth control measures is of highest priority, followed closely by the need for water supply and waste disposal improvement and the promotion of local food production and consumption to address serious environmental-health and nutrition-related health problems. Greater emphasis on tertiary education is necessary to appropriately prepare I-Kiribati for employment both at home and overseas.

Given the problems of saltwater intrusion, depletion and pollution, further tapping of the underground lenses for domestic water supply has limited potential. Most household water needs can be met by improving rainwater-catchment systems, and restricting the pumping of groundwater to periods of very special community need, such as extended drought. Abundant evidence from experience elsewhere confirms the value of such systems. The initial cost would be high, but so is the operation of a groundwater-

based reticulated water system. Durable roofing, guttering, downpipes, and storage tanks for highly corrosive salt-air environments could be made obligatory to reduce maintenance costs and recurrent expenditure. Kiribati would also benefit from packages of assistance to design and implement systematic installation of suitable rainwater catchments and storage on all domestic and public buildings.

Government emphasis on sustainable production systems will move away from coconut palm monoculture for copra production (for which there is a very depressed world market price) and towards more traditional agroforestry systems which incorporate a range of tree crops, long- and short-term ground crops and other plants of economic, cultural and ecological importance.

## **KIRIBATI COMMITMENT TO SUSTAINABLE DEVELOPMENT AND UNCED**

In, short, sustainable development in Kiribati must be seen as "ecodevelopment": development which gains for Kiribati the more appropriate technological and social benefits of modern urban industrial societies, while at the same time protecting, to the best of its ability, the social systems, knowledge and the terrestrial and marine resources that have allowed Kiribati to sustain atoll life in the past. The overall aim is to achieve the optimum balance between modern economic development and the protection of the traditional subsistence base so that future generations will have the same opportunities that the current generation has to be healthy and to realise a reasonably high standard of material and cultural wellbeing. To this end, the Government and people of the Republic of Kiribati have a firm commitment to the objectives of UNCED and other international initiatives designed to promote sustainability, environmental protection and the alleviation of poverty worldwide.

It is stressed that because most of the constraints to, and the possible actions or opportunities for promoting environmentally sustainable development are interrelated, the prioritisation in no way suggests that Kiribati will address these issues in isolation one at a time. Rather, the Government is fully committed to addressing these issues, simultaneously, in an effort to promote sustainable cross-sectoral development for the benefit of future generations. Moreover, it is stressed that many of these initiatives, including international treaties and accords, collaborative research, strengthening national environmental management capabilities, and the restructuring of the world economic order and current development thinking, along lines which will foster environmentally sound and sustainable development will require a truly multidisciplinary, cross-cultural and international effort.

Kiribati firmly believes that the UNCED Earth Summit may be the singly most important initiative towards realising the goal of environmentally sound and sustainable development in the history of the human race. Kiribati is thus honoured to participate in the UNCED deliberations, and through this document lends its full support to any resolutions that will enhance the chances for human kind, particularly the countries of the developing world, to address the environmental problems of our age for the benefit of future generations.

## SECTION I

### DEVELOPMENTAL TRENDS AND ENVIRONMENTAL IMPACTS

This section provides an overall picture of the potential for sustainable development in the Republic of Kiribati ("Gilberts" in the local orthography). It includes chapters on: 1) the natural resource endowment of the country; 2) patterns of economic development over the past two decades; 3) population and demographic trends; and 4) major environmental and cultural issues or constraints to sustainable development.



# CHAPTER 1

## NATURAL RESOURCE ENDOWMENT

### 1.1 INTRODUCTION

The natural resources of the Republic of Kiribati are either extremely limited, in the case of terrestrial, lagoonal and near-shore resources, or extremely vast and difficult to utilise and manage in the case of its oceanic marine resources within its extended exclusive economic zone (EEZ) of 3.55 million km<sup>2</sup>.

There is, consequently, a pressing need for improved development and management, on a long-term basis, of these resources to serve the commercial and subsistence needs of current and future generations of I-Kiribati (the people of Kiribati). To do so most effectively, there is a need for practical developmental research on the living and non-living natural resources of atolls. Such research might include: 1) generation of data on the extent, nature and current use or development and conservation status of its natural resources; 2) evaluation of current and potential development strategies (both traditional/local and modern/imported); and 3) assessment of the impact that different development or management alternatives might have on our resources or on the potential for sustainable management of these resources the people of Kiribati. Without such data, resource development, management and conservation will be problematic.

This chapter attempts to summarise the current state of information on the non-living and living resources available to the Republic of Kiribati. The resources that will be covered include: 1) total land and ocean area, 2) nature of the land, 3) climate, 4) water resources, 5) soil resources, 6) mineral resources, 7) vegetation, 8) fauna, 9) fisheries resources and 10) traditional agricultural resources and land use systems. The analysis will include: 1) the economic and social uses of these resources, 2) their environmental significance, 3) the nature of their ownership, and, 4) rates of change.

### 1.2 LAND AND OCEAN AREA

The Republic of Kiribati has a total land area of only 822.8 km<sup>2</sup>. It consists of 33 islands in three main groups - the Gilbert Islands (formerly part of the British Gilbert and Ellice Islands Colony and known locally as Tungaru) in the west, the Phoenix Islands in the centre, the Northern and Southern Line Islands to the east, plus the single island of Banaba, 400km to the west of the Gilbert Islands. The islands are extremely isolated and fragmented, covering an ocean area of some 13 million km<sup>2</sup> between 4 deg 43 min N and 11 deg 25 min S latitude and 169 deg 32 min and 150 deg 14 min W longitude. They extend some 3,870 km from Banaba on the west to Kiritimati (Christmas Is.) in the east and 2,050 km from Teraina (Washington Is.) in the Northern Line Islands to Flint Island in the Southern Line Islands. There is, thus, very limited land area, spread over millions of km<sup>2</sup> of deep ocean.

The main Gilbert (Tungaru) group, consists of 16 small atolls or limestone islets extending 640 km from north to south and located 700 km to east of Nauru, 400 km east of Banaba, and about 250 km to the south and north of the atoll nations of Tuvalu and the Marshall Islands. Although the total claimed land area of Kiribati is 822.8 km<sup>2</sup>, some 93.3% of the population of 72,298 live in the Gilbert Group, which constitutes only 278.4 km<sup>2</sup> (33.8%) of the total area. The islands, of the group, from north to south, include, Makin, Butaritari, Marakei, Abaiang, Tarawa, Maiana, Abemama, Kuria, Aranuka, Nonouti, Tabiteuea, Beru, Nikunau, Onotoa, Tamana and Arorae. All are true atolls with central lagoons, with encircling islets of varying size and shape, except Kuria, Tamana and Arorae, which are slightly raised limestone islets or "table reefs" with no lagoons. The size of individual islands ranges from Tamana and Makin, with areas of 5.2 and 7.2 km<sup>2</sup>, to Maiana, Abaiang and Tabiteuea, with areas of 28.1, 28.5 and 49 km<sup>2</sup>. Tarawa, the most populous island, where the capital is located, has islets with an estimated area of 19.9 km<sup>2</sup>, extending over 64 km from north to south.

The Phoenix group consists of eight scattered islands located between 2 deg. 30 min. and 4 deg. 30 min. S. lat. and 170 deg. 30 min. and 174 deg. 30 min. W. long. The islands, which have a total land area of only 28.7 km<sup>2</sup>, are Kanton (Canton), Enderbury, McKean, Birnie, Rawaki (Phoenix), Nukumaroro (Gardner), Orona (Hull) and Manra (Sydney). All are low atolls with enclosed lagoons.

The Line Islands are made up of three northern islands, Teraina (Washington), Tabuaeran (Fanning) and Kiritimati (Christmas) and five southern islands, Malden, Starbuck, Vostok, Caroline and Flint. They have a total land area of 515.7 km<sup>2</sup> and constitute 62.7% of the land area of Kiribati. the largest island in the group is Kiritimati with an area of 363.7 km<sup>2</sup>.

Banaba, an uplifted coral-limestone island is located 400km west of the Gilbert group at 0 deg. 53 min. S. lat. and 169 deg. 35 min. E. long.

### 1.3 NATURE OF THE LAND

In terms of the nature of land or geomorphology, Kiribati consists of true atolls which encircle or partly encircle central lagoons; limestone or reef islands, with no lagoons; and the uplifted phosphatic limestone island of Banaba.

#### 1.3.1 True Atolls

In general, the true atolls, such as those of the Gilbert, Phoenix and Line groups, usually have an uplifted fringing limestone reef in the wave zone on the ocean side, which may be covered by a sandy beach. This runs up to a raised rampart or shingle ridge of wave-washed boulders and coral fragments deposited during storms. This is commonly the highest portion of the island, or of the individual islets that comprise the atoll, and no more than 3 m above mean sea level. Inland of the rampart and extending towards the lagoon is an area of windblown sand. Near the lagoon shore, the increasingly finer



deposits are of lagoonal origin. Limestone outcrops with little or no soil and lowlying swampy areas are commonly found on islets.

On Teraina (Washington), which is about 3m above sea level, there is a large freshwater lake at its eastern end, and on Kiritimati, the largest purely coral limestone island in the world, there are over a 100 small saline lakes, some several kilometres in diameter.

### 1.3.2 Limestone or Reef Islands

Small low-lying limestone or reef islands (sometimes referred to as table reefs), with no sheltered central lagoon and very limited land areas include Makin, Kuria, Nikunau, Tamana and Arorae, the smallest being Tamana with an area of only 5.2 km<sup>2</sup>. Nikunau has a small landlocked lagoon in the north.

### 1.3.3 Banaba

Banaba (Ocean Island), a raised limestone island or "raised atoll" about 10 km in circumference, rises to a central plateau with a maximum elevation of about 78 m. It consists of a narrow coastal plain of variable width, encircling a limestone escarpment, which rises to a central plateau. The escarpment ranges in gradient from vertical cliffs to gradually-sloping areas of colluvial soil interspersed with limestone outcrops and pinnacles. The raised plateau consists of a matrix of coral-limestone pinnacles and limestone outcrops, between which lie extensive deposits of soil and tricalcic phosphate rock containing 39% phosphorous pentoxide with few impurities.

### 1.3.4 Quality of Anchorages

Some islands, such as Butaritari, Abaiang, Tarawa, Abemama and Tabiteuea in the Gilbert group; Orona (Hull) in the Phoenix group; and Tabuaeran (Fanning) and Kanton (Canton) in the Line group, have passes or channels giving access to suitable anchorages within the lagoons. Other islands, such as Banaba, the reef islands, Makin, Kuria, Nikunau, Tamana and Arorae, and atolls with no passes into the central lagoons, such as Maiana and Aranuka in the Gilbert group, McKean and Manra (Sydney) in the Phoenix group, and Teraina (Washington) in the Line group offer few safe anchorages. Teraina, for example, has been described as the most dangerous loading port of the Pacific, with offshore anchorages useable only during calm weather. Onotoa has a good boat channel, but no safe anchorages. Some with only small passes, such as Marakei and Nounouti in the Gilberts and Kiritimati in the Line group are only navigable by small boats. A boat passage has been blasted through the reef on Flint Island in the Line group.

## 1.4 LAGOONAL AND REEF RESOURCES

Most of Kiribati's islands have protected lagoons with significant sand and subsistence fisheries resources. Some islands, however, like Tamana and Arorae, are table reef islets with no lagoons. All islands have some fringing reef and reef slope resources, all of which are of critical subsistence importance, as well as being of limited, primarily local commercial importance, particularly in the case of the deep-water snapper resource. These will be discussed in detail below under fisheries resources.

## 1.5 OCEANIC/PELAGIC RESOURCES

Kiribati's EEZ of some 3.55 million km<sup>2</sup> has considerable potential for pelagic fisheries development, and, to a lesser extent, for the harvesting of deepwater corals. There is also longer-term potential for mineral resource development in terms of the occurrence of polymetallic manganese nodules and cobalt-rich crusts. In both cases, however, Kiribati lacks the technology, capital, and, in some cases, the knowledge of the nature of these resources, and must depend on outside assistance to negotiate the most appropriate aid-funded, joint-venture or leasing arrangements to exploit these resources. These resources will be discussed in detail below under mineral resources and fisheries resources.

## 1.6 CLIMATE

Climatically, Kiribati is located in the dry belt of the equatorial oceanic climate zone, with mean daily temperatures ranging from 26 to 32°C, with the recorded highs and lows being 22 and 37°C. Annual rainfall is extremely variable, both annually and between islands, with annual averages in the Gilbert group ranging from about 1000 mm for the drier islands such as Arorae and Tamana near the equator to 3000 mm for the wetter islands such as Butaritari in the far north, and 1,550 at Tarawa. Rainfall in a good year in the Phoenix group ranges from 1000 to 3000mm, while the Line Islands varies from about 700mm at Kiritimati to more than 4000mm at Teraina (Washington Island) some 400km away. The natural vegetation and crops are, consequently, much more luxuriant on islands like Butaritari and Makin in northern Kiribati proper and Teraina in the Line Group, which are outside the equatorial dry belt.

Severe prolonged droughts, with as little as 200 mm of rain per year, are common particularly in the central and southern Gilberts, on Banaba, the Phoenix Islands and on Kiritimati. Such droughts, such as that which prevailed over the group from 1987 to early 1989, lead to the death of non-coastal exotics such as breadfruit, giant swamp taro (*te babai*), and other food plants, severely restrict the production of coconut palms, the sole cash crop and the major staple food plant, and can place severe stress on even the most hardy coastal strand species.

The quantity and quality of groundwater (see below), a major determinant in the long-term ability of plants, animals and humans to survive in the small-island environment is severely affected during times of extended drought. Attempts by the British to

permanently settle I-Kiribati on the Phoenix Islands of Manra (Sydney) and Orona (Hull) in 1938 ended in failure due to drought and water scarcity, with the inhabitants being resettled in Solomons Islands in 1958 and 1963, respectively.

## 1.7 WATER RESOURCES

Apart from a number of landlocked saltwater lagoons and salt pools there are no surface freshwater resources on most of the islands in Kiribati. The only permanent freshwater resource is groundwater in the form of a "lens" of often slightly brackish freshwater, hydrostatically "floating" on the higher density saltwater beneath the island. The height of the lens above sea level and the level of salinity vary in relation to the elevation, shape and width of islets and the amount of water use and rainfall. Replenishment or recharge of the lens is solely dependent on rainfall. In areas where the lens is close to the surface, pools are often found during excessively wet periods, especially during high tides.

The location and degree of development of the groundwater resource influences the nature of the vegetation as well as the location of village wells and cultivation pits. As stressed above, the quantity and quality of groundwater and the habitability of islands is severely affected during times of extended drought.

On Teraina (Washington), which is about 3 m above sea level, there is a large freshwater lake at its eastern end, and on Kiritimati, the largest purely coral limestone island in the world, there are over a 100 small saline lakes, some several kilometres in diameter.

## 1.8 SOILS

The atoll soils of Kiribati are possibly among the most infertile in the world. They are young, shallow, alkaline, coarse textured and have carbonatic mineralogy. Because of their immaturity, are similar to the original coral-limestone parent material. They are composed of a variable layer of organic matter and coral sand and fragments overlaying a limestone platform. They range from 25 cm to 1 m or deeper, with some accumulation of clays and  $H_2S$  near the centre of islets near the water table. Potassium levels are often extremely low, and pH values of up to 8.2 to 8.9 and high  $CaCO_3$  levels make scarce trace elements, particularly iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn), unavailable to plants. Activity of soil micro-organisms is limited, soil water-holding capacity is very low because of coarse texture, and ground water is often saline. Fertility is, thus, highly dependent on organic matter for the concentration and recycling of plant nutrients to lower soil pH, and for soil water retention in the excessively well-drained soils. These factors together make conventional agriculture, as practiced on other larger Pacific islands, very problematic in Kiribati.

Although levels of organic matter can be relatively high in undisturbed soils under natural vegetation, it can decrease dramatically as a result of clearance by fire or replacement by coconuts or other introduced plants.

Although no data are available, the plateau soils of Banaba are probably similar to the soils of Nauru, which vary from shallow soils, composed primarily of organic material and sand or dolomite, with very little phosphate, on the tops of limestone pinnacles, to deep phosphatic soils and sandy phosphatic rock, up to over 2 m deep between the pinnacles. Topsoils range from 10 to 25 or 30 cm in depth overlaying a deeper material which is frequently reddish yellow between 25 and 75 cm depth, changing to pinkish grey at greater depth. Undisturbed plateau soils have a high level of organic material and are generally fertile. Calcium dominates the exchange complex and exchangeable magnesium is also high. Exchangeable potassium is low and extractable phosphate values generally high and sulphate moderate. The trace elements manganese, copper, cobalt and molybdenum are very low and these plus iron and zinc are rendered unavailable to plants under pH values >6.5.

Scattered throughout Kiribati, are also areas of phosphate-rich soils and phosphate deposits, which seem to have originated from guano deposits accumulated over long periods of time under *Pisonia grandis* groves, a favored seabird rookery species. These soils are often more acidic and darker than the surrounding soils.

In some low-lying areas on the islets of Kiribati there are poorly developed, but relatively fertile, wet soils.

## 1.9 MINERAL RESOURCES

The mineral resources of Kiribati include: 1) sand, coral, gravel and limestone rock aggregate; 2) tricalcic phosphate rock; 3) guano deposits; and 4) undetermined, potentially important unexploited concentrations of deep-sea-bed polymetallic manganese nodules and cobalt-rich crusts.

Although abundant, sand, coral, gravel and limestone rock for construction and reclamation purposes are often obtained at considerable environmental cost. In the case of sand mining and the use of dead and living coral from lagoons and fringing reefs, their removal can lead to accelerated coastal erosion and losses of considerable areas of land. In the case of the use of coral, often for seawall construction, there is considerable disturbance of marine habitats and an associated loss of fisheries resources. Nevertheless, if done in the most appropriate areas, the acquisition of these materials can be accomplished with minimum impact, and in the case of excavating new pits for the cultivation of *Cyrtosperma* taro and other food and non-food plants, can have a beneficial impact on sustainable development. The recognition of the value of sand, coral and aggregate as scarce resources and of the potential for environmental disruption in their removal has prompted landowners to now insist that both individuals and the government pay for it, whereas this was not necessarily the case in the past. This has occurred particularly with respect to the increasing needs for sand and aggregate for the construction of causeways joining islets and land reclamation and the construction of fish ponds and seawalls on Tarawa.

One attempt was made to export white sand from Tabuaeran and Teraina to Hawaii and the U.S. mainland on a commercial basis in the early 1980s, although this operation has since ceased.

One possible source of sand for construction and reclamation, which is being explored for the purpose of filling the "borrow pits" on Tuvalu is through appropriate dredging of sand and aggregate from lagoons. SOPAC is currently planning a pilot dredging project to determine the feasibility and the environmental impact of lagoon dredging in Tuvalu.

In terms of phosphate, because the open-cast mining, which ceased in 1979, was only 70% efficient (with 30% of the phosphate still remaining after mining), an Australian company showed interest in re-mining Banaba in the mid-1980s. The proposal was not pursued because of depressed world phosphate prices and because the plant and mining equipment left on Banaba could not be rehabilitated. Whether or not Banaba will ever be re-mined depends mainly on the world price of phosphate, and the political stability in South America and the Middle East, the sources of most of the world's phosphate.

Many of the islands of the Kiribati group have deposits of fossilised sea-bird guano, usually formed under groves of *Pisonia*, a favoured sea-bird rookery and roosting species. Most of the larger deposits in the Phoenix and Line Islands, where there have been large sea bird populations for thousands of years, were mined in the mid- and late-1800s by foreign interests. Islands where guano mining took place include Rawaki (Phoenix), McKean and Enderbury in the Phoenix group, and Kiritimati, Malden, Starbuck, Caroline and Flint Islands in the Line group. Some smaller deposits still exist on islands such as Onotoa in the Gilbert group, which could provide sources of guano for local food production.

There is also some longer-term potential for mineral resource development in terms of the occurrence of cobalt-rich crusts in the Phoenix group and polymetallic manganese nodules in the Line group. In both cases, however, Kiribati lacks the technology, capital, and, in some cases, the knowledge of the nature of these resources, and must depend on outside assistance to negotiate the most appropriate aid-funded, joint-venture or leasing arrangements to exploit these resources. Moreover, the cobalt and polymetallic manganese deposits in Kiribati's EEZ area are not as extensive and economically attractive as the cobalt and polymetallic manganese deposits in the EEZs of the Marshall and Cook Islands, respectively. There is, thus, little potential in the near future that the Kiribati deposits will be of economic significance.

Also often included under mineral resources, are the precious deep-water corals, which are discussed below under fisheries resources.

## 1.10 VEGETATION AND FLORA

The indigenous vegetation and flora of the atolls of Kiribati are among the poorest on earth. With the exception of some of the uninhabited islands in the Phoenix and Line groups, the coastal strand, mangrove and inland forest vegetation of Kiribati has been

severely modified due to: 1) thousands of years of habitation and selective removal of indigenous species for construction, boatbuilding, firewood and other purposes; 2) the expansion of monocultural coconut groves for export production of coconut oil and copra; 3) the expansion of coastal settlements, which in urban South Tarawa, occupy much of the coastline; 4) the widespread practice of allowing pigs to forage freely along beach flats; and, 5), in the case of Banaba, 70 years of open-cast phosphate mining. However, due to the unique adaptability of the vegetation and flora to the harsh conditions of the atoll environment, and their cultural and ecological utility, the protection and enhancement of the indigenous floras are crucial sustainable development and the cultural survival of the people of Kiribati.

### 1.10.1 Vegetation

The terrestrial vegetation associations of Kiribati are limited to: 1) coastal strand vegetation; 2) limited areas of mangroves and coastal marsh vegetation; 3) relict stands of inland forest; and, in the case of Banaba, 4) limestone escarpment or pinnacle vegetation. Secondary and cultural vegetation associations include: 5) coconut-palm-dominated agricultural lands, including giant swamp taro or *babai* pits, under various stages of cultivation and fallow; 6) houseyard and village gardens; 7) extensive and variable areas of ruderal vegetation; and, in the case of Banaba, 8) almost the entire island which is under severely-modified disclimax vegetation in various stages of succession after some 70 years of open-cast phosphate mining.

There is essentially no remaining primary inland forest in the main Gilbert group, with all of it, except for the rare relict stand or individual tree, having been replaced by coconut-dominated vegetation associations. Evidence indicates that the dominant inland forest species was probably *Pisonia grandis*, which is the typical woodland on many atolls, with other dominant elements including *Calophyllum inophyllum*, *Cordia subcordata* and *Hernandia nymphaeaefolia*, as the dominants, and *Barringtonia asiatica*, *Macaranga carolinensis*, and *Terminalia samoensis*, plus *Guettarda speciosa*, *Pandanus tectorius*, *Scaevola sericea* and *Premna serratifolia*, the later which are still common (see Appendix II for the Kiribati names for some species).

Some of the wetter islands of the Line group, such as Tabuaeran and Teraina support closed groves of *Pisonia*, coconuts and pandanus, and Nukumaroro (Gardner) in the Phoenix group reportedly supported groves of *Pisonia* and *Cordia* in the 1930s. Such groves, as suggested above, are important rookeries for noddies and other sea birds of considerable nutritional and ecological importance to Kiribati and mankind.

Coconut groves are the major vegetation type in Kiribati. They are found on both the major inhabited islands and on uninhabited islets. In most cases, plantations are comprised of randomly scattered trees of varying heights and ages. In the Gilberts dense stands with an almost continuous canopy are often found on limestone soils, both near the lagoons and along roads. More recent plantings, many of which were done under the Department of Agriculture's Grove Improvement and Replanting Programmes, are more regularly-spaced and of single age-classes. In the wetter Phoenix and Line islands, large

coconut plantations, planted by the previous owners of the islands are maintained by the Government.

Trees occasionally found as scattered individuals, but most certainly more numerous in the past, possibly as components of the dominant pre-settlement and pre-European-contact vegetation, include *Calophyllum inophyllum*, *Cordia subcordata*, *Hernandia nymphaeaefolia*, *Pisonia grandis*, and *Premna serratifolia*. These species have been almost totally replaced in the drive, over the past 40 years, to extend coconut plantings. Instead, clearings or open areas in the coconut canopy are commonly occupied by thickets of *Scaevola* and *Guettarda*, or by planted Pandanus groves or individual pandanus or native fig (*Ficus tinctoria*) trees, both important staples, particularly in the drier southern islands.

Houseyard and village gardens contain a greater proportion of recently introduced exotics and traditional cultivated plants introduced by early I-Kiribati settlers before European contact. Although exotic ornamentals are common in areas immediately surrounding dwellings, particularly in the highly urbanized South Tarawa, the dominant plants are important tree crops: coconut palms (often planted for toddy production), pandanus, papaya, native fig or *te bero* (*Ficus tinctoria*) and breadfruit (*Artocarpus altilis* and *A. mariannensis*). The latter two are found almost exclusively in villages around dwellings and bordering roads, with most families on wetter islands, such as Butaritari. On the drier southern islands, where breadfruit does not grow well, pandanus and *Ficus tinctoria* are dominant on the village periphery. Other food plants found in village gardens include the ceremonial staple giant swamp taro or *te babai* (*Cyrtosperma chamissonis*), which is also cultivated in pits within villages. Less widely cultivated food plants include sweet potato, cassava, pumpkin (*Cucurbita pepo*), lime (*Citrus aurantiifolia*, the one citrus species which seems to do well in alkaline atoll soils), sugarcane (*Saccharum officinarum*), hibiscus spinach (*Hibiscus manihot*), and a range of short-term vegetables, such as cabbages (*Brassica* spp.), long beans (*Vigna sequipedalis*), and cucurbits. The latter group have been promoted in hydroponic and mulching programs to increase supplies of nutritious vegetables.

In the central areas of the main islands of the Gilberts, and in and around villages, are extensive areas of pits for the cultivation of giant swamp taro or *te babai*. These pits have been excavated to the level of the freshwater lens, through the limestone bedrock to depths of 1.5 to over 4 m. Due to increasing salinity and the declining importance of *te babai* relative to copra production, cash employment and imported food, a large proportion of the pits on some islands have been abandoned. In some cases, such as on Onotoa, this occurred so long ago that the inhabitants have no recollection of their origin. On the wettest island of Butaritari, there is only limited or periodic evidence of neglect or serious underutilization, with some households having over 2,000 m<sup>2</sup> in productive pits.

Extensive areas of highly disturbed ruderal vegetation are found in Kiribati. Major contributing factors include: 1) long settlement; 2) disturbance and weed introductions during World War II; 3) increasing urbanization and transportation network development (e.g., roads, causeways and airfields); 4) total vegetation clearance and the use of heavy equipment, particularly in the case of the Phosphate industry; and, 5) the widespread

practice of keeping villages and plantations clean by continuous burning, sweeping and clearing of vegetation. These have created extensive areas of ruderal vegetation in settlements, waste places, along roadsides and airstrips. The dominant species in most areas are grasses, annuals and shrubby weedy species.

As a result of almost 70 years of open-cast phosphate mining on Banaba, the island is under severely-modified disclimax vegetation in various stages of succession. Based on studies on the analogous island of Nauru, given no deliberate human intervention, the succession to a disclimax vegetation association capable of sustaining human life will probably take "many thousands of years". It is ironic that Banaba's central plateau, from which the inhabitants formerly obtained some of the necessities of life, has been transformed to a "topographic jungle" stripped of its natural vegetation in order to provide the phosphate needed to revive phosphate-poor soils to fuel the development of Australia and New Zealand. The original inhabitants of Banaba were relocated to the island of Rabi in Fiji in the late 1940s after the war.

### 1.10.2 Flora

The flora of the main Gilberts group consists of approximately 306 species, of which only 83 are possibly indigenous. None are endemic. The balance is comprised of ornamentals, weedy exotics, food plants, and a limited number of other useful cultivated plants. Although greatly outnumbered by exotics, indigenous species still dominate some of the most disturbed habitats, as well as constituting the most culturally and ecologically important species. A large proportion of these indigenous species (40 of 83 for the Gilberts) are severely restricted in distribution, endangered or possibly extinct, due to removal and severe habitat modification or limitation.

Of the indigenous species, 8 are widespread pantropical or paleotropical pteridophytes or ferns, including *Psilotum nudum*, *Polypodium scolopendria* and *Ophioglossum*, *Pteris* and *Nephrolepis* spp. There are no indigenous gymnosperms (conifers), although the widespread cycad (*Cycas circinalis*) is found in cultivation. Indigenous monocotyledons are restricted to pandanus (*Pandanus tectorius*), some cultivars of which are undoubtedly aboriginal introductions, and a range of sedges and grasses (Cyperaceae and Poaceae), some of which could be aboriginal or recent introductions. The coconut palm is classified as an aboriginal introduction. The indigenous dicotyledons are comprised almost exclusively of salt-tolerant, widely-dispersed, pantropical coastal species.

Exotic species, which constitute 73 per cent of the current flora of the Gilberts, dominate the ruderal and houseyard vegetation in many areas. Such species include a wide range of ornamentals, weedy species, food plants and a number of other useful species. Ornamentals, which are normally confined to houseyard and village gardens, comprise some 28 per cent of the total species, whereas weedy species and food plants comprise about 22 per cent each.

Although food plants represent 22 per cent of the floras, due to the harsh environment, many of these species are restricted in numbers or utility and are often represented by experimental attempts to diversify food production or by individual, often



immature specimens of a given species. Food plants of particular importance include the indigenous species, native fig (*Ficus tinctoria*) and numerous edible pandanus cultivars, some of which are undoubtedly aboriginal introductions, and the aboriginal introductions, coconut palms and giant swamp taro (*Cyrtosperma chamissonis*). Recent introductions of more localized importance in recent urban home food production programmes in the Gilberts, include: the vegetables, hibiscus spinach (*Hibiscus manihot*), a range of Chinese cabbage cultivars (*Brassica* spp.), long beans (*Vigna sesquipedalis*), amaranthus spinach (*Amaranthus* spp.) and pumpkin (*Cucurbita pepo*); the staple root crops, taro (*Colocasia esculenta*), tannia (*Xanthosoma sagittifolium*), sweet potato (*Ipomoea batatas*) and cassava (*Manihot esculenta*); a range of banana and plantain cultivars (*Musa* cultivars); and the tree crops, lime (*Citrus aurantiifolia*), fig (*Ficus carica*), and the horseradish or drumstick tree (*Moringa oleifera*), all of which seem to do well in the harsh Kiribati environment. Important emergency or pig foods include Polynesian arrowroot (*Tacca leontopetaloides*) and purslanes (*Portulaca* spp.), and the leaves of *Morinda citrifolia*, *Pisonia grandis* and *Polyscias* spp., which were eaten as part of a campaign in urban Kiribati to arrest vitamin-A-deficiency-induced night blindness among children.

The floras of the Phoenix and Line groups are poorer, with the totals for Tabuaeran (Fanning), Kiritimati (Christmas) and Teraina (Washington) Islands of the Line group, numbering only 123, 91 and 69, respectively, with the totals for indigenous species being only 23, 25 and 19, respectively.

### 1.10.3 Ecological and Cultural Utility of Flora

Although highly disturbed, outnumbered and, in some ways, "enriched" by introduced exotics, the vegetation and flora of Kiribati constitute a critical ecological and cultural resource and a basis for sustainable development. This is particularly true for the indigenous species, virtually all of which have wide cultural utility within the subsistence economy and constitute real income which cannot, or which would be extremely expensive to replace with imported substitutes.

In terms of the more specific ecological attributes of coastal plant resources, the most important functions include the provision of shade and animal and plant habitats, protection from wind, erosion, flood and saltwater incursion, land stabilization, protection from the desiccating effects of salt spray, soil improvement and mulching.

Shade is important to humans, plants, and animals, especially in highly reflective low-lying coral island and lagoonal environments, and in villages and urban areas. As populations increase, shade and the role that trees and other coastal plants play as habitats for other important animal and plant species will become more important. Of particular importance are mangrove ecosystems which contribute either directly or indirectly, through primary and secondary productivity, to the nutritional requirements of a high proportion of marine food species. Research has shown that over 60% of commercially important marine food species live in mangroves or depend on mangrove food webs at some stage in their life cycle. Destruction and reclamation of mangroves have deleterious effects on fisheries yields, with studies in the Malacca Straits indicating that mangrove reclamation for

industrial expansion led to a substantial drop in catches per effort and to offshore fisheries' yield declines of 50 to 80%.

Damage from wind, erosion, and flood are increased when forests are removed; and mangrove and coastal strand forests stabilize tidal-zone soils and reduce the impact of storm surge and ocean salt spray. In Truk, in the Federated States of Micronesia, where mangroves were completely removed by Japanese woodsmen before World War II, the coast was washed away rapidly and left with coconut trees in various stages of falling into the sea. The role of coastal plants in soil stabilization is critical to the success of land reclamation and other low-cost coastal engineering works. Species already used for land reclamation in various areas of Asia and the Pacific include *Bruguiera gymnorrhiza*, *Calophyllum inophyllum*, *Casuarina equisetifolia*, *Cocos nucifera*, *Hibiscus tiliaceus*, *Lumnitzera littorea*, *Rhizophora* spp. *Scaevola sericea*, *Sonneratia alba*, *Terminalia catappa* and *Tournefortia argentea*. Many of the coastal herbs, grasses, sedges, vines and shrubs are also of considerable importance for coastal stabilization and land reclamation. In the Gilberts species of particular importance for the stabilization of the extensive reclaimed Temaiku milkfish ponds on Tarawa are *Scaevola sericea* and *Tournefortia argentea*.

One of the most important ecological roles played by coastal plants is the protection of inland agricultural areas, non-coastal vegetation and fauna, settlements, and water supplies from saltwater spray and storm surge. Of particular value because of their remarkable tolerance to high levels of salinity, are plants with particularly high tolerance to salt spray and saline soils. In this respect, farmers throughout the Pacific purposely leave strand or mangrove forests intact seaside of their gardens, as they know that to remove these trees would make farming problematic. In the Gilberts stands of *Pemphis acidula* are left seaward of agricultural areas to provide protection from salt spray and *Casuarina equisetifolia* has been planted to protect newly planted coconuts. Species commonly used for living fences or hedging include *Clerodendrum inerme*, *Cocos nucifera*, *Ficus tinctoria*, *Hibiscus tiliaceus* and *Premna serratifolia*. *Crinum asiaticum* is commonly used for garden borders. Low-growing *Hibiscus tiliaceus* cultivars are planted as windbreaks, and plant products such as woven coconut leaves or roots are used for sandcreens. Such practices will become even more important if a projected sea level rise due to global warming becomes a reality.

Soil improvement and the provision of organic material is also important to the success of agriculture in nutritionally poor and highly permeable coastal soils, particularly atoll soils, which are among the least fertile in the world. Organic material increases soil waterholding capacity, reduces soil pH to more favourable levels at which minerals become more available to plants. Organic matter also reduces runoff, water and wind erosion and water loss to evaporation. Consequently, the I-Kiribati have evolved sophisticated systems of fertilization and mulching using the leaves of coastal plants, with the leaves of *Guettarda speciosa*, *Tournefortia argentea* and *Sida fallax* being applied in pandanus baskets, along with other leaves and topsoil, as part of an elaborate mulching system for giant swamp taro *Cyrtosperma chamissonis*, pandanus and breadfruit. *Sida fallax*, in particular, is considered to be such a strong fertilizer that it is only occasionally added fresh to the soil in fear of injuring plants.

In terms of specific cultural utility, the most widely reported uses for atoll plants are for medicine, general construction, body ornamentation, fuelwood, ceremony and ritual, cultivated or ornamental plants, toolmaking, food, boat or canoe making, dyes or pigments, magic and sorcery, fishing equipment, cordage and fibre, games or toys, perfumes and scented coconut oil, fertilizer and mulching, woodcarving, weapons or traps, food parcelization, subjects of legends, mythology, songs, riddles, and proverbs, domesticated and wild animal feed, handicrafts, cooking equipment, clothing, fish poisons, items for export or local sale, adhesives or caulking, and musical instruments. Appendix I shows the results of a study of the utility of atoll and coastal plants in Melanesia, Polynesia and Micronesia, in which all of these uses were reported for at least eleven species. The analysis shows that there are some 75 different purpose/use categories for coastal plants, with the total frequency of usage for 140 plants being 1024, an average of 7.3 purpose/use categories per plant, ranging from no reported uses for only two species to as many as 125 for the coconut, if distinct uses within categories (e.g., tools with distinct functions) are counted (see Appendix II). Next in order of importance, all with 20 or more reported uses, are *Hibiscus tiliaceus*, *Pandanus tectorius*, *Calophyllum inophyllum*, *Cordia subcordata*, *Guettarda speciosa*, *Scaevola sericea*, *Pemphis acidula*, *Thespesia populnea*, *Rhizophora* spp., *Tournefortia argentea*, *Casuarina equisetifolia*, *Premna serratifolia*, *Morinda citrifolia*, *Pipturus argenteus*, *Terminalia catappa*, *Ficus tinctoria* and *Ficus prolixa* . . . all species found in Kiribati. Another 17 species, commonly found in Kiribati, have at least 7 uses each (Appendix II).

With specific reference to Kiribati, preliminary analyses of available data indicate 170 uses for 29 indigenous species and 104 uses for 39 exotic species. This gives a total 274 uses for 68 species, a clear indication of the cultural utility of plants in Kiribati.

It must be stressed that the analyses are based on traditional uses, many of which have lapsed or are only employed in emergency, because modern technology has pre-empted them. Modern medicine, clothing, fishing lines, matches, crockery, plastic bags, soap, and emergency food rations (food aid) have, for example, replaced traditional plant-derived products. Moreover, many of the current generation, schooled in the modern educational system and living in the cash economy, often know few of the traditional uses of plants, let alone their vernacular names . . . a state which could be referred to as "devegetation of the mind" . . . and which has undoubtedly contributed to the degradation of the indigenous and long-established aboriginal vegetation of Kiribati.

Of particular note is the importance of traditional food and beverage crops, the abandonment of which, for highly imported foods such as sugar, white rice and flour, cabin biscuits, noodles, canned fish, softdrinks, alcohol and tea, has led to dangerous levels of food dependency and some of the highest, or most rapidly increasing, incidences in the world of vitamin and mineral deficiency and nutrition related diseases. Diseases such as iron-deficiency anemia, vitamin-A-deficiency-induced night blindness, diabetes, cardiovascular disease, hypertension and stroke, gout and hyperuricemia, some forms of cancer and dental disease, which were rarely encountered in the past are now serious causes of morbidity and mortality in Kiribati, and among other atoll populations.

It is argued that, while floristic degradation in Kiribati appears to be among the most severe in the Pacific, the vegetation and flora of Kiribati still constitute a strategic

ecological and cultural resource that must be protected. Unfortunately, despite the undeniable developmental importance of vegetation protection in Kiribati, there is still a need for planners and national development plans in Kiribati to place a high priority on vegetation protection as a basis for sustainable development.

## 1.11 FAUNA

There is a general decrease in diversity of animals from west to east, from New Guinea, where the fauna is among the richest in the world, with a very high rates of endemism, to the small atolls of the eastern Pacific whose faunas are among the poorest. For example, Kiribati's native terrestrial fauna has only one reported endemic vertebrate, the Line Islands reed warbler (*Acrocephalus aequinoctialis*), and the only mammal (probably an aboriginal introduction) is the Polynesian rat (*Rattus exulans*). Papua New Guinea, in stark contrast, has about 100 species of mammals (mostly marsupials), 70 species of snakes, crocodiles, over 65 species of birds, and a very rich insect fauna which includes some of the rarest and largest moths and butterflies, and the dreaded malaria vector, the *Anopheles mosquito*, which is fortunately absent from Kiribati.

In terms of marine fauna, the atolls are not as impoverished, although there is still an attenuation of species with distance from Papua New Guinea, where there are about 600 species of finfish, but probably only between 300 to 400 in Kiribati.

### 1.11.1 Terrestrial Fauna

There are probably no indigenous land mammals in Kiribati, with the Polynesian rat (*Rattus exulans*) being probably an aboriginal introduction. The main indigenous land animals consist of birds, insects and some land crabs. Some of these constitute resources of considerable importance to sustainable development, both in terms of their cultural utility and their possible commercial importance to the development of national reserves and a limited tourist industry.

In terms of bird life, with the exception of a few introduced by humans, most are either sea birds or migratory species. The lagoonal and pelagic environments in Kiribati, provide an abundance of marine avifauna which nest primarily on uninhabited atoll or islets, and in vast number on the uninhabited atolls of the Phoenix and Line groups. Surveys carried out by the Smithsonian Institution Pacific Ocean Biological Survey Program in the 1960s and early 1970s indicated that the expanse of ocean and the areas encompassing the island groups of Kiribati form one of the largest marine avifauna flyways. Species include migratory species that use the north-south oriented island chains to stop and feed as well as those species that find the isolation, flora and atolls habitats ideal for breeding and nesting, the islands constituting some of the most important seabird rookeries (nesting areas) in the world.

In terms of animal protein, the I-Kiribati have long supplemented their mainly fish diets with a number of species of avifauna. Of much greater importance to sustainable development, both in the atolls and globally in terms of the protection of endangered

species, is the fact that the population studies conducted by the Smithsonian indicate that, in the Phoenix Islands, alone, there are several bird populations numbering in the millions. These birds belong, however, to less than a dozen families. These include: 1) petrels and shearwaters (Procellariidae), 2) tropic birds (Phaethontidae), 3) boobies or gannets (Sulidae), 4) man-o'-war or frigate birds (Fregatidae), 5) herons (Ardeidae), 6) ducks and geese (Anatidae), 7) plovers (Charadriidae), 8) sandpipers and their relatives (Scolopacidae), 9) phalaropes (Phalaropodinae), 10) gulls and terns (Laridae), 11) the migratory cuckoo (Cuculidae) and Old World insect eaters (Muscicapidae) (Appendix III).

On Orona (Hull) Island, alone, population censuses revealed islets with over one million nesting sooty terns (*Sterna fuscata*) and extremely large colonies of boobies (red-footed, brown and blue-faced) (*Sula* spp.). Associated with these "mega-colonies" can be found frigate birds (*Fregata* spp.), tropic birds (*Phaethon lepturus* and *P. rubricanda*), common and black noddies (*Anous stolidus* and *A. tenuirostris*), white terns (*Gygis alba*), a variety of shearwaters (*Puffinus* spp.) and petrels (*Pterodroma* spp.) and the blue-grey noddy tern (*Sterna* sp.).

Rare or endemic species include the *bokikokiko* or Line Islands reed warbler (*Acrocephalus aequinoctialis*), which is common on Kiritimati and Tabuaeran, and which may be represented by subspecies on each of the Line Islands, and the Red-tailed tropic bird (*Phaethon rubricauda*).

The rich avifauna constitutes an important resource both to the people of Kiribati and to the world. The islands constitute the most extensive system of seabird rookeries in the world, a system which should be protected because of its important role in the oceanic ecosystem. Although no reserves exist in the Gilbert Islands, numerous reserves and wildlife sanctuaries have been established in the Line and Phoenix Islands.

The insect fauna constitutes the majority of the terrestrial animals found on atolls. Many are important to the functioning of atoll ecosystems, whereas other such as mosquitos and flies, which spread disease, and cockroaches constitute noxious pests. The agricultural pest, the Papuana taro beetle, which seriously affects the production of *Cyrtosperma* and *Colocasia* taros and bananas (*Musa* cultivars), both important staple foods in Kiribati, is considered a major constraint to sustainable agricultural production. Others, include the "toddy beetle" (*Sessinia livida*), which contaminates and consumes toddy where it is found in large numbers.

### 1.11.2 Marine Fauna and Fisheries Resources

Kiribati's relatively rich marine fauna, which includes between 300 and 400 finfish species alone, is a critical strategic resource. Industrial fisheries make an important contribution to the national economy and small-scale fisheries are an important source of cash income and have important nutritional and social roles to play in sustainable development.

In terms of subsistence, the sea provides virtually all the animal protein in the diet, with terrestrial resources (formerly land birds, lizards and rats, and today pigs, chickens, dogs and sea birds) comprising an insignificant part of the diet. Studies on Butaritari, the most fertile island in Kiribati, for example, showed that terrestrial animal protein appeared in less than 1 per cent of the total meals. Virtually all non-toxic finfish species over a few centimetres in length and a majority of the non-fish marine organisms are eaten, and various shells, teeth and other hard parts are used in the material culture. On atolls with well-developed lagoons, lagoon and reef fish are more important, whereas on lagoonless islands, such as Arorae and Tamana, flying fish, tunas and sharks are more important.

Because of the limited terrestrial protein and carbohydrate resources, fish consumption is among the highest in the world, with an estimated average consumption of 565 g/capita/day on rural atolls, thus satisfying both the minimum daily protein requirements and much of the daily energy requirements. Consumption in urban South Tarawa was estimated to be 320 g/capita/day.

Although living marine resources are also important to the larger island countries, they are for many of the smaller countries, such as Kiribati, the sole opportunity for substantial economic development. The main categories of fisheries resources in Kiribati include: 1) the lagoonal and reef, or "inshore" fishery; 2) the "offshore" fishery, which includes both the pelagic and near-shore deep water fisheries; and 3) mariculture or aquaculture of finfish and seaweed. Appendices IV and V list of some of the more important finfish and non-fish species found in Kiribati.

Most of Kiribati's islands have protected lagoons with significant subsistence and small-scale fisheries resources. Some islands, however, like Tamana and Arorae, are table reef islets with no lagoons. All islands have some fringing reef and reef slope resources, all of which are of critical subsistence importance, as well as being of limited, primarily local commercial importance. Some islands, such as Maiana, have offshore banks, which are favoured fishing grounds. These are often difficult to fish because of strong currents and rough seas. Studies at Fanning and Washington in the Line Islands indicate that there are fisheries resources of commercial potential exist, with 89% of high catch rates consisting of commercially valuable species, as well as offering considerable potential for local sale.

The reef and lagoon resources of most inhabited islands in Kiribati are heavily exploited, with most of the potential for increased commercial catches being from deep water near-shore and pelagic species. Some islands in the main Gilberts group have lagoons, inland ponds or areas that can, or have been developed for mariculture. Some of the uninhabited and recently inhabited islands in the Phoenix and Line Islands do have unexploited lagoonal and reef fisheries resources of some developmental potential and inland fresh, or brackish water lakes which offer some potential for maricultural or aquacultural development. Milkfish mariculture is currently practised on Kiritimati, and brineshrimp mariculture as foodstock for the the tropical fish aquarium trade was also attempted in the 1970s.

The main categories of lagoonal and reef resources include: 1) a wide range of finfish (Appendix IV); and 2) a range of marine non-fish resources, including turtles,

crustaceans, shellfish, holothurians (beche-de-mer), sipunculid sea worms and jellyfish (Appendix V); and 3) marine seaweed and other plants. Kiribati's EEZ of over 3.55 million km<sup>2</sup> has considerable potential for pelagic fisheries development, and, to a lesser extent, for the increased exploitation of deepwater snappers and sharks and harvesting of deepwater corals. Studies in the early 1980s showed that although the catch rate of saleable fish/reel-hour compared well with other small islands in the region, and although there are areas of relatively shallow deep water (120 to 250 m) off the western edge of Tarawa and between Maiana and Tarawa and Abaiang and Tarawa, the outer reef slopes of most of the atolls drop off steeply and the total area of deep bottom fishing grounds available adjacent to the islands is relatively limited.

The main traditional fishing methods consist of: 1) reef gleaning at low tide in the intertidal zone; 2) poling and trolling for small surf and schooling tunas using pearl-shell lures; 3) the use of gill nets and encircling nets for catching mullet, milkfish, etc.; 4) handlining for reef and lagoon fish (rarely at depths greater than 50 m); 5) underwater spearfishing; 6) scoopnetting for flying fish at night by the light of storm lanterns; and, 7) deepwater handlining, primarily for oilfish, which is also carried out at night in depths of up to 150 m. Within these categories fishermen have developed many specialised techniques involving different types of nets, hooks and lines, baits, lures, spears, nooses, traps and fences, poisons and gleaning strategies, with as many as 33 distinct techniques having been recorded for some atolls.

On most islands, fishing is carried out from traditional sailing, or more rarely paddling canoes. In some areas, particularly in Tarawa, these have been superseded by outboard powered craft.

More modern methods include: use by local artisanal fishermen improved tackle, boats, nets and ice boxes; a modern locally-based pole-and-line industrial tuna fishing operation run by Te Mautari, the national fishing company; and the increasing use of improved deepwater handreels for commercial deepwater snapper and shark fishing. A number of fish aggregation devices (FADs) have been deployed to increase both subsistence and commercial catches.

### 1.11.3 Finfish Resources

The more important finfish species for subsistence and local sale in Kiribati include: 1) a wide range of shallow-water snapper, rockcod, grouper, or coral trout species (*Cephalophis*, *Epinephelus* and *Lutjanus* spp.); 2) emperors or breams (*Lethrinus* spp.); 3) goatfish (*Mulloidichthys*, *Parupaneus* and *Upeneus* spp.); 4) mullets (*Liza* spp. and *Valamulgil seheli*); 5) milkfish (*Chanos chanos*), 6) trevally or jacks (*Caranx*, *Carangoides* and *Seriola* spp.); 7) bonefish (*Albula vulpes*); 8) small herrings, sardines, sprats and their relatives (*Dussumieria*, *Herclotsichthys*, *Sardinella*, *Spratelloides* and *Rhabdamia* spp.); and the larger deepwater or pelagic species including; 9) tunas (see below); 10 ) a wide range of sharks (*Aprionodon*, *Carcharhinus*, *Galeocerdo*, *Ginglymostoma*, *Mustelus*, *Negaprion*, *Odontaspis*, *Sphyrna*, *Squalus* and *Triaenodon* spp.); 11) barracudas and seapikes (*Sphyrna* spp.); 12) billfish (*Istophorus platypterus* and

*Makaira* spp.) and, 13) flying fish (*Cheilopogon* and *Cypselurus* spp.) (Appendix IV). These species comprise the bulk of the subsistence and artisanal catch on most islands in Kiribati, with tunas, sharks, flying fish and billfish being of particular importance on those islands such as Arorae and Tamana, which have no lagoons, and from which sharkfin is the only fisheries export.

Other important species or groups of species include: parrotfish (*Scarus* spp.), rabbitfish or spinefoot (*Siganus* spp.), surgeonfish (*Acanthurus* spp.), squirrelfish (*Adioryx*, *Holocentrus* and *Myripristis* spp.), stingrays (*Aetobatus narinari* and *Himantura* sp.), wrasses (*Cheilinus* and *Cymolutes* spp.), silver biddy (*Gerres* spp.), moray eel (*Gymnothorax flavimarginatus*), barred garfish (*Hyporhamphus dussumieri*), topsail drummer (*Khyphosus* spp.), ponyfish (*Leiognathus* spp.), unicornfish (*Naso unicornis*), oilfish (*Ruvettus pretiosus*) and longtom (*Tylosurus crocodilus*), all of which are important food fish.

The pelagic species of increasing industrial, export or local commercial in Kiribati importance include: the tuna species, skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and dogtooth tuna (*Gymnosarda unicolor*); the tuna-like species (also members of family Scombridae), bigeye scad (*Selar crumenophthalmus*), queenfish (*Scomberoides* spp.); and a number of other species including rainbow runner (*Elagatis bipinnulatus*), wahoo (*Acanthocybium solandri*), and dolphin fish or mahimahi (*Coryphaena hippurus*). Skipjack stocks seem to be sufficient to sustain both a substantial commercial fishery and the existing subsistence and artisanal fisheries.

Of particular importance to the tuna industry, are a wide range of baitfish species used by Kiribati's pole-and-line boats. The most important species include hardyheads or silversides (Atherinidae), *Dussumiera* sp., *Herklotsichthys quadrimaculatus*, *Hyperatherina (Allanetta) ovalaua*, *Praneus pinguis*, *Rhabdamia (Apogon) cypselurus*, *Sardinella sirm*, *Selar crumenophthalmus* and *Spratelloides delicatulus* (Appendix IV). These, however, do not seem to be in sufficient abundance to support a locally-based commercial pole-and-line skipjack tuna fishery, thus necessitating the use of cultured milkfish from the Temaiku fishponds as the primary bait source. Furthermore, because *H. quadrimaculatus (tarabuti)* is also an important subsistence food resource, a serious conflict of interest could arise if commercial-scale bait-fish operations affect this resource.

The deepsea demersal species of increasing commercial importance include jobfish (*Aphareus* spp.) and the deepsea snappers (*Aprion*, *Etelis*, *Gnathodentex*, *Paracaesio*, *Pristipomoides* and *Tropidinus* spp.).

A range of other finfish species of more local or minor importance, which together also constitute a critical nutritional resource are listed in Appendix IV. It should also be mentioned that many of these species, often in their juvenile stages, such as the damsel, angel and butterfly fishes (*Chaetodon* and *Pomacanthus* spp.) are highly desired by tropical fish collectors and have been exported from Kiribati.



#### 1.11.4 Non-fish Resources

Marine non-fish species of considerable importance in Kiribati include: turtles; a wide range of crabs, shrimps, prawns, lobsters and other crustaceans; shellfish, including both bivalves and gastropods; holothurians or beche-de-mer; and a number of other marine organisms (Appendix V).

Both the hawksbill and green turtles (*Eretmochelys imbricata* and *Chelonia mydas*) are present in Kiribati. There are turtle nesting areas on some small islets and sandbanks in the Gilberts group. These include Teirio Islet on Abaiang, Katangateman sandbank near Makin and a sandbank near Nonouti, some of which have been proposed as reserves. Sea turtle nesting areas are also common in the Phoenix and Line Islands, with Flint, Canton and Enderbury being of particular importance. The green turtle is considered to be endangered, and turtles, in general, seem to be scarce as analysis of fisheries catch data for six islands in the Gilbert group recorded no turtle catches. Despite international efforts to protect these overexploited and endangered species, both are actively hunted and eaten and the shell used for handicrafts. Turtle eggs are also eaten and considered a delicacy.

Crustacean catches are generally minimal and primarily for subsistence purposes, although lobster (*Panulirus* spp.) is a major commercial resource which is shipped by airfreight to Hawaii from Kiritimati. There are a range of crabs, including the coconut crab (*Birgus latro*), and the mantis shrimp or *te waro* (*Lysiosquilla maculata*) is also commonly sought after and considered a delicacy which is sold to the main hotel (Appendix V).

Of the shellfish, the ark shell or *te bun* (*Anadara maculosa*), which is easily collected at low tide in the intertidal zone, is by far the most commonly consumed and marketed marine shellfish and, perhaps, the most commonly consumed marine food in Kiribati. It is found on Tarawa, Abaiang, Marakei, Tabiteuea and Nonouti, and studies are currently underway to determine if it can be introduced into other islands.

Also of major subsistence importance in terms of percentage of catch are giant clams. Four species are present in Kiribati. These include the rugose giant clam or *te were* (*Tridacna maxima*), which is most common, and the giant clam or *te kima* (*T. gigas*), the fluted giant clam or *te were matai* (*T. squamosa*) and the horse's hoof, bear paw or strawberry clam or *te neitoro* (*Hippopus hippopus*). *T. derasa*, the second largest species of giant clam, and *T. crocea* and *Hippopus porcellanus*, which are found only in the central Indo-Pacific faunal region, have not been reported from Kiribati. Giant clams are generally under heavy pressure, both for subsistence and commercial purposes (commonly through poaching by Taiwanese tuna or clamming vessels because of the high demand for giant clam meat in Taiwan), with some species, such as *T. gigas* extinct or close to extinction in Fiji and Tonga, and *H. hippopus* being a recent extinction in both Tonga and Fiji, where its shells are found in coastal middens.

Because of heavy subsistence pressure on the resource, it has been suggested that commercial fishing for giant clams in Kiribati should not be promoted, and would only lead to a rapid depletion of stocks. In response to serious overfishing of giant clams by

Asian fishing vessels, giant clam aquaculture has been promoted and shown considerable success in a number of areas in the Pacific and offers considerable potential in Kiribati.

Other shellfish of major subsistence and commercial importance, in terms of local sale, include *te koumara* (*Gafrarium pectinatum*), sanguin clam or *te koikoi* (*Asaphis violascens*), ram's-horn shell *te katura* (*Spirula spirula*) and the gastropod, bloodmouth conch or *te nouo* (*Strombus luhuanus*). Other bivalves and gastropods found to a lesser degree in the Tarawa lagoon, some of which are eaten are listed in Appendix V.

Shell collecting could have increasing importance because the range of shell species, often with a high degree of colouration. Sea shells are in great demand for their ornamental value and for local handicraft production. They will continue to form the basis of a promising but limited trade as long as the resource is not over-exploited. Most can be gathered using relatively simple techniques, such as reef gleaning, netting, trapping or dredging or diving. They can be marketed, locally and possibly overseas and form the basis of an important, and potentially sustainable, village-based industry. In the Philippines, an estimated 30,000 people make their living directly or indirectly in the specimen and commercial shell industry, as collectors, vendors, or in the shell jewelry and ornament trade.

Although many collectors specialise in the more attractive shell groups, such as the cowries (Cypridae), cone shells (Conidae), conches (Strombidae) and murexes (Muricadae), many of which are very rare and valuable, there is increasing popularity in mitres (Mitridae and Volumtomitridae), augers or terebras (Terebridae), olive shells (Olividae) and many of the other more common shells, including bivalves, which are found in Kiribati. Due to the abundance of books on shells and the increasing knowledge of the wide range of shells available in the Pacific, even the more common shells could form the basis for a specimen shell industry.

Although Kiribati has a poorer shell fauna (malacofaunas) than those of the larger Melanesian and Polynesian countries, there is a significant range of species of value for the handicraft industry, sale to tourists and export for ornamental value and to serious collectors. A one-month survey in Tuvalu in 1983, for example, recorded 119 specimen shell species from 14 families commonly sought by collectors; the total reported species from 21 families commonly sought by collectors is 186. Some of these fetch reasonably high prices from overseas collectors. Kiribati would probably have an even richer shell fauna.

As suggested above, most of these shells can be found almost anywhere and in almost all habitats using relatively simple collecting techniques, available to even outer islanders. Unfortunately, few people, except a few who live in urban areas or near tourist resorts know the true value of shells, except for some of the more well known species, some of which can fetch from US\$500 to 2000! Part of the problem is that, although there are local vernacular names for most shells, to commercialise the resource there is a need for a universally recognised set of names, so that the owners of the shell resources know what they are selling and can, thus, receive a fair price. Latin nomenclature, which is known by few islanders, is used for this purpose.

Another important constraint to the commercialisation of shell resources is that the living coral, upon which many of the more valued shells live, is very susceptible to damage and pollution.

In terms of the development of the industry in Kiribati, because tourism development is so limited, the main avenues for development of a high-value specimen shell industry, would be to promote catalogue sales to collectors throughout the world or to export shells or shell handicrafts, like the Philippines do to other Pacific countries which have established tourism industries. Packs of ten different shells, with accurate names and locality data, for example, sold well in Papua New Guinea and Australia. The quality of shells is also important in obtaining maximum returns to the seller and the country. Finally, in terms of maintaining the resource, shell collecting if done correctly can insure sustainability. Practices that should be encouraged include keeping only high quality shells and returning poor specimens to their original habitat, leaving very young shells, returning all stones or pieces of coral disturbed during collecting to their original places, and rotating the areas where collecting is done to allow the resource to breed and recover.

Seaslugs or beche-de-mer (holothurians), which were one of the first export products from Kiribati after European contact, are also present in Kiribati, and offer some potential for commercial development. Studies carried out in the 1970s indicated that there were thirteen species from four commercially valuable genera (*Actinopyga*, *Thelenota*, *Bohadschia* and *Holothuria*) present in the former (Gilbert and Ellice Islands Colony (GEIC)(see Appendix V). Many of these are eaten in Polynesia and Melanesia and are considered a delicacy in Southeast Asia and areas where ethnic Chinese communities exist. Some species are reportedly being eaten in South Tarawa in the past few years.

In Fiji, for example, the sandfish or *dairo* (*Metriatyla scabra*) is of great subsistence value and marketed locally on a large scale (27.8 tonnes in 1989). Most of the other species are of some subsistence value, are occasionally marketed locally, and are heavily harvested for local processing and export. The export value of these species from Fiji has increased so dramatically over the past years, that concern over the potential overexploitation of these resources, has led to legislation banning the export of giant clam meat, sandfish, and any beche-de-mer under 3 inches in length was introduced in 1989. Licences are now issued only to members of a Beche-de-mer Exporters Association to encourage more responsible exploitation of these resources.

The four species of relatively high value in Kiribati include the white and black teatfish (*Microthele fuscogilva* and *M. nobilis*), prickly redfish (*Thelenota ananas*), blackfish (*Actinopyga miliaris*) and deepwater redfish (*A. echinites*). Most of the other species, including *Halodeima atra* and *Metriatyla scabra*, are edible, and have been exported to Asia in the past or are consumed in other areas of the Pacific. The best areas for exploitation are the shoals and reef slopes in deep water passes and the deeper outer reef flats, where the main stocks of valuable species are found, and the shallow sand flats of the lagoons, which produce the greatest biomass of the less valuable species, such as *Halodeima atra*, *Metriatyla scabra* and *Bohadschia* spp.

Although the density of these species is comparable to other Pacific lagoons, the overall potential of beche-de-mer as a money earner is limited due to the small localized habitats where the more valuable species occur, e.g., *Microthele* spp. in deepwater passes. It was suggested, however, that a small-scale industry based initially on the relatively small localized stocks of the above species, could be established, while the potential for the more common species found in the lagoons should be investigated.

#### 1.11.5 Seaweed

A range of indigenous marine seaweeds or algae constitute an important nutritional and commercial resource in many areas of the Pacific, although few are traditionally eaten in Kiribati. The most important of the indigenous species is sea grapes or *nama* (*Caulerpa racemosa*), which is very common in Tarawa Lagoon, but which is not eaten. It is an important subsistence food and commercial product for local sale in Fiji.

Of particular interest is the mariculture of eucheuma seaweed (*Eucheuma cottonii*), which is currently exported from Abaiang, Onotoa, Abemama and Maiana. Eucheuma is sundried for export overseas, where it is processed into carrageenan, a food additive for stabilizing milk products such as ice cream and yoghurt. A eucheuma farmer can produce 3 to 4 crops per year yielding up to 24 tonnes of dry seaweed per hectare (10 per acre), with minimal initial capital if the site is favourable. Its production which requires 60 to 70 cm stakes to support the growing seaweed has, however, led to increased deforestation.

#### 1.11.6 Importance of Marine Resources to Sustainable Development

As suggested above, these diverse marine food resources, which have helped sustain the people of Kiribati since their first arrival over three thousand years ago, constitute a renewable subsistence and commercial resource if managed wisely. The potential sustainability of the resource is evidenced by the fact that, despite thousands of years of almost daily "reef gleaning" at low tide for almost anything edible, and of almost any size, it is still possible, even in South Tarawa and other densely populated areas, for poor families to glean their daily protein needs from the intertidal zone and fringing reef areas.

However, the scarcity of certain marine organisms, such as turtles, large reef cods (Serranidae) and giant clams (*Tridacna* spp.), and smaller catches and decreasing average size of species individuals, indicate that atolls have been overfished in the past. There is also evidence of declining yields of bonefish and flying fish, possibly due to local overfishing, and in yellowfin tuna, attributed to overfishing by long-liners and purse-seiners.

Of perhaps greater concern, is that increasing commercialisation of many of these species, such as tuna, baitfish, giant clams, and a wide range of other finfish and crustaceans, has put increasing pressure on these resources, thus underlining the need for protective legislation and sustainable production strategies.

Fortunately, the conservation ethic remains strong among most of Kiribati's rural peoples and the wide range of conservation practices still in use indicates that I-Kiribati traditionally attempted to manage their marine resources on a sustainable basis. This was based on an extensive knowledge of fish, fishing technology, and the sea. Some of the main mechanisms included secrecy about fishing grounds and techniques, temporary or seasonal taboos or bans on species or fishing grounds, restrictions on the consumption of certain species (e.g. some species such as turtles or giant clams were reserved for chiefs or priests), fines or penalties for resource abuses, and clan tenure or limited access to reef and lagoon areas.

Unfortunately, the principle of limited access and some of the other marine resource management mechanisms are breaking down. The main factors seem to be the amalgamation and relocation of settlements during the colonial period, increased use of motorised boats capable of fishing in the open ocean, and increased emphasis on commercial fishing, modern education and development along Western lines. In 1951, for example, the people of Onotoa agreed to abolish traditional tenure arrangements and declared the lagoon "public domain".



## CHAPTER 2

# PATTERNS OF ECONOMIC GROWTH

An analysis of the economy and the potential for economic growth in Kiribati must take into account the country's small size, its narrow resource base, geographical isolation and fragmentation, and its openness and vulnerability to external economic factors and forces beyond its control. To a large extent, the predominance of the public sector and the high degree of dependence on aid in the Kiribati economy seem to conform to Bertram and Watters' (1985) model of a MIRAB economy in which migration, remittances, aid and bureaucracy play the dominant economic roles.

### 2.1 PATTERNS OF GROWTH

Gross domestic product (GDP) at current factor costs has increased from \$23.5 million in 1980 to \$40.7 million in 1988, i.e., at a modest rate of about 7.2 per cent. Growth has, however, not been consistent and uniform, with real rises in GDP some years being largely offset by declines in others. Moreover, given an average annual inflation (increase in prices) of 6.0 per cent and a population growth of about 2.0 per cent per annum, real per capita GDP, in terms of buying power, appears to have declined by about 1 per cent per annum over this period. This has been compounded by the fact that subsistence production, in terms of non-cash incomes per capita, has also declined at a faster rate than cash incomes.

Prior to 1979, the year of the cessation of mining on Banaba, economic activity was dominated by phosphate mining, with more than half of the total Government revenue deriving from a tax on mined phosphate (royalties). With the cessation of mining Government revenue was immediately halved (see below). On the positive side, the establishment of a Revenue Equalisation Reserve Fund (RERF), primarily from phosphate tax income, but also from Government savings, has allowed Kiribati to build up an investment portfolio to help overcome the budget deficits expected with the cessation of phosphate mining (This is discussed in more detail below). Since then, Government has invested heavily in the infrastructure with a view of providing a base for future growth. This is slowly yielding fruit.

Presently, Government administration and infrastructure sectors contribute about 50 per cent of GDP. Despite severe constraints, the contribution of two major productive sectors, agriculture (almost exclusively based on copra) and fisheries has grown significantly from about 18.2 per cent in 1980 to about 29.7 per cent in 1988. Manufacturing, which started almost from scratch, has increased significantly with the development of a few small industries producing consumer goods, such as hard biscuits, steel buckets, soap and coconut oil, exercise books, flipflops (rubber sandals) and garments. These developments have been reinforced through the increasing wholesale and retail trade in such items.

However, the above composition of GDP by sector hides the fact that resident disposable incomes in the country have increased somewhat faster over the last 8 years (1980-88) than GDP figures indicate. This is because Kiribati has received significant "invisible exports" (cash and foreign exchange earnings) in the form of, often unrecorded, cash remittances from seamen working on foreign ships, and property and entrepreneurial income from the RERF and other investments abroad. Preliminary estimates indicate that Kiribati GNP per capita is about 45 per cent higher than GDP. Accordingly, per capita resident disposable income increased from \$40.6 million in 1980 to \$71.5 million in 1988. Thus, even allowing for inflation, the real per capita consumption in the country has increased significantly, a trend which although, perhaps, positive from a "world economy" point of view, may only reflect increasing dependency on imported goods, subject to deterioration in terms of trade and inflation, and a corresponding decline in per capita production of subsistence production of food and other products, which are essentially not subject to inflationary pressures and deterioration in terms of trade.

## 2.2 PUBLIC FINANCE AND FISCAL POLICY

After the cessation of phosphate mining, phosphate taxes or royalties, which contributed about \$8.35 million to Government revenues in 1979, ceased to contribute to Government revenue. Thus, there was a sharp fall in Government revenue from about \$17.5 million to about \$9.2 million in 1981. In anticipation of the exhaustion of phosphate, the then colonial Government in 1956 set up the Revenue Equalisation Reserve Fund (RERF) out of the phosphate tax incomes. The RERF, which stood at about A\$220 million at the end of 1990, was boosted by the phosphate price boom in the early 1970s, and is currently managed by a reputable firm of Investment Managers in the UK. Income from the RERF has become as a major source of Government revenue and foreign exchange earnings over the years. The gap in Government revenues has been, therefore, covered partly from foreign grants and partly by withdrawal from the interest income from the RERF.

In an economy with a very significant subsistence and small production base, avenues for raising new sources of revenue are limited. There has been, however, some growth of about 15 per cent per annum in Government revenue since 1981. Tax revenue increased in 1988 to about \$7 million, i.e., to about 18 per cent of GDP, because of a sharp increase in direct tax revenue in recent years, the average ratio to GDP rising from 4.4 per cent in 1980 to 7.5 per cent in 1989. Indirect tax revenue, in the form of customs duties also increased with increasing imports, but as a ratio of GDP, has remained around 14 per cent. This is mainly because most of the duties have been specific and have not yielded revenue proportionate to the increase in imports.

Non-tax revenue is derived mainly from interest income from the RERF, and from licensing fees from foreign vessels fishing within Kiribati's EEZ, which have also has grown steadily over the past decade. The drawings from the RERF income have represented residual needs, which have increased gradually from \$4.25 million in 1980 to \$8.0 million in 1988. Income from fish licensing fees has increased from \$616,000 in 1980 to about \$2.87 million in 1989.



Government has followed a very prudent fiscal policy designed to restrict expenditure to available resources thus achieving a budgetary balance in most years. Recurrent expenditure in real terms has, therefore, declined from about 65 per cent of GDP in 1980 to only 50 per cent in 1988. Development or capital expenditure on the other hand has been financed almost entirely from external aid. In line with this tight fiscal policy, recourse to borrowing has been avoided as far as possible. Debt servicing has, therefore, remained negligible. A major aim of Government Policy in this regard has been to encourage private sector development and to focus on the development of productive and infrastructure sectors, which could provide for sustainable, and relatively debt-free, future growth. As a result, a reasonably sound infrastructural base, in terms of transportation and communications, electricity, water supply, etc., has now been laid. It is hoped this will facilitate sustainable development in the coming years.

A major objective of the Government has been to raise the capital value of the RERF in real terms. Based on the guidelines approved by the RERF Investment Committee under the Chairmanship of the Minister for Finance and Economic Planning, the Fund is invested abroad in a diversified portfolio of bonds and equities. The value of the Fund has increased sharply over the last 10 years, rising from A\$69.3 million in 1979 to A\$220 million in 1990. This significant increase in the Fund value has been realised through appropriate switches between different currency holdings and bonds and equities and also by restricting withdrawals from the Fund for recurrent budgetary purposes to a maximum of about 4 per cent of the Fund value. Obviously the Fund has emerged as a major pool of savings and income, which provides an important source of financial security and a basis for sustainability for the country's future. Keeping in view that the current budgetary needs to be met from the Fund will remain low at around A\$6 to 8 million annually in the near future, and that investment in reputed equities yields much higher returns over a longer run, the RERF Investment Committee has recently approved a maximum investment of 50 per cent in equities and a minimum of 50 per cent in Bonds.

### 2.3 NON-FINANCIAL PUBLIC ENTERPRISES AND PRIVATISATION

Due to lack of entrepreneurship, skills and capital, in the early years of independence, Government remained responsible for providing certain essential basic services, such as fuel supply, printing, shipping, etc., generally through direct investment and the setting up statutory bodies. These accounted for a significant proportion of Public Sector investment and were funded mainly through external aid.

These enterprises have, however, not been subject to strict financial control, and due to a shortage of commercial and managerial skills, have often run at a low level of efficiency or at a loss, often requiring considerable subsidies. Conscious of this problem, Government has attempted to improve its operational efficiency, and has, consequently, been able to reduce subsidies gradually from \$2.7 million in 1982 to only \$400,000 in 1990. Government has also, made a priority, the privatisation of selected enterprises. In this respect, policy guidelines have been established under which Public enterprises are proposed to be transferred to the private sector through divestment of ownership, joint venture undertakings and/or management contracts. Due to constraints, including shortage of domestic private capital, entrepreneurship and initiative, success in this field

has, so far, been very limited. It is hoped that continued efforts in this regard will eventually bear fruit.

## 2.4 TRADE AND BALANCE OF PAYMENTS

Kiribati has been following an open and free-trade policy, with presently no restrictions on imports, payments or exchange transactions.

Aggregate imports, which have risen from about \$18.3 million in 1980 to about \$28 million in 1988, roughly contribute about 70 percent of GDP and are comprised chiefly of food items, fuel oil, manufactured goods and machinery and equipment. The main trading partners are Australia, UK, Japan, New Zealand and Fiji. A significant proportion of the imports, particularly capital goods, is aid funded.

Since the loss of phosphate revenues, merchandise exports declined sharply, in one year, from \$21.8 million in 1979 to only \$2.4 million in 1980. There has been some increase since then, particularly in terms of fish exports, with aggregate exports (commodity exports plus re-exports) amounting to \$5.8 million in 1988, copra and fish being the only major commodity exports, the latter gradually increasing in importance.

The trade deficit averages about \$20 million per annum. For the last few years efforts have been made to expand the narrow production base of the economy through the establishment of small-industry production of consumer goods, such as cabin biscuits (hard biscuits), steel furniture, flip flops (rubber sandals), exercise books (stationery) for schools, garments, etc. This will, hopefully, gradually foster import substitution and a slight reduction in the trade deficit.

The large trade deficit, over the years has been covered by sizeable surpluses on the services account, mostly generated by remittances from merchant seamen, licensing fees from foreign fishing vessels, fish royalties and increasing interest and dividend income from the RERF and Kiribati Provident Fund (KPF) investments abroad. Significant external aid flows have also helped to reduce the trade deficit and convert the overall balance of payments into a surplus. Due to limited opportunities for primary production and export diversification and instability of export earnings from copra and fish, interest and dividend income from accumulated external financial assets from the RERF, KPF, etc. have imparted substantial resilience to Kiribati's external financial position.

## 2.5 MONETARY DEVELOPMENTS

There is no central bank or central monetary authority in Kiribati, with the Australian Dollar (\$A) serving as the official currency. No firm estimates of money supply in the country are thus available. Since there is insufficient scope for an active monetary or exchange rate policy, the possibility of issuing local currency or setting up a central monetary authority in the near future is very remote.

## 2.6 SAVINGS AND INVESTMENT

There is no independent estimate of savings and investment in Kiribati. A rough idea can only be obtained from the National Accounts statistics in which these estimates are derived as a residue. Nonetheless, it is certain that due to the low levels of incomes and growth, propensity to save remains very low.

Despite some increase in commercial bank deposits and contributions to the Kiribati Provident Fund, aggregate domestic savings are estimated to be negative, thus implying higher consumption. The increase in consumption, mainly by the private sector households, has been sustained by net factor incomes from outside the country, predominantly remittances from merchant seamen working abroad. Public savings also remain negative, mainly because tax and non-tax revenues, though rising, have not increased enough to meet recurrent expenditure needs.

The level of gross investment as a proportion of GDP has been quite high over the years. A major share of this has been contributed by the Public Sector, chiefly because of the need to provide certain essential basic services and the requisite infrastructure for future growth. The wide gap in domestic savings and investment has been funded through aid from abroad.

## 2.7 RECENT ECONOMIC DEVELOPMENTS

The economy grew strongly in 1988 as the fish catch recovered considerably due to favourable weather conditions. Copra production also rose to its highest level in recent years, largely a result of dry weather favourable to copra drying. In 1989, growth performance was mixed. The fish catch again increased by about 50 per cent, partly due to a net addition to the size of the commercial fishing fleet, and both construction activity and manufacturing output were buoyant. On the other hand, copra production declined sharply due to extended drought.

Since 1988, however, financial problems, fleet maintenance problems and shortage of baitfish, have led to a decrease in tuna exports. At the same time, exports of Euclidean seaweed have surpassed copra in value, with production having increased from 750 to over 1000 tonnes from 1990 to 1991, with production expected to reach 1,500 tonnes by 1992. Abaiang accounts for about two-thirds of the current production, with Onotoa, Abemama and Maiana producing the balance. Unfortunately, a drop in the world market price from US\$675 to US\$500 coupled with high freight rates and a break-even price of US\$550, have cast some doubt on the sustainability of the industry and the ability of Kiribati to compete with the Philippines which produces 75 to 80% of the world's supply at a break-even price of only US\$475.

Overall, real GDP is estimated to have increased marginally by about 1 per cent over 1988. Consumer Price inflation was in the range of about 4 per cent, reflecting the weakening of the Australian Dollar against major currencies. However, the inflation rate in Kiribati was significantly lower than that in other countries.

In terms of Government finance, fishing license fees in 1989 declined substantially to \$2.9 million due to poor return from the American Fishing Treaty. Revenue from direct and indirect taxes, however, improved to \$3.1 and \$5.2 million respectively. With regard to recurrent expenditure, the government continued to maintain tight control. By holding current expenditures below the budget levels, Government was able to off-set the shortfall in fishing license fees. Consequently, drawdown from the RERF income was restricted to only A\$5 million, considerably less than the budget estimate of \$7.5 million.

Imports during the year rose further to \$28.5 million and exports to \$6.4 million due, despite the fall in output and price of copra. The trade deficit therefore was slightly lower, with the balance of payment position remaining relatively favourable due mainly to continued fiscal restraint, increased remittance from merchant seamen, RERF interest income and external aid flows. The Current Account surplus increased due to higher net services receipts and higher official transfers. The value of RERF increased by 11.4% and at the end of 1989 stood at A\$200.9 million, equivalent to about 7 years of imports. The increase was also partly due to the weakening of the Australian Dollar against major world currencies.

The preliminary estimates for 1990 do not give a pleasant picture. Construction activity increased with the construction, and recent completion, of the new Japanese-aid-funded hospital. Manufacturing production has also increased, with a number of small businesses and production units established in the last two years having gone into full production. However, copra production has declined further on account of heavy rains. Fish catch was also poor partly due to a poor fishing season, possibly due to overfishing by other nations, and partly due to mechanical problems with the fishing fleet. Thus the contribution of both the major productive sectors was significantly negative. It will be difficult to offset this decline by improvement in other sectors.

The fiscal out-turn is expected to be considerably better. Government revenue from both direct and indirect taxes, has improved with the increase in imports and new direct tax legislation introduced from 1 January 1990 which, besides covering new ground, has helped tighten the tax administration. Revenue from fishing license fees would have doubled to about \$5.8 million. Recurrent expenditure has also increased but only moderately. On the external account, imports may rise further to about \$35 million, while exports declined to about \$3.0 million. But net receipts from the Services account will improve further. With continued restraint, the overall position is expected to remain considerably one of surplus, with the capital account remaining broadly in balance.

## 2.8 OUTLOOK AND PROSPECTS IN THE MEDIUM TERM

Despite severe constraints to economic growth, the country has made reasonable progress during the past 10 years. Faced with the loss of phosphate revenues, resulting in substantial declines in GDP, Government revenue and exports, and a consequent curtailment of basic essential services, the country has tried hard to adjust to the new conditions. No doubt, generous aid from friendly countries had made the process of

adjustment less painful and disruptive. However, due to the extremely limited resources base, infertile soil and lack of skilled manpower the adjustment process has been rather slow.

Over this period a high proportion of public investment has been directed toward the creation of basic infrastructure, particularly in transport and communication, education and health sectors. The tax base has been broadened and recurrent expenditure, especially on wages and salaries, has been kept under tight control. Recourse to borrowing has been avoided, and withdrawals from the RERF have been kept to the minimum. The Country has followed a free trade policy without any import restrictions. Accordingly the RERF value has increased more than three times from \$69 million in 1979 to \$220 million in 1990. Starting from scratch, a few small domestic manufacturing units have been established. All these measures are intended to support the underlying objective to maximise self-reliance, and promote growth in an environmentally and culturally sound and sustainable manner.

## 2.9 OUTLOOK AND PROSPECTS IN THE LONG TERM

In the long term the marine resources within Kiribati's extensive EEZ and the quality and experience of our merchant seamen probably offer the most potential for sustainable development and economic growth. This will depend, of course, on our ability to diversify the productive base through effective utilisation of these resources. Some options include the expansion of the range of fisheries products exploited, adding value through local processing, and possibly establishing bunkering facilities for shipping.

At present there is little reliable data on the actual catch by other nations fishing in Kiribati's EEZ, with the country receiving only a nominal amount of about \$2.5 million in 1988 through licensing fees. The fact that some countries with more limited EEZs than Kiribati are receiving higher revenues from licensing fees indicates that with appropriate surveillance and policing of foreign vessels, there is considerable scope for increasing licensing revenues.

Furthermore, Kiribati has a small reservoir of highly skilled fishermen and merchant seamen who have already earned a name for the country. If a long term strategy for employment of these people abroad can be negotiated with major maritime countries, it could provide an increasing and regular source of earnings through remittances from those thus employed.

Given the limited contribution of the manufacturing sector at present of only 2 per cent of the GDP and the heavy dependence and increasing dependence on imports, there is also scope for the establishment of small scale manufacturing units for consumer products by the private sector.

Finally, the Line and Phoenix Islands constitute about 60 per cent of the country's total land area but, at present, have only 4 per cent of the total population. Given that these islands are much closer to the main markets and international air and sea routes and, in some cases have better soils than the islands of the Gilberts group, there is some scope

for encouraging fisheries and aquacultural development, fostering ongoing attempts at decentralisation and resettlement of the islands, and the development of the ecotourism potential based perhaps on their rich marine bird populations.

## **CHAPTER 3**

### **DEMOGRAPHIC TRENDS**

#### **3.1 INTRODUCTION**

The high population densities and demographic characteristics of Kiribati constitute, perhaps, the major constraint to sustainable development and the management of scarce resources. Thus, population growth, degree and rate of urbanisation, emigration, off-island work opportunities, ethnicity, and health and nutritional status of the population, constitute major considerations in assessing the opportunities for sustainable development.

Ethnically, the indigenous peoples of Kiribati are Micronesians, who have probably inhabited the islands for up to 3000 years or more. There has been Polynesian influence due to long contact with Polynesia, particularly with Tuvalu to the south. Of the current estimated 1991 population of 72,298, about 96% are I-Kiribati, the balance comprising Tuvaluans and a few hundred expatriates working temporarily in the country. Thus, common culture, a common language, a common environmental land use tradition, and the absence of significant ethnic divisions in the country constitute favourable demographic considerations in the promotion of sustainable development.

#### **3.2 THE NATURE OF ATOLL DEMOGRAPHICS**

As stressed by Bakker (1990), in his paper "Some demographic characteristics of the atoll populations of the South Pacific", of the total population of approximately 6.2 million in the developing countries of the South Pacific Region in 1990, only a very small fraction lives on atolls. These include the populations of the countries of Kiribati, Tuvalu, the Marshall Islands and Tokelau, which live entirely on atolls or small limestone islands, and people who live on atolls in the Tuamotu Islands of French Polynesia, the northern Cook Islands, Yap, Chuuk and Pohnpei in the Federated States of Micronesia, and the "Polynesian outlier" atolls of Solomon Islands and Papua New Guinea. In 1990, the total size of the population in the South Pacific living on atolls was probably not more than about 160,000 persons or about 2.6% of the entire population of the region. The people of Kiribati constitute almost half of these.

#### **3.3 POPULATION DENSITIES**

Although atoll people make up only a small proportion of the total population in the Pacific islands, because of the very limited land area, they constitute some of the highest crude population densities in the world. The following Table 3.1 gives 1990 estimates for the atoll populations of Kiribati and three other Pacific island atoll countries (including figures for the main Gilbert Islands group, urban south Tarawa, and urbanised

Funafuti in Tuvalu). As can be seen from these figures, population densities are extremely high, especially in the Gilbert group, where 96% of the population of Kiribati live, and particularly in highly urbanised South Tarawa, at 1,596 persons per square kilometre, and 4167 persons per square kilometre on Betio Islet -- a density which is expected to rival that of Hong Kong by the late 1990s. Furthermore, by the year 2015 the Kiribati population is projected to increase by at least 40%, which will place even greater stress on the limited resource endowment of the country.

Such population densities are a particularly serious obstacle to sustainable development, given the extreme infertility of the soils and scarcity of fresh water on most atolls, and, thus, constitute "nutritional population densities" (the average number of persons per unit of arable land) that are significantly higher than the crude population density figures indicate.

Table 3.1 Estimated 1990 populations for Kiribati and three other atoll countries (plus the Gilbert Islands, urban South Tarawa, and Funafuti) in the South Pacific Region.

Country	Population	Land Area	Population Density
Republic of Kiribati	70,000	822.8 km <sup>2</sup>	85
(Gilbert Islands)	67,200	278.4 km <sup>2</sup>	241
(Urban South Tarawa)	30,000	7.2 km <sup>2</sup>	4167
Republic of the Marshall Islands	47,000	171.0 km <sup>2</sup>	274
Tuvalu	9,000	25.9 km <sup>2</sup>	347
(Funafuti)	3,000	2.8 km <sup>2</sup>	1071
Tokelau	2,000	12.2 km <sup>2</sup>	164
Total	155,000		

Source: Adapted from Bakker, 1990; Douglas and Douglas, 1989.



### 3.4 AGE STRUCTURE AND DEPENDENCY RATIOS

The population of Kiribati, has an age-sex structure which is broad to very broad at the base. This means that the percentage of the population under the age of 15 is high to very high and consequently youth dependency as well as overall dependency ratios are high as well, and the median age low. These indices, based on the age-sex structure, for Kiribati and three other atoll countries, are given in Table 3.2.

Table 3.2. Selected structural characteristics of the populations of Kiribati, Marshall Islands, Tokelau and Tuvalu at the time of the most recent census.

Country	% of pop. in age group			Dependency Ratio	Median Age
	<15	15-59	60+		
Kiribati	39	55	6	81	20
M. I.	51	44	5	126	14
Tokelau	43	45	12	119	20
Tuvalu	32	60	8	66	22

Source: Adapted from Bakker, 1990.

The increasing youth of the population and increased dependency ratios are partly due a rapid decrease in mortality since World War II. This decline has, however, shown signs of levelling off in Kiribati.

### 3.5 MORTALITY, FERTILITY AND LIFE EXPECTANCY

Differential mortality in Kiribati by geographic area is also extreme, with far higher mortality in the Northern Gilberts than in the Southern Gilberts, despite the fact that the physical environment of the Northern group is less harsh than that of the Southern group. Generally speaking, mortality of atoll populations remains fairly high by Pacific standards. This is particularly true for Kiribati which has the highest rate of infant mortality and the lowest life expectancy among the four atoll countries under consideration (Table 3.3).

The difference between fertility and mortality is natural increase. If the rate of natural increase is adjusted for net-migration, the annual rate of growth is obtained. Table 3.3 provides some basic indices of fertility and mortality of the same four countries as in

Table 3.2. The rate of natural increase and the rate of growth at the time of the most recent census are also shown.

Table 3.3. Selected indices of fertility, mortality, natural increase and population growth in Kiribati, Marshall Islands, Tokelau and Tuvalu at the time of the most recent census.

Country	Indices Of				Pop. Growth	
	Fertility		Mortality		Rate of natural increase (%)	Annual rate of growth (%)
	Total Fert. Rate	Net Repr. Rate	Infant Mort. Rate (‰)	Av. life expect. at birth (yrs)		
Kiribati	4.9	2.1	82	53	2.4	2.1
Marshalls	7.2	3.0	57	61	4.1	4.2
Tokelau	-	-	37	-	1.5	1.4
Tuvalu	2.8	1.2	43	59	1.8	0.2

The "fertility transition" (from high to lower fertility) in Kiribati, Tokelau and especially Tuvalu has also started (Table 3.3). The fertility decline in Kiribati, however, seems almost to have come to a standstill. It is interesting to note that, as in the case of mortality, there is a very significant difference between the level of fertility in the Northern and Southern Gilberts, with fertility in the northern group being significantly higher. It is not unlikely that differential mortality and fertility of these two regions of Kiribati are related, i.e., high infant mortality induces families to have more children to replace those who don't survive.

Since the age-sex structure of the Kiribati population is broad to very broad at the base because of high fertility, the built-in potential for growth or momentum is very large. Given the estimated growth rate of 2.1%, the estimated doubling time for the population of Kiribati would be 35 years. Even in the very unlikely event that the fertility level would decrease very drastically during the next decade or so and that the level would reach replacement level fertility (that is a net reproduction rate of 0) in the near future, the population would continue to grow for a very long time. It is of course possible (although undesirable from a development perspective) that mortality will start to increase again and bring the future growth rate down.

### 3.6 MIGRATION TRENDS

Although reliable figures on internal migration do not exist, up until the early 1970s the population of the rural outer islands of Kiribati remained virtually static, and only grew by 0.8% per year from 1973 to 1978. This suggests that there has been outmigration from the rural outer islands to urban Tarawa and to work as contract workers in the phosphate industries of Banaba and Nauru. With the cessation of mining on Banaba in 1979, many I-Kiribati have returned to their home islands, leading to a population increase of 1,960, or 5%. However, as suggested above, there continues to be considerable migration from outer islands to urban South Tarawa.

There is very limited opportunity for permanent outmigration overseas. There are currently about 1000 I-Kiribati contract workers in Nauru, several hundred seamen who work as merchant marines on overseas ships, and a small number of highly trained I-Kiribati working for regional organisations, most of whom send a large percentage of their earnings home to support their families. With the projected cessation of mining operations on Nauru near the turn of the century, most I-Kiribati can be expected to return either to Tarawa or their home islands, thus placing increased pressure on already strained resources and eliminating a source of both family and overseas income for the country. There are plans for major land resettlement schemes in the Line Islands

### 3.7 SUMMARY OF DEMOGRAPHIC TRENDS AND IMPACT ON THE ENVIRONMENT

Given extremely high population densities, high fertility rates, declining mortality and resultant youthfulness of the population, coupled with a limited resource endowment and little or no opportunity for outmigration, the future for sustainable development in Kiribati does not look good. Projections based on even medium assumptions indicate that current demographic trends will very soon lead to disastrous crude population densities on the generally marginal land of Kiribati. The "nutritional densities" are certainly very significantly higher than these crude density figures given in Table 3.1. The continuation of current population growth rates will soon result in densities which are physically impossible to support, not only in urban areas, but also in many of the rural outer islands.

As Bakker (1990) argues, although the annual growth rates on all rural atolls are below the Kiribati national average of 2.1% annually, it should be realised that this is mainly because of internal migration from these atolls to the urban areas. As suggested above, however, it can be expected that the future will see some return migration. As a consequence, population growth rates of many of the rural atolls will increase in the near future, even if fertility starts to decline. He stresses that these crude densities give a far too optimistic picture of the situation since crude density takes the **entire** land area of the atolls into account and **not** that part which is suitable for agriculture. Alternately he says that the density figures should probably also be adjusted for the fact that many households on the rural atolls get at least a part of their food from the sea. Such increases can only further stress the carrying capacities of these atolls and surrounding seas and lagoons in

terms of food productive capacity, but also in terms of drinking water, toilet facilities, waste disposal and sources of energy for lighting and for cooking. There is thus, a priority need for a culturally acceptable and effective family planning programme as a prerequisite for sustainable development in Kiribati.

## CHAPTER 4

# CONSTRAINTS TO THE SUSTAINABLE USE OF RESOURCES AND DEVELOPMENT

### 4.1 INTRODUCTION

To be successful, atoll development must take into consideration the constraints to sustainable development imposed by: 1) the existing environmental and social conditions within Kiribati, and 2) external conditions or factors (e.g., the stability of the world economic system and the nature of the development models that are being used).

More specifically, this section focuses on constraints to sustainable atoll development related to: 1) the geography and natural environment of Kiribati; 2) the nature of current development strategies and the signs of environmental and ecological breakdown globally and in the Pacific atolls caused by these models; and, 3) cultural factors or human-induced effects which make sustainable atoll development problematic.

### 4.2 ENVIRONMENTAL CONSTRAINTS TO SUSTAINABLE DEVELOPMENT

One overriding constraint to atoll development is the well-known fragility of island ecosystems and the extreme vulnerability of their plant, animal, soil and water resources, and their cultures and traditional resource-use systems, to outside human disturbance and pollution. Whereas the richer continental environments have shown considerable resilience to environmental degradation and external pressures, the limited resources and cultures of small islands have historically shown to be highly susceptible to irreversible degradation and extinction. There are countless examples of island plants, animals, AND peoples that have been irreversibly degraded or brought to extinction due to contact with foreign peoples, diseases and economic and military activities. There is an equally large literature on the failure of external economic initiatives promoted in the island environment.

Some of the more important physical or environmental constraints to conventional economic development in the atoll environment include: 1) isolation and inaccessibility from markets and sources of imported products; 2) geographical fragmentation; 3) small size and land scarcity; 4) mineral scarcity; 5) tropical cyclones and strong winds; 6) periodic drought, water scarcity or absence of surface water resources and high salinity; 7) extremely poor or deteriorating soils; and, 8) the poor or endangered indigenous biota (plants and animals) (Table 4.1). All of these must be considered when selecting development alternatives.

Table 4.1. Nature and degree of severity of physical or environmental challenges or constraints to sustainable development in Kiribati (+++ = severe or of serious concern; ++ = warranting concern; + = of localised concern in some areas; - = non-existent or minimal concern).

Constraint	Severity of Concern
Isolation and Inaccessibility	+++
Geographical Fragmentation	+++
Small Size and Land Scarcity	+++
Mineral Scarcity*	+++
Tropical Cyclones/Strong Winds	++
Drought	+++
Water Scarcity/No Surface Water	+++
High Salinity	+++
Poor or Deteriorating Soils	+++
Poor or Endangered Biota	+++

\* The phosphate resources of Banaba (Ocean Island) were depleted in 1979.

#### 4.2.1 Isolation and Inaccessibility

Kiribati suffers from isolation from important metropolitan centres which are the markets for their export products and sources of consumer and capital goods. Potential for the development of outer island fishing to supply increasing urban markets on South Tarawa and the competitiveness of Kiribati's *Eucheuma* seaweed and tuna export industries, for example, both suffer from high internal and external transport and fuel costs that make such development initiatives less viable in Kiribati than in Asia and other Pacific islands closer to the main markets. On the other hand, increased dependence on food or other imported products always costs Kiribati more than it does other countries, both in terms of economic costs and in increasing vulnerability, should the importation of strategic consumer and capital goods become economically nonviable.

Kiribati also has outer islands or rural areas, which are effectively isolated from the social services and employment opportunities of urban centres within a group or from important overseas metropolitan centres. Similarly, outer islands suffer greatly in terms of the high cost and difficulty of government administration and the provision of social services because of their highly dispersed nature. Kiribati, for example, is responsible for the development and management of the extremely isolated Phoenix and Line Islands, many of which have no air links with other islands.

#### 4.2.2 Small Size and Land Scarcity

Small size and consequent land scarcity is a critical environmental issue in Kiribati. As suggested above, the problem of land scarcity is particularly serious given the infertility of the soil and limited water availability on atolls which makes the "nutritional population densities" particularly high and the carrying capacities of atolls, at least in terms of terrestrial resources, extremely limited. This is particularly serious in urbanised South Tarawa, where, population densities are extremely high.

#### 4.2.3 Drought

Insufficient rainfall or drought is common on many of the small low-lying and equatorial islands of Kiribati. During such periods, rainfall may be as little as 20 mm per year. Drought plays havoc with agricultural systems which require a reliable water supply, with numerous reported cases of breadfruit dying off, coconut palms ceasing to produce nuts for consumption and copra production, and even indigenous plants dying off during droughts in Kiribati. Such conditions severely restrict the options for sustainable agricultural development on all atolls, particularly the drier atolls of the southern Gilbert group and the Phoenix and central Line Islands.

Recent shifts in weather patterns over a large part of the Pacific, in the forms of increased incidence of tropical cyclones and increased rainfall in some areas and prolonged drought in others, have been associated with the occurrence the El Nino (pronounced Ninyo) Southern Oscillation (ENSO) conditions and associated increasing atmospheric instability over the central equatorial Pacific due to cyclical warming of the eastern Pacific Ocean. ENSO conditions seem to have intensified in recent years, thus possibly reinforcing the potential negative impacts of projected sea level rise due to Global Warming.

#### 4.2.4 Tropical Cyclones and Flooding

Excessive flooding and hurricane-force winds caused by tropical cyclonic activity and tsunamis cause widespread destruction to crops, housing, tourist facilities, infrastructure and natural features. Although not being a serious threat in Kiribati, they may become more frequent if global warming continues.

Associated with the high incidence of such natural disasters, is a widespread deterioration in the traditional capability of local communities to prepare for, respond to, and recover from natural disasters, including drought. This seems to be related to the increasing willingness of central governments and international agencies to rush in with relief supplies and material and manpower assistance, before the severity of a given disaster is adequately assessed, thus inducing dependence and possibly paving the way for greater suffering in the future, when aid funds may not be so forthcoming.

#### 4.2.5 Mineral Scarcity

Most of the smaller, geologically-recent islands on the Pacific Plate, such as Kiribati, have historically shown little potential for mineral development. Notable exceptions to this are, of course, the phosphate-rich upraised coral-limestone islands such as Banaba (Ocean Island) and the recently discovered, and potentially mineable phosphate deposits under the lagoon of Matahiva atoll in the Tuamotus of French Polynesia. There are also deposits of sand, gravel, and limestone aggregates found on all atolls.

Also of potential importance to Kiribati is what is probably the world's richest source of manganese nodules. These are widely scattered on the ocean floor at depths of up to six thousand metres inside a 30 million km<sup>2</sup> triangle extending to the southeast of Hawaii and including areas of the Exclusive Economic Zones (EEZs) of Kiribati, the Marshall Islands, the Cook Islands, and a number of other island states. A single nodule may contain more than 30 different metals, including cobalt, nickel, copper, and manganese, the first three of which are in great demand for producing steel "super-alloys".

Perhaps more important economically, are the recent deep-ocean discoveries of zinc-, copper-, and iron-rich polymetallic sulfide deposits, all of which seem to have been formed very recently along presently active mid-ocean rift zones. Also of future importance could be the occurrence of cobalt-rich manganese crust surrounding Pacific Plate seamounts, such as those which extend to the west of the active volcanic island of Hawaii.

Unfortunately, even when valuable deposits do exist, these will probably not be mineable in the foreseeable future and Kiribati does not possess the technical or financial resources to mine them, and by necessity will have to rely on large mining conglomerates from metropolitan countries. The seabed resources pose the further problem of ownership, and international mining interests are now negotiating for free access to these deep-sea riches, thus underlining the critical importance of the ongoing Law of the Sea negotiations and the need for a firm and united stand to be taken by Pacific states, with respect to sovereignty to the respective EEZs.

Other problems include depletion of mineral deposits and low world market prices, which can be the economic death knell for some countries and often lead to closure of mines or the non-exploitation of deposits. The phosphate deposits of Banaba are already exhausted, and the projected date for the exhaustion of Nauru's deposits is the turn of the century. Kiribati depended heavily on Ocean Island phosphate returns for their past favourable balance of trade situation, but suddenly had severe balance of payment problems when phosphate royalties and employment ceased in 1980. When Nauru's deposits are exhausted, a major source of overseas income for I-Kiribati contract workers there will also be lost.



#### 4.2.6 Water Scarcity and Absence of Surface Water

Most of Kiribati's islands have no surface water sources, and, in the case of the smaller atoll islets, little or no freshwater lens (water table) development. Consequently, the potential for industrial, irrigated agricultural, or urban development is severely limited. Moreover, the groundwater on some islands is not potable by U.S. Department of Health standards, and even on the larger, wetter atolls, there is, serious periodic water scarcity.

#### 4.2.7 Earthquakes and Vulcanism

Other specifically geological problems include earthquakes and active vulcanism, and associated seismic sea waves or tsunamis. Although Kiribati is in a seismically stable area of the Pacific Plate, earthquakes and volcanic eruptions cause seismic sea waves or tsunamis, which travel thousands or miles across the ocean and constitute serious hazards to atoll communities, especially if sea levels rise due to global warming.

#### 4.2.8 Poor or Deteriorating Soils

As detailed above, the excessively well-drained calcareous soils of the low-lying coral-limestone islands of Kiribati are among the poorest in the world. They are almost devoid of soil macronutrients and micronutrients apart from calcium, and have little or no organic matter. Even if nutrients are available, high pH and carbonate content make soil nutrients, such as iron, copper and zinc, unavailable to plants. Furthermore, the use of inorganic fertilisers is ineffective due to high pH and are easily leached into the fresh water lens, which constitutes a serious health problem in terms of contamination of limited domestic water supplies.

#### 4.2.9 Poor or Endangered Biota

As detailed above, the terrestrial floras and faunas are among the poorest and most highly degraded and endangered in the world. In terms of marine flora and fauna, Kiribati is not as impoverished, although there is still an attenuation of species with distance from Papua New Guinea, where there are about 600 species of finfish, but probably only between 300 to 400 in Kiribati.

Such floristic and faunal poverty represents a major limiting factor to sustainable development in comparison to the rich resource endowments of the larger inslands, especially those in the far western Pacific. There is scope, however, for the introduction of appropriate species which might be appropriate to the environmental and cultural conditions of atolls. Examples include the trochus shell (*Trochus niloticus*) which has been successfully introduced into many atoll lagoons, and has become a major economic resource in the Marshall Islands to the north of Kiribati, since its introduction there by the Japanese before World War II.

### 4.3 CURRENT DEVELOPMENT TRENDS AND SIGNS OF ENVIRONMENTAL AND ECOLOGICAL BREAKDOWN GLOBALLY AND IN THE PACIFIC ATOLLS

#### 4.3.1 Nature of Current Development Models

Perhaps the major constraint to sustainable development is that current development models do not seem to be sustainable, even in the richer continental environments they were designed for, let alone in the fragile resource-poor atoll environment. Put very simply, the dominant development trend is based on the wishes of national governments and international donor agencies to have atoll societies, both rural and urban, use their environmental resources (oceans, islands, lands, forests, labour and culture) to make money, to generate foreign exchange, to repay loans, to provide cash employment, to dispose of toxic waste from metropolitan countries, or for military activities.

Some of these "developments" pursued in the atoll environment include: 1) catching fish, crabs and lobsters or collecting shellfish to be either exported overseas or sold at local markets; 2) aquacultural production of fish for baitfish or export or seaweed for export; 3) clearing forest, fallow lands or food gardens in order to plant cash crops, such as coconuts, which are then processed for export overseas, instead of following traditional agroforestry land use systems where a diversity of tree crops, food crops, and other useful plants were planted or protected along with limited small animal production; 4) reclaiming coastal land for urban, transportation (wharfs, causeways, roads and airfields), tourism or industrial development; 5) increasing use of costly and dangerous pesticides, inorganic fertilisers, livestock antibiotics, and other chemicals to increase short-term production and cash returns; 6) the dumping or incineration of toxic or radioactive wastes on islands or in the shared oceanic environment; and, 7) land alienation for the testing of nuclear weapons, weapons disposal or other military activities.

All of these types of development, have a number of things in common: 1) they are usually capital-intensive (in terms of money capital) requiring large sums of money (often in the form of loans or aid), which force countries into indebtedness; 2) they depend on overseas or urban-trained experts, rather than on local knowledge and expertise; 3) they often depend on costly imported non-traditional technologies, which are not completely understood by the people of the community; and 4) they often have unfavourable or negative effects on the fragile atoll environment. This includes negative effects on both: a) **natural resources**, such as land, soils, water, trees, animals, lagoons and reefs; and b) **cultural resources**, such as land tenure systems, social organisation, traditional production systems, traditional education systems, and the productive roles of children, youth and women. Furthermore, such development initiatives often take little notice of, or are started with little knowledge of technologies and systems of resource use, which already exist within Kiribati, and rarely take into consideration the possible effects that new developments or introduced technologies will have on these existing technologies and atoll environments and societies.

Unfortunately, because development planners, policy makers, and international aid agencies have only limited understanding of the nature of the atoll environment, and the

importance of traditional environmental management systems to the stability and maintenance of Pacific atoll communities, the introduction of new, often western-inspired modern technology often replaces, destroys, or "underdevelops" the existing systems that have proved reasonably sustainable in the atoll environment for thousands of years. This underlines the urgent need to limit technological change to appropriate technology and to develop means or measures for assessing whether a given technology or development initiative is appropriate and sustainable in the atoll environment.

#### **4.3.2 Signs of Environmental and Ecological Breakdown in "Developed" Industrialised Countries**

Perhaps the most frightening sign of environmental stress and breakdown, that Pacific atoll societies should take note of, is that imported "modern" development strategies are not even working in the resource-rich ecosystems they were designed for. Moreover, overconsumption in the industrialised nations, whose per-capita consumptions range from ten to one hundred times (!) that of the "developing" countries, leaves less of the "world cake" for developing countries. Even if there were enough resources to make it possible, universal industrialisation would impose intolerable stress on world ecosystems.

There are already clear signs of ecological and cultural breakdown in the urban-industrial nations. The world economic situation is the bleakest since the "Great Depression" of the 1930s, unemployment, social and political breakdown, repressive governments, war and crime are more widespread than ever, and ecological breakdown has reached a truly crisis stage in the developed countries. Even in economic terms, the long-term costs of pollution, pesticide poisoning, and ecological breakdown may surpass the profits made in the short-run by using production-oriented strategies. The fact that this is happening is clearly signalled by the potentially negative impact of global warming and the increasing attempts of the industrialised countries to export to the atolls their wastes and pesticides or nuclear and non-nuclear weaponry, which are considered too toxic or dangerous for their own environments and peoples.

If "ecological scarcity" were ever a concern, it would be in atoll countries, such as Kiribati, where resources, particularly land-based resources are so severely limited. Moreover, because of the fragility of the atoll environment, to let other larger over-consuming countries dump their hazardous wastes and test their weapons in the atoll environment can only serve to add insult to injury in terms of further compromising the potential for healthy sustainable development in atoll countries.

#### **4.4 CULTURAL OR HUMAN-INDUCED TO SUSTAINABLE DEVELOPMENT**

Signs of human-induced environmental degradation and social and economic deterioration, and an absence of appropriate development, are increasingly visible in Kiribati and constitute perhaps the most visible and serious constraints to sustainable development. These constraints to sustainability include: global warming/sea level rise.

demographic problems/overpopulation, ecological blindness, malnutrition/poor health, agricultural/subsistence deterioration, inappropriate fisheries exploitation, nuclear pollution/presence, non-nuclear pollution, energy dependency, economic vulnerability/foreign domination of economy, landform destruction, deforestation, agrodeforestation, species extinction/endangerment, soil destruction/deterioration, limited industrial potential, inadequate infrastructure, rapid urbanisation/centralisation, inappropriate education, landlessness, inappropriate technology, social disintegration, military/defence activities, epidemic pest infestations, overgrazing, inequality of women, mining-induced damage, tourism-induced disruption and indiscriminate pesticide use (Table 4.2).

Table 4.2. Nature and degree of severity of cultural or culturally-induced constraints to sustainable development in Kiribati (+++ = severe or of serious concern; ++ = warranting concern; + = of localised or minor concern in some areas; - = non-existent or minimal concern).

Constraint	Severity of Concern
Global Warming/Sea Level Rise	+++
Demographic Problems/Overpopulation	+++
Ecological Blindness	+++
Malnutrition/Poor Health	+++
Agricultural/Subsistence Deterioration	+++
Inappropriate Fisheries Exploitation	+++
Nuclear Pollution/Presence	+++
Non-Nuclear Pollution	+++
Energy Dependency	+++
Economic Vulnerability/Foreign Domination	+++
Landform Destruction	+++
Deforestation	+++
Agrodeforestation	+++
Species Extinction/Endangerment	+++
Soil Destruction/Deterioration	+++
Limited Industrial Potential	+++
Inadequate Infrastructure	+++
Rapid Urbanisation/Centralisation	+++
Inappropriate Education	+++
Landlessness	+++
Inappropriate Technology	+++
Social Disintegration	++
Military/Defence Activities	++
Epidemic Pest Infestations	++
Overgrazing	++
Inequality of Women	++

Mining-Induced Damage	++
Tourism-Induced Disruption	+
Indiscriminate Pesticide Use	+

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Many of these are interrelated and there are no doubt more that could be added to the list. These are all, however, signs of present or future ecological stress and breakdown resulting from a breakdown of the natural and cultural ecosystems of atoll societies caused by inappropriate development models. Together, they must be seen as the major constraints to sustainable resources and development in Kiribati and other atoll nature, they must be considered as constraints to sustainable environmental development given the fact that atoll societies are, and have always been, part of, and not separate from their environment.

#### 4.4.1 Global Warming and Eustatic (Worldwide) Sea Level Rise

There is grave concern that the atolls of Kiribati will become uninhabitable as a result of global warming and associated sea level rise. This has caused serious concern at all levels in the community, and threatens the very existence of atoll societies.

It has been widely predicted that during the next century, there will be a eustatic (worldwide) rise in the sea level ranging from a moderate 44 cm to an extreme of 258 cm by the 2075 due to global warming. IPCC predictions are from 12 to 40 cm by the year 2030 and 30 to 100 cm by the end of the next century. Although there have been rises and falls in sea level due to natural global warming and cooling in the past, the rise this time would be faster and due mainly to human activities, the main factor being the "accumulation of so-called greenhouse gases (carbon dioxide, nitrous oxide, methane, chlorofluorocarbons, and others) that alter the outgoing radiation and thus affect ocean volume and glacial melting. Although evidence from El Nino phenomena shows that the sea-level near Kiribati has risen from time to time as much as 40 cm higher than its current average level, there is doubt as to whether Kiribati could cope with a similar El Nino rise superimposed on higher average levels associated with global warming.

If such a scenario should eventuate, the implications for the small-island states and coastal areas are serious. Some of the potential effects of rising sea levels on low-lying islands and coastal areas include: 1) increased frequency of tropical cyclones and storminess; 2) increased flooding and inundation of wetlands, coastal agricultural areas and other low-lying areas; 3) increased saltwater incursion and storm overwash into coastal aquifers, freshwater lenses, and agricultural area; 4) increased destructiveness of especially if they coincide with exceptionally high tides; 5) increasingly destructive wave activity and decreased protection from submerged offshore reefs; 6) increased coastal erosion; 7) loss of mangrove forests; 8) loss of agricultural areas and fuelwood resources;

9) loss of seagrass beds; 10) declining fisheries productivity; 11) increased coral mortality; 12) changes in oceanic currents and upwelling; 13) breakdown in natural community (ecological) interrelationships; 14) loss of property and structures; and, 15) the total disappearance of some atoll nations. Most of these potential effects would have serious implications for the survival of Kiribati as a nation.

Although we don't know for sure what the extent of sea level rise will be in Kiribati, there are some inexpensive, and locally implementable development strategies, such as coastal forest protection and reforestation using indigenous species, and appropriate land reclamation, which, if done now, could address many of the projected negative impacts of global warming, while at the same time address many of the other more immediate stated development goals and constraints to sustainable development.

#### 4.4.2 Demographic Problems

The constraint to sustainable development posed by increasing population, including rural to urban migration, which puts excessive stress on natural and cultural resources, undermines any hope of sustainability in areas such as urbanised South Tarawa. None of the problems associated with acute land shortage, land fragmentation, the poverty of terrestrial resources, the fragility of marine resources, or those related to overexploitation and the threat posed by pollution and waste disposal can be addressed unless we do something about controlling our high rates of population growth and rural to urban migration.

As argued in the section on "Demographic Trends", demographic constraints, such as high population growth rates, increasingly unfavourable age structures, and increasing urbanisation on islands with limited land availability are quite clear and will ultimately limit atoll development alternatives. On the other side of the coin, depopulation, especially in terms of "brain drain" is also an obstacle to most kinds of development, especially on outer rural atolls.

Increasing urbanisation is another indicator of increasing population pressure. An increasing proportion of Kiribati's people now live in urban areas, where land scarcity, unemployment, and housing shortages have led to social problems, increasing consumption of nutritionally-inferior imported foods, and squatterisation, all of which place increasing pressure on existing resources, water supplies and food systems. Although some atoll countries such as Tokelau and the Cook Islands have declining or stabilised populations, because of free migration to New Zealand, there is very limited potential for this in Kiribati.

#### 4.4.3 Environmental Blindness

Increasing environmental blindness and neglect of traditional environmental and resource-use knowledge may be the overriding constraint to sustainable atoll development. A rapidly increasing number of the urban-born or urbanised, and some urban- or overseas-educated leaders have lost touch with the ecological wisdom of the past. Their modern

education "teaches" them economics, accounting, administration, politics, history and even modern agriculture and fishing . . . the tools of western development and modernisation. Such an orientation has induced, and will continue to induce widespread environmental blindness which will foster an adherence to existing, environmentally-disruptive development alternatives.

The answer is to integrate environmental education, particularly aspects of traditional sustainable atoll resource-use systems into both the formal and non-formal education systems.

#### 4.4.4 Malnutrition and Poor Health

The state of health and nutrition in a country is probably one of the most important indicators of societal wellbeing and development. Although the people of Kiribati are generally well-nourished and healthy, there are some increasingly serious nutritional problems and health disorders, which are related to changes in resource use systems, increasing population densities, and urbanisation.

Time-depth studies beginning over 30 years ago showed that, with the exception of vitamin B deficiency (especially vitamin B2 or riboflavin), there was little evidence of nutritional disorders (malnutrition) or nutrition-related non-communicable disease in Kiribati where people subsisted on a traditional diet of unrefined local food.

Studies in the early 1950s on rapidly urbanising Tarawa and the rural island of Maiana (where significant amounts of imported food were already being consumed), showed some iron deficiency anaemia among pregnant women and infants between 0 and 4 years of age and some general poor nutrition. There were also some cases of adult malnutrition, mainly vitamin B-complex deficiencies, vitamin A deficiencies, and some vitamin C deficiencies. In almost all cases, these nutritional disorders were related to either poor weaning diets or excessive dietary dependence on rice, white flour, and sugar.

A study of the same areas, a decade and a half later, also showed only limited evidence of severe adult malnutrition, only a few cases of pre-school malnutrition, but cases of both vitamin A and vitamin B deficiency in all age groups, and dental disease, particularly in school-age children, in most cases, where there seems to have been excessive dietary dependence on white rice, white flour, and sugar. Night blindness (a common vitamin A deficiency-related disease) was also reported in a small percentage of the population in urbanised Betio, but not on rural Maiana.

Recent studies throughout the Pacific also show that similar correlations seem to exist between increasing consumption of imported refined foods and increases in non-communicable diseases such as diabetes, hypertension, cardio-vascular disease, hyperuricaemia, and certain forms of cancer (neoplastic diseases). Studies of the Micronesian people of the highly-urbanised phosphate-rich equatorial island of Nauru, have recorded among the highest prevalence of diabetes in the world, as well as very high prevalences of obesity, hypertension (high blood pressure), hyperuricaemia (often manifested as acute or chronic arthritis) and gout, diseases of the digestive system,

cirrhosis of the liver, and cancer. All ranked high in, or were contributory to the major causes of death in Nauru. A Study by Pargeter *et al.* (1984) showed that similar trends are prevalent in Kiribati, and are closely related to an abandonment of traditional foodstuffs and an increasingly urbanised lifestyle. Dental disease is also increasingly widespread in urban Kiribati.

In terms of other health problems and causes of mortality, diarrhoeal diseases, influenza, perinatal complications, skin diseases, eye diseases, sexually transmitted diseases (STDs), and a number of other infectious diseases remain among the major health problems in Kiribati, and, in many cases, are related to poor management of scarce water resources, poor nutrition, overcrowding and poor environmental hygiene, and the lack of ability to provide both primary and secondary health services to isolated rural areas.

Influenza, historically responsible for devastating epidemics throughout the Pacific, is still the most common infectious disease. The true incidence would undoubtedly be much higher, if non-reported cases were also included. Influenza, at times, becomes almost epidemic in Kiribati, where almost one-half of the population reportedly suffered from it and 991 people died in 1983 (SPEHIS, 1983).

There are high rates of infantile diarrhoea in Kiribati, and adult diarrhoea and other gastrointestinal problems constitute serious health hazards in some areas. With increasing populations in urban areas, the situation could worsen in the future.

One of the most frightening health problems is the almost epidemic outbreak of venereal or sexually-transmitted diseases (STD's) in some Pacific countries. The situation is particularly serious in urbanised areas of Papua New Guinea, New Caledonia, Fiji, French Polynesia, the Federated States of Micronesia, Palau and the Marshall Islands. Particularly concerning is the increase in penicillin-resistant strains of gonorrhoea and the increasing occurrence of the incurable and ultimately fatal acquired immune deficiency syndrome (AIDS), which is reportedly now present in the Pacific, with an increasing number of cases having been reported from Saipan, American Samoa, French Polynesia, Fiji and Papua New Guinea, respectively.

The situation is not as bad in Kiribati, although there are signs of increasing incidences of STDs, with the first case of AIDS having been recently reported, and the potential for an outbreak of STDs in urban Tarawa is great and would constitute a serious constraint to sustainable development.

Bacterial and viral forms of conjunctivitis, trachoma, and other eye diseases are particularly common in Kiribati. Conjunctivitis is very contagious, as was evidenced by the epidemics of viral conjunctivitis which sweep the islands periodically. Trachoma, a separate, but more serious eye disease, is reportedly also increasingly common, an Australian team recently finding over half of children tested to be suffering from either trachoma or night blindness (due to vitamin A deficiency) or both. Although conjunctivitis and trachoma are the most common eye diseases, the most serious blinding disease is cataracts, which is associated with the aging process, and which occurs earlier in atoll countries than in developed countries, between the ages of 30 and 50.



Fish poisoning is particularly common in Kiribati and other areas where fish is the main local protein source and where a great variety of fish have shown to be toxic. According to figures reported to the South Pacific Commission, the highest annual rates of morbidity per 10,000 population from ciguatera poisoning (the most common form of fish poisoning) range from 51.8 to 98.6 for French Polynesia, Tuvalu, Tokelau, and Kiribati. The true rates are undoubtedly higher due to under-reporting and non-diagnosis, but with increasing information on ciguatera, and through improved education and screening of fish species, it should be possible to minimise the number of serious cases (Lewis, 1983).

Skin diseases, such as scabies, tinea, and ringworm are very common, and underreported throughout the Pacific in the areas where personal hygiene is poor or fresh water supplies inadequate. They are, especially common in Kiribati.

Cholera, which causes severe diarrhoea and dehydration, often in the form of epidemics, striking many people at once, seems to be most common in Micronesia. After a 1977 cholera epidemic in Kiribati, which killed 18 persons, a WHO team was brought to the islands to help implement stricter measures for water control and sanitation.

#### 4.4.5 Deterioration of Traditional Agricultural and Subsistence Systems

One of the most serious constraints to sustainable development in Kiribati is the deterioration of the traditional agricultural and subsistence production systems. Intensive excavated-pit cultivation (particularly, *Cyrtosperma taro*) has declined drastically on some islands. "Agrodeforestation", the neglect of tree planting and/or the elimination of trees from existing agricultural and urban landscapes, referred to above, and increasing dependency on imported foods, fuel, medicines, agricultural technology and other products once produced locally from the traditional agricultural system has also reached a serious level.

A particularly important role of the agricultural system, in addition to food and export production, is the production of a wide range of other useful products such as medicines, beverages, animal feed, fuelwood, fertiliser, tools, fishing equipment, handicrafts, construction materials, canoes, fencing, fibre and cordage, dyes, oils, perfumes, body ornamentation and toys, the value of which, when added to the value of subsistence fishing, is estimated to constitute between 20 to 80 per cent of the real incomes of Kiribati's rural, outer island communities. The protection of this time-tested subsistence production system is seen as a priority for sustainable development because of the limited opportunities for cash income in Kiribati and because the replacement of these products with imported substitutes would either be impossible or extremely expensive and subject to the same deterioration in terms of trade and inflationary pressures affecting all imports.

#### 4.4.6 Inappropriate Fisheries Exploitation

Inappropriate use and overfishing of reef, lagoon, reef-slope and pelagic (open ocean) fisheries resources is a major constraint to development. For Kiribati, the fisheries

resource has tremendous long- and short-term potential for development. Unfortunately, little information exists concerning the carrying capacity and the extent of over exploitation of fisheries resources in highly urbanised areas such as Tarawa Lagoon. A priority of the Kiribati Government is a study of Tarawa Lagoon, which is scheduled to commence in 1991.

The lack of regulation of the use of the traditional reef, lagoon and inshore or freshwater fisheries, and of the EEZ and international waters is of particular concern. Localised exploitation of crustacea (lobster, prawns, etc.) for export and increasing harvests of all marine foods in these zones, for rapidly expanding local urban markets and growing rural populations, have led to the depletion of these resources. Of particular concern is the commercial overexploitation of lagoonal fisheries which could undermine the sustainability of important subsistence and local artisanal fisheries.

The abandonment of traditional taboos, marine tenure systems, and fishing regulations, which have been responsible for relatively sustained-yield production over thousands of years, coupled with widespread use small-mesh gillnets, are also rapidly degrading important fisheries resources.

Species of particular nutritional and cultural importance which already show evidence of overexploitation include bonefish (*Albula vulpes*), giant clams (*Tridacna* spp. and *Hippopus hippopus*), and an endemic cockle (*Anadara maculosa*).

The pelagic (free-swimming, often migratory species) or deep ocean fishery is almost universally underexploited, despite years of exploitation by American and east-Asian distant-fishing powers. At present, Kiribati has not successfully developed its own distant-fishing capability, although Te Mautari, the national fishing company, owns a few boats and has attempted to develop the industry. The fish caught by Kiribati vessels is either frozen or taken to foreign canneries for processing. Such policies, although probably necessary in the short-run, limit economic benefits to Kiribati, in terms of gross returns, employment and value added.

Rights to exploit the resources within Kiribati's EEZ are sold or leased (on a licence basis) to distant-fishing powers, such as Japan, the USA, the Soviet Union, Korea or Taiwan. At present, this arrangement, which has been particularly lucrative for Kiribati, is the only economically and technically feasible means of exploiting this underutilised resource, as the national fishing agency Te Mautari has reduced its operation due to technical and economic difficulties, and insufficiency of baitfish resources.

Another underexploited resource is the reef-slope or island platform fishery (extending from depths of six to 1,000 metres) with its rich resources of prawns, deep-water snapper and other demersal species, which were rarely if ever traditionally exploited. Most of the species from this fishery, in fact, have no local names. Kiribati is currently exploiting this rich resource, having recently established a lucrative airfreight export market in Hawaii for deep-water snapper, and tuna for the sashimi (raw tuna) market. Such developments, however, depend on dependable air transport unavailable to most atoll countries. However, the long-term potential for this type of fisheries development is limited due to the limited area of ocean bottom between 100 and 200 m deep in Kiribati,

in comparison with the larger islands, such as Tonga and Fiji, with more extensive areas of offshore banks and reef platforms.

Another area of potential development is increased local artisanal commercial fishing for pelagic flying fish, which are a traditionally important food species in Kiribati.

An associated problem, in terms of fisheries development, is among the highest incidence in the region of small fishing vessels in distress or lost at sea (40 to 50 in 1989-90). This seems to have resulted from the increasing use of outboard-powered craft instead of traditional paddling or sailing canoes, and has involved considerable expense, in terms of search and rescue, and loss of life. The main causes are poor engine maintenance and engine failure, overloading, running out of fuel after chasing tuna schools, and rain squalls that obscure islands (McCoy, 1991).

#### 4.4.7 Nuclear Pollution

The Pacific, and in particular the ecologically fragile atolls, has one of the longest continuous histories of nuclear pollution in the world. There has been widespread testing of nuclear weapons, the continued presence of nuclear vessels and arms, and the past and proposed disposal of nuclear wastes. These must be seen as one of the most serious obstacles to sustainable development, both globally and for Kiribati.

The U.S. has tested nuclear weapons on Bikini and Enewetak in the Marshalls, the British and U.S. on Kiritimati (Christmas) and Johnston Islands (a U.S. possession) in the neighbouring Line Islands. Most recently, the French have tested over 100 nuclear devices on Moruroa and Fangataufa atolls in the Tuamotus atolls of French Polynesia. There are also an estimated 8000 nuclear weapons stored and deployed by the U.S. and 40 Soviet nuclear submarines located in the Pacific. The Soviet Union, China and the U.S. also use the Pacific as an intercontinental ballistic missile range.

There have been joint U.S. and Japanese proposals for the "interim" storage of 10,000 tons of spent nuclear fuel from Japan, South Korea and the Philippines and two Japanese proposals to dump containers of high- and low-level nuclear waste in the Pacific. More recently, the U.S. has begun, as part of a "huge war dump burn-off" to burn millions of litres of toxic nerve gas and dispose of other dangerous weapons at a \$US150 million "chemical warfare base" on Johnston Island, despite strong objections by the nearby Marshall Islands and Federated States of Micronesia, Kiribati and the other independent states of the Pacific Ocean. In spite of the opposition, the US military has already begun operations. In 1978, the incinerator ship *Vulcanus* anchored off-shore from Johnston Island to burn 17 million litres of the dioxin (one of the most deadly chemicals known to humans) and a renown carcinogen-contaminated defoliant "Agent Orange", some of which reportedly "spilled" into the Pacific. All of these activities have potentially very negative impacts of the shared oceanic and atmospheric environments and the health of the people of Kiribati, and in particular on the nearby Kiribati islands in the Line group, currently inhabited by I-Kiribati.

The proven danger of such activities to the oceanic and island environments and the fatal somatic (to generations directly affected) and genetic (to future generations of affected individuals) damage induced in living organisms is widely documented.

Studies on Bikini in the Marshall Islands, where the U.S. tested nuclear devices in the 1950's, showed that the radioactive isotopes strontium-90 and caesium-137 (which act chemically like calcium and potassium, two major plant macronutrients and essential minerals for animals) were apparently working their way out of the soil and into important food crops such as breadfruit, pandanus and coconuts which all showed high radiation levels in the mid-1970's. The Department of the Interior warned the islanders (who had been recently resettled on their home island after over 20 years) to ignore the surrounding plants and to eat only the food that was shipped in from outside -- such warnings were often ignored! Medical surveys of Bikinians who had returned showed that in only a year's time there has been a 75 percent increase of caesium in their bodies (Ronck, 1978), in some cases, more than twice the maximum considered safe in the USA. Most experts feel that Bikini cannot be safely resettled for at least another 20 years, but other estimates range from 30 to 90 years. The US Defence Nuclear Agency, which is responsible for the cleanup, has stated " that it is impossible to reduce contamination to pre-test levels" (McHale, 1981). Similarly, in an attempt to make Enewetak safe for human habitation, the US carried out a US\$20 million cleanup campaign, and in 1980 dug a huge pit on Runit islet to dispose of 84,150 m<sup>3</sup> of radioactive debris mixed with cement. The pit was then covered with a concrete dome 113 m in diameter, 7.6 m high and 0.5 m thick. Nuclear scientists say the contents of the pit will remain radioactive for 25,000 years! (Carter, 1984)

Sources indicate there is an exceedingly high rate of thyroid cancer among Bikinians. High rates of thyroid cancer have also been found among Marshallese from the surrounding islands of Rongelap and Utirik which were exposed to radiation resulting from the 1954 "Bravo" atmospheric test. In the cases of Rongelap and Utirik, more than 200 Marshallese and 28 Americans monitoring the test were contaminated by radioactive ash which fell onto the islands and into drinking water. The people of Rongelap, who were evacuated over 24 hours after the blast, and the people of Utirik, who were not evacuated until three days later, suffered not only the immediate effects of radiation poisoning . . . itching and burning of the skin, eyes and mouth, nausea, vomiting, diarrhoea and loss of hair . . . , but also the more serious long-term somatic and genetic effects.

McHale (1981) reports, in his article "Paradise Lost", that "up until 1958, the incidence of stillbirths and miscarriages among exposed Rongelap women was more than twice that of unexposed Marshallese women." Similarly, in 1961, ten years after "Test Bravo" and three years after they were "allowed" to return to their islands to have their body radioactivity increased, the first cases of thyroid cancers appeared. Since that time, over 90% of the Rongelap children who were under 12 years of age in 1954 have all developed thyroid tumours. Some of these have died, and many more will undoubtedly die prematurely, despite costly US-sponsored thyroid operations. Moreover, 40%! of all exposed Marshallese have developed thyroid problems as compared to an average of 3 to 4 per cent among Americans. More recent evidence suggest that there are now high levels of radiation cancers throughout the Marshall Islands.

Although France has steadfastly refused to release data comparable with those from the former American territories, some evidence indicates that the same gruesome history of miscarriages, cancer and genetic damage experienced in Micronesia will be repeated. The French, for example, did not bother to build shelters on islands, such as Tureia, in the immediate vicinity of Moruroa, and only after two years, after testing began, did they evacuate the people of Tureia to Papeete for a "holiday". The extent to which the Tureians were contaminated is based on evidence that a French helicopter pilot, who flew to Tureia to pick up two meteorologists who had been left there, at the time of the explosion, together with the population of about sixty persons, and who spent only three minutes on the atoll and wore special boots and gloves, was found to have radioactive iodine in his thyroid glands. The pilot was given a special shampoo, and the two meteorologists, who were there longer, had to undergo a much more extensive decontamination procedure onboard a French hospital ship. One can only assume that the Tureians, who had not been evacuated, who had not received any instructions as to how to protect themselves, and who were not decontaminated after the blast, received much higher doses and will probably experience the same long-term health hazards as the people of Rongelap.

It is interesting to note that when the French Atomic Energy Commission (CEA-CEP) announced the first test, they sent out a warning to all ships and aircraft to keep out of the danger zone within a radius of 400 km around Moruroa. When it was pointed out that no fewer than seven inhabited atolls were located within this zone, the CEP admitted their "miscalculation" and "corrected" the figure to 222 km. Tureia, however, was still within this zone! When one realises that increased fallout and blowback from these tests was experienced as far away as the Cook Islands, Western Samoa, Kiribati, and Fiji, there is no guessing what the effects have been on the people of Tahiti and French Polynesia, especially the inhabitants of the most-exposed islands of the Tuamotu and Gambier groups (such as Tureia, Marutea, Mangareva, Matureivavao, Vahitahi, Pukana and Reao), with populations varying between 50 to 500 persons (McHale, 1981). WHO figures do, however, indicate that cancer was the number one cause of mortality in French Polynesia in 1981, although the figures are not broken down to indicate the exact types of cancer (WHO 1984).

It could also be expected, that there might be similar high levels of radioactive pollution and the same associated long-term health hazards and future high rates of cancer in persons who worked at, or are residing near former nuclear testing sites on Kiritimati Island. Despite its similar history of atmospheric testing, Kiritimati is still occupied by a sizeable population of over 2000 working on coconut plantations, fish farms, a small tourist hotel and for the Government. The island is also the main target for a major resettlement scheme.

Calculations in an unpublished report by a Director of the now-defunct Centre for Applied Studies in Development (CASD) of the University of the South Pacific indicated that the levels of radioactivity found present Kiritimati in the mid-1970 were considered by him to be dangerous to human health. The report clearly states:

If one uses the U.S. Federal Radiation Council (FRC) Radiation Protection Guides (RPG) to evaluate exposure

options (and it has been suggested that the values should be reduced by 50% for individual exposure and 20% for gonadal exposure to allow for uncertainties in dose predictions) guides for cleanup or non-settlement would be the same for Enewetak E.I.S., i.e.

Whole Body and bone marrow	0.25 REM/year
Thyroid	0.75 REM/year
Bone	0.75 REM/year
Gonads	4.00 REM/year.

Therefore, in the absence of better input information and on the basis of the above calculations (which could be more worrying if better information was obtainable about other fallout and weapon radionuclides), there appears to be cause for concern about risk and radiological hazard on Christmas Island (Medford, 1978:5).

Nevertheless, I Kiribati continue to work, farm, fish, and reside there, despite the fact that any ill effects of their stay on Kiritimati will probably not show up for years, or generations. It is thus seen as critical to have Kiritimati Island reassessed for radioactive contamination in light of the increasing evidence based on the cancer levels in the Marshall Islands, even among people who have not spent time on islands directly affected by nuclear testing.

In short, the long-term, the almost certainly irreversible environmental and human damage that has and will continue to result from the use of nuclear technology and other military activities in the Pacific, is one of the most crucial environmental issues affecting sustainable environmental development in atoll states such as Kiribati.

#### 4.4.8 Non-nuclear Pollution

Non-nuclear pollution, including solid waste disposal, soil pollution, water pollution, and air pollution, is also a major concern in Kiribati. Although the total volumes of waste produced may not be large compared to other countries, the effects of the disposal of increasing amounts of waste on fragile small islands environments are likely to be extreme and constitute a very serious constraint to sustainable development. This is particularly true for atolls with limited fresh water supplies and inshore lagoonal marine ecosystems that are easily contaminated.

Solid-waste disposal (e.g., the disposal of dilapidated motor vehicles, plastics, beer cans, unused pesticides and pesticide containers, waste oil, sewerage sludge, and toxic wastes such as polychlorinated biphenyls (PCB's) and spent dry-cell and car batteries) is a major problem. Discarded motor vehicles and other solid waste can be seen along roads, beaches and backyards, creating hazards for children, serving as mosquito breeding sites, and restricting land use. There is extremely limited land available for landfill sites; no

disposal facilities for hazardous waste, the health hazards related to the improper disposal of which may not be realised for years; increasing dependence on imported non-biodegradable products and packaging; a lack of information on the nature and origin of waste and its environmental impacts; and a lack of legislation controlling toxic and non-biodegradable waste.

Of serious concern have been recent attempts by companies of dubious credibility to dispose of, in the atoll and oceanic environment, extremely hazardous wastes, the disposal of which is banned in the USA, as well as in most other countries where their disposal has been attempted. The inability to stop such use of neighbouring islands and oceanic areas as waste disposal/reduction sites (e.g. Johnston Is. for JICADS) is a major concern.

Water pollution from domestic and animal waste and leaching of agricultural chemicals are also on the increase, with two of the major water reserves on South Tarawa having been closed due to overdraught and contamination. Oil pollution is increasingly common in harbours, and coliform bacteria (associated with faecal matter) concentrations in lagoons are dangerously high in densely-settled areas, such as in South Tarawa. Although little documentation exists, the leaching of inorganic fertilisers and heavy metals into groundwater, and the concentration of these substances in food chains could also be a problem in some areas.

Industrial air pollution is at present not a serious problem in Kiribati, although smoke from wood burning stoves and open fires constitutes a significant health hazard, as excessive exposure to smoke has been linked with eye disease and lung cancer, especially among women, with studies in India indicating that women suffer extreme exposure to smoke pollution equivalent to smoking 20 packs of 20 cigarettes a day! (Smith, 1985).

#### 4.4.9 Energy Dependency

The absence of proven fossil-fuel reserves in Kiribati, makes increasing dependence on non-renewable fossil fuels a major constraint to sustainable atoll development. Petroleum imports, as a percentage of domestic exports, were 150 for Kiribati in 1983. This means, for example, that more than every single dollar received from exports is used to pay for fuel. Such dependency on imported fuel for energy leaves Kiribati economically vulnerable to increases in oil prices.

Further underlining the critical nature of increasing dependence on fossil fuels, is the rapid depletion of fuelwood. Fuelwood, particularly, high quality fuelwood, is in short supply in the densely populated areas of South Tarawa Kiribati, where because of increasing demands on scarce resources, partly due to the increasing cost of kerosene, it has been estimated that the biomass resource may be exhausted by 1990. Firewood scarcity is the "real energy crisis" of the poor, and can only further tighten the vicious circle and further plundering of remaining fuelwood resources, associated environmental deterioration, and further fossil-fuel dependency.

In Kiribati it was estimated that fuelwood and coconut residues accounted for 77% of domestic energy needs on urban South Tarawa and 97% on the outer islands within the Gilbert group and 49% of overall energy requirements in the Line and Phoenix groups in 1985. A 1985 PEDP study showed that fuelwood accounted for 59.6% of total household energy use and 88.6% of energy use for cooking in urban South Tarawa, and that on rural Abaiang and Tamana 98 to 100% of households use fuelwood.

In Kiribati, most cooking with fuelwood is done over open fires). Unfortunately, the efficiency of cooking over an open fire is very low: about 5 to 10% of biomass energy being converted to useful cooking energy. Moreover, as stressed above, cooking over an open fire poses serious health risks from chronic smoke inhalation. There is, thus, a need for the development of more efficient and less-smoky stoves or means of cooking.

#### 4.4.10 Economic Vulnerability/Foreign Domination

Kiribati's economy is extremely vulnerable and dependent, with the high degree of foreign domination, either direct or indirect, which limits its autonomy to follow its own strategies to promote sustainable development. Six key constraints contribute significantly to this situation: lack of political freedom, poor fiscal integrity, over-reliance on foreign aid, limited range of exports, heavy dependence on imported food, and the previously discussed fossil-fuel dependency.

Firstly, Kiribati is still politically and economically tied to its former colonial master Great Britain and to the larger metropolitan countries such as Australia which provide a large percentage of capital expenditure. Kiribati, however, has shown in its negotiations with the Soviet Union related to licensing of fishing rights in its EEZ, and with The People's Republic of China regarding the development of a new airport, that freedom to negotiate economic agreements is a major consideration in the sustainable development of a country's resources.

In terms of fiscal (financial) integrity, Kiribati has only limited local economic productivity (in terms of cash) to support ever-expanding government activities. This severely limits the ability of Kiribati to initiate new and innovative programmes, and necessitates heavy reliance on borrowing or aid to finance even recurrent expenditures. This makes Kiribati vulnerable to political and economic changes in the donor countries and/or multilateral aid agencies, (e.g., regional or U.N agencies). It must be stressed, however, that the wider the base of aid (i.e., the more countries that aid is received from) or the greater the dependency on multilateral rather than bilateral sources reduces vulnerability. In this respect, Kiribati has widened its donor basis away from its traditional donors.

Kiribati depends on a very narrow range of exports, with copra, seaweed, fish (including fees from foreign vessels fishing in its EEZ) and postage stamps constituting the only significant exports. Moreover, due to technical and managerial problems, and limitations imposed by limited baitfish resources, Kiribati's national fishing company Te Mautari significantly reduced its fishing output in 1990.



The economic implications of increasing food dependency are also serious, with the value of imported foods far exceeding the total value of domestic exports, a situation which augers poorly for the future given the limited productivity of atoll soils. Kiribati's population may have, in fact, outgrown its resource base, with its existing population unable to feed itself from available land and sea resources. Should the supply of imported food be cut off, some people could literally starve.

Other, often related economic problems, which auger poorly for sustainable development, include increasing income disparity within Kiribati, rapid inflation and increasing unemployment, particularly in South Tarawa.

#### **4.4.11 Landform Destruction**

Unique landforms such as swamps, reefs, lagoons, coastlines and individual islands are found in Kiribati and constitute important cultural and economic resources. The destruction of these landforms, must be seen as a major environmental issue. The almost total destruction of the phosphate island of Banaba (Ocean Island) is the most dramatic example. Widespread coastal erosion and reef and island destruction due to dynamiting, sedimentation and the construction of causeways and air strips are also widespread, but not as obvious.

#### **4.4.12 Deforestation**

Few stands of economically and ecologically precious inland forest remain, except on some uninhabited islands in the Phoenix and Line Islands. Small areas of mangrove or ubiquitous coastal strand forest have been preserved on some atolls, but deforestation has proceeded at a frightening rate. The few remaining coastal forests and native trees, including mangroves, continue to be transformed into degraded ruderal vegetation, housing, industrial estates, roads, airports or monocultural coconut plantations, or cut down for firewood or to build frames for seaweed mariculture. The removal of coastal strand species and mangroves in many areas has led to accelerated coastal erosion. In perhaps the most extreme cases, like Banaba, almost the entire indigenous forest and much of the coastal strand forest have been transformed into a virtually unusable moonscape by open-cast phosphate mining.

Although some larger countries and territories have conservation legislation and forestry ordinances and increasingly effective systems of forest reserves and conservation areas, Kiribati does not have effective legislation to protect their valuable tree resources against the onslaught of modernisation.

#### **4.4.13 Agrodeforestation**

Although deforestation, as such, has received most attention from the international community, probably of tantamount importance is "agrodeforestation", in the forms of both declining tree planting and the elimination of trees from agricultural and urban

landscapes. The situation is particularly serious on atolls where there is little or no remaining native forest, where the main agricultural and food crops are trees, and where agricultural areas and houseyard gardens serve as the few remaining reserves where endangered plant varieties can be protected.

Most of the trees that provide food, timber, firewood, medicines and serve other important cultural and ecological functions today have been planted or protected in the past, but are not being replaced or protected by the present generation. Serving imported rice or tinned peaches for a feast, going to the local dispensary or pharmacy for medicines, or purchasing imported plastic flowers, perfumes and deodorants are increasingly replacing the products that depend on the planting or protection of trees. Only recently, for example, has the Kiribati government begun to acknowledge that some 20 years of institutionalised coconut replanting and rehabilitation have led to serious "agrodeforestation" and the gradual elimination of a wide range of ecologically and culturally important tree species, all traditionally components of the sustainable Kiribati integrated agricultural system.

Although Kiribati has established some conservation areas and reserves, there are no legislation or programmes prohibiting the cutting, or promoting the replanting of important or endangered tree species as part of agricultural or other modern-sector development. Thus, agrodeforestation continues, with little or no official recognition or resistance to it.

#### 4.4.14 Species Extinction and Endangerment

Given the extremely poor floras and faunas and limited land area of atolls, habitat disruption and overexploitation have either brought to extinction or endangered many atoll plant and animal species. Once-common native trees favoured for woodcarving, such as *Calophyllum inophyllum*, *Cordia subcordata* and *Thespesia populnea*, and a wide range of plants used to scent coconut oil, for natural ornamentation and for medicinal purposes are now exceedingly rare. Even formerly abundant species such as *Pemphis acidula* and *Pisonia grandis* are rare in some areas. As these trees become endangered so do the sea birds and other animals that depend on them for food, habitat or roosting. The elimination of groves of te buka (*Pisonia grandis*), the favoured nesting species for sea birds, for example, has led to a decrease in bird populations and the associated problem faced by fishermen of increased difficulty in locating tuna schools by the presence of sea birds.

#### 4.4.15 Soil Deterioration

Thoughtless deforestation, the widespread practice of burning organic debris and the decline in traditional intensive mulching systems have led to soil deterioration in some areas of Kiribati. Inorganic fertiliser use, which although greatly increasing immediate crop yields, and perceived, by some, as particularly needed in the atoll environments, seems to impoverish the soil of organic matter and destroy the natural nitrogen-fixing ability of the soil. Moreover, in the high pH soils of atolls the use of inorganic fertilisers is less effective and can lead to dangerous pollution of scarce groundwater resources.

#### 4.4.16 Limited Industrial Potential

For Kiribati, there is very limited potential for industrial development. This is due to limited mineral, water and land resources, coupled with isolation from generally protected overseas markets for manufactured goods, and the high cost of imported fuel, technology and expertise, which limit the multiplier effect of industrial development.

#### 4.4.17 Inadequate Infrastructure

Although greatly improved since independence, Kiribati requires strengthened infrastructural development for the provision of government and non-government services to, and marketing of local products, particularly fish, from rural areas. The pattern established during the colonial period to support export (and import) activities, tourism, etc., has been perpetuated in the post-colonial period. Whereas sophisticated marketing networks exist for copra, *Echeuma* seaweed, phosphate and fresh or frozen fish, similar infrastructure does not exist for the distribution of food crops and fish to urbanised South Tarawa.

#### 4.4.18 Rapid Urbanisation and Increasing Centralisation

Rapid urbanisation, rural-to-urban migration and increasing centralisation of employment opportunities, social services, infrastructure and administration are major problems in Kiribati, with most employment opportunities occurring in urban South Tarawa.

These trends and urbanisation in general seem to be related to perceived better opportunities for personal or family advancement through cash employment and education or, more generally, to the incorporation of Kiribati into the global cash economy, and, in some cases, to the very limited resource bases for further development in outer island rural areas. The result of course is unequal pressure on both natural and cultural resources of a country, and in most cases increasing emphasis on unsustainable development of scarce resources, including increasing population density, shanty-town development, social dislocation, and environmental degradation. These phenomena place undue stress on limited land and financial resources, while at the same time siphoning some of the most able persons from rural areas where they can contribute to more sustainable and equitable development.

#### 4.4.19 Inappropriate Education

Although seen as the most important means for developing human capital, formal education in Kiribati may be inappropriate in terms of its predominantly western, urban-industrial bias. Formal education generally prepares students for "white-collar" urban and/or government jobs, and alienates the young from the traditional resource-use systems and wisdom of the past, only to replace it with imported, often ecologically and culturally-insensitive, overseas educational models.

Few of the younger generation know the names of native trees, the life cycles of marine organisms, planting technologies or traditional handicraft and food preparation technologies which have supported atoll peoples for generations. Inappropriate education must be seen as one of the major obstacles to capitalising on time-tested, ecologically-conservative social and scientific technologies of the past as bases for sustainable development. As suggested above, focussing on the appropriateness of ecologically-conservative social and scientific technologies (including traditional environmental education strategies) and their importance as foundations for sustainable development must, therefore, be seen as a priority in the formulation of appropriate development strategies.

#### 4.4.20 Landlessness and Land Alienation

Land shortage, landlessness and land fragmentation are major constraints to sustainable development, whether economic, social or environmental, with land being sacred and integral to the very survival of atoll peoples and, along with marine resources, the only resource which will protect them from increasing vulnerability to a very unstable world economy, deterioration in terms of trade, inflation and other factors beyond the control of people at the village and community levels. With increasing population and rural to urban migration, land disputes and land shortage have become increasingly common.

Land has been used as airstrips, originally for military or strategic purposes, on many islands in Kiribati. Even civilian airstrips require large areas of scarce land on small islands. Apart from taking up a considerable portion of the productive land, airstrip construction also requires construction materials and is often fraught with land disputes. The acquisition of land for water reserves has also led to disputes.

Finally, there are also cases in most islands where some groups or individuals have limited access to land, due either to maldistribution within a society or an influx of migrants from outer islands, which has led to high-density, often shanty, settlements, such as in South Tarawa. In such areas agricultural self-sufficiency is problematic, with high-intensity systems being required, where possible, to maximise self-sufficiency. The development of such systems for atoll urban areas is seen as one of the major challenges facing developers. Another means to alleviate the situation which has been also pursued is land reclamation

#### 4.4.21 Introduction of Inappropriate Technology

The "tropicalisation" or "atollisation" of mid-latitude, continental technologies is often inappropriate. Examples, such as mechanisation, the use of inorganic fertilisers, pesticides, herbicides, dynamite and small-gauge gillnets for fishing, imported animal breeds and crop varieties, and some imported foods and medicines have already been shown to be inappropriate in terms of increasing dependence on costly, imported resources, the stress they put on the environment and human health, and their displacement of labour, etc.

There are countless other examples of inappropriate technologies that have been introduced into the atolls, sometimes with good intentions, such as goats, snack-food manufacturing using imported products, outdated drugs, etc., but the biggest problem in the short-run is probably the lack of trained local scientists and technicians, including local agricultural scientists, who can assess new technologies before they replace existing, more appropriate technologies. Even when local scientists are trained, most end up working for production-oriented industries, with little involvement in research and development of appropriate technologies adapted to atoll conditions. As a result, most atoll countries are becoming increasingly dependent on expensive, often aid-tied, inappropriate imported technology.

Before the proliferation of international technical aid, atoll peoples were able to, on their own terms and at their own speed, observe, evaluate, and selectively adopt new technologies such as new crops, metal axes and hoes, outboard engines, spearguns, fish hooks, etc. which they saw as appropriate. Today, with aid-tied technological assistance, well-warranted reluctance is often seen as backwardness, and widespread technological change is often implemented before the long-term environmental and social implications are fully understood. Such considerations are critical in the fragile atoll environment, with its scarce groundwater and soil resources and fragile ecosystems. As stressed by the Kiribati Government, one of their highest priorities is to develop a locally-based research capability to conduct applied research in atoll development, not only for the benefit of Kiribati, but also for the benefit of other atoll communities with similar development problems and constraints.

#### 4.4.22 Social Disintegration

Signs of social disintegration are increasingly common in Kiribati, especially in urban areas. The extended family system and wider kin-based, traditional "social security" systems are weakening, with nuclear, often broken families becoming increasingly common. Similar signs of the declining status of the family figure head and the family as an "emotional sink", and the declining status and wellbeing of the aged are also prevalent, but not yet widespread in Kiribati.

Burglaries and crimes of violence are increasingly widespread, especially in Tarawa. Much of this has been associated with increasing use of alcohol and drunkenness. "White-collar" crimes, such as embezzlement, bribery of officials, unethical business practices, tax evasion, illicit remission of large sums of money overseas, abuse of public office, and various other forms of corruption, increasingly widespread in the Pacific, are so far uncommon in Kiribati.

Increasing consumption of alcohol and alcoholism, as both a major social problem and a health problem, have caused particular concern in urban Tarawa. Excessive alcohol consumption has negative effects on work attendance and performance, as well as on the proportion of incomes which reach families in the form of nutritious foodstuffs. As an energy-rich substance alcohol is a major cause of obesity, and has been shown to lead to higher rates of heart disease, cancer, and is the major cause of cirrhosis of the liver. It is

also highly correlated with increasing rates of homicide, fatal traffic accidents, and crimes of violence in the Pacific.

Part and parcel of the entire process of social alienation and disruption is the declining influence of spirituality and the church. Of critical social importance in all groups, the churches have lost considerable support of the economically-active middle-aged members of society. The Bishop of Agana, Guam has stressed how urbanisation and technological society have been a major factor in the phenomenon of spiritual alienation, and that:

The majority of the present social problems confronting us stem from alienation, either in alienated youth or adults. Drug abuse, sexual excesses and perversions and crime, and anti-life attitudes are but a few . . . . Briefly stated, the waning of religion in the West has deep and far-reaching effects upon humankind. The loss of an entire system of symbols, images, dogmas, and rites by those who have opted for the gods of technology has led man to a strange world (Flores, 1975: 319-320).

In Kiribati, such alienation from the traditional social system, which still respects trees, sharks and other components of the environment as totems or integral to their traditional spirituality and religion, can only serve to undermine sustainable use and protection of our natural heritage.

#### 4.4.23 Military/Defence Activities

The impact of World War II on Pacific Island societies and environments is legend. The destruction of vegetation through bombing, airstrip construction, and military operations have affected Kiribati, particularly Tarawa during World War II, but also the Line and Phoenix groups, where nuclear weapons were tested at Kiritimati. Although the historic World War II sites on Tarawa now constitute a tourism resource, the atmospheric testing of nuclear weapons on Kiritimati in the 1956-58 and 1962, by the British and USA, respectively, and military activities elsewhere in Micronesia may (as stressed in the next section) continue to constitute a major constraint to sustainable development and the habitability of some islands.

#### 4.4.24 Epidemic Pest Infestations

Although not a widespread problem in Kiribati, epidemic pest infestations are a serious constraint to sustainable atoll development, especially where monocropping or large-scale livestock operations are concerned. On South Tarawa, the Papuana taro beetle (*Papuana heubneri*), which was accidentally introduced from Solomon Islands with soil in the 1930s, has made it very difficult to cultivate giant swamp taro (*Cyrtosperma chamissonis*), the only major staple root crop on many low-lying atolls. It has also seriously affected banana cultivation, which is important on the wetter atolls in northern

Kiribati. Although currently restricted to South Tarawa, the spread of the Papuana beetle to other islands would have disastrous consequences on agricultural production in Kiribati. Another serious pest is the breadfruit mealy bug (*Acerya aegyptiaca*) which is currently restricted to the northern island of Butaritari.

A major constraint to the development of aquaculture in Kiribati has been the introduction of the tilapia (*Oreochromis mossambica*) in the 1960s, which has been responsible for the decrease of milkfish, mullet, bonefish and other culturally acceptable fish species on Tabuaeran (Fanning) and other islands, and has been a serious pest in the Temaiku milkfish ponds on Tarawa. The introduction of tilapia has been cited by the former Kiribati Minister of Natural Resources Development, Taomati Iuta, as one of the best examples of the introduction of an inappropriate technology which has caused serious environmental and cultural disruption. A major priority is the Tilapia Eradication Project in the Line Islands.

Other destructive pests include rats, unfenced feral and domesticated animals, particularly feral and domesticated pigs and goats, which cause considerable damage to both commercial and subsistence crops. There have also been periodic outbreaks of coccidiosis and a number of other poultry and swine diseases on large-scale poultry and pig farms, both of which are being promoted in Kiribati. Such outbreaks have considerable negative impact on commercial livestock production, as well as necessitating the increasingly widespread prophylactic (preventive or protective, rather than curative) use of drugs in large-scale livestock operations. The development of such practices, for economic reasons, has shown to lead to the development and accumulation, in animals, of resistant bacteria strains, which are then passed on through the food chain to humans.

Without a strengthening of agricultural quarantine procedures, particularly on Kiritimati Island and other islands targeted for agricultural resettlement, many of these pests could become serious obstacles to sustainable development in Kiribati. The introduction of new pests could also lead to the need for unnecessary, costly and dangerous pesticides.

#### 4.4.25 Overgrazing

Overgrazing, although most common on the larger islands of the western Pacific, where it has led to severe soil erosion, uncontrolled foraging by pigs and devegetation by aid-funded introductions of goats in Kiribati has led to a loss of scarce plant resources.

#### 4.4.26 Inequality of Women

Women have traditionally played a critical, often dominant role in Kiribati society. They are cultivators, livestock husbanders, fishers (primarily reef gleaners), producers of handicrafts and material goods, and had primary responsibility for food processing, preservation, and preparation and child-rearing. In the modern development process, however, women's status seems to have deteriorated, while at the same time her role in

subsistence production has increased. Although not as serious as in Melanesia, modern development in Kiribati has not involved women in both the planning and participation phases commensurate with their roles and contribution to "traditional development".

Commercial agriculture, capital-intensive livestock schemes, commercial fishing development, access to new technologies, and business are predominantly male-centred. With increased cash cropping, deforestation and commercial fishing near villages, women must go further afield to obtain food, firewood and water needed to prepare the family meal. The increased use of imported household goods (e.g., mattresses, pillows, blankets, plastic bags, etc.), imported medicines and the increasing dependence on breastmilk substitutes, has even degraded women's role in family and community development.

Male domination in the leadership of administrative areas of government, political parties, religious bodies and planning agencies is the predominant trend in Kiribati. Such discrimination, especially where women are the sole repositories of a great body of priceless traditional ecological, social, medicinal and nutritional wisdom, can only compromise the prospects for sustainable development . . . for both men and women!

#### **4.4.27 Mining-Induced Damage**

Environmental damage associated with mining, as suggested above, is a major concern only in terms of the future habitability, if it were possible, of Banaba. Past deforestation and environmental disruption also occurred during the middle and late of last century due to mining of guano deposits in the Phoenix and Line Islands. The removal of limestone rock, aggregate and sand and living and dead coral for construction and reclamation purposes have also led to negative impacts on the environment in Kiribati.

Also related to sustainable development are who owns and who benefits from mineral resources. In most cases, mines are owned by overseas and government interests, with local people receiving only employment or minimal royalties. There has been an ongoing conflict over reparation payments to the people of Banaba and the Kiribati Government over what should have been just remuneration for the phosphate mined there. There has also been conflict over the status of Banaba, because the former inhabitants, who now live in Fiji, wanted to secede from Kiribati. Such issues are likely to arise again if the question of re-mining Banaba is raised again, and if technologies are developed for mining seabed mineral deposits.

#### **4.4.28 Tourism-Induced Disruption**

Tourism has some potential for developing underutilised resources and diversifying Kiribati's economy. It is an increasingly important source of foreign exchange in Fiji, Tonga, and the Cook Islands, and is a major industry in Guam and French Polynesia.

There are, however, aspects of tourism which may be detrimental to sustainable development in Kiribati. The pre-emption of land and the inflationary impact that hotel development has had on land values are of major concern. Others include the limited



involvement of locals in upper-level jobs and management, the restricted benefits that luxury tourism has for the wider population, and its role in cultural erosion in terms of its effect on the significance of traditional art, artefacts and ritual ceremonies, which are "produced" for the tourist. It has been reputed that tourism has "killed agriculture dead" in areas such as the Caribbean, leads to violence between locals and tourists, and, in general, carries significant social costs. There are also ecological consequences of the pre-emption of land, foreshore, scarce fresh-water supplies, and the capacity of the environment for waste disposal in Kiribati.

Problems relating to tourist-local interaction, such as tourism-related pornographic and sex-related developments, criminal acts against tourists, tourism arrests for drug offences, and land disputes are only some of the signs of the "fading smiles of tourism" elsewhere in the Pacific. Finally, all of the above aspects of tourism, plus its almost total dependence on the health of the "leisure revolutions" in source countries and on the uncertainty of international air transport in Kiribati makes tourism development exceedingly vulnerable to the vagaries of the world economy.

The potential for disruption is real, but so are the benefits, given the limited development options. In Kiribati, there has been some benefit from sale of local handicrafts, limited employment and some potential for ecotourism, especially in the Line and Phoenix Islands where there are some of the world's most extensive sea-bird nesting areas.

#### 4.4.29 Indiscriminate Pesticide Use

Although not currently of major concern in Kiribati, apart from limited use of pesticides for control of household pests, given increasing interest in intensive vegetable gardening and the presence of the Papuana beetle in South Tarawa, indiscriminate use of pesticides must be guarded against. As stressed above, many pesticides have been shown to be hazardous to humans and the environment and thus inappropriate, even in the industrialised countries. Accordingly, they must also be seen as particularly hazardous in the atoll environment. Despite the proven toxic and genetic effects, multinational companies continue to market dangerous pesticides overseas.

As Wier and Shapiro (1981:3) argue, the Third World has become a "booming growth market" for pesticides, as well as a "dumping ground" for pesticides considered too dangerous to be used in the countries where they are manufactured. The Pacific Islands are not free from this victimisation. Of the 585 pesticides reportedly "registered for use, used, or recommended for use" in the member countries and territories of the South Pacific Commission, 76 are banned or restricted for use in the United States or European Community countries (Mowbray, 1984:85-92).

Moreover, the rate of pesticide poisoning in Third World countries is 13 times that in the United States, despite greater use there. Although there is little data available, the situation seems to be the same in the Pacific where: people either don't understand or don't read labels or warnings on containers; there are no unions or laws to protect labourers; there are few, if any, trained scientific personnel needed to investigate pesticide

dangers and malpractices; and where the recommended safety equipment, if even available, is either too expensive or never used!. In the Pacific, lack of regulations, illiteracy, poor labelling, free distribution regardless of age, unavailability of protective clothing and absence of disposal facilities can turn even safe pesticides into deadly weapons.

Perhaps the more important issue is that pesticides may never be successful in the long-run because of the severe ecological damage and disturbance they cause. Not only do they poison humans and cause soil and water pollution, they also usually destroy beneficial plants and animals and the natural predators of the very pests the pesticide user wishes to destroy. This coupled with the incredible diversity, mobility, prolificity, adaptability, and associated genetic plasticity of insects, which has led to the development of widespread pest resistance to pesticides among over 432 species of arthropods, 50 or so species of plant pathogens, five species of weeds, and two species of nematodes (Georghiou, 1981:117), has led to multiresistance among some pests, pest resurgence, and the creation of new secondary pests, all of which put farmers on what van den Bosch (1978: 22-24) calls the "pesticide treadmill" and which requires that they use greater and greater amounts of increasingly more toxic pesticides. It's anyone's guess as to what the long term ecological impact will be!

Again, given the limited opportunities for agricultural development and the fragility of the atoll environment, it could be argued that the use of pesticides in places like Kiribati should be avoided at all costs, given their dubious role, if any, in promoting sustainability.

#### **4.5 A PLEA FOR CULTURALLY AND ECOLOGICALLY APPROPRIATE ACTION TO PROMOTE SUSTAINABLE DEVELOPMENT**

Perhaps the real overriding constraint to the promotion of sustainable development, not only in Kiribati, but throughout the world is inaction in the face of clear evidence that current models of development are not sustainable in ecological and cultural terms. In short, it is not enough to focus solely on problems or constraints to atoll development, and to malign the "development community", including our own "managerial elite", for our continued plunder and degradation of atoll resources and cultural traditions. We must be prepared to be innovative and actively search out innovative strategies which achieve a balance between traditional and modern ways of production.

The image of the fragmented, isolated, overpopulated and land- and resource-poor atoll states of the Pacific, beset with problems of frequent natural disasters, species extinction, widespread deforestation and agrodeforestation, soil impoverishment, breakdown of ecologically conservative traditional land and marine use systems, major nutritional and health problems, nuclear and non-nuclear pollution, increasing militarisation, inappropriate education, and signs of social breakdown and spiritual impoverishment, is grim to say the least. At first sight, these many and varied environmental and cultural constraints to development in Kiribati seem almost unsurmountable.

Fortunately, there may be "a way forward", because the situation, in Kiribati does NOT seem to have reached the critical, perhaps irreversible stage, that it has in other regions. Although many traditional cultures and their strategies have disappeared from the earth, I-Kiribati (the people of Kiribati) have maintained a high degree of cultural integrity because several of their ways of life (particularly their traditional agricultural and marine resource-use systems) have assets which seem especially valuable as a basis for sustainable development. Despite the great challenges and environmental and cultural constraints to such development, there is an endless array of strategies that have either been time-tested in the atoll environment, or which have proven successful elsewhere. There are also yet unproven technologies and strategies which could benefit Kiribati. These could very well solve some of the problems of capital-poverty faced by most atoll states, thus allowing them to participate more fully in the benefits of the global cash economy.

The question which must be asked, however, is whether it will be possible to learn from the mistakes made in other countries and return to a more sustainable standard of living which can provide everyone in Kiribati with at least a reasonable level of "subsistence affluence". The waters, soils, animals, plants, oceans and minerals were traditionally allies keeping atoll societies in this state of affluence as long as their relationship with the natural environment remained symbiotic and sustainable. Scarce atoll resources were treated not as income to be spent, but as capital to be cared for, and preserved as the basis for future generations' subsistence affluence. It was a system where humans, their physical and spiritual needs, and their culture were very integral parts of the atoll ecosystem. To remain an effective and stabilising force in the system, it was critical that humans understood its internal makeup and functioning, and most importantly, the impact that their quest for basic needs and "luxuries" had on it.

Unfortunately, or more appropriately, tragically, most cultures are steadily losing their traditional understanding of human ecological principles, particularly the concept of ecological scarcity. Modern development and what Tudge (1977) refers to as the "commercial imperative" have changed our resource perception. It has taken us from traditional, in-the-community, in-the-field education and put us into schools where we are taught less and less about our place in, and effect on the environment, and more and more about how we can exploit its resources faster and farther to further "development". What is happening, is that over three thousand years of human and experimentation in the unique atoll environment ... empirical education... is being cast aside for imperfect, untested models developed during the relatively short span of only two hundred years since the industrial revolution and the expansion of the European cultural realm over the earth's surface.

The signs of social and ecological breakdown are clearly before us. Today's development agendas seem to be taking the atolls further adrift towards increasing dependency, social breakdown, and ecological ruin. The critical constraint is whether the rapidly emerging Pacific atoll "managerial elite" (politicians, policy makers, community leaders, educators and agricultural and marine scientists) will selectively foster the conservation, modification and adoption of those traditional or existing strategies which seem to have relevance today, along with appropriate introduced or locally-developed new strategies, which could provide the foundation for sustainable atoll development.

## **SECTION II**

### **RESPONSES AND PRIORITIES FOR PROMOTING SUSTAINABLE DEVELOPMENT**

Whereas Section I provided an overall picture of the potential for and constraints to sustainable development in the Republic of Kiribati, Section II includes chapters on 1) responses by the Kiribati Government to address the constraints to, and to promote sustainable atoll development, and 2) a prioritisation of the constraints and opportunities for future action.

## CHAPTER 5

# RESPONSES TO ENVIRONMENT/DEVELOPMENT ISSUES

### 5.1 ENVIRONMENTAL ISSUES IN PERSPECTIVE AND THE BANABA CASE

For over seventy years of colonial rule, the economy of the Republic of Kiribati (then known as the Gilbert Islands, and part of the Gilbert and Ellice Islands Colony of Great Britain) was dominated by a single industry based on a single non-renewable resource, phosphate from the island of Banaba. This industry contributed around 85 per cent of the country's export earnings, 45 per cent of Gross Domestic Product and 50 per cent of Government revenue. The mining of phosphate also provided the partners (Australia, Great Britain and New Zealand) in the mining consortium, the British Phosphate Commissioners (BPC), with extremely cheap fertiliser to revitalise phosphate-poor soils. The years of open-cast mining also turned Banaba into an almost unrecognisable moonscape, which necessitated the resettlement of the original inhabitants on Rabi Island in Fiji in the late 1940s.

The exhaustion of Banaba's phosphate in the same year as independence epitomised the problems of vulnerability related to the predominance of the colonial power's commercial/economic interests over the environmental concerns and desire for sustainable development on the part of the people of Kiribati. The cessation of phosphate mining also put the new state of Kiribati in an awkward position of having lost its substantial degree of economic self-reliance at the same time it achieved its political and constitutional independence. The lesson of Banaba is a lasting reminder to Kiribati decisionmakers of the desirability of planning for sustainable development, development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sound environmental management and protection policies are central to the process of planning for sustainable development. For Kiribati, in particular, environmental planning, management and protection are of utmost importance given the scarcity of terrestrial resources and the vulnerability of the country's terrestrial and oceanic environment to the forces of external development.

### 5.2 POLICIES, LEGISLATION AND INSTITUTIONS IN GENERAL

Kiribati does not have a comprehensive national environmental policy, but there are already in place legislation and sectoral policies addressing specific environmental concerns. These need both updating (including, in the case of legislation, amendments to meet current environmental concerns and to relate to relevant international conventions) and integration into a national multisectoral umbrella arrangement encompassing resource



and environmental protection and management. In this vein, one of the stated objectives of the 6th National Development Plan 1987-91 is "sustainable use of resources".

Similarly, the September 1991 "Policy Statement" of the newly created Ministry of Environment and Natural Resources Development stresses the serious concern that the current Government has over a number of environmental issues and particularly over the potential dangers of global warming and sea-level rise. The need to take into account environmental considerations as an integral part of the development process and to promote sustainable development which will ensure that the present generation will be able to earn its living without compromising the ability of future generations to live out of the same natural resources were also stressed in the statement.

### 5.3 NATIONAL LEGISLATION

The Constitution of the Republic of Kiribati does not include set clauses relating directly to environment policy, but its preambular declaration that "the natural resources of Kiribati are vested in the people and their Government" can be taken to imply the notion of sustainable resource use.

Existing legislation relevant to specific environmental concerns, such as 1) land or resource use and management and access to terrestrial and marine resources, 2) coastal management and protection, 3) conservation of strategic or endangered marine and terrestrial resources, 4) water, sanitation and environmental health, and 5) control of specific potentially polluting, dangerous or environmentally disruptive substances and materials, include:

#### Land or Resource Use and Management

1. Native Lands Ordinance (1957) which relates to native land and registration of titles thereof.
2. Neglected Lands Ordinance (1957) to provide for the purchase of neglected land and to regulate the sale thereof to indigent natives.
3. Mineral Development Licensing (1978) to regulate the granting of licences to search for and win minerals, and for purposes incidental thereto and connected therewith.
4. Prohibited Areas Ordinance (1957) to provide for certain islands and their territorial waters to be declared prohibited areas.
5. Land Planning Ordinance (1973) to provide for the control of the development and use of land.

6. Marine Zones (Declarations) Act (1983) to make provisions in respect of the internal waters, archipelagic waters, the territorial sea, the exclusive economic zone (EEZ) and the contiguous zone of Kiribati.
7. Kiribati Public Protection Act (1989) to make provisions for the protection of Public Highways.
8. Fisheries (Pacific Island States' Treaty with the United States of America) Act (1988) to give effect to the Treaty on Fisheries between the Governments of certain Pacific Island States and the Government of the United States of America.

#### Coastal Management and Protection

9. Foreshore and Land Reclamation Act (1969) to declare the ownership of the foreshore and regulate certain reclamation projects

#### Conservation of Strategic or Endangered Marine and Terrestrial Resources

10. Wildlife Conservation Ordinance (1975) to provide for the conservation of wildlife, in particular birdlife.
11. Plants Ordinance (1976) to provide for the protection of endangered or culturally important plants species within Kiribati.
12. Fisheries Ordinances (1978) to make provisions for the regulations of fishing and fisheries industries and to provide for the protection of specified fish species in Kiribati and within its EEZ.

#### Water, Sanitation and Environmental Health

13. Quarantine Ordinance (1931) to regulate the importation of agricultural and other products which may harbour pathogens of danger to sustainable development.
14. Public Health Ordinance (1926) to maintain adequate standards of public health.
15. Importation of Animals Ordinance (1964) to regulate the importation of animals.



Control of Specific Potentially Polluting, Dangerous or Environmentally Disruptive Substances and Materials

16. Wrecks and Salvage Ordinance (1966) to provide for rights to wrecks and salvage.
17. Merchant Shipping (Oil Pollution)(Gilbert Islands) Order (1975) to apply provisions of the U.K. Merchant Shipping (Oil Pollution) Act of 1971.
18. Nuclear Installations (Gilbert and Ellice Islands) Order (1972) to apply provisions of the U.K. Nuclear Installations Act of 1965.

Under these regulations there is considerable scope for initiatives which can further the interests of conservation of natural and cultural resources and sustainable atoll development.

In addition, the Local Government Act of 1984, which provides for the establishment of local government through a system of Island Councils, includes, among the Councils' wide-ranging functions (see schedule under sections 45 and 116), several functions which relate to environmental management and protection in areas such as agriculture, livestock and fisheries, building/town/village planning, forestry and trees, land management/protection (including the prevention and control of land erosion by the sea or other causes) and public health.

An example of how Island Councils have exercised the powers conferred on them by the Local Government Act, is that several Island Councils have bye-laws prohibiting certain fishing methods (e.g., the use of pressure lamps and fishing nets to catch flying fish and prohibiting the use of motorised canoes for trolling) with the view of either conserving existing stocks or ensuring more equitable benefit to all members of the community from the resource.

#### 5.4 INTERNATIONAL CONVENTIONS

Because of the small size and limited political leverage of Kiribati and other Pacific Island states, regional and international conventions and initiatives have shown to be among the most effective ways of addressing both global and many national environmental issues.

Kiribati is a signatory, or has succeeded to the following environment-related conventions:

1. Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention).
2. South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty).

3. Nuclear Non-Proliferation Treaty.
4. Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific (Tarawa Declaration)
5. London Dumping Convention
6. International Maritime Organisation Convention
7. Maritime Pollution Convention (MARPOL)

Kiribati has, and continues to, devote considerable diplomatic efforts to environmental matters and issues. At the 1983 meeting of the London Dumping Convention, Kiribati and Nauru proposed a complete ban on the dumping of all nuclear wastes in the ocean environment. The proposal, which sought to reverse the prevailing practices of allowing certain categories of acceptable disposal, met strong objections from the nuclear nations. As a compromise, Spain proposed a moratorium on all kinds of ocean dumping of radioactive wastes pending the review of the Kiribati/Nauru proposals by an expert group.

During the drafting of the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP Convention), Kiribati insisted on a more extensive coverage of the Convention area to include the Northern Pacific areas as well as the high seas between the country's component groups or archipelagos (EEZs).

More recently, with increased international attention to global warming and rising sea levels, Kiribati has been a regular participant in relevant forums including the Alliance of Small Island States and the Intergovernmental Committee Negotiating a Framework Convention on Climate Change.

## 5.5 CO-ORDINATING ENVIRONMENTAL PLANNING

In July 1991, following the General and Presidential Elections and the restructuring of ministries, the responsibility for the co-ordination of environmental planning and management was transferred to a new Ministry of the Environment and Natural Resources Development. The Ministry, which has an Environment Unit, is headed by Kiribati's first President, Ieremia Tabai. Prior to this, the Ministry of Home Affairs and Decentralisation, which had taken a lead role in concerns over the impact of global warming (climatic change) and possible sea level rise on Kiribati, held this responsibility. Within this framework different ministries/divisions of Government are actively involved with specific environmental concerns which fall directly within their terms of reference.

The Government has also established a Kiribati Task Force on the Environment (KTFE); an Environmental Co-ordinator was appointed in May 1991; and a request made to the South Pacific Regional Environment Programme (SPREP) for the provision of a

Technical Adviser to assist the Environment Unit. It is hoped that, when fully functional, the Environment Unit will be responsible for formulating and implementing a multisectoral programme of environmental planning and management. In the long term, the coordinating role of this Division/Ministry could be strengthened with the establishment of an inter-sectoral Advisory Committee comprising representatives of all ministries, divisions, statutory bodies and relevant non-governmental organisations (Sullivan and Gibson, 1991).

## 5.6 LAND USE MANAGEMENT

Through its Lands and Survey Division, the Ministry of Home Affairs and Rural Development has been responsible for physical planning, particularly in South Tarawa. Under the provisions of the Land Planning Ordinance 1977 (cap 48), the Minister for Home Affairs and Rural Development appoints two Local Boards and a Central Board which are responsible for the administration of a General Land Use Plan for the three urban centres -- Bairiki, Bikenibeu and Betio.

The Lands and Survey Division is also active in coastal protection by designating areas from which sand and gravel may be removed. The division is also the national implementing agency for the South Pacific Applied Geoscience Commission (SOPAC) Beach Profile Project which is responsible for monitoring coastal erosion and changes in the foreshore.

## 5.7 OUTER ISLANDS DEVELOPMENT

The Ministry of Home Affairs and Rural Development is also responsible for coordinating outer island development. Most of the projects under this programme aim at promoting self-reliance and sustainable development in the islands and rural areas outside South Tarawa. Recently, the Ministry has initiated a series of Integrated Island Profiling and Development Planning Workshops with the aim of achieving a wider and more meaningful participation of people in planning their island's development. It is noteworthy that environmental protection enjoys either the first or second priority in the overall development strategies for Aranuka and Kuria, the first two islands to complete their development plans.

The Government's decentralisation efforts and resettlement programme aim to reduce high population densities in the Gilbert Group and to develop the Northern Line Islands by resettling people from South Tarawa and other islands in the Gilbert Group to the Line Islands. The success of these policies will depend in large measure on the economic opportunities and quality of life offered to the new Line Islands communities. The programme will require a significant long-term funding commitment, and feasibility studies have already commenced.

## 5.8 AGRICULTURE, FISHERIES AND ECOTOURISM

Apart from its environmental role, the Ministry of the Environment and Natural Resources Development, as its name suggests, is responsible for the development of the country's natural resources through its two main divisions, the Agricultural and Fisheries Divisions.

There are five main areas of activity under the Agricultural Division. These are:

1. **Coconut Replanting**, which involves encouraging landowners to replant their coconut groves in the hope that with the use of proper spacing, deeper planting holes, selected seedlings, the application of trace elements and improved maintenance, the production of copra for export and coconut for domestic consumption would be improved on a sustainable basis in the long run (Sixth National Development Plan).
2. **Coconut Timber Utilisation**, which involves the milling of senile coconut trees felled as part of the Coconut Replanting scheme.
3. **Crop Research and Development**, which has placed major focus on research and development of both exotic varieties and traditional food crops. More recently, the project has been involved with the investigation of the potential of subsistence and commercial development of sweet potatoes and other crops as inter-row crops on newly replanted coconut schemes.
4. **Livestock Investigation and Development**, which has focused on the improvement of local chicken and pigs by cross breeding with high grade imported stock. Activities in this area also include the commercial production of eggs, chicken and pork with the aim of making the urban centres self-sufficient in these products.
5. **Pest Control and Quarantine**, which includes research into, and control of, various pests, particularly the taro beetle, the breadfruit mealy bug (scale insect) and rats. The Division also implements restrictions on the importation of plant and animal materials in an attempt to control the introduction of further pests and diseases.

The Fisheries Division is directly responsible for co-ordinating development of fisheries and marine resources. The main areas of activity include:

1. Assessment of fish stocks and species to establish their commercial and subsistence development potential.
2. Monitoring of fish catches (particularly commercially and nutritionally important species).
3. Aquaculture/mariculture.

4. Licensing of foreign fishing vessels.
5. Surveillance of Kiribati's EEZ.

There are concerns that increasing population, particularly in the urban areas, together with increasing commercial fishing and exploitation of other marine resources is likely to lead to overfishing and unsustainable production systems. In an effort to regulate and counteract these adverse effects, the Fisheries Division has instituted a programme of long-term monitoring of catches by artisanal fishermen, the national fishing company (Te Mautari Ltd.) and foreign vessels fishing in Kiribati's EEZ.

The Fisheries Ordinance provides for the introduction of conservation regulations as deemed necessary. Existing measures to regulate overfishing and over-exploitation of marine resources include the prohibition of purse seine fishing by foreign fishermen close to land, regulatory measures relating to lobsters (crayfish) and the suspension of the exportation of corals by a local businessman pending a detailed impact assessment.

Further efforts in the development of conservation regulations and measures are constrained by the lack of scientific data relating to the resource (species, size, distribution, reproductive/recruitment characteristics, degree of current exploitation, endangerment status, and ecosystem/habitat status).

The Fisheries Division also undertakes constant monitoring of environmental effects from pollution, seaweed farming, causeways and other human activities and man-made structures on marine life and ecology. The Fisheries Division has been instrumental in ensuring that causeway designs include openings to minimise disruption of lagoonal circulation and lagoonal/coastal ecosystems.

The Ministry of Transport, Communication and Tourism is involved in ecotourism development, particularly on Kiritimati Island, where the industry is based primarily on wildlife observation, with particular emphasis on the island's extensive seabird populations.

## 5.9 WATER AND SANITATION

Many of the basic community health problems in Kiribati are attributable, to a great extent, to the contamination of water supplies from inadequate sewerage facilities. Following the cholera epidemic of 1977, a major sewerage project (with a capital cost of A\$6.4 million) was implemented in 1978. The project, funded under the Australian Government's bilateral aid programme to Kiribati, provided for a salt water system with electrical pumping of sewage to outfalls beyond the reefs. The system has been fully operational since 1982 and is currently under the direct responsibility of the Public Utilities Board (PUB).

The PUB is also responsible for the South Tarawa Water Supply system, a major Australian-funded project which began in 1983. The project is currently in its second

stage, which involves the identification of potential water reserve areas in North Tarawa. In the case of the islands outside Tarawa, an Outer Island Water Supply Unit has been established within the Ministry of Works and Energy to co-ordinate and prepare policy and guidelines for outer island water schemes. The aim of the Outer Island Water Supply Unit is to provide safe drinking water from one handpump well (or tap) for every ten households. There are also plans to construct more rainwater tanks and to improve collection facilities on South Tarawa, and to charge a more (higher) economic rate for water, especially to commercial and industrial users and Government Departments in an effort to encourage water conservation. Consideration is also being given, in the planning stages of the new airport, to utilising the run-off from the runway.

The Ministry of Health, Family Planning and Social Welfare is involved in routine monitoring of water resources. In the urban areas of South Tarawa where there is a reticulated water system, the monitoring entails analysis of samples from specific points. In the rural areas, and in certain parts of South Tarawa where people depend on water from private wells, samples are taken randomly. The samples are analysed for their total coliform, faecal coliform and dysentery bacteria counts. Regular monitoring of sewage for faecal coliform is also carried out.

The Ministry is also the secretariat of the National Water and Sanitation Committee, chaired by the Chief Medical Officer and comprising the Public Utilities Board (PUB) Water and Sewerage Engineer (Vice Chairman), the Senior Health Inspector (as Secretary) and representatives of the Ministries of Environment and Natural Resources Development, Works and Energy, Home Affairs and Rural Development, Finance and Economic Planning, and Commerce, Industry and Employment. The committee is an advisory body on water and sanitation for the whole of Kiribati.

The Ministry of Health, Family Planning and Social Welfare is also active in the area of waste disposal, including both human and solid wastes. In the rural areas, the ministry provide materials, supervision of the building of, and advice on the siting (e.g., at least 30 metres from nearby wells) of water-seal toilets. Its network of Island Health Workers also provide advice on sanitary disposal of garbage (including advice on disposal pits). In urban areas, the ministry provides professional advice to the two urban authorities -- the Teinainano Urban Council (TUC) and the Betio Town Council (BTC) -- on safe and sanitary disposal of garbage.

There are plans to expand the pollution monitoring roles of the ministry to include atmospheric monitoring, particularly of emissions of carbon dioxide, carbon monoxide and lead. It is hoped that this activity will begin in two years time following the training of the officer to be involved and the acquisition of necessary equipment.

#### **5.10 PUBLIC WORKS, COASTAL PROTECTION AND ENERGY**

The Ministry of Works and Energy is involved in several environmental efforts, including coastal protection, improvement of water supplies and the development of appropriate energy sources.

Coastal protection is a regular activity of the Ministry, for which funds are provided annually in the recurrent budget. The coastlines of many of the islands of Kiribati are subjected to erosion by heavy seas. Man-made structures, such as causeways, and human activities, including the removal of reef stones and coral, tend to exacerbate coastal erosion. In implementing coastal protection, the Ministry responds to requests from other ministries or individuals. In the outer islands, while the primary responsibility is vested in the Island Councils, the ministry does provide assistance if the work required is beyond the capacity of the Council. The main method of coastal protection is the provision of stone-filled gabion baskets or sand bags to the affected areas. This method offers protection in the short term, although the Ministry continues its efforts to identify the most effective means of coastal protection, one of which seems to be traditional seawall construction technology, employing layers of vertically arranged rocks and coral which absorb or disperse wave impact more effectively than gabion baskets and sand bags. The traditional technology does require, however, large amounts of rock and coral, often including living coral.

Many of the Ministry of Works and Energy's construction and civil works require the use of materials from the foreshore, particularly sand, aggregate and coral. Fully aware of the impact of the removal of these materials in terms of accelerated erosion, attempts have been made to minimise their removal from the foreshore and intertidal zone. To this end, limestone rock from the reef is crushed to provide the aggregates required for construction. The environmental impact of the removal of limestone boulders from the reef is constantly monitored.

In a related area, the Ministry of Communication, Transport and Tourism is currently monitoring the impacts on coastlines and marine ecosystems resulting from blasting reef passages in the outer islands (see 5.11 below).

In the area of energy development, an Energy Planning Section was established within the Ministry of Works and Energy in 1984. Staffed by a UNDP-funded Energy Planner and an Assistant Project Engineer, the section has undertaken a number of activities, involving both local and overseas agencies such as the Public Utilities Board (PUB), the Kiribati Oil Company and the UNDP Pacific Energy Development Programme (PEDP). The activities of the section include:

1. Establishment of an information and data base.
2. Energy surveys on South Tarawa, Abaiang and Tamana to provide contrasting data on energy use in the urban and rural settings.
3. Collection of data on electricity production and use of petroleum products; and
4. Investigation of alternative and environmental-friendly or renewable energy sources.

The use of solar photovoltaic technology, for example, has been promoted, given its useful application in the outer islands where there are neither centralised power

supplies nor regular fuel supplies for generators. A Solar Energy Corporation was established in 1985 with USAID assistance to provide appropriate infrastructural and technical services for the importing, retailing and servicing of photovoltaic equipment. Training courses, demonstrations and public education in the use of this technology, AND investigations of other renewable energy sources have also been undertaken in cooperation with PEDP and the Forum Secretariat Energy Unit.

### 5.11 REEF PASSAGES OR CHANNELS

Reef passages or boat channels, built by blasting of coral heads to clear a passage to the open sea, are common forms of outer island infrastructural development in Kiribati. The passages provide an all-tide access for fishermen to the open sea as well as for the transportation of cargo to and from ships. Passage development, however, has generally not taken into consideration the impact on fish stocks and marine resources, stability of the reef and islands and coastal erosion, particularly during storms, and the impact on the incidence of ciguatera fish poisoning.

In 1988, the New Zealand Ministry of External Relations and Trade commissioned ecologists at the University of Auckland to carry out an Ecological Impact Assessment of the effects of boat channel construction by blasting on Pacific atolls. The study was carried out in Tuvalu. The results of the study, which are currently being studied by the Ministry of Communication, Transport and Tourism, showed that channel construction:

. . . did not have a big effect on the numbers of the 229 animals (e.g., fish), algae and sediments. In about 9 per cent of cases, the number of animals declined, while in 7 per cent of cases they showed an increase. The general conclusion of the study was that provided certain limits were placed on how, where and when channels were built, they would not cause widespread damage to reef communities (Kaly, U.L. and G.P. Jones 1990).

The study recommended measures and guidelines to minimise negative impacts and to, perhaps, increase the number of fish in the channels. It was suggested that both old and new passages could be improved by:

1. Limiting the number of channels built on any island.
2. Building channels so that their walls and floors are complex (This means that they should have several different types of materials on their floors and holes and overhangs in their walls in order to attract and provide habitats for a wide variety of fish).
3. Minimising the size of channels and locating them away from the beaches (By keeping their ends well away from beaches, at least 10 metres, will help ensure that they do not drain the sand from the beach).



4. Minimising blasting damage to fish (This can be done by either blasting only after 11 am or by setting a small initial blast to frighten fish).
5. Avoiding building or enlarging channels which connect with lagoons (As tidal currents running through such channels can move large amounts of sand and can kill off animal and algae communities in the lagoon and on the outer reef at the channel mouth).
6. Never building a channel connecting a ponding lagoon with the ocean (as this will cause the level of water in the lagoon to drop during low tide, thus killing corals, fish and other lagoonal life).
7. Building channels on protected sides of islands, avoiding points around the reef, or using areas which have already been damaged in other ways (This limits channels to areas of lower productivity, lower exposure to storms and minimises the total area of damaged reef on islands).
8. Not spreading spoil from the blasting over a wide area of the tidal rock platform (This practice unnecessarily disrupts the ecology of the tidal platform, which is an important source of food for some fish during high tides. It could also make the reef more likely to have an outbreak of ciguatera by disturbing established communities of algae).
9. Lining channels with boulders, though not required (A wall of boulders running either side of a channel provides shelter which increases the number of fish species. They may also reduce some of the water flow into channels from the rock platform).
10. Stabilising the upper beach near the channels (This can be done by angling the access road to the village away from the channel, and by planting both sides of the roadway and top of the beach with coconut palms and low bushes for 20 to 50 m on either side to stabilise areas where people use the beach the most).
11. Replanting coral seed stock (This is to encourage natural populations of corals, fish and algae. It could be done by collecting 5 cm fragments of living coral from the surrounding reef and scattering them over damaged areas during long spells of calm weather. These fragments must be kept covered by seawater at all times. They may also help restabilise the blasted area and reduce the possibility of an outbreak of ciguatera).
12. Creating reef reserves (These are small sections of the reef set aside as permanent reserves to compensate for the loss of sections to channels).

## 5.12 CLIMATE CHANGE AND RISING SEA LEVEL

A major environmental concern is the potentially disastrous impact that climate change or global warming and associated sea level rise could have on the habitability of the low-lying atolls of Kiribati. Climatic data in Kiribati is collected by the Meteorological Service of the Ministry of Transport and Communication, which operates 20 stations, including its headquarters on Betio, Tarawa. Of these, only five make full daily climatological observations which include wind speed and direction, rainfall and temperature and, in the case of 3 stations, barometric pressure. The remaining 15 stations record daily rainfall only.

As part of global efforts to monitor climatic change and rising sea levels, the Kiribati Meteorological Service is participating in the Tropical Oceanic Global Atmosphere (TOGA) programme, established by the World Meteorological Organisation and administered by the US National Oceanic and Atmospheric Administration (NOAA). The main emphasis of the programme is the study of the atmosphere and the oceans and the interface and interactions between them, in the area 20 degrees north and south of the Equator. As part of the programme, a TOGA project was started on Kanton Island in 1985. Operated by I-Kiribati personnel with technical backup provided by TOGA, the project observes and monitors tides, temperature, rainfall and upper wind velocity. The University of Hawaii also operates a tide gauge based at the Betio Harbour.

The 1989 South Pacific Forum in Tarawa agreed to establish a series of monitoring stations in the region, including Kiribati. The project is yet to be implemented.

As part of the increasing interest in climatic change and rising sea levels, the Meteorological Service is planning to establish the post of Scientific Officer with the responsibility, among other things, of collating and interpreting climate and sea level data.

## 5.13 SPECIAL PROJECTS/PROGRAMMES

The growing concern about environmental degradation, whether caused naturally, or resulting from increasing population pressure on the environment or from specific development projects, has led the Kiribati Government to initiate a number of new environment projects or programmes. Of note, are two important complementary programmes which are additional to the on-going sectoral concerns covered above. These include: 1) a pilot environmental study of the Outer Island Development Programme, and, 2) an applied atoll ecological study.

The pilot environmental study of the Outer Island Development Programme was commissioned in 1990 with the aim of strengthening the role of the Ministry of Home Affairs and Rural Development's Outer Island Development Programme for improving the quality of life in the outer islands and bringing about self-reliant and sustainable development. The study's main targets were the evaluation of the impact of the location and design of: 1) the new causeways/bridgeways to be built between the islets of North Tarawa; 2) the existing causeways which will be opened at Bonniki-Tanaca and North

Tarawa; 3) the causeway at Onotoa Atoll; and, 4) the packages of island micro-projects in North Tarawa, Onotoa and Tabiteuea.

For each of these targets, the study looked at the impact of the proposed designs/plans on lagoon and island ecology, including water movements, salinity and sediment levels, marine biology, erosion, waste disposal, sand deposition and local vegetation (Gilmour and Colman, 1990). The study concluded by identifying the need for further data collection to facilitate improved environmental management. It also recommended further research, collection of data and the provision of a technical advisory service in relation to causeway design and construction as well as to other small rural development projects in outer islands of Kiribati, with the emphasis being placed on environmental impact assessment (EIA), socio-economic impact assessment, baseline studies and engineering design. It is very likely that this study will give rise to environmental management guidelines for the outer islands.

The Applied Atoll Ecological Study is a joint effort between the Government of Kiribati and US Agency for International Development (USAID). It will also involve research institutions such as the University of the South Pacific (USP) and the University of Hawaii. The programme is for a period of five years beginning in 1991, at an estimated cost of A\$1.6 million. The main thrust of the programme will be to address long term issues of marine resource management and environmental protection for atoll communities by generating scientific information needed for the formulation of appropriate resource management strategies and environmental policies (Terubea 1990:32).

The implementation of the programme will be undertaken primarily through a five-year technical assistance contract which will provide a series of short-term technical assistance missions and support a small, locally-hired full-time staff. Key outputs of the programme will include: 1) assessment and comparison of shellfish and finfish stock size/relative abundance and habitat (between heavily exploited South Tarawa and lightly fished North Tarawa); 2) determination of the impact on marine resource yields and the lagoon ecosystem of land-based activities such as causeway construction, mangrove destruction and sewage disposal; and, 3) development of marine resources management strategies based on the results of the applied research and policy dialogue with the Government of Kiribati.

#### 5.14 TRAINING, EDUCATION AND PUBLIC AWARENESS

It is believed that without improved environmental awareness and a firm educational basis (in terms of both formal and non-formal education) improved environmental management and sustainable atoll development will be problematic. Accordingly, considerable effort must be placed on improving formal environmental education in primary and secondary schools, providing training in environment-related areas and in improving public awareness of environmental issues and the need for sustainable development.

At the primary school level, there is currently an Environmental Studies course which is more a "Nature Study" rather than a course that focuses on environmental change

and human impact on the environment. There is obviously the need as Sullivan and Gibson (1991) suggested for materials and content on environmental change and human impacts on the environment to be introduced into the present Environmental Studies curriculum. This should include the concept of the climatic change and sea level rise and other issues/problems such as land degradation, loss of biodiversity, pollution and loss of traditional agricultural, fishing and environmental knowledge.

There is currently no formal Environmental Studies at the secondary level, although environmental issues are addressed in different subject areas like Geography, Chemistry and Biology. There is, however, a major focus on environmental issues and options for sustainable development in the Pacific Islands in the Geography component of the recently established Kiribati Seventh Form high school programme. This programme is based on University of the South Pacific's Foundation geography materials, with the major assignments and exams marked by USP staff. There is, however, the need for environmental studies to be taught as a separate multi-disciplinary subject examinable at the national Kiribati Junior and Form 6 levels.

In terms of training, apart from plans by the Ministry of Health and Family Planning for overseas training in the area of atmospheric monitoring in 1992, there are currently no plans for specialised training in environmental management, although a number of I-Kiribati graduates have Geography or Science (Environment-related) first degrees which may qualify them for postgraduate environmental studies. There are also a Bachelor of Science degree in Environmental Studies and a Diploma in Environmental Education offered by USP which are increasingly in demand from other regional countries, but which have not been utilised by Kiribati.

In terms of public awareness, while there is a considerable degree of awareness of environmental issues, largely from personal experiences, there has been very little effort to heighten this awareness through radio programmes or other forms of public education. There is currently a regular programme on Radio Kiribati on Public Health, which could become the model for a possible environmental awareness radio programme. There has also been a major media campaign to promote water conservation.

### 5.15 NON-GOVERNMENTAL INITIATIVES

There are a number of non-government and regional initiatives which have addressed some of the major environmental issues and promoted sustainable development. At the national level, these include women's organisations which have been active in promoting sustainable development among women; and youth associations which are instrumental in mobilising youth effort directed towards activities contributing to sustainable development. On individual islands, traditional political structures such as the Unimane (Council of Elders) have also been instrumental in identifying development needs. As repositories of local knowledge and experience, their advice and participation should be sought in the protection/management of the environment and in the promotion of sustainable development.

Almost all national non-governmental organisations (NGOs) are part of, or affiliated to, a wider network of regional or international networks of NGOs. Government should therefore facilitate the establishment of a national NGO umbrella arrangement which could be coordinated with and strengthened by national and regional or international efforts in relation to the promotion of sustainable development, including the channelling and identification of national environmental management needs, funding sources and appropriate support organisations or agencies for appropriate NGO initiatives.

Several international agencies (both intergovernmental and non-governmental) which have programmes supporting local NGO's initiatives in the areas of environmental management and education and the promotion of sustainable development, some of which have already benefited Kiribati, include: 1) the UNDP Integrated Atoll Development Programme, 2) the UNICEF and Foundation for the Peoples of the South Pacific (FSP)'s programmes promoting home food production and the strengthening of mixed food gardening, 3) the South Pacific Commission, which has active programmes in the areas of agriculture, fisheries, population, food and nutrition and health development, 4) Save the Children Fund, 5) the South Pacific Action Committee on Human Ecology and the Environment (SPACHEE), 6) Greenpeace, and 7) the South Pacific Regional Environment Programme (SPREP). Efforts should be intensified to further strengthen links with these and other appropriate organisations to enhance the ability of both NGOs and government agencies to address major environmental issues.

## CHAPTER 6

### PRIORITIES FOR FURTHER ACTION

#### 6.1 ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT AS A PRIORITY

As stressed in the September 1991 "Policy Statement" of the Ministry of Environment and Natural Resources Development: "the incorporation of 'Environment' in the new name of this Ministry expresses the concerns that the Kiribati Government has over a number of environmental issues and particularly over the potential dangers of 'sea-level rise'." In stressing the need to take into account environmental considerations in its development planning efforts it was stated:

Our aim is to achieve what is normally referred to as an environmentally sustainable development, means that the present generation will be able to earn its living without compromising the ability of future generations to live out of the same natural resources.

Former President of the Republic of Kiribati, current Minister for the Environment and Natural Resources Development, and recently elected Secretary General of the Forum Secretariat, The Honourable Ieremia Tabai, puts it more succinctly in saying:

For the people and Government of the Republic of Kiribati the object of the exercise of 'sustainable development' is to survive on the atolls forever . . . until the end of the world! . . . Sustainability is the idea that we can survive from day to day and ever after."

It is stressed that, although the I-Kiribati (people of Kiribati) have lived a relatively sustainable way of life for thousands of years in the atoll environment, this was at a relatively low level of material wellbeing, a level which is no longer considered adequate. The level of wellbeing is observed not only to vary from place to place but also in terms of people's perspectives of their own wellbeing. Our people desire some of the more appropriate modern technologies and social services that will make their life easier, safer, healthier and more enjoyable in today's world. This requires increased cash incomes and foreign exchange and changes in lifestyles which, if NOT pursued in the right manner, could undermine the cultural and traditional resource use systems which have promoted sustainability in the past. This is the difficulty, in terms of promoting sustainable development, which faces the people and Government of the Republic of Kiribati.

Sustainable development in Kiribati must be seen as "ecodevelopment": development which gains for Kiribati the more appropriate technological and social benefits of modern urban industrial societies, while at the same time protecting, to the best of its ability, the social systems, knowledge and the terrestrial and marine resources that

have allowed Kiribati to sustain atoll life in the past. The overall aim is to achieve the optimum balance between modern economic development and the protection of the traditional subsistence base so that future generations will have the same opportunities that the current generation has to be healthy and to realise a reasonably high standard of material and cultural wellbeing.

## 6.2 CONSTRAINTS AND PRIORITIES

There are, unfortunately, a number of constraints to sustainable "ecodevelopment" in Kiribati which need to be addressed and prioritised. These are related to: 1) the scarcity of land and terrestrial resources; 2) the predominant importance of marine resources in the context of modern development; 3) the dominant role of subsistence production as the main component of real income for most of our people; 4) the extremely limited range of sources of cash income and foreign exchange, and their variability and susceptibility to economic and political pressures beyond our control; 5) the susceptibility of atoll ecosystems and cultures to disturbance and degradation; and 6) the more culturally-based areas of concern or constraints to sustainable development described above. This section attempts to prioritise: 1) the constraints to, and 2) opportunities for sustainable use of resources and development, from the perspective of planning for and the promotion of environmentally sustainable development in the Republic of Kiribati.

It must be stressed, however, that because most of these issues or constraints are interrelated, the prioritisation in no way suggests that Kiribati will address these issues in isolation one at a time. Rather, the Government is committed to addressing these issues, simultaneously, in a cross-sectoral effort to promote sustainable ecodevelopment for the benefit of future generations.

It must also be made clear that Kiribati has a firm commitment to addressing both global environmental issues, through its support of international initiatives, and well as addressing local concerns at the national and community levels. For simplicity's sake the issues will be broken down into: 1) broader, sometimes global, cross-sectoral issues of concern or constraints which affect all sectors and all environments or resources, and 2) those which pertain to specific sectors or resources. These are listed in Tables 6.1 and 6.2. Appendix VI lists the issues, constraints and opportunities for sustainable development in detail.

Highest on the list is the threat posed by climatic change or global warming and associated sea level rise which could make the habitation of low-lying island and coastal areas problematic. This has caused serious concern at all levels in the community, and threatens the very existence of atoll societies. Although there is uncertainty as to the amount and rate of potential sea level rise, it remains a major consideration in planning for sustainable development.

Of almost equal concern is the constraint to sustainable development posed by increasing population, including rural to urban migration, which puts excessive stress on natural and cultural resources and undermines any hope of sustainability, particularly in urbanised South Tarawa. None of the problems associated with acute land shortage, land

fragmentation, the poverty of terrestrial resources, the fragility of marine resources to overexploitation and the threat posed by pollution and waste disposal can be addressed unless we do something about controlling our high rates of population growth and rural to urban migration.

Because of the critical importance of good nutrition and health as the basis for a healthy society, and because of the critical role that subsistence production plays as a component in the real incomes of our people, the breakdown of our subsistence production systems, perhaps most importantly the deterioration of our traditional food system, is seen as a major constraint to sustainable development. With the declining consumption of local foods, medicines, fuel and other subsistence products that have provided the basis for the health of Kiribati society for thousands of years, there have been serious increases in the incidence of vitamin and mineral deficiency, obesity, diabetes and cardiovascular disease and increasing and costly dependence on other imported products which can be produced locally in a sustainable manner. Humans and their subsistence production systems, as integral and dominant components of the atolls ecosystem, must be protected along with the natural environment to ensure sustainability.

Because of the susceptibility of our natural resources to degradation and their continuing subsistence and potential commercial importance as the basis for sustainability, and as the basis for almost all cash and non-cash "income", high priority is placed on the conservation, protection and enhancement of freshwater resources, soils, terrestrial plants and animals, and reef, lagoon and ocean marine resources. In the same context, the conservation of biological diversity, of both wild and domesticated species, as a basis to support continuing human habitation of the atolls is a priority. Of particular importance is the enhancement of rainwater catchment capacity and the protection of existing groundwater resources and coastal waters from pollution.

Other areas of major concern which, in concert with all other ecological problems, undermine sustainability of atoll living include: coastal erosion; waste management and disposal; and increasing dependence on a non-renewable energy source in the form of imported fossil fuel for transportation, cooking, lighting and other developmental purposes, a trend that is not sustainable in the long term. Coastal erosion is particularly serious in the Gilbert group, where there has been causeway development, and on Kiritimati in the Line Islands.

Of particular concern is the long term impact of nuclear weapons testing and nuclear pollution on the peoples of Kiribati, their island environments (in particular Kiritimati Island, where atmospheric tests were conducted by the Americans and the British), and on the shared oceanic environment. As shown by experiences in the neighbouring Marshall Islands, even very low levels of nuclear radioactivity resulting from past and present nuclear testing constitute a severe long-term health hazard and obstacle to habitation of our islands. There is similar concern over the negative impacts of the disposal of hazardous and military wastes in neighbouring island groups and in the oceanic environment, and the inability of Kiribati to control such actions.



Also of concern is the rehabilitation of the open-cast-mined island of Banaba and other areas where phosphate mining has rendered these areas uninhabitable.

Table 6.1. Main issues of concern or constraints which affect all sectors and all environments or resources in relation to the promotion of sustainable development in Kiribati.

- 
1. CLIMATE CHANGE AND SEA LEVEL RISE (land loss, flooding, salt water incursion, property damage)
  2. POPULATION PRESSURE (rapid growth, urbanisation and pressure on limited resource base)
  3. BREAKDOWN OF THE TRADITIONAL FOOD SYSTEM AND OF THE SUBSISTENCE PRODUCTION SYSTEMS, INCREASING DEPENDENCE ON AN UNSTABLE GLOBAL CASH ECONOMY AND ASSOCIATED INCREASING VULNERABILITY AND LOSS OF SELF-RELIANCE (declining consumption of local foods and increasing vitamin and mineral deficiency, obesity, diabetes and cardiovascular disease, declining availability of local medicines, fuel, fibre and other locally produced products, increasing monetisation, aid dependency and associated loss of self-reliance and environmental degradation)
  4. ENVIRONMENTAL BLINDNESS AND LOSS OF TRADITIONAL KNOWLEDGE OF RELEVANCE TO SUSTAINABLE DEVELOPMENT/NEED FOR ENVIRONMENTAL EDUCATION (current lack of traditional and modern emphasis on environmental education and sustainable development in the formal education system, deterioration in the Kiribati language, ignorance of traditional fishing, agricultural, medicinal, navigational and other survival skills among the young)
  5. CONSERVATION OF BIOLOGICAL DIVERSITY (terrestrial and marine animal and plant diversity of both wild and domesticated species as a basis for human survival)
  6. NUCLEAR POLLUTION, WEAPONS TESTING AND HAZARDOUS WASTE DISPOSAL (residual and current impact of nuclear weapons testing and pollution, especially on Kiritimati Island, and of the disposal of hazardous waste and weapons on neighbouring islands and in the shared oceanic environment)
  7. INADEQUACY OF DATA ON RESOURCES AND SUSTAINABILITY OF STRATEGIC ECOSYSTEMS (need for data on fish stocks and recruitment, lagoonal processes and ecosystems, etc.)
  8. NEED FOR ENVIRONMENTAL PROTECTION INFRASTRUCTURE (laws, agencies, training/expertise, funding, conservation area development, etc.)
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Finally, three major areas of concern which will affect the ability of Kiribati to address all issues or areas of concern, and which thus must be considered of high priority are: 1) the need for environmental education, including both traditional and modern environmental education, to eliminate "environmental blindness" and to stress, in both the formal and nonformal education systems, the constraints to and opportunities for sustainable development in Kiribati; 2) the inadequacy of data and the need for research on resources and sustainability of strategic ecosystems as a basis for informed national and local planning and development; and 3) the need for environmental protection infrastructure in the form of legislation, agencies, research, training and conservation area development.

Table 6.2. Main issues of concern or constraints which pertain to specific sectors or resources in relation to the promotion of sustainable development in Kiribati.

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1. PROTECTION OF MARINE RESOURCES (reef, lagoon, ocean and maricultural)
  2. CONSERVATION/PROTECTION OF FRESHWATER RESOURCES (groundwater and water catchment systems)
  3. PROTECTION OF TERRESTRIAL RESOURCES (combating deforestation, loss of soil fertility, declining food production, declining bird populations)
  4. LAND SCARCITY, COASTAL EROSION AND LAND RECLAMATION (combating coastal erosion resulting from both natural causes and modern coastal development)
  5. WASTE MANAGEMENT AND DISPOSAL (foreign toxic and hazardous waste, local solid waste, sewage and industrial waste)
  6. ENERGY DEPENDENCY (increasing dependence on imported fossil fuels for transportation, cooking, lighting and other purposes and fuelwood shortage)
  7. REHABILITATION OF DEGRADED LANDS (rehabilitation of the open-cast-mined island of Banaba, seawall construction and coastal protection)
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Without a firm basis of traditional and modern environmental education, particularly public environmental education, and environmental infrastructural development, the promotion of sustainable development in Kiribati will be problematic. Because of the overemphasis on modern education along western lines, mainly to prepare the young for a role in the modern cash economy or monetised sector, and almost exclusively in English at the more advanced levels, there is increasing ignorance of the natural environment. This includes ignorance of traditional resource-use systems and of the

Kiribati language relating to such issues. With many of the younger generation having little knowledge of the Kiribati names for plants, fish and other natural phenomena, it is no wonder that knowledge of traditional sustainable subsistence production systems is being lost.

### 6.3 CONSTRAINTS TO ADDRESSING MAJOR ENVIRONMENTAL ISSUES

The more specific constraints to addressing these major environmental concerns in Kiribati are interrelated and consist of a wide range of geographical, ecological, technological, social and economic constraints which are common to most isolated small island states. Some of the more important constraints referred to in Chapter 4 and in Tables 6.1 and 6.2, and summarised in Table 6.3 include: 1) an extremely limited resource base to cater for both subsistence and increased commercial export production; 2) inadequate knowledge of the status of existing resources and environment and the impact of modern development on them; 3) the extremely fragmented and dispersed nature of the islands and Kiribati's EEZ which makes resource management, the provision of social services and programme implementation difficult; 4) increasing economic, technological and nutritional dependency on foreign industrialised countries and external forces beyond the control of the Kiribati government and the people; 5) increasing propensity of industrialised countries to export their inferior, often non-biodegradable, products and industrial and military wastes to oceanic islands and their surrounding seas in an attempt to enhance or protect their own economies and environments; 6) inappropriate or unbalanced planning and aid, which overemphasises commercial/export and monetised development at the expense of subsistence resources and production systems as a basis for the sustainable development of non-industrialised societies, like Kiribati, in which culture, traditional production systems and the environment cannot be separated; 7) continuing dependence on often inappropriate education systems, strategies and curricula, usually in the English language, at the expense of traditional knowledge and wisdom; 8) the difficulty in establishing conservation areas or enforcing environmental legislation due to the economic costs involved, lack of information on the status of resources, the dispersed nature of the islands, and traditional land and marine tenure systems; and 9) inappropriate and unsustainable consumption patterns (overconsumption and associated pollution) in industrialised countries which severely affect sustainability both globally and in non-industrialised countries.

Table 6.3 Geographical, ecological, social, technological and economic constraints to addressing major environmental issues in Kiribati.

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#### GEOGRAPHICAL

1. Extremely limited land area available for habitation, landfill sites or other forms of development relative to population size and density.

2. The extremely fragmented and dispersed nature of the islands and EEZs which makes programme implementation, provision of social services and resource management difficult;
3. Extreme difficulty of policing extensive coastal areas and EEZs.
4. Extremely poor and endangered terrestrial biota.
5. Extremely poor and limited soil resources.
6. Extremely limited water resources and periodic drought.
7. Highly mobile nature of some animal populations (e.g., migratory birds, turtles and pelagic fish species).

#### ECOLOGICAL/RESEARCH

1. Uncertainty about time frame and local impacts of developments on the environment and ecological processes, in particular, the uncertain impacts of climate change and sea-level rise.
2. Inadequate knowledge of the current status of resources (species, size, distribution, reproductive/recruitment characteristics, degree of current exploitation, endangerment status, impact of pollution and ecosystem/habitat status).
3. Inadequate information on/examples of the impact of development on the atoll environment and strategic plant and animal species.
4. Inadequate information on the effects of loss of biodiversity on ecological balance and the subsistence economy.
5. Competing demands on limited freshwater resources.
6. Lack of information on the nature and origin of waste and its long-term impact on the environment.
7. Increasing scarcity of fuelwood, particularly in urban areas.

#### TECHNOLOGICAL

1. Loss of traditional knowledge of resource management strategies, traditional agricultural and fishing technologies, and food preparation and preservation technologies.
2. Increasing dependence on costly and polluting imported technologies.

3. Increasing importation of and dependence on non-biodegradable products and packaging.
4. Increasing interest by metropolitan powers in disposing of their hazardous and military wastes in the atoll and oceanic environments.
5. Increasing dependence on fossil fuels, e.g., use of kerosene for cooking and dependence on outboard motors and air travel between islands.
6. Lack of an energy conservation policy.

#### SOCIAL/TECHNOLOGICAL/PHILOSOPHICAL

1. Inappropriate and unsustainable consumption patterns (overconsumption and associated pollution) in industrial countries which severely affect sustainability both globally and in non-industrialised countries.
2. Extreme dependence on actions taken by and support/aid from industrialised countries to promote sustainable development.
3. Lack of international and local appreciation of the ecological and economic importance of biodiversity to ecosystem and cultural stability.
4. Lack of legislation controlling waste at its source or restricting the use of non-biodegradable waste.
5. Inability to restrict neighbouring islands from being used as waste disposal/reduction sites (e.g. incineration of toxic military wastes and munitions at Johnston Island).
6. Lack of proper land use planning.
7. Traditional attitudes towards marine resources as being bountiful and inexhaustible.
8. Land and marine tenure systems, limited and fragmented land area and the subsistence importance of the environment which makes western-style conservation area development and resource protection problematic.
9. Little or no emphasis on environment, agriculture and food and nutrition in the formal education system (environmental and nutritional ignorance/blindness).
10. Overemphasis on Western educational models and education for urban sector/white collar jobs.
11. Narrowness of Western environmental education and conservation strategies which place little emphasis on people as part of nature and dependent on it for subsistence.

12. Dependence on foreign curriculum experts and the English language in formal education.
13. Limited opportunity for external migration and overseas employment.

#### ECONOMIC

1. Narrow economic base and limited financial and technological capabilities of the country.
  2. Commonly held view that environmental protection is an obstacle to, rather than a foundation for development.
  3. Overemphasis on short-term, aid-funded economic development, often with no provision for environmental impact assessment (tight timetables and budgets set by donor agencies).
  4. Multidisciplinary and cross-sectoral nature of environmental management which makes its integration into narrow sector-based national planning problematic.
  5. Limited recognition or understanding of the economic importance of subsistence production to sustainable development, on the part of planners and international organisations.
  6. Overemphasis on commercial and export production at the expense of environmentally sustainable traditional production systems.
  7. Increasing monetisation and the increasing promotion of and dependence on imported food and other consumer and capital goods.
  8. Increasing cost of imported fuel, relative to export earnings and per capita incomes, and vulnerability of fossil fuel source areas and pricing to conflict (e.g., the Gulf War) and price fluctuation.
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#### 6.4 OPPORTUNITIES AND REMEDIAL STRATEGIES TO ENCOURAGE SUSTAINABLE DEVELOPMENT

Appendix 6.1 lists some of the specific strategies or "opportunities" that could be employed to address some of the major environmental issues and to overcome some of the internal and external constraints to sustainable development. These include both local and international initiatives, some which can be implemented at the community level with little or no external financial or technical assistance, whereas others require major funding and international cooperation.

### 6.4.1 Local Initiatives

Some of the local initiatives that could foster sustainable development include:

1. Make the strengthening of environmental management infrastructure a priority.
2. Establishment of an autonomous, cross-sectoral environmental ministry, unit, or board and an associated environmental impact assessment capability.
3. Incorporation of environmental impact assessment procedures in all development strategies/initiatives as an integral component of the planning process.
4. Draft and strengthen appropriate environmental legislation and enforcement procedures.
5. Strengthening of both formal and public environmental education, including the increase of local input and traditional knowledge, as a basis for sustainable development.
6. Strengthening of the national research capability to assess the national resource base/environment and the impact of development on it, and to compile information on traditional resource-use systems and environmental knowledge.
7. Make training in environmental management a priority in manpower planning.
8. Establish/strengthen a system of appropriate terrestrial and marine parks, wildlife reserves and conservation areas, which takes into account both the nature of the resources and their subsistence importance.
9. Land reclamation, seawall construction/stabilisation and coastal reforestation schemes.
10. Strengthening of family planning and population control programmes.
11. Strengthening of the traditional subsistence production system, particularly the terrestrial and marine food production systems, in concert with, rather than in conflict with export-oriented development.
12. Establish germ plasm collections of, or nurseries for endangered or economically and culturally important wild and domesticated plant species.
13. Shift commercial fisheries emphasis to underexploited species and ecosystems (e.g., pelagic and reef-slope areas), maricultural production or to

appropriate introduced species (e.g., giant clams, pearl oysters, eucheuma seaweed).

14. Make decentralisation a priority, including the promotion of viable resettlement schemes and the strengthening of social services and infrastructure in rural outer island areas.
15. Encouragement of appropriate water conservation policies and water collection and desalinisation technologies.
16. Promotion of soil improvement technologies, including traditional mulching and fertilisation practices.
17. Promotion of renewable energy alternatives, such as solar power, in an effort to reduce increasing dependence on imported fossil fuels.
18. Adopt appropriate strategies for waste disposal including the reduction of dependence on non-biodegradable or hazardous products and the adoption of appropriate disposal or recycling strategies.

As stressed above, many of these initiatives, some of which have already been implemented, will require government and/or international funding, whereas many can be implemented immediately at the national and community or island level given the political will to do so.

#### 6.4.2 International Initiatives

Initiatives requiring international action and solidarity which are seen as a priority by the Kiribati Government include:

1. Action by industrialised countries to reduce emission of greenhouse gases.
2. Action to reduce deforestation and encourage reforestation.
3. Research to identify means of preparing for/addressing global warming.
4. Establishment of a Global Fund to help developing countries respond to climate change and sea level rise.
5. Guarantees of the 'Right to Development' and continuance of aid to low-lying developing countries, despite potential negative impacts of global warming on aid-funded development initiatives.
6. Accession to international treaties prohibiting the use of destructive fishing technologies and exploitation of endangered/restricted species (e.g., bans on oceanic driftnetting, CITES, etc.).



7. Accession to international agreements and programmes to conserve biodiversity and endangered ecosystems.
8. Accession to accords/treaties restricting the movement and disposal of toxic and hazardous waste in the island/oceanic environment.
9. Accession to accords/treaties prohibiting: a) the testing of nuclear weapons, disposal of nuclear wastes, b) supporting initiatives to conduct and release the results of unbiased research on the impacts of nuclear weapons testing on the habitability of islands and the health of peoples affected by nuclear testing, and c) supporting proposals to decontaminate islands or compensate peoples/countries affected by nuclear testing/pollution.
9. Continued collaboration with international institutions such as SPREP, Forum Secretariat, USP, FFA, UNDP/FAO, SPC, ICOD, ICLARM, USAID, AIDAB and other bilateral aid programmes to strengthen national and regional environmental management infrastructure and research capabilities.
10. Support of all international initiatives, in particular UNCED, which could bring about a change in the world economic order so that it increasingly leads to economic and trade relationships, and consumption and pollution levels which foster sustainable lifestyles in countries, like Kiribati, where export and subsistence production will probably remain the basis for economic and cultural wellbeing.

## CHAPTER 7

### PROCEDURAL MATTERS RELATED TO THE PREPARATION AND ENDORSEMENT OF THE REPORT

This chapter describes: 1) the process used in the preparation of the Republic of Kiribati National Report for the United Nations Conference on Environment and Development (UNCED); 2) the composition of the Kiribati National UNCED Task Force; and 3) the level of government endorsement of the report and commitment to the principles of UNCED.

#### 7.1 PREPARATION OF THE NATIONAL REPORT

The preparation of the national report was carried out over a ten-month period by SPREP Consultants, Uentabo Neemia and Professor Randolph R. Thaman, in close consultation with the Ministry of the Environment and Natural Resources Development, the National UNCED Task Force and other relevant ministries, agencies and persons in Kiribati and the region (see Appendix VII). A wide range of published and unpublished reports and other relevant materials were also consulted. The chronology of the report preparation process was as follows:

1. Commencement of preparation of Draft Report (May 1991)
2. Visit by U. Neemia to Kiribati to: 1) discuss the preparation of the Kiribati National Report to UNCED with the Ministry of Energy and Natural Resources Development, the Ministry of Home Affairs and Decentralisation (which was responsible for environmental affairs under the Government at the time) and other relevant ministries, 2) to consult with the National Task Force, and to 3) collect relevant data from relevant Ministries, Departments and other agencies or persons (15 to 22 May 1991).
3. Completion of first draft of main chapters of Report for submission to Government and SPREP for consideration the SPREP Workshop on South Pacific Preparations for UNCED held in Nadi from 4 to 6 June 1991 (June 1991) to prepare 1) a Regional Ministerial Declaration, 2) a list of Regional Priorities and Objectives, both for consideration by the SPREP Ministerial-level Intergovernmental meeting to be held in Noumea in July 1991 and the Third UNCED Preparation Committee Meetings (PrepCom) which was held in Geneva in August 1991, and 3) a framework for the Regional UNCED Summary Report (June 1991).

4. Attendance by T. Abete (Kiribati Government Representative) and U. Neemia and R. Thaman (SPREP Consultants) at the SPREP Workshop on South Pacific Preparations for UNCED held in Nadi (4 to 6 June 1991).
5. Attendance by T. Abete at the SPREP Ministerial-level Intergovernmental Meeting held in Noumea (July 1991).
6. Completion of Draft Report for submission to government for consideration in preparation for second visit of consultants (Neemia and Thaman) and as a basis for; 1) Kiribati's representation at the Third Intergovernmental Meeting of the South Pacific Regional Environment Programme (SPREP) held in Noumea from 24 to 28 September 1990; 2) Kiribati's representation at the Third PrepCom held in Geneva in August 1991 (August 1991); and, 3) preparation of a Draft Regional Synthesis Report to UNCED to be prepared by SPREP.
7. Attendance by N. Teuatabo at the Third UNCED Preparation Committee Meetings (PrepCom III) held in Geneva (August 1991).
8. Visit by Neemia and Thaman to Kiribati to: 1) discuss the Draft National Report with the National UNCED Task Force and other relevant parties; and to discuss the Draft Report with the new Government and representatives of the reorganised Ministry of Environment and Natural Resources Development (11 to 16 September 1991).
9. Attendance by T. Abete and R. Thaman at Workshop on the South Pacific Preparations for UNCED held in Port Vila, Vanuatu to: 1) finalise the Draft Regional Synthesis Report to UNCED; 2) finalise the summary National Reports as appendices of the Regional Synthesis Report; 3) to identify common areas of concern in the Region; 4) to identify major constraints to sustainable development and strategies needed to address these constraints; 5) to identify the human, financial and human inputs needed to implement such strategies; and 6) to relate these to key cross-sectoral issues in terms of sustainable development (21 to 23 October 1991).
10. Completion of amended/strengthened versions of Kiribati National Summary Report for inclusion in the Regional Synthesis Report and for approval by National Task Force (November 1991).
11. Incorporation of changes to the National Summary Report and notification of changes to SPREP (December 1991).
12. Completion of National UNCED Report for final endorsement by the Kiribati UNCED Task Team and the Government of the Republic of Kiribati for forwarding to SPREP and the UNCED Secretariat (January 1991).

## 7.2 ROLE AND COMPOSITION OF THE KIRIBATI NATIONAL UNCED TASK FORCE

The role the Kiribati National UNCED Task Force was to represent relevant ministries and coordinate efforts in: 1) the completion and endorsement of both the Kiribati National Report to UNCED and the Kiribati National Summary Report which will serve as an appendix to the Regional Synthesis Report to UNCED; 2) coordinate the attendance and input of Kiribati to UNCED and all regional and international preparatory meetings or fora leading up to UNCED; and 3) liaise with, coordinate and facilitate the in-country visits of the SPPREP Consultants and respond to the Drafts of both the National Reports and National Summary Reports to UNCED.

The members of the Kiribati National UNCED Task Force are as follows (see Appendix VII for a complete list of those persons consulted in Kiribati and elsewhere):

Mr Nakibae TEUATABO	(Chairman) Secretary for Environment and Natural Resources Development, Ministry of Environment and Natural Resources Development
Ms Tererei ABETE	(Secretary) Environmental Officer, Ministry of Home Affairs and Decentralisation/Ministry of Environment and Natural Resources Development
Mr Baraniko BAARO	Secretary for Finance and Economic Planning, Ministry of Finance and Economic Planning/Secretary for Home Affairs and Rural Development
Mr Enari BAURO	Senior Assistant Secretary, Ministry of Home Affairs and Decentralisation
Mr Nauan BAURO	Secretary for Education, Ministry of Education
Mr Tiriata BETERO	Chief Lands Officer, Lands and Survey Division, Ministry of Home Affairs and Decentralisation
Mr Tokia GREIG	Senior Assistant Secretary, Ministry of Natural Resources Development/Ministry of Environment and Natural Resources Development
Mr Uarai KONETETI	Meteorological Officer, Meteorological Office

Mr. Peter NEWHOUSE	Water Engineer/Water and Sewerage Adviser, Public Utilities Board, Ministry of Works and Energy
Mr Kaburoro RUAIA	Assistant Secretary, Ministry of Foreign Affairs and International Trade
Dr. G.S. SANDHU	GTZ Biocontrol Adviser, Division of Agriculture, Ministry of Environment and Natural Resources Development
Mr Rubetaake TABURUEA	Senior Assistant Secretary, Ministry of Communication
Mr Tukabu TEROROKO	Senior Fisheries Officer, Fisheries Division, Ministry of the Environment and Natural Resources Development
Mr Neeri TIAEKE	Senior Health Officer, Ministry of Health, Family Planning and Social Welfare
Mr Peter T. TIMEON	Secretary for Foreign Affairs, Ministry of Foreign Affairs
Mr Rui WILLIAMS	Acting Secretary for Health and Family Planning, Ministry of Health and Family Planning
Mr Alex Osei-Gyau	Senior State Advocate, Attorney General's Chambers
Mr Titaake	Acting Chief Engineer, Public Works Division

Near the end of both visits of the Consultants, meetings with the National Task Force were held to discuss the current status of the National Report, with particular emphasis on major issues which were seen as a priority to the Government and people of Kiribati. At these meeting changes in emphasis, wording or major amendments to the Report were identified and noted by the Consultants.

### **7.3 GOVERNMENT ENDORSEMENT OF THE NATIONAL REPORT AND SUPPORT OF THE PRINCIPLES OF UNCED**

The Government of the Republic of Kiribati very strongly endorses the National Report to the United Nations Conference on Environment and Development (UNCED) for submission to the UNCED Secretariat. We also see the document as an important source

of information and a guideline which can be used by Government and non-government organisations to promote sustainable development in Kiribati.

The report is based on a review of the available literature and documents and consultations with governmental officials, public servants, aid agencies, NGO representatives, community leaders and other persons with relevant knowledge. Particular thanks are given to SPREP, ADB and UNDP for their support in producing the report, those persons who contributed their time and expertise, the National Task Force for its work in reviewing and strengthening the report, and in particular the SPREP Consultants, Uentabo Neemia and Professor Randy Thaman of the Institute of Pacific Studies and the Geography Department of the School of Social and Economic Development of The University of the South Pacific, respectively, for their assistance in producing the Report. Because of the breadth of information required to adequately assess constraints and opportunities for sustainable development in the atoll environment, the report is necessarily general in its coverage, although detailed information in Appendices and a Bibliography of relevant sources are provided. It is hoped that the report accurately expresses the diverse concerns of the Republic of Kiribati in relation to its stated commitment to environmentally and culturally sustainable development in the atoll environment.

Through this National Report, the Government and people of the Republic of Kiribati express their strongest support for the principles and objectives of the United Nations Conference on Environment and Development (UNCED) and the promotion of environmentally and culturally sustainable development, globally, regionally and in the atoll Republic of Kiribati.

As stressed in the Report, the establishment, in September 1991, of the reconstituted Ministry of Environment and Natural Resources Development, the continuing concern that the Kiribati Government has over a number of environmental issues and particularly over the potential dangers of global warming-related sea-level rise, and its continual support of regional and international initiatives to protect the shared resources and environments of both the Pacific Ocean and the Planet Earth clearly reflect the strong commitment of the Government and the people of the Republic of Kiribati to the promotion of environmentally sustainable development and the principles of the United Nations Conference on Environment and Development (UNCED).

Although the constraints to sustainable development, especially in the isolated, fragmented resource-poor developing atoll countries of the Pacific Ocean, are many and formidable, the opportunities to foster more environmentally and culturally sustainable forms of atoll development are many. As stressed in this document, a main guiding principle of future development, at all levels, must be the maintenance of intergenerational, inter-regional and international equity. In other words, there is a need for all international agencies, nations, large companies, communities and individuals to promote development which, in their own self-interest, does not compromise the ability of future generations, other countries or businesses, and less advantaged communities and individuals to live out of the same global natural resource endowment. Overuse and overpollution by some groups of countries or individuals within countries, is thus seen as the major overriding constraint to sustainable development both globally and locally.

The Republic of Kiribati is, thus, totally committed to development and restructuring of the world economy which will improve international and local equity in terms of the right to environmentally, economically and culturally sustainable development. In this context, it is stressed that, although I-Kiribati (the Kiribati people) have lived a relatively sustainable way of life for thousands of years in the atoll environment, this was at a relatively low level of material wellbeing, a level which is no longer considered adequate. Our people desire some of the more appropriate modern technologies and social services that will make their life easier, safer and more enjoyable in today's world. This requires increased cash incomes and foreign exchange and changes in lifestyles which, if NOT pursued in the right manner, could undermine the cultural and traditional resource-use systems which have promoted sustainability in the past. As such, we must promote ecologically sustainable development which on one hand attempts to gain for our people the more appropriate technological and social benefits of modern urban industrial societies, while at the same time protecting, to the best of our ability, the social systems, technologies, knowledge and the terrestrial and marine resources that have allowed us to sustain atoll life in the past. This is the difficulty, in terms of promoting sustainable development, which faces the people and Government of the Republic of Kiribati.

It is the hope of the Government and people of the Republic of Kiribati, that the United Nations Conference on Environment and Development (UNCED), the "Earth Summit", to be held in Rio de Janeiro, Brazil in June 1992, will achieve its objectives in promoting environmentally sustainable development for the countries and people of Planet Earth. It is our hope that UNCED will play a major role in helping not only Kiribati, but all of the developing and developed peoples of the world, solve the dilemma of development and to identify and implement forms of development that will promote environmentally and culturally sustainable "ecodevelopment" and associated intergenerational, inter-regional and international equity. We are proud to participate in this undertaking, and via this document and through our continuing international, regional and local actions to promote environmentally sustainable development, unconditionally reaffirm our commitment to the objectives of UNCED.

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Appendix I. Frequency of the usage for specified purposes of 140 widespread Pacific Island atoll and coastal plant species.

Purpose/Use	Ferns x/10	Herbs x/17	Grasses /Sedges x/11	Vines/ Lianas x/14	Shrubs x/26	Trees x/62	Total x/140
Medicinal/Health	6	15	7	11	23	51	113
General Construction	-	-	-	-	6	54	60
Body Ornamentation	6	8	3	7	12	26	62
Firewood/Fuel	-	-	-	-	8	43	51
Ceremony/Ritual	3	4	-	5	6	23	41
Cultivated/Ornamental	4	3	-	2	10	20	39
Tools/Toolmaking	-	-	-	-	4	33	37
Emergency/Famine Foods	4	5	2	2	4	18	35
Boat/Canoe Building	-	-	1	-	3	30	34
Dyes/Pigments	-	-	-	2	4	24	30
Magic/Sorcery	1	6	1	1	6	14	29
Fishing Equipment	-	1	2	-	8	17	28
Cordage/Fibre	2	2	2	6	3	10	25
Games/Toys	-	-	1	4	4	16	25
Supplementary Foods	2	2	-	2	3	14	23
Scenting Oil/Perfumery	1	1	1	1	6	11	21
Fertiliser/Mulching	1	2	2	1	4	11	21
Weapons/Traps	-	-	-	-	6	14	20
Woodcarving	-	-	-	-	1	18	19
Food Parcelisation	3	1	-	3	1	11	19
Animal Feed	1	4	-	3	2	9	19
Legends/Mythology	-	-	-	-	3	15	18
Handicrafts	1	1	3	2	1	9	17
Clothing	-	1	3	-	1	9	14
Musical Instruments	-	-	-	-	1	13	14
Cooking Equipment	-	-	-	-	1	12	13
Fish Poisons	-	-	-	3	4	4	11
Export/Local Sale	-	1	-	-	2	8	11
Adhesive/Caulking	-	1	-	1	-	9	11
Fire by Friction	-	-	-	-	1	8	9
Soap/Shampoo	-	1	-	3	3	2	9
Containers	-	-	-	-	1	7	8
Repellents/Fumigants	-	-	-	-	2	6	8
Wild Animal Foods	-	-	-	-	3	5	8
Tannin/Preservatives	-	-	-	-	1	6	7
Antitoxins	-	1	-	1	1	4	7

Living Fences/Hedges	-	1	-	-	1	5	7
Staple Foods	-	1	-	-	-	5	6
Drinks/Beverage	-	1	-	2	1	1	5
Strainers/Filters	-	-	2	-	-	3	5
Toilet Paper	-	-	-	-	1	4	5
Land Reclamation	-	-	-	-	-	5	5
Calendars/Clocks	-	-	-	-	-	5	5
Contraceptives/ Abortifacients	-	-	-	-	3	2	5
Thatching/Roofing	-	-	-	-	1	3	4
Illumination	-	-	-	-	-	4	4
Combs	-	-	-	-	-	4	4
Animal Cages/Roosts	-	-	-	-	-	4	4
Oils/Lubricants	-	-	-	-	-	3	3
Brushes	-	-	-	-	-	3	3
Fans	-	-	-	-	-	3	3
Corks	-	-	-	-	-	3	3
Fishing bait	-	-	-	-	-	3	3
Other Uses*	-	-	2	-	5	27	34
<b>TOTAL</b>	<b>35</b>	<b>63</b>	<b>32</b>	<b>62</b>	<b>161</b>	<b>671</b>	<b>1024</b>
<b>NO USES</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>

\* Other uses include stimulants/teas, flavouring/spices, ear cleaners, splints, aphrodisiacs, hair remover, masticants/chewing gum, abrasives, tooth brushes, cigarette wrappers, coconut climbing bandages or harnesses, measuring tapes, fireworks, windbreaks, sand screens, ladders, walking sticks, tethering posts, punishment/torture, communication/language, and computation or counting.

Source: Thaman, 1990.

Appendix II. Atoll and coastal plant species found in Kiribati which are of particular cultural utility in Melanesia, Polynesia and Micronesia, based on an analysis of different uses listed in the Appendix I (Note: not including a wide range of ecological functions or uses).

Latin Name (Kiribati Name)	Uses
<i>Cocos nucifera</i> (te ni)	125
<i>Hibiscus tiliaceus</i> (te kiaiai)	57
<i>Pandanus tectorius</i> (te kaina)	53
<i>Calophyllum inophyllum</i> (te itai)	43
<i>Cordia subcordata</i> (te kanawa)	40
<i>Guettarda speciosa</i> (te uri)	36
<i>Scaevola sericea</i> (te mao)	32
<i>Pemphis acidula</i> (te ngea)	30
<i>Thespesia populnea</i> (te bingibing?)	26
<i>Rhizophora</i> spp. (te tongo)	25
<i>Tournefortia argentea</i> (te ren)	23
<i>Casuarina equisetifolia</i> (te katurina, te burukam)	22
<i>Premna serratifolia</i> (te ango)	22
<i>Morinda citrifolia</i> (te non)	22
<i>Pipturus argenteus</i> (te aronga?)	21
<i>Terminalia catappa</i> (te kunikun)	21
<i>Ficus tinctoria</i> (te bero)	21
<i>Ficus prolixa</i> (te kiriawa?; common on Banaba)	20
<i>Hernandia nymphaeaefolia</i> (te nimareburebu, te bingibing)	18
<i>Lumnitzera littorea</i> (te aitoa)	17
<i>Pisonia grandis</i> (te buka)	17
<i>Bruguiera gymnorhiza</i> (te tongo buangi)	16
<i>Barringtonia asiatica</i> (te baireati)	14
<i>Gardenia taitensis</i> (te tiare)	12
<i>Sida fallax</i> (te kaura)	11
<i>Triumfetta procumbens</i> (te kiaow)	11
<i>Vitex</i> spp. (te kaitu)	11
<i>Dodonea viscosa</i> (te kaiboia)	11
<i>Cerbera manghas</i> (te reiango)	10
<i>Clerodendrum inerme</i> (te inato)	10
<i>Cassytha filiformis</i> (te ntaniini)	10
<i>Tacca leontopetaloides</i> (te makemake)	9
<i>Crinum asiaticum</i> (te kiebu)	9
<i>Polypodium scolopendria</i> (te keang)	8
<i>Ipomoea pes-caprae</i> (te ruku)	7

Source: Thaman, 1990.

Appendix III. Indigenous bird species of Kiribati reported present in the Gilbert, Phoenix and Line Islands (R = resident all year, but not necessarily breeding; M = migratory breeder, which breeds at the locality, but departs for the rest of the year; V = includes passage migrants as well as vagrants; W = winter resident; resident during the nonbreeding season, from the bird's perspective, e.g. some species visit during the austral winter and some during the northern hemisphere winter; X = extinct; ? = unconfirmed record).

Common Name	Latin Name	Gilberts	Phoenix	Line
pink-footed shearwater	<u>Puffinus creatopus</u>			V
wedge-tailed shearwater	<u>Puffinus pacificus</u>		R	M
sooty shearwater	<u>Puffinus griseus</u>		V	V
short-tailed shearwater	<u>Puffinus tenuirostris</u>	V	V	V
Christmas shearwater	<u>Puffinus nativitatis</u>	V	R	R
Audubon's shearwater	<u>Puffinus lherminieri</u>		R	M
Bulwer's petrel	<u>Bulweria bulwerii</u>		R	
black-winged petrel	<u>Pterodroma nigripennis</u>		V	V
white-naped petrel	<u>Pterodroma cervicalis</u>	V	V	V
mottled petrel	<u>Pterodroma inexpectata</u>		V	V
Bonin petrel	<u>Pterodroma hypoleuca</u>		V	V
Stejneger's petrel	<u>Pterodroma longirostris</u>		V	V
collared petrel	<u>Pterodroma brevipes</u>		V	V
Cook's petrel	<u>Pterodroma cookii</u>		V	V
Phoenix petrel	<u>Pterodroma alba</u>		R	R
Juan Fernandez petrel	<u>Pterodroma externa</u>	V	V	V
Wilson's storm petrel	<u>Oceanistes oceanicus</u>		V	
Polynesian storm petrel	<u>Nesofregatta fuliginosa</u>	V	R	M
Leach's storm petrel	<u>Oceanodroma leucorhoa</u>		V	V
band-rumped storm petrel	<u>Oceanodroma castro</u>		V	
white-tailed tropic bird	<u>Phaethon lepturus</u>	R	V	R
red-tailed tropic bird	<u>Phaethon rubricauda</u>	V	R	R
masked booby	<u>Sula dactylatra</u>	V	R	R
brown booby	<u>Sula leucogaster</u>	R	V	R
red-footed bobby	<u>Sula sula</u>	R	R	R
great frigatebird	<u>Fregata minor</u>	R	R	R
lesser frigatebird	<u>Fregata ariel</u>	V	R	R
Pacific reef heron	<u>Egretta sacra</u>	R	R	R
Canada goose	<u>Branta canadensis</u>	V		
green-winged teal	<u>Anas crecca</u>			V
mallard	<u>Anas platyrhynchos</u>	?		
northern pintail	<u>Anas acuta</u>			V
northern shoveler	<u>Anas clypeata</u>	V		V
gadwall	<u>Anas strepera</u>			X

Eurasian wigeon	<u>Anas penelope</u>		V	
gray/black-bellied plover	<u>Pluvialis squatarola</u>	V		
lesser golden plover	<u>Pluvialis dominica</u>	W	W	W
stilt	<u>Himantopus sp.?</u>	V		
wandering tattler	<u>Heteroscelus incanus</u>	W	W	W
Siberian tattler	<u>Heteroscelus brevipes</u>	W		
common sandpiper	<u>Actitis hypoleucos</u>		V	
Tuamotu sandpiper	<u>Prosobonia cancellatus</u>			X
whimbrel	<u>Numenius phaeopus</u>	V		
bristle-thighed curlew	<u>Numenius tahitiensis</u>	W	W	W
black-tailed godwit	<u>Limosa limosa</u>	V		
bar-tailed godwit	<u>Limosa lapponica</u>	V		
ruddy turnstone	<u>Arenaria interpres</u>	W	W	W
sanderling	<u>Calidris alba</u>	W	W	W
pectoral sandpiper	<u>Calidris melanotos</u>		V	
sharp-tailed sandpiper	<u>Calidris acuminata</u>		V	V
red phalarope	<u>Phalaropus fulicarius</u>			V
Pomarine jaeger	<u>Stercorarius pomarinus</u>		V	V
long-tailed jaeger	<u>Stercorarius parasiticus</u>		V	V
South Polar skua	<u>Catharacta maccormicki</u>	?	V	V
laughing gull	<u>Larus atricilla</u>		V	V
Franklin's gull	<u>Larus pipixcan</u>			V
ring-billed gull	<u>Larus delawarensis</u>			V
great crested tern	<u>Sterna bergii</u>	R	V	R
black-naped tern	<u>Sterna sumatrana</u>	R		V
little tern	<u>Sterna albifrons</u>	V		
spectacled/gray-backed tern	<u>Sterna lunata</u>	V	R	R
sooty tern	<u>Sterna fuscata</u>	R	R	R
brown noddy	<u>Anous stolidus</u>	R	R	R
black noddy	<u>Anous minutus</u>	R	R	R
blue-gray noddy	<u>Procelsterna cerulea</u>	R	R	R
common fairy tern	<u>Gygis alba</u>	R	R	R
little fairy tern	<u>Gygis microrhyncha</u>		?	?
rock dove	<u>Columba livia</u>	R		
Polynesian ground dove	<u>Gallicolumba erythroptera</u>		?	
shy ground dove	<u>Gallicolumba stairii</u>	R?		
Pacific pigeon	<u>Ducula pacifica</u>		R	
Micronesian pigeon	<u>Ducula oceanica</u>	R		
Kuhl's lorikeet	<u>Vini kuhlii</u>			R
long-tailed cuckoo	<u>Eudynamis taitensis</u>	W	W	
bokikokiko/Line Islands	<u>Acrocephalus aequinoctialis</u>			R
reed warbler				

Source: Adapted from Pratt et al., 1987.

Appendix IV. Marine finfish of major and minor strategic dietary or economic importance in Kiribati due to their nutritional value and subsistence and/or commercial economic importance. Notes: 1) under names, j = name given to the juvenile stage of a given species; 2) Under "Importance", S and s = major or minor subsistence dietary importance, C and c = major and minor local commercial importance; E and e = major and minor importance as an overseas export product; and B and b = major and minor important to the tuna export industry as live baitfish for pole-an-line skipjack fishing; ? = unknown or potential importance.

Latin Name	Common Names	Kiribati Names	Importance
<u>Acanthocybium solandri</u>	wahoo	bwaara	s,c,e
<u>Acanthurus gahiti</u>	blue-barred	riba	s,c
<u>Acanthurus triostegus</u>	convict surgeon-fish, tang	koinawa	S,c
<u>Acanthurus xanthopterus</u>	yellowfin surgeon-fish, tang	mako	S,c
<u>Adioryx spinifer</u>	scarlet-fin squirrelfish	taa	s,c
<u>Aetobatus narinari</u>	spotted eagle ray	atunaomata	s,c
<u>Albula vulpes</u>	bonefish	ikari	S,c
<u>Amblygobius albimaculatus</u>	butterfly goby	?	b
<u>Anisochaetodon auringa</u>	threadfin coral-fish	ibwabwa	s,c
<u>Aphareus rutilans</u>	red jobfish	bukinrin	s,c,e
<u>Aphareus spp.</u>	jobfish	ikakoa, tekoaa	s,c
<u>Apogon fraenatus</u>	spiny-eyed cardinalfish	?	s,b
<u>Apogon fragilis</u>	fragile cardinal-fish	?	s,b,
<u>Apogon fowleria</u>	cardinalfish	?	b



<u>Aprion virescens</u>	green jobfish	awai	s,c,e
<u>Aprionodon brevipinna</u>	whaler shark	bwabutababa	s,c
<u>Archamia lineolata</u>	bronze-streaked cardinalfish	?	s,b
<u>Archamia fucata</u>	red-barred cardinalfish	?	b
<u>Archamia zosterophera</u>	girdled cardinal- fish	?	b
<u>Arothron aerostaticus</u>	diagonal-banded toadfish	buni	s
<u>Arothron immaculatus</u>	Narrow-lined toadfish	buni	s
<u>Atherinomorus lacunosus</u>	slender hardyhead	rerekoti	b
Atherinidae spp.	hardyheads, silver- sides	rerekoti	s,b
<u>Ballistes undulatus</u>	white-barred triggerfish	bubu	s
<u>Bothus pantherinus</u>	leopard flounder	davilai, dabilai	s
<u>Bregmaceros</u> sp.	?	?	b
<u>Caesio caeruleus</u>	blue-and-gold fuslier	?	b
<u>Carangoides chrysophrys</u>	longnosed trevally	tibetibe	s,c
<u>Carangoides laticardis</u>	blue trevally	kona, tauman, kungkung (j)	S,c
<u>Carangoides orthogrammus</u>	gold-spot trevally	matabareka	s,c
<u>Caranx ignobilis</u>	great trevally, yellowfin jack	urua	S,C
<u>Caranx lugubris</u>	black trevally	aonga	s,c
<u>Caranx melampygus</u>	bluefin trevally	rereba	s,c

<u>Caranx sansan</u>	Papuan trevally	kuianrereba	s,c
<u>Caranx sexfasciatus</u>	dusky trevally	barebu	s,c
<u>Carcharhinus melanopterus</u>	blacktip reef shark	baiburoro	s,c
<u>Cephalopholis argus</u>	peacock rockcod	nimwanang	s,c
<u>Cephalopholis cyanastigma</u>	blue-spotted rock	rekereke	s,c
<u>Cephalopholis urodelus</u>	flagtail rock cod	nimako	s,c
<u>Chanos chanos</u>	milkfish	awatai, baneawa (j) lawa, lairi (larvac)	S,C,E
<u>Cheilinus undulatus</u>	hump-headed Maori wrasse	?	s,c
<u>Cheilodipterus macrodon</u>	eight-lined cardinalfish	?	b
<u>Cheilopogon spp.</u>	flying fish	onauti	S,C
<u>Chromis sp.</u>	chromis	?	b
<u>Coryphaena hippurus</u>	dolphin fish, mahimahi	naritakua, takua	s,c
<u>Cymolutes lectuse</u>	brown-lined wrasse	kiari	s,c
<u>Cypselurus spp.</u>	flying fish	onauti	S,C
<u>Decapterus pinnulatus</u>	mackerel scad	barii	s
<u>Diodon hystrix</u>	porcupine fish, pufferfish	tauti	s
<u>Dussumieria acuta</u>	rainbow sardine	tarabuti	S,E,b
<u>Echeneis naugrates</u>	slender suckerfish	taritari	s,c
<u>Elagatis bipinnulatus</u>	rainbow runner	kamaa	s,c
<u>Epinephelus flavocaeruteus</u>	purple rock cod	baru	s,c
<u>Epinephelus maculatus</u>	marbled rock cod	kuaubani	S,c

<u>Epinephelus merra</u>	honeycomb rock cod	kuau, bakatii	S,c
<u>Epinephelus spp.</u>	rock cod	maneku, kauato	s,c
<u>Etelis carbunculus</u>	red snapper, onaga	arataba	s,C,E
<u>Etelis sp.</u>	deepwater snapper	?	s,c,e
<u>Euleptorhamphys viridis</u>	long-finned jarfish	anaororo	
<u>Euthynnus affinis</u>	mackerel tuna	tawatawa	s,c,e
<u>Fistularia petimbsa</u>	smooth flutemouth	kekerikaki	s
<u>Galeocerdo cuvieri</u>	tiger shark	rokea	S,C
<u>Gerres argyreus</u>	silver biddy	ninimwai	s,b
<u>Gerres ovena</u>	silver biddy	ninimwai	S,c
<u>Ginglymostoma ferrugineum</u>	tawny shark	bakoa	s,e
<u>Gnathodentex aurolineatus</u>	gold-line bream	neia	s
<u>Gnathanodon speciosus</u>	golden trevally	ree	s,c
Gobiidae spp. gobies	ntarema	b	
<u>Grammatorcynus bicarinatus</u>	scad, salmon mackerel	kimokimo	s,c
<u>Gymnosarda unicolor</u>	dogtooth tuna	buari	s,c
<u>Gymnothorax flavimarginatus</u>	moray eel	kairoro?, rabono (j)	S
<u>Heniochus acuminatus</u>	pennant coralfish	ibabanrotuma	s,c
<u>Herklotsichthys quadri-</u> <u>maculatus (H. punctatus)</u>	goldspot herring	tarabuti	s,c,B
<u>Himantura sp.</u>	stingray	maii	s
<u>Holocentrus violaceus</u>	violet squirrelfish	bureinawa	s
<u>Holocentrus sp.</u>	squirrelfish	kuu	s

<u>Hyperatherina ovalaua</u> ( <u>Allanetta ovalaua</u> )	hardyhead	rerekoti	s,B
<u>Hyperatherina barnesi</u>	hardyhead	rerekoti	b
<u>Hyporhamphus dussumieri</u>	garfish	kaabubu	s,c
<u>Istiophorus platypterus</u>	sailfish	rakuriri	s,c
<u>Katsuwonus pelamis</u>	skipjack	ati	S,C,E
<u>Khyphosus cinerascens</u> ( <u>Khyphosus</u> spp.)	topsail drummer	imeonikai?	S,c
<u>Labroides dimidiatus</u>	bridles beauty	beru	s,c
<u>Lactoria comuta</u>	long-horned cone- fish	toaua	s
<u>Lethrinus elongatus</u>	long-nosed emperor	ikamatoa	S,C
<u>Lethrinus miniatus</u>	long-faced emperor	ikamatoa, rou, taabou	S,c
<u>Lethrinus nebulosus</u>	spangled emperor	morikoi	S,C
<u>Lethrinus reticulatus</u>	<u>reticulated emperor</u>	<u>maoko</u>	<u>S,c</u>
<u>Lethrinus ramak</u>	orange-striped emperor	okaoka	s,c
<u>Lethrinus variegatus</u>	variegated emperor	roubaneawa	S,C
<u>Liza acrolepis</u>	mullet	bauamaran (j)	S,c,b
<u>Liza vaigiensis</u>	diamond-scale mullet	auataba, bauamaran (j)	S,c
<u>Lutjanus bohar</u>	red bass	ingo, boingo	S,c
<u>Lutjanus fulviflammis</u>	golden snapper,	baweina black-spot sea perch	S,c
<u>Lutjanus fulvus</u>	redtail snapper	bawe	S,c
<u>Lutjanus gibbus</u>	hump-backed red snapper, paddletail	ikanibong	S,C

<u>Lutjanus janthinapterus</u>	blue-lined snapper	takabe	S,C
<u>Lutjanus kasmira</u>	blue-lined snapper	baweata, takabe	S,c
<u>Lutjanus lineolatus</u>	big-eyed snapper	takabe	s,c
<u>Lutjanus rufolineatus</u>	rufous sea perch	baweina	S,c
<u>Lutjanus russelli</u>	Russell's snapper	baweina	S,c
<u>Lutjanus sp.</u>	red-tailed snapper	tinaemea	s,c
<u>Makaira indica</u>	black marlin	?	c
<u>Makaira mazura</u>	blue marlin	?	c
<u>Muraenesox cinereus</u>	Arabian eel pike	nimaninaba	s,c
<u>Monotaxis grandoculis</u>	humpnosed large eye bream	matakore	s,c
<u>Mulloidichthys vanicol- ensis</u>	goatfish	tewe	S,C
<u>Muraenesox cinereus</u>	pike eel	nimaninaba	s,c
<u>Mustelus sp.</u>	hound shark	?	s,c
<u>Myricthus maculosus</u>	spotted snake eel	imeone	s
<u>Myripristis berndti</u>	orange-lined soldierfish	mon	s,c
<u>Naso unicornis</u>	unicornfish, leatherjacket	bokaboka	S,c
<u>Odontaspis sp.</u>	shark	?	s,c
<u>Paracaesio sp.</u>	bedford, deepwater bream	?	s,c,e
<u>Paracirrhites forsteri</u>	freckled hawkfish	bibi	s,c
<u>Parupaneus barberinus</u>	bicolor goatfish	mawa	s,c
<u>Parupaneus chryserydros</u>	goldsaddle goatfish	mawa	s,c
<u>Platax orbicularis</u>	longnosed batfish	ibwabwa	s,c

<u>Pogonoperca punctata?</u>	clown grouper	?	s,c
<u>Pomocanthus</u> spp.	damsel fish, angelfish	?	s,c,b
<u>Pranesus pinguis</u>	broad-banded hardyhead	rerekoti	s,b
<u>Priacanthus humrur</u>	lunartailed bulls-	montaibakoa	s,c
<u>Pristipomoides auricilla</u>	yellowtail snapper	buki iaro	
<u>Pristipomoides fila- mentosus</u>	red-finned opaka- paka	no local name	s,c,e
<u>Prometichthys prometheus</u>	snake mackerel	?	s,c
<u>Pseudernia</u> spp.	cardinal fish	?	b
<u>Pseudobalistes</u> sp.	triggerfish	?	s,c
<u>Ptereleotris</u> sp.	goby, gudgeon	?	b
<u>Pterocaesio diagramma</u>	yellow lateral- line fusilier	?	b
<u>Pterocaesio tile</u>	bartail fusilier	?	b
<u>Rhabdamia cypselurus</u> ( <u>Apogon cypselurus</u> )	cardinal fish	ika kirati	s,B
<u>Ruvettus pretiosus</u>	oilfish	ikanibeka	S,c
<u>Rhynchorhampus georgi</u>	long-billed garfish	anaa	S,C
<u>Sardinella sirm</u> ( <u>Amblygaster sirm</u> )	blue sardine	tiatiin, ika taura	s,c,b
<u>Scarus ghobban</u>	blue-barred orange parrotfish	ouru	S,c
<u>Scarus venosus</u> ( <u>Scarus</u> spp.)	five-banded parrotfish	inai	S,C
<u>Scarus</u> sp. filament parrot-	ikamawa fish	s,c	

<u>Scomberoides lysan</u>	queenfish	nari	s,C
<u>Selar crumenophthalmus</u>	bigeye scad, mackerel scad	barii, ikariki- riki (j)	s,c,b
<u>Seriola</u> sp.	jack	?	s,c
<u>Siganus argenteus</u>	silver spinefoot	imnai	s,c
<u>Siganus rostratus</u>	rabbit-faced spinefoot	imnai	s,c
<u>Sphyræna barracuda</u>	great barracuda	nunua, baninua	S,c
<u>Sphyræna forsteri</u> ( <u>Callosphyræna toxoema</u> )	seapike	ikabauea	s,c,b
<u>Sphyrna lewini</u>	hammerhead shark	anoi	S,c
<u>Spratelloides delicatulus</u>	blue sprat	auan	s,B
<u>Squalus</u> sp.	spiny dogfish	?	s,c
<u>Stethojulis</u> sp.	wrasse	?	b
<u>Strongylura incisa</u>	long-scale longtom	tau	s,c
<u>Synanceichthys verrucosus</u>	reef stonefish	nou	s
<u>Synodus variegatus</u>	variegated lizard-	uningabo	s,c
<u>Tetrapturus audax</u>	stripped marlin	?	s,c
<u>Thunnus albacares</u>	yellowfin tuna	ingimea, baewe, baiura	s,c,e
<u>Thunnus obesus</u>	big-eye tuna	baiura	S,c
<u>Trachinotus bailloni</u>	black-spotted swallowtail	ikanarina	s,c
<u>Triaenodon obesus</u>	white-tip reef shark	bakoa	s,c
<u>Trichiurus</u> sp. hairtail	?	s,c	s,c

<u>Tropidinus zonatus</u>	gold-bar snapper?	?	e
<u>Tylosurus crocodilus</u>	longtom, houndfish	raubana, tau?	s,c
<u>Upeneus taeniopterus</u>	goatfish	maebo	s
<u>Valamulgil seheli</u> ( <u>V. buehanani</u> )	bluetail mullet	auamaran, bwaua (j)	S,c,b
<u>Variola</u> sp.	lunar-tailed cod?	?	s,c
<u>Xiphias gladius?</u>	swordfish	?	s,c

Sources: Lewis, c.1985, c.1986, c.1987b; Fisheries Division, 1989; Burgess et al., 1988; Wheeler, 1975; Fowler, 1959; Mees, c.1985; Taumaia and Gentle, 1983; Kleiber and Kearney, 1983; McCarthy, 1985; Merrick, 1989b; Fisheries Division, Pers. com.,1991; Tebano, 1991.



Appendix V. Marine non-fish food species of major and minor strategic dietary or economic importance in Kiribati due to their nutritional value and subsistence and/or commercial economic importance (Notes: 1) Under "Importance", S and s = major or minor subsistence dietary importance, C and c = major and minor local commercial importance; and E and e = major and minor importance as an overseas export product, ? = unknown or potential importance.

Latin Name	Common Names	Kiribati Names	Importance
<b>REPTILES</b>			
<u>Eretmochelys imbricata</u>	hawksbill turtle	on	s,c,e
<u>Chelonia mydas</u>	green turtle	on	s,c
<b>CRUSTACEANS</b>			
<u>Birgus latro</u>	coconut crab	aii	s
<u>Cardisoma carnifex?</u>	land crab	manai	S,c
<u>Carpilius maculatus</u>	three-spotted crab	ntabaabaa	s,c
<u>Lysiosquilla maculata</u>	mantis shrimp, banded prawn- killer	uaro, waro	s
<u>Panularius spp.</u>	rock lobster	ura, neue	S,c,e
<u>Penaeus sp.?</u>	saltwater prawn	niwarowaro	s
?	sea crab	tabwanou	s,c
<b>SHELLFISH (Bivalves and Gastropods)</b>			
<u>Anadara maculosa</u>	ark shell	te bun	S,C
<u>Asaphis violascens</u>	sanguin clam	te koikoi	S
<u>Gafarium pectinatum</u>	venus shell	te koumara	S

<u>Hippopus hippopus</u>	horse's hoof, bear paw, strawberry clam	te neitoro	S
<u>Lambis</u> sp.	spider conch, spider shell	?	s
<u>Spirula spirula</u>	ram's-horn shell	te katura	S
<u>Strombus luhuanus</u>	bloodmouth conch, red-lipped stromb	te nouo	S
<u>Tapes literata</u>	littleneck clam, lettered venus clam	te nikatona	s
<u>Tridacna gigas</u>	giant clam	te kima	s,C,e
<u>Tridacna maxima</u>	rugose giant clam	te were	S,C,e
<u>Tridacna squamosa</u>	fluted giant clam	te were matai	S,C,e
<u>Turbo</u> spp.	turban shells	tuumara	s
 <u>HOLOTHURIANS</u>			
<u>Actinopyga echinites</u>	deepwater redfish	?	e?
<u>Actinopyga mauritiana</u>	surf redfish	tewaeura	e?
<u>Actinopyga miliaris</u>	blackfish	?	e?
<u>Bohadschia marmorata</u>	chalky sandfish	tewaemai	e?
<u>Bohadschia vitiensis</u>	Brown sandfish	uninganibakoa	e?
<u>Bohadschia argus</u>	eyed sandfish, leopard fish	tebunia	e?
<u>Halodeima atra</u> ( <u>Holothuria atra</u> )	lollyfish	ten tabanebane	s,e?
<u>Halodeima edulis</u> ( <u>Holothuria edulis</u> )	pinkfish	?	e?
<u>Metriatyla scabra</u>	sandfish		s,e?

(Holothuria scabra)

<u>Microthele fuscogilva</u> ( <u>Holothuria fuscogilva</u> )	white teatfish	temaimmamma	s,e?
<u>Microthele nobilis</u> ( <u>Holothuria nobilis</u> )	black teatfish	terommamma	s,e?
<u>Stichopus chloronotus</u>	sea cucumber	teingiroro	e?
<u>Thelonata ananas</u>	prickly redfish	teuningauninga	
MISCELLANEOUS			
?	jellyfish	bwaitari	s
<u>Octopus sp.</u>	octopus	kiika	S,c
<u>Sepioteuthis sp.</u>	squid	riro	s
<u>Siphonosoma australe</u>	peanut worm	ibo	s

Sources: Lewis, c.1987a; Fisheries Division, 1990; Merrick, 1989b; Cernohorsky, 1972, 1978; Dance, 1974; Taniera, 1988; Munro, 1988; Langi, 1990; Eys and Philipson, 1989; McElroy, 1990; Tabano, 1991.

Appendix VI. Main issues/constraints and opportunities/remedial strategies in relation to the promotion of sustainable development in The Republic of Kiribati.

ISSUES	CONSTRAINTS	OPPORTUNITIES
<p>1. <b>Climate change and sea level rise</b></p>	<p>Uncertainty about time frame and impacts;</p> <p>Feeling of helplessness with:</p> <ul style="list-style-type: none"> <li>- dependence on industrialised countries;</li> <li>- most protection measures beyond Kiribati's financial and technological capabilities;</li> </ul> <p>Low-lying nature, and susceptibility of all islands to inundation;</p> <p>Extensive area of coastline relative to total land area;</p> <p>Extensive nature of current coastal erosion;</p> <p>Disincentive to investment and development initiatives.</p>	<p>Local programmes of seawall construction, land reclamation, and coastal reforestation;</p> <p>Support regional and international action to:</p> <ul style="list-style-type: none"> <li>- reduce emission of greenhouse gases;</li> <li>- reduce deforestation and encourage reforestation;</li> <li>- identify means of preparing for global warming;</li> </ul> <p>Establish Global Fund to help DCs respond to sea level rise;</p> <p>International guarantee of 'Right to Development' and continuing aid to low-lying DCs.</p>
<p>2. <b>Population growth and distribution</b></p>	<p>Extremely limited land area;</p> <p>Concentration of population in South Tarawa;</p> <p>High natural population growth rates;</p> <p>Limited opportunity for external migration and overseas employment;</p> <p>Extremely high population density relative to land productivity.</p>	<p>Implement strong family planning;</p> <p>Promote further decentralisation and resettlement;</p> <p>Improve social services to outer islands;</p> <p>Intensify local food production and promote urban food gardening;</p> <p>Educate for gainful employment in rural areas or overseas.</p>

<p>3. <b>Deterioration of traditional food and subsistence production systems; and associated increasing incidence of nutritional disorders and nutrition-related diseases and dependence on an unstable global cash economy</b></p>	<p>Loss of knowledge of traditional agriculture and food preservation;</p> <p>Limited recognition of economic importance of subsistence production;</p> <p>Overemphasis on coconut monoculture;</p> <p>Pest infestations (e.g. <i>Papuana taro beetle</i>);</p> <p>Overexploitation of marine food resources in South Tarawa;</p> <p>Increasing acceptance of and ability to buy imported foods and beverages;</p> <p>Inadequate nutrition education.</p>	<p>Public education on nutrition-related health problems;</p> <p>Promote subsistence food production and tree planting;</p> <p>Establish national food and nutrition policy and committee;</p> <p>EIA to include impact on subsistence production system;</p> <p>Strengthen plant and animal quarantine programmes;</p> <p>Management of inshore marine food resources;</p> <p>Restrict harvesting of inshore marine food resources for local consumption.</p>
<p>4. <b>Environmental education and public awareness</b></p>	<p>Ignorance of major environmental issues and the need for environmental protection;</p> <p>Lack of data on impact of development on the atoll environment;</p> <p>Inappropriate western education models and dependence on foreign curriculum experts;</p> <p>Loss of knowledge of traditional resource-use systems.</p>	<p>Increase local content and use of traditional environmental knowledge in curricula and public education;</p> <p>Make environmental studies an examinable subject at all levels;</p> <p>Increase emphasis on training in environment-related fields;</p> <p>Train local people in curriculum development;</p> <p>Compile knowledge of traditional environmental management.</p>

<p>5. Conservation and protection of freshwater resources</p>	<p>No surface water and very limited groundwater;</p> <p>Low rainfall and periodic prolonged drought;</p> <p>High population densities in urban areas;</p> <p>Competing demands on limited water resources;</p> <p>Susceptibility of groundwater to contamination by salt water incursion and human waste;</p> <p>Over-reliance on wells and urban reticulation systems;</p> <p>Limited development of rainwater catchment potential.</p>	<p>Increased use and development of rainwater catchment systems;</p> <p>Soft loans for rainwater catchment and storage systems;</p> <p>Building code to require tank construction with all new structures;</p> <p>Promotion of water conservation;</p> <p>Feasibility studies of desalination;</p> <p>Public education on the importance of water conservation;</p> <p>Introduction of full cost recovery for reticulated water.</p>
<p>6. Protection of marine resources from overexploitation</p>	<p>Traditional attitude of inexhaustible marine resources;</p> <p>Inadequate data on resource status;</p> <p>Marine pollution;</p> <p>Disruption of lagoon circulation and coastal ecosystems by causeway construction;</p> <p>Overexploitation of reef and lagoon fisheries;</p> <p>Indiscriminate use of modern fishing techniques;</p> <p>Poaching by foreign vessels;</p> <p>Extreme difficulty of policing extensive coastal areas and EEZ.</p>	<p>Public awareness campaigns;</p> <p>Assessment and monitoring of resource status;</p> <p>Introduce appropriate species (e.g. <i>Trochus</i>, <i>Tridacna</i>, seaweeds);</p> <p>Promote maricultural development;</p> <p>Shift emphasis to underexploited species (e.g., tuna);</p> <p>Catch regulations for given species;</p> <p>Accede to treaties on marine resource protection;</p> <p>International collaboration.</p>

7. Protection of terrestrial resources	<p>Limited land area relative to population;</p> <p>Lack of appreciation of economic value of terrestrial atoll resources;</p> <p>Land tenure issues;</p> <p>Mining of sand, aggregates and coral construction;</p> <p>Coastal deforestation;</p> <p>Overemphasis on coconut monocultures;</p> <p>Lack of proper land use planning and EIA procedures;</p> <p>Lack of data on land resource assessment;</p> <p>Inadequate land use legislation and enforcement;</p>	<p>Develop a National Environmental Management Strategy (NEMS);</p> <p>Public education and awareness programmes;</p> <p>Research on terrestrial resource status and development impacts;</p> <p>More effective land use legislation and enforcement;</p> <p>Systematic coastal reforestation and agroforestry programmes.</p>
8. Conservation of biological diversity	<p>Lack of public understanding of importance of biodiversity;</p> <p>Lack of knowledge of species and endangerment status;</p> <p>Effects of diversity loss on ecological balance and subsistence economy not appreciated;</p> <p>Land tenure issues;</p> <p>Highly dispersed nature of Kiribati;</p> <p>Highly mobile nature of some animal populations (e.g., migratory birds, turtles and pelagic fish).</p>	<p>Public education and awareness programmes about biodiversity;</p> <p>Accede to international agreements promoting biodiversity protection;</p> <p>Institute resource inventories and research on the ecological and cultural importance of biodiversity;</p> <p>Establish a system of protected areas;</p> <p>Establish "germ plasm" collections of important wild and domesticated species.</p>

<p>9. Nuclear pollution and its irreversible long-term impact on human health and the habitability of islands</p>	<p>Past history of atmospheric and underground or under water nuclear testing in Kiribati (Kiritimati Island) and neighbouring island groups (e.g. Marshall Islands)</p> <p>Long-term and delayed (often for generations) somatic and genetic effects of radioactivity on human health</p> <p>Lack of data on the environmental and human health impacts of nuclear testing because of confidentiality or unwillingness of responsible parties to conduct such research</p> <p>Inability to destroy and danger of disposal of nuclear waste</p> <p>Fragility and mobility of the Pacific oceanic and atmospheric environments which spreads the potential risk of nuclear pollution throughout the Pacific</p> <p>Unwillingness of nuclear powers to accede to Pacific countries' demands to ban nuclear weapons testing and nuclear waste disposal</p>	<p>Accede to treaties and actions to halt nuclear weapons testing and the disposal of nuclear wastes in the Pacific islands and the surrounding oceanic environment</p> <p>Promote the formation of regional or international task forces to conduct unbiased scientific assessments of the impacts of nuclear weapons testing on the habitability of affected islands and the health of affected peoples</p> <p>Promote initiatives to rehabilitate islands and compensate communities affected by nuclear pollution/destruction</p>
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<p>10. Waste management and disposal</p>	<p>Susceptibility of groundwater and marine resources to pollution;</p> <p>Increasing pressure from metropolitan powers to dispose of hazardous waste in atoll and oceanic environments;</p> <p>Extremely limited land available for landfill sites;</p> <p>Lack of disposal facilities for hazardous waste;</p> <p>Increasing dependence on imported non-biodegradable products and packaging;</p> <p>Lack of information on the nature and origin of waste and its environmental impacts;</p> <p>Lack of legislation controlling toxic and non-biodegradable waste;</p> <p>Inability to stop use of neighbouring islands as waste disposal/reduction sites (e.g. Johnston Is. for JICADS).</p>	<p>Implement recycling programmes;</p> <p>Isolate toxic waste disposal from groundwater and marine resources;</p> <p>Sewage outfalls and waste treatment development with no impact on groundwater and lagoon ecosystems;</p> <p>Public education on waste disposal;</p> <p>Use non-hazardous waste for land reclamation and sea wall construction;</p> <p>Reduce importation of non-biodegradable, non-recyclable and hazardous waste;</p> <p>Substitute biodegradable for non-biodegradable packaging;</p> <p>Research on appropriate waste management (e.g., Greenpeace Waste Trade Programme).</p> <p>Accede to accords/treaties on movement and disposal of toxic and hazardous waste.</p>
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<p>11. Increased dependency on global cash economy/limited local monetary economic development potential/relative poverty in monetary terms</p>	<p>Overemphasis on short-term, aid-funded economic development;</p> <p>Overemphasis on commercial and export production at expense of environmentally sustainable traditional production systems;</p> <p>Continued deterioration in terms of trade between primary exports and imported manufactured consumer and capital goods</p> <p>No developing planning assessment of the long-term impact of modern development and the cash economy on subsistence production systems and traditional resource management knowledge;</p> <p>Loss of traditional environmental knowledge and production systems.</p>	<p>Require aid donors to fund an EIA component, which includes impact on subsistence production, for all development projects;</p> <p>Greater commitment to maintenance of traditional subsistence production and resource management;</p> <p>Studies of the economic importance of traditional resource management systems;</p> <p>Public education on the importance of traditional resource-use systems;</p> <p>Restructuring of the world economic order to improve terms of trade between exporters of primary products and industrialised countries which produce and export manufactured goods.</p>
<p>12. Energy dependency on imported fuels</p>	<p>Lack of an energy conservation policy;</p> <p>Absence of fossil fuel resources;</p> <p>Increasing cost of imported fuel relative to export earnings;</p> <p>Increasing dependence on outboard motors and air travel between islands, and associated high transportation costs;</p> <p>Deforestation and fuelwood scarcity in urban areas.</p>	<p>Promote energy conservation;</p> <p>Promote renewable energy alternatives;</p> <p>Public information programmes on energy dependency and conservation;</p> <p>Research on energy alternatives and conservation;</p> <p>Support negotiations for more equitable regional prices for fossil fuels.</p> <p>Promote sail power as an adjunct to engine driven craft;</p> <p>Expand fuelwood resources;</p> <p>Promote adoption of efficient wood burning stoves;</p>

<p>13. Need for environmental protection infrastructure</p>	<p>Cross-sectoral nature of environmental management;</p> <p>Lack of integrated legislation for environmental management and protection;</p> <p>Lack of trained manpower in environmental planning, law, conservation and EIA;</p> <p>Lack of funds for protection infrastructure and conservation area establishment;</p> <p>Tenure system and limited land area make western style conservation area development inappropriate;</p> <p>Inadequate data base on resources or development impacts.</p>	<p>Acquire funding for management infrastructure development;</p> <p>Establish autonomous cross-sectoral environmental administrative unit with EIA capability;</p> <p>Incorporate EIA procedures in all development planning;</p> <p>Draft umbrella environmental legislation and enforcement regulations;</p> <p>Make training in environmental planning, law, conservation and EIA a priority.</p> <p>Establish system of protected areas of ecological and subsistence importance.</p>
<p>14. Land Reclamation and Rehabilitation of Banaba</p>	<p>Lack of funds for reclamation works;</p> <p>Land tenure arrangements among original land owners;</p> <p>Identification of sand and aggregate sources for reclamation;</p> <p>Unknown impacts of reclamation on island ecosystems;</p> <p>Extensive nature of degradation on Banaba;</p> <p>Isolation of Banaba.</p>	<p>Solicit funding and technical assistance for reclamation;</p> <p>Research on appropriate methods for reclamation and revegetation of degraded lands, including effective seawall construction;</p> <p>Establish nurseries of plants for reclamation of degraded lands;</p> <p>Development of technologies to recapture fill.</p>

Appendix VII. Persons in Kiribati and elsewhere consulted during the preparation of the Republic of Kiribati National Report to UNCED (Note: where two designations are listed separated by a / the first indicated the former position and the second the latter).

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## KIRIBATI

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