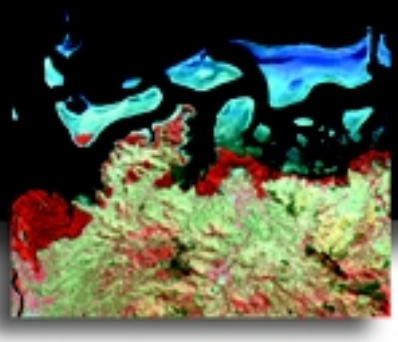
SOPAC

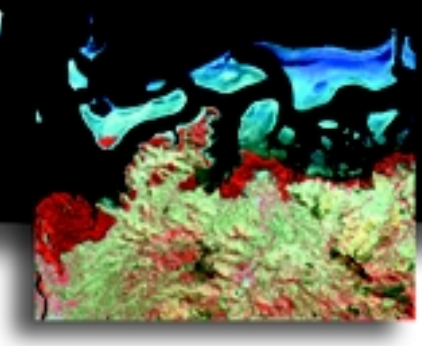


COUNTRY PROFILE

FIJI

SOPAC Secretariat Private Mail Bag Suva Fiji.
Tel: (679) 381 377 Fax: (679) 370 040 http: //www.sopac.org.fj/

SOPAC



Our Vision

The improved health, well being and safety of the Pacific and its peoples

The South Pacific Applied Geoscience Commission (SOPAC) is an independent, intergovernmental, regional organisation established by South Pacific nations in 1972, and dedicated to providing geotechnical services to the countries it serves. Its Secretariat is located in Suva, Fiji, and has about 40 professional and support staff.

SOPAC's work for its member countries focusses on three key areas; resource development; environmental geoscience; and national capacity development in the geosciences. To effectively deliver these services SOPAC maintains a regional data centre, provides information services, and offers technical and field services for specific project work.

THIS COUNTRY PROFILE WAS PRODUCED TO PROVIDE A SNAPSHOT OF THE CURRENT ISSUES FACED BY THE COUNTRY AND SOPAC'S ROLE IN ASSISTING COUNTRIES TO ACHIEVE SUSTAINABLE DEVELOPMENT

SOPAC Secretariat Private Mail Bag Suva Fiji.
Tel: (679) 381 377 Fax: (679) 370 040 http: //www.sopac.org.fj/

FIJI COUNTRY PROFILE

Fiji Islands: Our Future

"…our islands have finite carrying capacity for their human populations. Clearly we need to recognise the physical limitations of our island homes, as well as identifying the unique opportunities which they offer, if we are to attain the social and economic goals which we set for the last decade of the 20th Century."

Berenado Vunibobo
Minister for Trade and Commerce, Fiji. (1998)

Capital:	*Suva*
Population:	*801 500 (1999 est.)*
Land Area:	*18 333 sq. km*
Max. Height above Sea-level:	*1 324 m (Tomanivi)*
Geography:	*Over 320 islands (105 inhabited); mostly volcanic in origin; largest islands are Viti Levu (10, 390 sq km) and Vanua Levu (5 538 sq km)*
EEZ:	*1.26 million sq. km*
Climate:	*Tropical oceanic with tempering influences of the prevalent Southeast trade winds*
Rainfall:	*Varies; windward sides of larger islands are extremely wet while leeward sides have considerably less rainfall; ranges from approximately 440 mm in the west and 1120 mm in the Southeast per annum*
Mean Temperature:	*28°C*
Economy:	*Diverse with strong tourism sector, sugar, agriculture, garment and mining industry; exports include sugar, garments, gold, coconut products, tropical fruits, root crops, vegetables, tobacco, fish, and timber products*
GDP per Capita:	*US$ 2 684 (1998 est.)*
Currency:	*FJ$*
Energy Sources:	*Hydro, biomass, solar, wind, wave, geothermal*
Freshwater Sources:	*Groundwater, surface water*
Natural Hazards:	*Cyclone, storm surge, coastal flooding, river flooding, drought, earthquake, landslide, tsunami and volcanic eruption*
Mineral Potential:	*On-land – gold, silver, copper; Offshore – polymetallic sulphides (gold, silver, copper, lead and zinc), hydrocarbons*
Languages:	*English, Fijian, Hindi*
Government:	*Independent state since 1970*
SOPAC Membership:	*Full member since 1971*
Country Representative:	*Director. Mineral Resources Department*
	Private Mail Bag. GPO Suva
	Tel: (679) 387 065. Fax: (679) 370 039
	Email: brao@mrd.gov.fj

The Fiji Islands

Fiji is an archipelago of over 320 islands scattered over approximately 1.3 million sq km of the South Pacific Ocean. Its total land area is about 18 333 sq km and the maximum height is 1 324 m above sea level.

The population of Fiji was estimated at 801 500 in 1999[1], with most people being located on the two main islands Viti Levu and Vanua Levu. The majority of the population is made up of two ethnic groups - indigenous Fijians and Indians. The remaining people who account for about 5% of the population are Rotumans, Chinese, Europeans, part-Europeans and others.

Children of Fiji

Situated in the tropics, Fiji has a tropical maritime climate with frequent torrential rain. Catastrophic climatic events such as cyclones can occur from November to April and these can trigger flooding in low-lying areas. Changing weather patterns is also a cause of droughts in the country. All these events have major effects on the economy and infrastructure.

The sugar, garment and tourism industries are the mainstays of the economy in Fiji. However, agriculture, fisheries, forestry and gold also contribute to the export earnings of the country.

Landsat TM image of Northern part of Viti Levu

There are several resource and environmental issues, common to island nations, affecting sustainable development in the Fiji Islands. These include an array of issues from climate and sea-level variability, environmental degradation and pollution to resource management. More specific challenges to sustainable development include coastal erosion, water quality, water availability and sanitation. Sustainable management of resources such as aggregate, terrestrial and offshore minerals, and renewable energy are other issues in Fiji's quest for development.

The Fiji Islands is a founding member of the South Pacific Applied Geoscience Commission (SOPAC) since 1971. SOPAC is an independent, intergovernmental, regional organisation, which provides expert technical assistance, policy advice and information on the sustainable management of these natural resources. SOPAC also contributes to a variety of geoscientific training and educational opportunities at all levels to increase the country's capacity in science and resource management. Additional assistance is made available by SOPAC through technical support for the establishment and maintenance of database information systems and for electronic exchange of information. Expertise in hazard and risk assessment, disaster preparedness, mitigation and management is also provided.

Resource Development and Management

For Small Island Developing States (SIDS), natural resource development and management holds the key to rapid economic development. Unwise exploitation of non-renewable resources and exploitation of renewable resources at a pace higher than the natural rate of replenishment could prove detrimental to the sustainable development plans of the country.

[1]SPC Demography Programme

MINERALS

Fiji is richly endowed in mineral deposits of gold, copper, lead and zinc. Gold has been exported from the country since 1932 and continues to be a major foreign exchange earner. Emperor Gold Mining Company Limited operates the largest mine in the country with an annual production of 4430 kg of gold (1999) and a workforce of over 2000 people. The company's Vatukoula mine is situated on the margin of the Tavua Caldera in northern Viti Levu, the largest island in Fiji. Mt Kasi mine in the Yanawai Goldfield of southern Vanua Levu is the other major goldmine in the country.

The discovery of large copper deposits at Namosi in east-central Fiji could see the emergence of a new metal in Fiji's mineral basket.

The other terrestrial and coastal resources include the hardrock, gravel and sand that are feeding into the upsurge in construction activities.

There is also potential for hydrocarbons in Fiji. In 1993, a natural oil seep was confirmed in the South Bligh Water. This has given an added thrust for oil exploration in Fiji. The mining laws of Fiji have been amended to facilitate private-sector participation, as heavy investments would be required for further exploitation.

Offshore exploration is still at a nascent stage in Fiji. Exploratory surveys, however, reveal the extensive presence of polymetallic massive sulphides (rich in copper, lead, zinc gold and silver) in the Exclusive Economic Zone (EEZ) in water depths of 2500 m, around the Fiji Islands. Several exploration companies have expressed interest in these findings and have applied for exploration licences to assess the scope and potential for development. Fiji is currently formulating an Offshore Policy to set up the legal and regulatory framework for private marine mineral exploration.

Sand-mining in reefal areas cause coastal instability

ENERGY

With light industries and tourism acting as the main engines of economic growth, the energy requirements of Fiji have been growing rapidly. Currently 80% of the power requirements is met from the 80-MW hydroelectricity project at Monasavu on the main island. There are a few isolated micro and mini hydroelectric power projects as well. The increasing demand for imported petroleum products for the growing fleet of vehicles and motorboats, and for electricity generation on the outer islands has been straining the foreign exchange reserves. The Emperor Mine alone has a diesel-based 30-MW installed thermal-electric project. Liquefied Petroleum Gas (LPG) is commonly used in the household and commercial sectors to meet cooking and heating requirements.

Non-conventional sources of energy are being popularised in Fiji to tide over the energy constraint. A notable example is the Fiji Sugar Corporation using bagasse - a sugarcane residual - for most of its energy requirements. The Fiji Industries Ltd cement factory fires its kilns with electrical energy from imported coal while the steel rolling and fabrication industry meets part of its requirements through waste oil. Several isolated power projects use coconut oil, biogas and biomass as alternative fuels. A 10-KV photovoltaic installation has been set up at Lautoka; but the high cost of the photovoltaic cells places a constraint on the introduction of similar projects elsewhere.

Wind is a renewable source of energy that could have a crucial role if the remaining 40% of the Fijian population is to have access to electricity. Hybrid power systems that use renewable sources of energy along with fossil fuels

(wind/solar with diesel/coal) are currently being assessed for their viability in Fiji and other Pacific countries. Geothermal energy is another renewable source of energy that could be exploited to further the goals of sustainable development in Fiji. Efficiency in production, transmission and consumption is essential to optimise available energy sources while new avenues are being explored.

WATER

Fresh water is a fundamental resource for small island nations. Most development plans are pivotal on the availability of fresh water. Clean water and proper sanitation enhance the health and productivity of the work force and have particular implications for the children and future generations. Fiji is better off than many Pacific Island nations as 70% of the population has access to proper piped water supplies. However, as demand increases, proactive measures are needed to increase supply and reach.

Challenges to Sustainable Development and SOPAC's role in Fiji

MINERALS

SOPAC has been assisting Fiji in addressing issues related to the development of mineral resources. Assistance has included field surveys, assessment studies, workshops, training sessions, public awareness campaigns and policy formulation.

Gold has recently been the primary focus of exploration surveys in Fiji. SOPAC has been involved in assessing the value of detrital gold at Ba River delta[2], Nadi (1993)[3], (1994)[4], Nasivi River delta in Tavua (1995)[5], Momi Bay (1996) and Yanawai in Savusavu (1998). In 1995, SOPAC documented an extensive review of the placer gold locations in Fiji.

Field surveys

The data from such surveys are of value to the government and the mining companies. In 1998, SOPAC produced an attractive promotional brochure on the aeromagnetic surveys carried out in Fiji for circulation among mining companies. Data compilation and management is crucial for planning and administration of the mineral resources. SOPAC has initiated a project to maintain and update a mineral industry database for all the Pacific Countries including Fiji. Industry-level databases enhance the ability of governments of SIDS to negotiate with powerful transnational mining companies. In 1993[6], SOPAC established a comprehensive Oil Company Database at the Secretariat to assist the member countries in their dealings with oil companies. This was a follow-up to the consultancy that SOPAC offered in 1992[7], to promote the hydrocarbons potential of the South Pacific nations to the Oil Industry.

SOPAC has undertaken several offshore projects to assess the potential for hydrocarbons in Fiji waters since the 1980s. Some key areas investigated were:

- Bligh Water and Bau Waters - 1980,1982, 1990[8].
- Swath Mapping surveys in Fiji's EEZ waters - 1988[9], 1989[10].
- Lau Ridge - 1989[11].
- Bligh Water – 1993[12].

[2]SOPAC Technical Report 98
[3]SOPAC Technical Report 172

[4]SOPAC Technical Report 227
[5]SOPAC Technical Report 231
[6]SOPAC Miscellaneous Report 146
[7]SOPAC Miscellaneous Report 141
[8]SOPAC Technical Report 112
[9]SOPAC Technical Report 108
[10]SOPAC Technical Report 130
[11]SOPAC Technical Report 114
[12]SOPAC Technical Report 189

In 1999, SOPAC partnered the Japan Deep-sea Minerals Programme in two survey trips to assess the potential for polymetallic sulphide deposits in the North Fiji Basin. These surveys have given room for optimism as the Fiji EEZ has shown extensive presence of polymetallic massive sulphides (PMS). Further extension of research is required to confirm these findings. The expression of interest by an Australian mining company in exploration licences in Fiji waters has provided further encouragement. However, SOPAC and the government of Fiji understand that before private companies are permitted, it is essential to have broad regulatory, legal and environmental regulations in place. SOPAC has been involved in the formulation of the Offshore Mineral Policy for Fiji[13]. The draft, currently in its final draft stage, is undergoing outsider stakeholder review before it proceeds to the parliament. In February 1999, SOPAC co-ordinated an Offshore Mineral Policy Workshop at Madang in Papua New Guinea to evolve the systems and guidelines for preparing Offshore Mineral Policies in South Pacific. The Pacific Exploration Technology Seminar that SOPAC had organised at Nadi in 1998, which had several modules on offshore mining as well, has proved to be useful in setting the stage for offshore mining.

Active fault scarp

Environmental pollution, adverse social impact and economic redistribution are the biggest concerns arising out of mining and mineral exploration. Air pollution, water pollution and deterioration of land quality are the primary damages inflicted by mining operations. The disposal of mine tailings is an arduous task in small, land-scarce islands. Mining also leads to loss of green cover and diminished aesthetic appeal of natural surroundings, and renders the land unsuitable for other applications, even long after the closure of the mine. Offshore mining could unleash a whole new host of problems ranging from the irreversible destruction of the fragile ecosystem to loss of fishing grounds.

Mineral-resource development often leaves indelible scars on the fabric of traditional societies through the resultant change in lifestyle, perceptions and values that it inevitably effects. While displacement and compensation for externalities form a complex range of issues on their own, the assignment of pecuniary or economic value to communally owned properties like land has often led to social disharmony. The loss of land or fishing grounds deprives many of their traditional lifestyles, and the resultant unemployment catalyses alcoholism, violence and crime in the affected societies. SOPAC understands the impact of these externalities on Fiji's goal of sustainable development and has attempted to address them through formulation of appropriate policies. SOPAC has worked closely with the Mineral Resources Department (MRD) in framing the Terrestrial and Offshore Mineral Policy, the Compensation Policy and the environmental regulations. Social cost-benefit analysis and social and environmental impact assessments are advocated for all mining projects in Fiji. The proximity of the SOPAC Secretariat to MRD has fostered an excellent working relation between the two organisations.

Capacity development in the member states is one of the top priorities of SOPAC. Training in the field for technical personnel from the member countries is an ongoing process with the aim of enhancing in-country capacity to undertake assessment studies and field surveys. This training is carried out through workshops and seminars and through the courses in the Earth Science and Marine Geology Certificate Programme, which has been undertaken for 21 years.

ENERGY

Fiji is confronted with the urgent need to introduce supply-side and demand-side management programmes to attain efficiency in the power sector. To economise on the existing supply of power, Fiji Electricity Authority (FEA) has been promoting consumer awareness. Besides these educational programmes, FEA has also been encouraging the use of energy-saving devices, viz. timers, fluorescent lamps and regular maintenance of heavy-duty appliances like air conditioners and industrial equipment. The results have been encouraging so far.

[13]SOPAC Technical Report 287

Installation and testing of photovoltaic cells

SOPAC's role has been more on the supply side and its role in Fiji began in 1987[14] with the wave-data collection programme. Besides providing information useful for coastal protection, harbour design and wave forecasting, wave data was used to study the feasibility of generating electricity from tidal waves. A series of studies on the wave energy programme followed in 1991[15], 1992[16], and 1993[17]. The outcome of SOPAC's research was published in a brochure called "Ocean Wave Energy in the South Pacific" that provides extensive information on the results, status of wave energy internationally and avante garde technology in the field. The brochure also proved to be a useful promotional pamphlet for the potential that the South Pacific has in this area[18]. Several training workshops have been organised by SOPAC in Fiji and the other island nations on wave measurement and wave climatology.

To reduce the dependence on imported fossil fuels in the domestic sector, SOPAC examined the prospect of geothermal energy as an alternative energy source for Fiji in 1993[19].

In 1991[20], a geophysical survey was carried out in the Monasavu Reservoir to monitor the possible siltation resulting from agriculture, logging activities and landslides within the catchment area. A second survey in 1993[21] came out with a detailed model of the reservoir and height-volume relationship, which could be used for accurate energy planning. In 1999[22] the Public Works Department requested SOPAC to carry out a survey to delineate the extent of sedimentation at Headworks 3 on the Savura Creek, Wailoku.

[14]SOPAC Technical Report 205
[15]SOPAC Technical Report 153
[16]SOPAC Technical Report 184
[17]SOPAC Technical Report 210
[18]SOPAC Miscellaneous Report 234
[19]SOPAC Miscellaneous Report 198
[20]SOPAC Technical Report 129
[21]SOPAC Technical Report 270
[22]SOPAC Technical Report 271

1999[23] also saw the completion of the photovoltaic grid-connected project that demonstrated the technical and economic viability of this new technology to supplement conventional sources of electricity. This source of power has environmental implications as well through the reduction in greenhouse gas emission.

Ongoing projects in Fiji include electrical appliance labeling (1998), solar heater efficiency monitoring (1998) and energy conservation project (1999). SOPAC has organised several regional workshops and training programmes in Fiji. In 1998, SOPAC convened a regional energy programme design workshop at Nadi, which outlined the energy sector priorities of the Pacific nations and drew up a programme for the period 1999-2004. Wind, geothermal energy, biomass and hybrid power systems were identified as energy sources of the future for the islands[24].

SOPAC has recommended that Fiji implement the following measures for the sustainable development of the energy sector:

- development of clear electrification policies and guidelines;
- popularisation of low emission technologies and native energy sources; and
- provision of reliable energy sources based on the least cost strategy.

WATER & SANITATION

SOPAC has attempted to assist the Fiji Islands with the water and sanitation issues through field surveys, assessments and capacity building through training programmes and workshops.

Sanitation and garbage disposal is a major predicament for small land scarce islands with fragile ecosystems. Only 12% of Fiji's population have access to sewage-treatment facilities. Landfills are operated for urban waste disposal. The growth of the tourism and hospitality

[23]SOPAC Technical Report 279
[24]SOPAC Miscellaneous Report 315

Water sampling

industry has made it essential to develop better waste management systems and strategies for Fiji. Hygienic and sustainable disposal of sewage is important not only to maintain the ecological balance, but also to protect the health of the people. Feasibility studies for the existing Kinoya sewer outfall in Laucala Bay were carried out in 1998[25]. Seismic-reflection techniques were used in this study to locate bedrock in the vicinity of the Kinoya sewer outfall for possible future outfall development. The Small Scale Waste Water Treatment Plants project commenced in 1999, with the goal of identifying appropriate wastewater treatment technologies such as treatment plants, high loaded treatment lagoons and community septic tanks for selected villages in Fiji and other Pacific countries.

Several workshops have been organised by SOPAC to evolve strategies on water resource management and development. A regional consultation workshop on water resource management in the Pacific regions was held in 1996[26]. Some of the constraints specific to Fiji that were identified are non-availability of data , inappropriate and underused equipment and lack of technical expertise. In the same year SOPAC organised a workshop at the Secretariat on Technologies for Maximising and Augmenting Freshwater Resources in Small Islands[27]. This workshop contributed towards a Source Book of Alternative Technologies for Freshwater Augmentation in Small Island Developing States to be published by SOPAC in a user-friendly format for application by water sector managers and planners in developing countries like Fiji.

On-the field training

In 1997[28], SOPAC organised a workshop to review the photovoltaic pumping technology and determine the causes for their failure in the South Pacific. The workshop also looked at ways for making the technology more affordable to villages and households.

Similarly, a SOPAC/ACTEW workshop on Numerical Modelling of Water Distribution Networks was run in1998[29]. The workshop achieved the following:

- Improved the hydraulic design capabilities of the Public Works Department Water and Sewerage Sections.
- Enhanced operational capabilities in each Divisional Water Supply area.
- Improved Operation and Maintenance Programme in the PWD.
- Improved the understanding of hydraulic and interconnection problems among the Water Works Employees to speed up action during emergencies.
- Took the preliminary step towards developing a general model for Water Supply systems in Fiji.

During the 1999 World Water Day, SOPAC organised an Essay and Poster Competition for schools. The theme 'Everybody Lives Downstream' helped raise public awareness on the flow-on effects of water pollution and mismanagement. The day also highlighted the need in island nations to manage freshwater resources wisely and a public forum was organised as well.

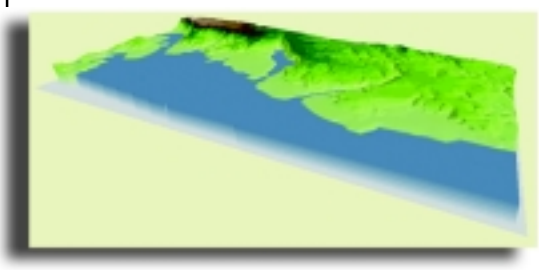
In addition to these, SOPAC has been running an Earth Science and Marine Geology Certificate Programme for technicians from Fiji and the region since 1979. Since 1995, when the Water and Sanitation Programme was first attached to SOPAC, a module relating to water issues has been added to the certificate course which is run by SOPAC at the University of the South Pacific.

[25]SOPAC Technical Report 267
[26]SOPAC Miscellaneous Report 229
[27]SOPAC Miscellaneous Report 223
[28]SOPAC Miscellaneous Report 251
[29]SOPAC Miscellaneous Report 287

HAZARDS & DISASTERS

Geo-hazards are real threats to Fiji, given its location in the seismically active Pacific 'Ring of Fire'. Fiji also falls in a tropical cyclone belt with an average of one cyclone passing through Fiji waters every year. Cyclones have had disastrous effects on Fiji, with large amounts of national development funds having to be diverted for mitigation. For instance, the damage caused by Cyclone Kina in 1993 was valued at US$124 million. The government had to divert about 40% of the capital expenditure budget for recovery work and this proved to be a big drag on the economic growth of the country. Given the high cost that disaster mitigation expenditure has, hazard assessment and disaster mitigation are of crucial importance to high-risk countries like Fiji. Though Fiji is yet to feel the impact of an intense cyclone hitting a densely populated area, experiences from the other parts of the world has shown that poor building standards could aggravate the human catastrophe and infrastructural damage.

Being in a seismically active zone, Fiji stands the risk of experiencing immensely destructive earthquakes. The 1953 earthquake in Suva caused extensive damage to buildings and total destruction of the wharf, and generated a tsunami that killed six people. Research shows that there is roughly a 10% chance of a similar intensity earthquake striking Fiji in any 50-year period. Given the rapid urban development that has taken place in the interim, the effects of such an earthquake in Suva or any of the major towns could be devastating. Investigations are also underway, as part of the Pacific Cities project, to determine the likely effects of a severe tsunami or storm surge striking the city's shores.



Digital Terrain Model of Suva showing Suva Harbour

Flash flooding in Western Division, 1998

Earthquakes and tropical rainfall can lead to landslides, which also have had a high human cost in Fiji in the past. The effects of human-induced hazards on the environment and populace are also being examined via the Pacific Cities project. SOPAC is modelling sewage pollution and oil spills in Laucala Bay and Suva Harbour to better understand their potential effects.

SOPAC has been trying to assist Fiji come to terms with these threats through numerous field investigation projects, workshops and training programmes. Some of the key field surveys that have been focussed on include:

- The likelihood of a major earthquake in Suva specifically affecting areas which have been reclaimed over deep sediments. Building height and foundation conditions are key determinants of the amount of damage that might occur.
- The possible impact of a tsunami or storm surge in Suva Harbour and Laucala Bay in Viti Levu.
- The development of a comprehensive multi-hazard risk-assessment programme based on a geographic information system (GIS) database under the Pacific Cities project in Suva. Under this project, zonation of all hazards and their distribution, frequency and likely impact on the city are being carried out. The database is vast in its coverage and even information on all buildings in high-risk areas is included to assess the response of the structures to a wide range of hazards like cyclone, earthquake and sea-level rise. Training of technical personnel in risk analysis, disaster mitigation and civil protection measures is also being undertaken as part of the project.
- An assessment study of the Cyclone Kina in 1993[30] to reduce risk, improve planning, awareness, vigilance and disaster mitigation.
- Volcanic Risk Mapping in Taveuni to update the

[30]SOPAC Miscellaneous Report 149

existing information and records for improving emergency response planning (1998).

- The Ba Flood Preparedness Project, to strengthen the ability of the community to anticipate and cope with flood hazards. It is intended to develop a Ba Community Flood Operational Plan with the intention of developing educational literature, spreading flood awareness and expanding the focus to industrial and commercial sectors as well.

All these contribute towards SOPAC's vision of strengthening Fiji's capability to assess natural and man-made hazards and improve post-disaster rehabilitation.

CLIMATE & SEA-LEVEL VARIABILITY

Global climate variability may be responsible for increasingly more-frequent and more-severe cyclones, interspersed with scorching droughts. The impact of this variable climate has been harsh on ecosystems and coastal, terrestrial and marine biodiversity. Economically, the impact has translated into decreased agricultural yield, death of livestock and decrease and loss of marine biodiversity. This has caused loss of revenue, which can have detrimental effects on the social and economic system of SIDS and developing economies. As the majority of the people dependent on these sources of income are poor, the poverty implications of variable climate are high.

The El Niño Southern Oscillation Index (ENSO) effect caused by regional atmospheric variations has had drastic effects on the precipitation and climate patterns in Fiji. The ENSO effect led to an extended drought in the northern and western parts of the two main islands of Fiji in 1997-98, with a consequent debilitating effect on the economy, as losses to the sugar industry alone totalled F$150 million.

SOPAC conducted its initial study of climate and sea-level change in 1996[31]. The study assessed the physical effects of potential accelerated sea-level rise on the Suva Peninsula and also analysed the response to mollify the effects. A further study was carried out in 1997[32] on coastal vulnerability in and around Suva. Such studies might prove important with the growing understanding of human activities and their repercussions on the environment and climate.

A starving cow - result of the prolonged drought in 1998

More recently, SOPAC did an impact assessment of sea-level rise on Viti Levu as part of a World Bank Regional Economic Review for the Pacific for 2000[33]. Impacts of climate change on coastal areas were reviewed and discussed, together with recommendations for coastal adaptation technology.

COASTAL MANAGEMENT

Fiji has very distinctive coastal areas comprising features such as fringing reefs, lagoons, natural beaches, sea-grass beds and mangroves. There have been rapid changes in the coastal geography associated with increasing reclamation as a part of burgeoning tourism and urbanisation. To protect reclaimed land from the onslaught of the sea, various protection systems such as concrete walls, groynes and riprap revetments have been constructed haphazardly. However, the success of these protection structures has been minimal owing to a lack of understanding of the wave and current pattern around the islands, and the misconception that coasts are inherently and eternally stable. Poor construction and development practices, indiscriminate reclamation and aggregate mining in the reef areas cause coastal instability and beach erosion. In addition, coastal pollution damages and reef.

SOPAC has been assisting Fiji in addressing the coastal erosion issues through coastal-zone field surveys, coastal mapping workshops and public awareness workshops.

[31]SOPAC Technical Report 242

[32]SOPAC Miscellaneous Report 277
[33]SOPAC Consultant Report to the World Bank, 1999

Some of the key projects undertaken in Fiji include:

- Coastal erosion survey in Savusavu Bay in 1986[34].
- A study of the coastal processes and problems with shifting sediments around the Rotuma wharf at Oinafa in 1992[35].
- Field surveys along beaches to examine evidences of nett sand transport along the entire length of Suva Peninsula in 1996[36].
- Assessment of lagoon sand resources in Laucala Bay in 1998[37].
- Assessment of alternative lagoon sand resources in Laucala and Namuka Bays in 1999.
- Survey in Natadola and Momi areas for tourism development.
- Revision of Fiji's V&A study on coastal erosion, coastal management and climate change as a part of the World Bank Economic Review for the Pacific for June 2000.
- Advice on a National Implementation Strategy on Climate Change and Sea-level Rise.

ESMG students during a beach mapping exercise

Several recommendations have been made by SOPAC to tackle coastal erosion and manage aggregate:

- implementation of appropriate environmental policies and legislation;
- use of advanced technology for shoreline protection;
- management and maintenance of coastal structures;
- better monitored reclamation and shorefront development; and
- identification of alternative coastal resources using remote sensing and ground surveys.

SOPAC also conducted a coastal workshop in 1990[38] to train technical personnel in survey and analytical skills.

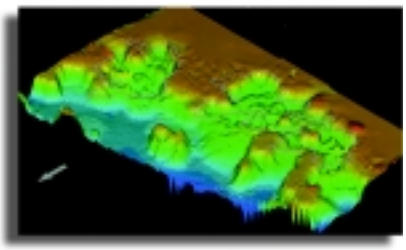
Given the critical importance of sustainable development in Fiji, SOPAC will continue playing an important role in coastal preservation and the development of sound policies to ensure better management of coastal resources.

STEPS INTO THE FUTURE: INFORMATION TECHNOLOGY & COMMUNICATION

For effective resource management and planning, the storage and processing of timely and accurate scientific data is critical. Island nations face the fundamental crisis of geographic isolation and high cost of communication between the various islands. Given the small size of these nations, technology providers are reluctant to supply cutting-edge technology because of poor economies of scale and difficulties in monitoring. Low human capital endowment further complicates the situation. While these problems are not as grim for Fiji as it is for other Pacific countries, they have remained a constraint in its pursuit of rapid growth.

SOPAC has been assisting Fiji to improve its management systems and train personnel in Information Technology[39], Geographical Information System (GIS) and Remote Sensing. As part of a partnership with the Remote Sensing Unit of the Forestry Department, SOPAC has delivered several systems to manage their resources. The other projects undertaken have focussed on upgrading of information systems and assisting in the development of Internet in Fiji in various regional and local organisations.

A computing unit for GIS and remote sensing work was provided by SOPAC to Fiji in 1993



3-D digital elevation model of a resource area for offshore carbonate sand mining

[34]SOPAC Technical Report 60
[35]SOPAC Technical Report 146
[36]SOPAC Miscellaneous Report 102
[37]SOPAC Technical Report 250
[38]SOPAC Technical Report 148
[39]SOPAC Miscellaneous Report 164

through funding under Lome III. Technical assistance, hardware and support continue to form an integral part of SOPAC's workplan for Fiji.

As a regional data centre, SOPAC has been compiling geographical data on Fiji.

In future, the focus will be on:

- development of appropriate, economic and scalable technologies;
- increasing the number of IT professionals in the local population;
- improving Internet access; and
- further development of GIS and Remote Sensing techniques.

Future directions in Fiji

In future, SOPAC will continue its partnership with Fiji, to overcome the hurdles in the path of sustainable development. SOPAC will use its key 'ownership advantage' - the expertise in applied sciences - to help Fiji manage and develop its non-living resources sustainably.

SOPAC will further its partnership with Fiji in developing onshore and offshore resources for minerals and hydrocarbons. Policy formulation will be one of the key areas that SOPAC will develop as one of its core professional activities. Development of appropriate legislations to manage coastal erosion and regulate aggregate mining will be a priority in the near future.

Sustainable development, conservation and management will be the guiding principles in the water and energy sectors. Policy development will be an activity in both these areas as well. Groundwater legislation is also part of the future work SOPAC will be performing in Fiji for the water sector.

Training programmes, workshops and seminars will be organised regularly to assist Fiji in creating a national capacity in the applied sciences. SOPAC will continue its work to reduce Fiji's vulnerability to natural disasters and improve preparedness.

Island systems management will be a future area of focus, given its ability to improve database management and decision-making processes. SOPAC intends to support the development of information technology and communication infrastructure in Fiji to achieve this.

By performing its functions as the specialised scientific organisation that it is, SOPAC has been addressing some of the fundamental factors that have impeded the development process.

Reference Materials

SOPAC provides access to a variety of information relating to Fiji. This can be accessed through our library database, PIMRIS or the Internet.

Some of these reference materials relevant to the Fiji Islands are:

- Maps of Fiji (coastal, aerial, bathymetric)
- Project Reports (Technical, Cruise, Preliminary Reports, etc.)
- Education/Awareness Pamphlets
- Videos (eg. SOPAC/Japan deep-sea mineral exploration)
- Deep-sea mineral database
- Geological samples
- General reference material on Fiji (eg. Development Plans)

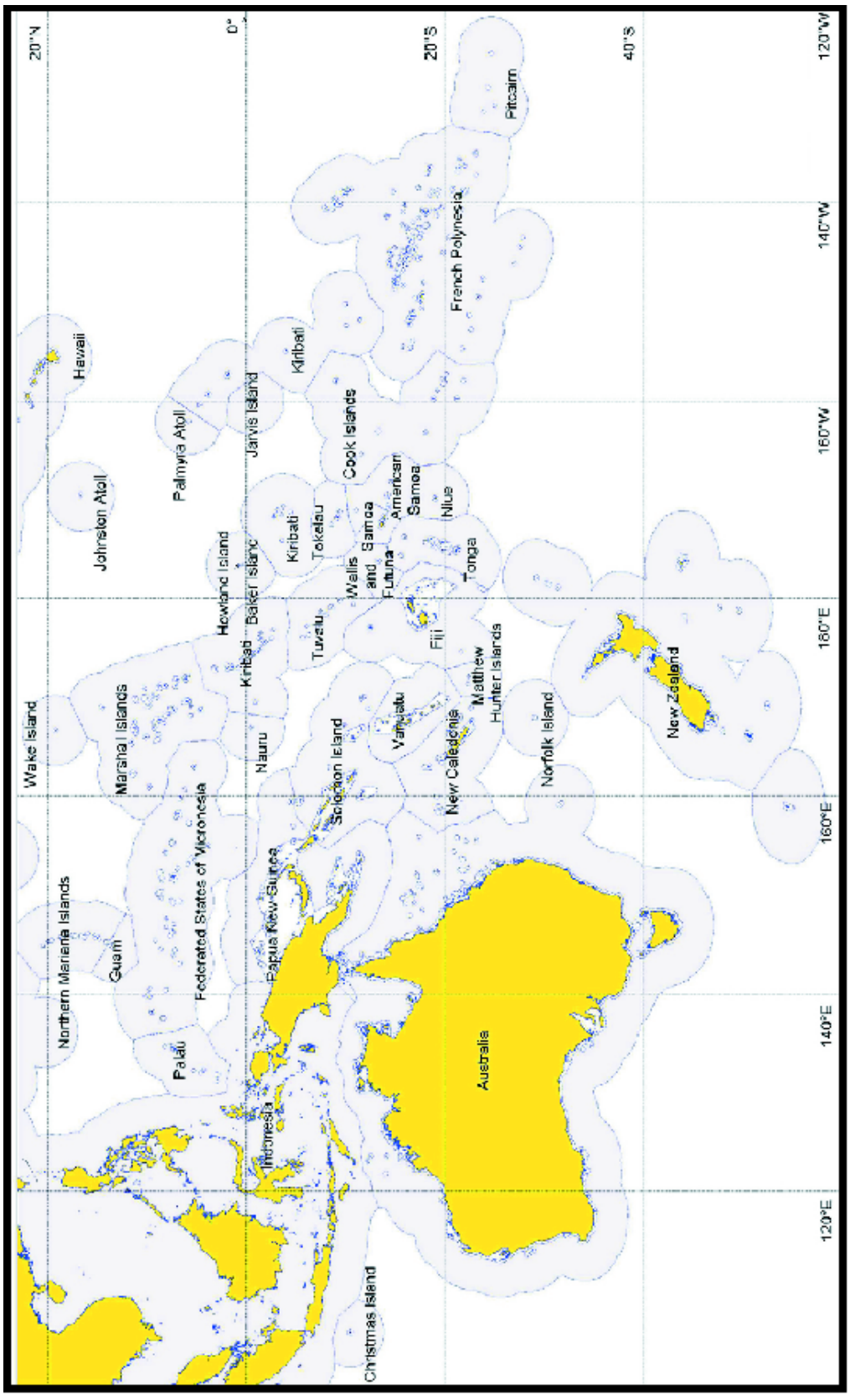
Please refer to the Fiji Bibliography for SOPAC's full reference and material listing.

For more information please contact:
The Librarian
South Pacific Applied Geoscience Commission
Private Mail Bag, GPO
Suva, Fiji Islands

Phone : (679) 381377, Fax : (679) 370040
Email : postmaster@sopac.org.fj
Website : www.sopac.org.fj

Issues and SOPAC's Responses for Further Development

ISSUES	CONSTRAINTS	RESPONSES FOR FURTHER DEVELOPMENT
Water & Sanitation	· Water wastage through poor demand and conservation practices · Strain on water supply as a result of population growth · Need for better waste management systems and strategies · Insufficient sewerage systems in rural and outer island areas	· Development of resource policy and legislation · Increasing public awareness on sustainable water management, safe sanitation and waste disposal practices at all levels · Improvement of infrastructure within the water and sanitation sector
Coastal Management	· Inappropriate coastal development and protection works · Indiscriminate reclamation · Increasing coastal pollution · High population densities putting increasing strain on coastal areas	· Implementation of appropriate policies and legislation · Educating the public about coastal degradation and management through workshops and field surveys · Dialogue with the government and private sector on coastal development and managment
Minerals	· Inadequate scientific research to define full potential of resources · High risks and costs associated with acquisition of data · Increasing environmental pollution due to terrestrial mining works · Deterioration of land quality due to mining	· Development of resource policy and legislation for management and development of offshore mineral exploration in Fiji · Assessing the potential of cobalt-rich manganese crusts in Fiji's EEZ · Encourage further research
Energy	· High demand for energy due to increasing population and industries · Lack of public awareness on the management of energy resources	· Development of energy supply and demand side management programmes · Conducting educational programmes on efficient use of energy · Development of energy policies and legislation
Hazards & Disasters	· Prone to earthquakes, cyclones, tsunamis, storm surge, landslides, climate change, ENSO impacts and droughts · Lack of community awareness regarding the effects of natural hazard impacts	· Natural Hazard Impact Assessment of historic and future disaster events impacting Fiji · Conduct training workshops and disaster management and response for disaster managers and the wider community · Raise awareness of hazards and assist with preparedness and mitigation actions of vulnerable communities
Information Technology & Communication	· Limited availability and poor access to information · Lack of regional and local data · Lack of skilled personnel in IT sector · High cost	· Development of appropriate, economic and scalable technologies · Conducting training to build human resource capacity in information technology and GIS/RS · Improvement of Internet access in Fiji · Coordination, compilation and creation of standardised geographic data sets
Human Resource Development	· Weak human resource base · Limited financial and institutional resources · Limited expertise	· Conducting workshops and technical training programmes to improve national capacity in the geosciences · Running the Earth Science and Marine Geology course to improve the human resource base · Fellowship attachments



South Pacific Region Maritime Limits

SOPAC Member Countries: Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, Guam, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Kingdom of Tonga, Tuvalu, and Vanuatu. French Polynesia and New Caledonia are Associate Members.