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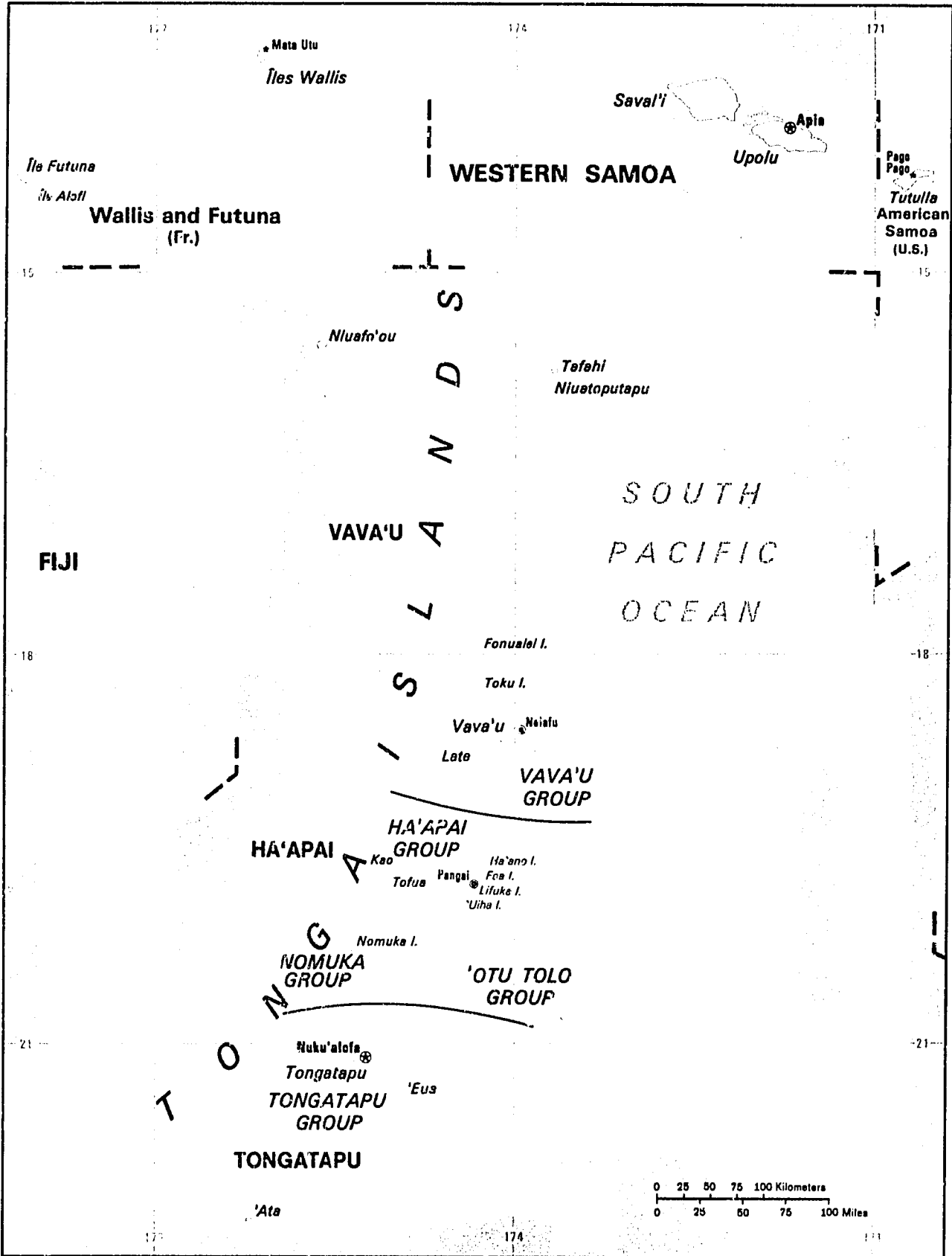
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Tonga

A Country Profile

Office of Foreign Disaster Assistance
Agency for International Development
Washington, D.C. 20523

Tonga



503885 6-78 (543822)
 Mercator Projection
 Scale 1:5,000,000

- ⊕ National capital
- Territorial capital
- District capital
- District boundary

TONGA: A COUNTRY PROFILE

prepared for

The Office of U.S. Foreign Disaster Assistance
Agency for International Development
Department of State
Washington, D.C. 20523

by

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Evaluation Technologies, Inc.
Arlington, Virginia
under contract AID/SOD/PDC-C-3345

The country profile of Tonga is part of a series designed to provide baseline country data in support of the planning and relief operations of the Office of U.S. Foreign Disaster Assistance (OFDA). Content, scope, and sources have evolved over the course of the last several years and the relatively narrow focus is intentional.

We hope that the information provided will also be useful to others in the disaster assistance and development communities. Every effort is made to obtain current, reliable data; unfortunately it is not possible to issue updates as fast as changes would warrant.

We invite your comments and corrections. Address these and other queries to OFDA, A.I.D., as given above.

October 1986

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1. General Information1.1 Geographic Codes

AID Standard	882*
State Region	TN
FIPS	EA

* under Fiji

1.2 Host Mission to the U.S.

The only Tongan diplomatic mission abroad is headed by the High Commissioner in the United Kingdom, who is accredited to other European countries and to the U.S.A.

Tonga High Commission
12th Floor, New Zealand House
Haymarket
London SW1Y4TE

1.3 U.S. Mission in Tonga

The U.S. has no consular or diplomatic offices in Tonga. The resident Ambassador in Suva, Fiji is accredited to Tonga as well as Fiji, Tuvalu, and Kiribati.

Embassy of the United States
31 Loftus Street
P.O. Box 218
Suva, Fiji
Tel.: 314466, 314069, 311399, 311989

The USAID Mission at the same address can be reached at 9-011-679-311389

(Direct dial service is available from the U.S. to Fiji)

1.4 Time Zones

EST + 17
GMT + 12

1.5 Currency

Pa'anga (\$T) 1.57 = U.S. \$1.00 (October 1986)

All figures in this profile are in U.S. dollars.

1.6 Travel and Visa Requirements

Passport and Visa: A valid passport and an onward airline ticket are required of U.S. citizens. Visas are required for visits longer than 30 days and may be obtained in Tonga or at the U.K. consulate.

Health Requirements: Yellow fever vaccination certificate required of travelers over one year of age arriving from infected areas.

1.7 Holidays and Calendar

New Year's Day.....	January 1
Good Friday.....	Variable
Easter.....	Variable
ANZAC Day.....	April 25
Crown Prince's Birthday.....	May 4
Emancipation Day.....	June 4
King's Birthday.....	July 4
Constitution Day.....	November 4
King Tupou Day.....	December 4
Christmas.....	December 25
Boxing Day.....	December 26

1.8 Treaties and Agreements

With U.S.:

- Commerce
- Consuls
- Extradition
- Peace Corps
- Trademarks
- Visas

With U.K.: The Tongan Prime Minister stated at independence that treaties between Tonga and the U.K. are binding until legally terminated.

1.9 Memberships in International Organizations

ADB, Commonwealth, ESCAP, EEC, FAO, GATT, IBRD, IDA, IFC, IMF, International Fund for Agricultural Development, International Telecommunication Union, SPEC, South Pacific Commission, South Pacific Forum, UNESCO, Universal Postal Union, University of the South Pacific, WHO

1.10 Ethnic Groups and Culture

Tongans, a Polynesian group with a very small mixture of Melanesian, represent more than 98% of the inhabitants of the Tongan islands. The remaining two percent are European, part-European, other Pacific Islanders, and Chinese. (Caucasians are commonly referred to as "Europeans.") Approximately 40,000 Tongans resided overseas in mid-1984.

The indigenous population shares a cultural heritage that has the extended family as the basis for social organization. Social ranking is based on complex kinship relationships. Males defer to their sisters on important social occasions and in many families, the eldest sister still presides at family functions. However, males dominate political and economic affairs and sons receive favors from their maternal uncles that are valuable in their quest for status.

Tongan society is highly stratified. At the top are the royal family and nobility, in the middle a group of matapule (who traditionally were titled servants to the nobility), and at the bottom the commoners. There are six titled matapule lines that own hereditary estates. The commoners, who under the Constitution are entitled to allotments of land, are free of the servitude to the nobles practiced in ancient Tonga but they retain their identification with individual nobles and matapule. However, obligations and responsibilities are reciprocal, and although the nobility are able to extract favors from people who live on their estates, they must likewise extend favors to their people.

1.11 Language

Tongan, a Polynesian language, is the official language and English is the principal second language. English is the common language among the ethnic groups. Some 90 to 95% of all adults can read and write in Tongan and most secondary school students speak English.

1.12 Religion

Virtually the entire Tongan population has been Christian since the conversion of King Tupou I in the mid-1800s. The Free Wesleyan Church, headed by the King, is supported by 30% of the population. The remainder of the Christian population is divided between the fast-growing Seventh Day Adventist, Assembly of God, and Mormon churches. The Constitution declares it unlawful to work, play, or trade on Sunday.

1.13 History and Government

Early History:

Archaeological evidence suggests that the first people settled Tonga some 3,000 years ago, possibly arriving from Samoa or Fiji. The early settlers were members of the Lapita culture, characterized by its beautifully crafted pottery. The first Europeans to sight the Tongan archipelago were Dutch navigators in 1616. Continual contact with Europeans, however, did not begin until more than 125 years later.

According to Tongan legend the first king, called the Tu'i Tonga, descended from a Polynesian god of the sun or sky. Later, during the 14th century, the King of Tonga delegated much of his temporal power to a brother. This process was repeated by the second royal line, thus resulting in three distinct lines. Rivalries between the lines resulted in a civil war that lasted from 1799 to 1852. The war undermined the efforts of the first Christian missionaries sent from

the London Missionary Society in 1797. Later, Wesleyan missionaries had more success and managed to convert Taufa'ahua, a leader and soldier who was later christened "King George." He eventually made himself undisputed King of all Tonga and became known as King George Tupou I. The King's principal advisor, Wesleyan missionary Shirley Baker, drafted the Tongan Constitution. However, in 1880 he resigned from the ministry and became virtual dictator of the country, ruling in the King's name. In 1890 he was deported at the request of the British High Commissioner resident in Fiji. In 1893 the King died and was succeeded by his grandson.

Complaints from Tongans and foreign residents alike about the incompetence of King George Tupou II prompted the British to declare a protectorate over the Kingdom in 1901. Under this agreement, the United Kingdom agreed to handle Tonga's foreign affairs and protect it from external attack. A new treaty of friendship and protection with the U.K. was signed in 1958 providing for a British Commissioner and consul.

Modern Tonga:

Queen Salote III ruled from 1918 to 1965. Her son, King Taufa'ahua Tupou IV, is the present King. He was prime minister during much of his mother's reign and ascended the throne after her death. In 1970 he achieved his goal to end the British protectorate.

Since the early 1970s Tonga has endured a period of rapid social and economic change but it has managed to maintain its social and political stability. King Tupou IV's reign has been punctuated by the emergence of several social and development problems. These include unemployment, landlessness, external and internal migration, the breakdown of the extended family, and some disaffection by young people for the nobility. Rapidly increasing population has pressured people to move to Tongatapu in search of better opportunities for education, health services, and employment. Landlessness

and unemployment have resulted, creating social as well as economic stresses. The monarchy and nobility have retained much of the land, further skewing its distribution. Many Tongans in recent years have emigrated overseas in search of brighter opportunities. However, they remain extremely loyal to their families and send a high volume of remittances back to the country. In 1982/83 foreign remittances accounted for 14 percent of GDP.

Tonga is a constitutional monarchy with no political parties. The executive branch includes the Prime Minister and the Cabinet. The unicameral Legislative Assembly consists of seven nobles who are elected by the 33 hereditary nobles of Tonga, and seven people's representatives elected by the public for three-year terms. Additionally, seven Cabinet ministers appointed by the monarch hold office until they reach retirement age. The governors of Ha'apai and Vava'u are appointed to their posts and serve as ex officio members of the Cabinet.

1.14 Economy

General Situation:

Tonga's economy today is characterized by a large non-monetary sector and a heavy dependence on plantation and subsistence agriculture. Coconuts, vanilla beans, and bananas are the major cash crops. The tourist industry remains relatively undeveloped but the government is making efforts to increase this source of revenue.

Like most other developing countries, Tonga has faced major challenges since 1979 in adjusting to a difficult international economic environment. Nevertheless, Tonga's economy in the early 1980s has shown growth that is remarkable in a period of world recession. According to government estimates, real GDP between 1980/81 and 1983/84 grew by 9.8% on annual average as compared to a growth rate of 5% a year from

1975/76 to 1979/80. However, much of the growth is attributable to the non-monetary economy which accounted for at least 35% of GDP in 1982/83. Higher levels of remittances from Tongans abroad and foreign aid inflows, including development and Cyclone Isaac-related assistance, contributed to this trend.

Tonga's GDP at current market prices in 1982/83 totaled \$74.8 million, of which agriculture, forestry, and fishing represented 41.5%, trade and catering 14.8%, transport and communications 5.7%, manufacturing 5.0%, construction 3.9%, and the remaining sectors 29.1%.

Balance of Payments:

In 1982/83, the balance of payments deficit was \$39.5 million. The overall balance showed a surplus until 1981/82 but reversed to a deficit in 1982/83 with the slowdown in non-monetary capital borrowings, including public and private loans. No overall balance of payments data have been finalized for 1983/84 but they are expected to show an improvement in the overall balance resulting from a higher increase in exports and external assistance.

Exports:

Between 1980/81 and 1982/83 export earnings fell to \$5.5 million a year but this deteriorating trend reversed to almost \$6.4 million in 1983/84 mainly because of sharp increases in the world market price for coconut oil, a major export. The sluggish performance of exports during the period can be attributed partially to the depletion caused by Cyclone Isaac of some agricultural stocks and the subsequent drought later in the year. The composition of Tonga's exports has changed somewhat in the recent past. Coconut oil has retained its predominance while exports of vanilla beans and watermelons have grown substantially as a share of total exports. Other exports include dessicated coconut and bananas.

Tonga's banana plantations have been ravaged by disease and weather; exports are now much smaller than they were 20 years ago. The main destinations of Tonga's exports are New Zealand and Australia.

Imports:

Imports in 1983/84 amounted to \$41 million, more than six times that of total export earnings. They are primarily composed of manufactured goods, food, and fuels and are supplied mainly by New Zealand and Australia.

External Debt:

As a result of a large increase in commercial loans, Tonga's external debt has quadrupled over the past four years to reach \$25 million by the end of 1984. The ratio of debt service payments to exports of goods and services rose from 3% in 1979 to 6% in 1982, before declining to 5% in 1984 due to higher export earnings.

1.15 Population

A November 1984 mini-census estimated the population of Tonga at 96,592; however, there is thought to be some underenumeration. Of the total population, 69% live in urban areas (Nuku'alofa) and 31% in rural areas. Despite the concentration of people in Nuku'alofa, the majority of the population depend on subsistence agriculture and fishing. At the end of 1984 approximately 85% of all households were engaged in some form of farming activity and an estimated 60% of all household heads were mainly farmers. The following table shows the population by region in 1984.

Table 1

Area and Population of Tonga, 1984

<u>Districts</u>	<u>Capitals..</u>	<u>Area</u> Sq Km	<u>Population</u> 1984 Census
'Eua	Ohonua	87.4	4,017
'Eua Fo'ou		---	1,812
'Eua Proper		---	2,205
Ha'apai	Pangai	109.3	8,561
Foa		---	1,299
Ha'ano		---	881
Lulunga		---	1,461
Muomua		---	895
Pangai		---	2,665
Uiha		---	1,360
Niuas	Hihifo	71.7	2,517
Niuafu'ou		---	830
Nuatoputapu		---	1,687
Tongatapu	Nuku'alofa	258.6	66,420
Kolofo'ou		---	15,846
Kolomotua		---	13,371
Kolovai		---	4,356
Lapaha		---	7,668
Nukunuku		---	6,159
Tatakamotonga		---	7,280
Vaini		---	11,740
Vava'u	Neiafu	119.2	15,077
Hahake		---	2,314
Hihifo		---	2,035
Leimatua		---	2,760
Motu		---	1,359
Neiafu		---	5,501
Pangaimotu		---	1,108
Total Land Area		717.7	
Total		747.3	96,592

Source: Britannica, Book of the Year, 1986.1.16 Health

Vital Statistics:	Births/1,000 population.....	28
	Deaths/1,000 population.....	4
	Infant mortality/1,000 live births.....	15
	Life expectancy at birth, years.....	64

Health expenditures in Tonga during 1984 amounted to \$1.8 million providing a net per capita health expenditure of \$18. In 1984, the doctor to population ratio was 1:1,822; and the nurse to population ratio was 1:460. The number of people covered by Tonga's health services in 1984 was close to 100%.

The delivery of health services in Tonga is the responsibility of the Ministry of Health. Hospital fees are nominal and highly subsidized. Admission to general wards is approximately 20¢ per day. Children under 12 years of age and those with communicable diseases or psychiatric illnesses are admitted free. The majority of nurses are trained locally at the Queen Salote School of Nursing. The school enrolls from 20 to 30 new students each year for the three year course. Doctors are trained overseas in Fiji, Australia, New Zealand, and Papua New Guinea.

1.17 Education

About 92% of children of primary school age attend government schools; the remainder are enrolled in church schools. Primary education from age six to 14 is compulsory and free of charge. The three government-run secondary schools provide education to only 11% of the student body. The remaining secondary school students attend one of the 44 church-related schools. Government assistance to private schools is under consideration. Other learning institutions include government-run training schools for teachers, police officers, and public works officers; a private business school; and an extension center of the University of the South Pacific.

1.18 Communications

Radio:

The Tonga Broadcasting Commission (TBC) provides broadcasting services through two 10 kW AM transmitters. Nearly 60% of

households have radios, amounting to approximately 9,000 listeners. The TBC's transmissions can be heard in Fiji, Samoa, Niue, Kiribati, and New Zealand.

Television:

ASTL-TV3 is the local broadcast TV station. It has been operating since 1984 and may soon be joined by a second channel operated by an American religious group. ASTL-TV3 presently has 300 subscribers and broadcasts a variety of popular American television shows that have been prerecorded.

Telephones:

Tonga had 2,046 telephones in 1980, or 45 per 1,000 people.

Press:

The Tongan Chronicle is printed in English and the circulation is 900. Its Tongan language counterpart, Ko e Kaloni-kali Tonga has 3,700 subscribers. The newspapers sometimes take five days to reach the outer islands. It is estimated that about 30,000 people read newspapers.

See also Section 3.7, Communications.

1.19 Transportation

Roads:

The Ministry of Works is responsible for the road network and its maintenance. In 1984, Tonga had 300 km of formed roads including 190 km on Tongatapu, 74 km on Vava'u, and 16 km on 'Eua. Of these roads, 155 km are classed as main roads that have either bitumen (52 km) or coral (103 km) surfaces. In recent years, priority has been given to sealed rather than coral roads.

Air:

Fu'amotu International Airport on Tongatapu is Tonga's major airport. Scheduled international flights are available to Fiji, Western Samoa, American Samoa, New Zealand, and New Caledonia. In addition, small planes fly between Tongatapu and airfields of the other Tongan islands.

Ports:

Tonga's ports of entry are at Nuku'alofa, Pangai, Neiafu, and Niuatoputapu.

(For more information on transportation, see Sections 3.8, 3.9, and 3.10.)

2. Disaster Vulnerability

2.1 Physical Environment

The Kingdom of Tonga comprises about 169 islands with a land area of 668 square km. They are scattered over an ocean area of 363,000 square km between 15°S and 23.5°S and 173°W and 177°W. Tongatapu accounts for about one-half of the total land area and contains most of the population. It extends about 34 km in its longest east to west axis and 15 km north to south.

The islands of Tonga are mainly in three groups: Tongatapu in the south, Ha'apai in the center, and Vava'u in the north. Further to the northeast and northwest of Vava'u are the Niuaus, namely Niuatoputapu and Niuafu'ou. The islands of the Kingdom are either of volcanic or coral material. Some of Tonga's volcanic islands are characterized by upstanding relief with a few low coastal areas and mainly cliffed coastlines. Most of the volcanic islands with these characteristics lie to the north and west. Another type of volcanic island found in Tonga has raised land, primarily of volcanic tuff or breccia with incorporated coral rocks. This type of island is based on submarine plateaux less than 90 meters below sea level. A number of the islands in the Ha'apai and 'Eua groups have these characteristics.

Many of the islands of the Tongatapu and Vava'u groups, the northern islands in the Ha'apai group and Nomuka are classified as coral islands. Comparatively flat with substantial coastal margins below five meters, these islands are often encircled by barrier or fringing reefs. Some of the coasts are cliffed but elsewhere, such as the north coast of Tongatapu, areas of the low lying coasts are at risk from raised sea levels.

Permanent streams are found only on 'Eua. In many areas there is no fresh surface water. Fresh water lenses are often too thin to support wells and in such circumstances rainwater must be collected from the roofs of buildings and stored in cisterns. (See Section 3.5, Water Supply.)

Climate

During the dry season from May to November, the Tongan climate is cooler than that of most tropical locations; highs rarely exceed 80°F and humidity is relatively low. The rainy season, from December to April, has temperatures up to 90°F and high humidity. Mean daily temperatures range from 74°F on Tongatapu to 80°F on Niuatoputapu, which is five degrees closer to the equator. Rainfall averages about 2,600 millimeters per year in the north and 1,700 millimeters in the south; more than one-half of the rain falls during the wet season.

2.2 Cyclones

The most frequent and widespread destruction in Tonga is caused by tropical cyclones. In their study, J. Oliver and G.F. Reardon cite a total of 108 tropical cyclones or storms that were recorded in Tonga between 1830 and 1982. Cyclones feature heavy rains, dangerous seas and coastal conditions, and very steep pressure gradients. The incidence of cyclones is two per year but this figure disguises variations from season to season. In fact, Oliver and Reardon's data show that during the 152 year period, 79 seasons passed with no cyclonic activity. However, three cyclonic events are known to have occurred in a single season on several occasions, but not all of these storms were severe.

Most cyclones in the Tonga area occur from December through April as indicated in Figure 1. The recognized season extends from October to May, taking account of the possibility of early and late events. As shown in Figure 2, cyclones affecting Tonga tend to form in the seas northwest or northeast of the group and travel to the east, southeast or south.

The most destructive aspect of cyclones are the accompanying high winds that cause severe damage to trees, crops, buildings, and other structures. The small flat islands of Tonga offer little protection to each other from such winds. Each island receives the full impact depending upon its distance from the storm's center. Moreover, Tongan villages are mainly located around the perimeters of islands and houses tend to be arranged in a long and narrow pattern. Thus if the winds approach from the sea, the houses have virtually no protection. Vegetation may offer some degree of protection if the winds approach from another direction. However, the natural vegetation of most of the islands has been replaced by coconut plantations or crops. Forests of limited commercial value cover around 15 percent of the land.

The customary pattern of food production in Tonga often becomes disrupted following a cyclone. This can have severe implications for the economy, since it is based on the export of agricultural products. Severe wind damage, especially to wind-sensitive plants such as bananas, pawpaws, and breadfruit, can cause supply problems which persist for several months. Coconut palms may take as long as two years to recover. In the case of root crops, which are often intercropped under coconut palms, wind damage can severely affect the foliage. Tubers can easily rot in the wet ground; six months must then pass before a new crop can be planted and ready for harvest. Local sources of planting material may be difficult to locate and cannot be imported due to quarantines.

TONGA: INCIDENCE OF CYCLONES BY MONTH

1830/31 to 1981/82

NUMBER OF CYCLONES OR TROPICAL STORMS

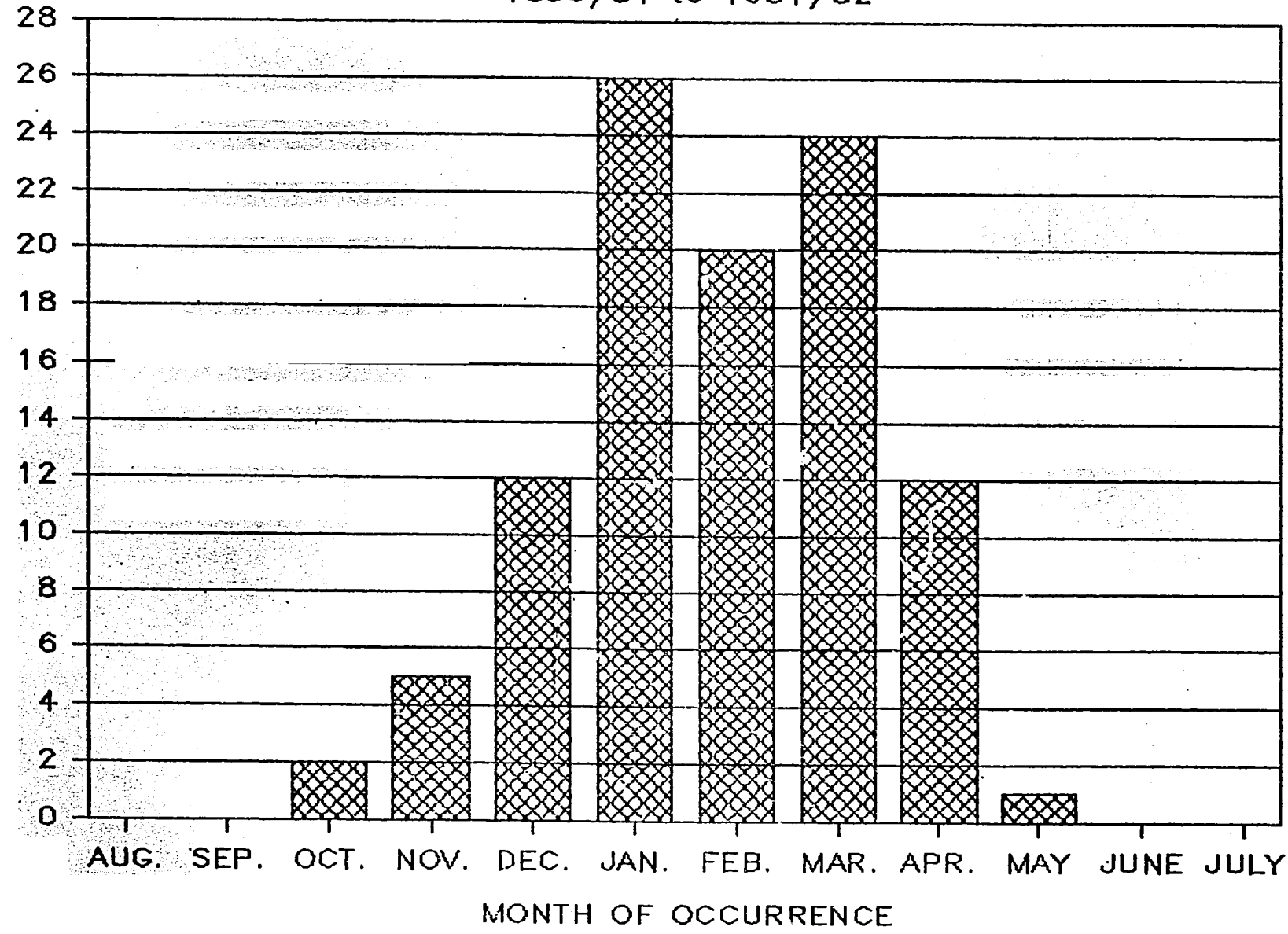
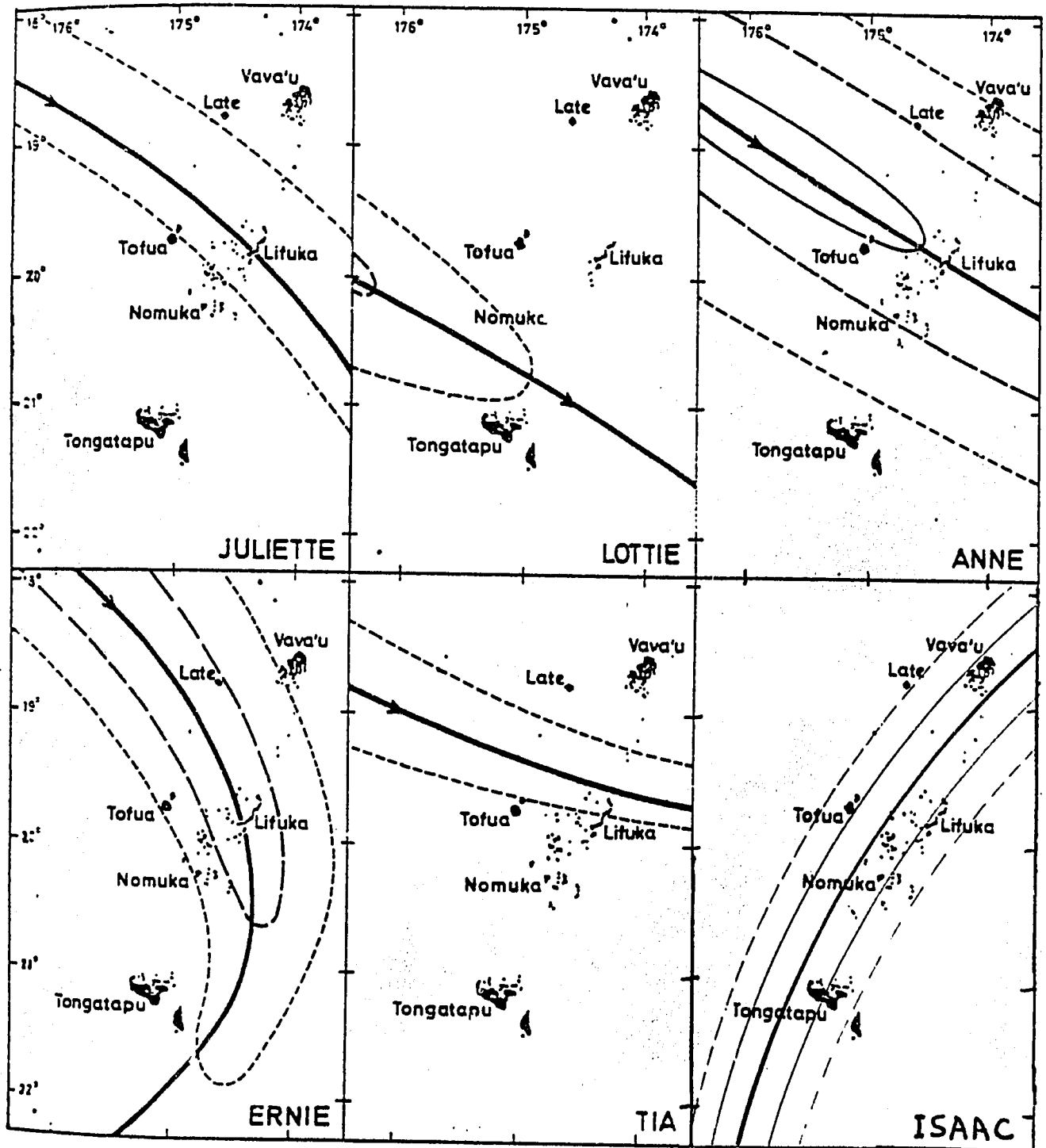


Figure 1

5T

Source: Tropical Cyclone 'Isaac', Disaster Investigation Report No. 5, James Cook University of North Queensland; OFDA Disaster History.

Figure 2: The main tropical cyclones affecting the Tongan region 1973-1982.
 (Courtesy of the Fiji Meteorological Service).



Source: Tropical Cyclone 'Isaac', Disaster Investigation Report No. 5, James Cook University of North Queensland.

Fishing is also an important part of the domestic economy and may also be adversely affected by cyclones. Rough seas and high winds may damage boats and motors along with fish traps on the reefs. Villages are unlikely to have the finances to replace fishing resources.

Private homes in Tonga have in the past suffered considerable damage from high winds, particularly to roofing, and water damage from rain and storm surges. The devastation is compounded by poor construction and lack of attention to hurricane-resistant techniques. (See also Section 3.12, Housing.) More importantly, tropical cyclones are life threatening. In the wake of Isaac, six persons were left dead and 150 injuries were reported. Flying debris, collapsed buildings, and rising flood waters pose the greatest hazards in a cyclone.

2.3 Storm Surges

A storm surge is a temporary rise in the level of the sea that is not caused by tides. As Ram Krishna (Fiji's Director of Meteorology) explains in Tropical Cyclones, two main factors contribute to storm surges. First, very low pressure at the center of a cyclone causes the water level near the center to rise. The other factor is the accumulation in coastal areas of water dragged in by high winds circulating around the cyclone's center. Especially at high tide, the effects of storm surge can be as destructive as hurricane-force winds. Villages are washed away, coastal installations and vessels are destroyed, shorelines are eroded, and water supplies and soil become contaminated.

The reefs surrounding the islands offer some protection against a surge and reduce the wave length and energy on the beaches themselves. A few areas of Tonga are sufficiently close to the high water mark to be seriously at risk from a surge of the height that can be expected. Sopu, located west of Nuku'alofa, is in a particularly unfavorable location. It is settled by people who have migrated to Nuku'alofa from other islands and because of land pressures have settled outside the city. This area suffered the worst surge damage from Cyclone Isaac. Other coastal areas of Tongatapu affected by the surge were to the west (Kolovai) and to the east (east of Manuka). Low lying coastal portions of Nuku'alofa were also inundated. Ha'apai and Vava'u did not suffer significant surge damage from Isaac.

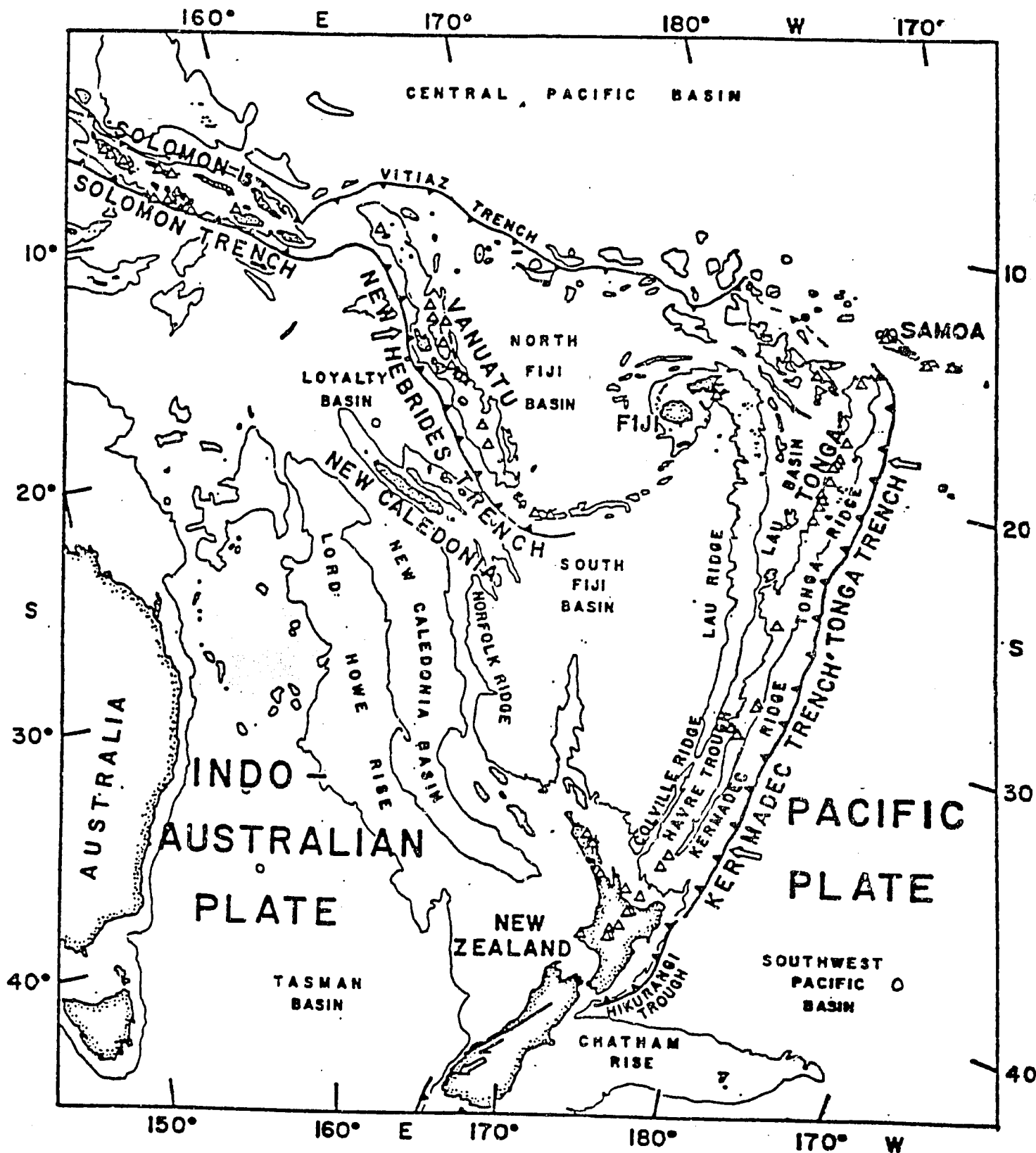


Figure 3. Regional setting of the Fiji-Tonga-Vanuatu region. Open arrows indicate direction of relative plate convergence. Contour line shows 2-km isobath. Holocene volcanoes are indicated by open triangles.

Source: Cornell University. Evaluation of Seismic Risk in the Tonga - Fiji - Vanuatu Region; Quarterly Progress Report to OFDA.

2.4 Earthquakes and Tsunamis

Approximately 70 percent of the world's deep earthquakes occur in the Southwest Pacific region but they seldom cause damage on land surfaces. A large number of shallow earthquakes also take place in the region. Many of these events occur in the Tonga-Kermadec trench, along the convergent boundaries of the Pacific and Australian plates. As indicated in Figure 3, Tonga is situated in this area of considerable seismic activity, underscoring the risk of significant future earthquakes.

As Nuku'alofa develops, it becomes increasingly vulnerable to earthquake damage. The introduction of multistory buildings and the Queen Salote wharf combine with growing urban concentrations to raise the potential for human and economic losses brought about by a large earthquake. In 1977, areas of Nuku'alofa were damaged by an earthquake measuring 7.2 on the Richter scale. The Prime Minister's office and other government buildings were partly destroyed, roads suffered structural damage along with Vuna Wharf, Queen Salote Wharf, and 15 primary schools.

Shortly after this major earthquake, the Office of U.S. Foreign Disaster Assistance began funding a team of Cornell University seismic experts to undertake an evaluation of seismic risk in the Tonga-Fiji-Vanuatu region. The program was carried out over a period of eight years through cooperative work with in-country agencies including the Tongan Department of Lands, Surveys, and Natural Resources.

The program included detailed seismotectonic studies of the northern termination of the Tonga Trench known as the "Samoa Corner." This area has been the source of at least seven earthquakes since 1900 with magnitudes greater than seven and presents a major hazard to Tonga, Western Samoa, and American Samoa. The "Samoa Corner" is characterized by a complicated mixture of thrust-faulting, hinge-faulting, and strike-slip faulting within a relatively small area as well as a crowded nest of shallow earthquakes. On a global scale this zone presents a hazard of particular concern since it is the region's major source area for Pacific-wide tsunamis. Figure 4 shows the locations of past tsunamis in the Tonga-Fiji-Vanuatu region.

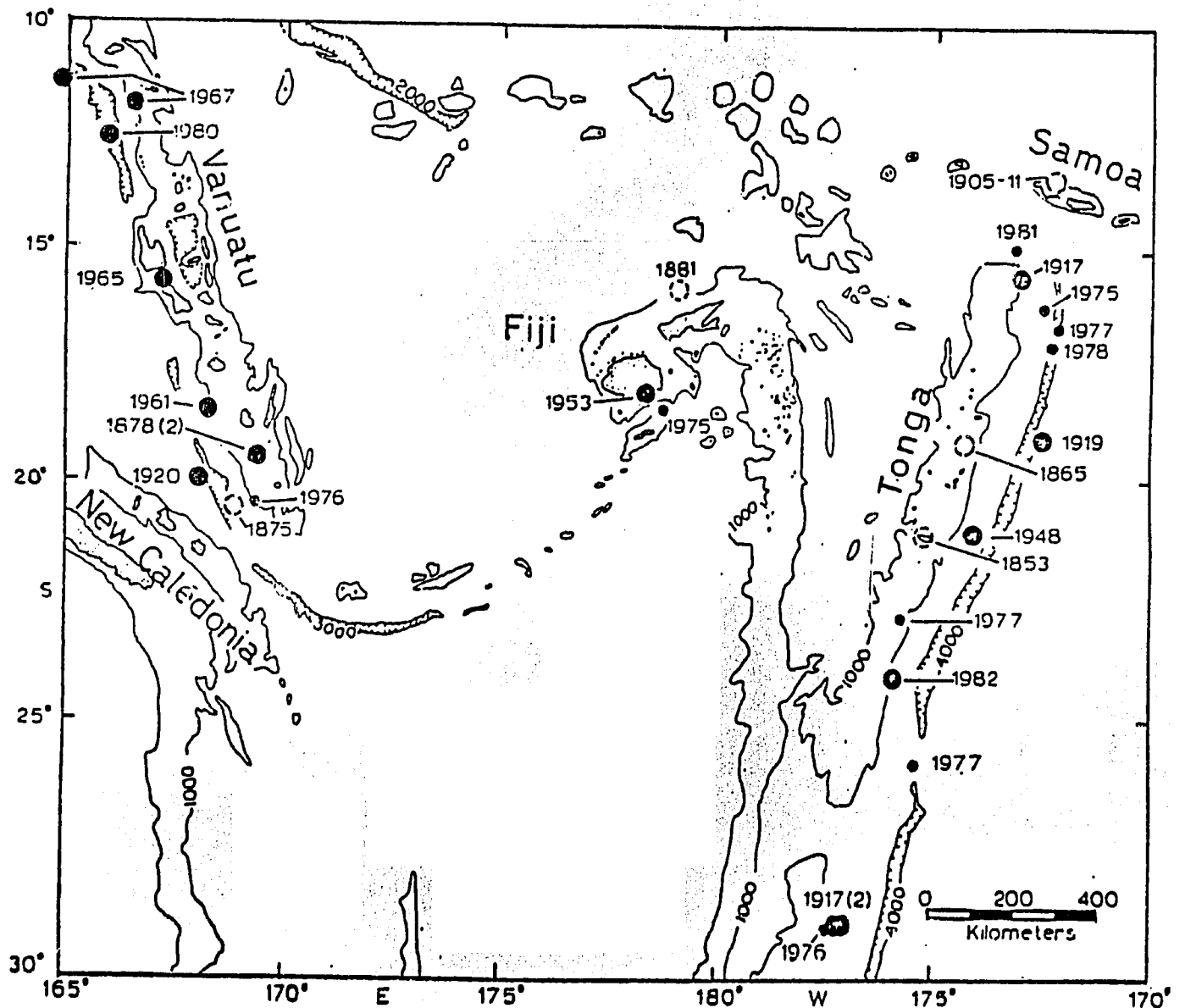


Figure 4 . Tsunamis in the Tonga-Fiji-Vanuatu region. Major tsunamis indicated by large circles, dashed where location uncertain. Minor, instrumentally recorded tsunamis shown by small circles. Date of occurrence is shown next to each event.

Source: Cornell University. Evaluation of Seismic Risk in the Tonga - Fiji - Vanuatu Region; Quarterly Progress Report to OFDA.

2.5 Volcanoes

Several of the islands in the northern part of Tonga contain active volcanoes including Late, Tofua, Falcon, Fonua Lei, and Niuafu'ou. Only Tofua and Niuafu'ou are now inhabited with populations of 120 and 660 respectively. An eruption occurred in 1930 on Niuafu'ou destroying a town and one-third of the cultivated land on the island. A second eruption in 1946 on the same island severely damaged crops and forced the evacuation of the 2,500 inhabitants. Eventually, 1,800 of these persons were moved to 'Eua. Tofua island last experienced an eruption in 1906. Other volcanic eruptions occurred on Late in 1854, Falcon in 1927, and Fonua Lei in 1847, 1939, and 1974. Figure 3 on page 18 identifies holocene volcanoes in the region.

2.6 Floods

Tropical cyclones are almost always accompanied by torrential rains that cause flooding. A tropical storm may also produce continuous high intensity rainfall, sometimes lasting for several days. The most recent case of serious flooding occurred as Cyclone Isaac passed over Tonga in March 1982, flooding low lying areas with a combination of high tides and tidal swells.

2.7 Drought

Prolonged severe drought can occur in Tonga. The Ha'apai group is considered the most vulnerable to drought conditions particularly because of water shortages. Water is a constant problem in Ha'apai and rainwater is often the only source (see Section 3.5, Water Supply). Devastation to export crops from drought may depress trade and adversely affect the economy. Notable periods of drought occurred in Tonga in 1926, 1930, 1951-1953, and 1977-78.

2.8 Disaster History

Tonga has a history of disasters that have caused significant damage; the great majority have been either tropical storms or cyclones. The following is a selected list of some of the most devastating disasters although a few of those included were of a lesser magnitude.

Table 2

Selected Major Disasters (since 1900)

<u>Type</u>	<u>Date</u>	<u>Location</u>	<u>No. Killed</u>	<u>No. Affected</u>
Cyclone	01/30/12	Entire country	n.a.	n.a.
Cyclone	02/09/30	Vava'u, Ha'apai	n.a.	n.a.
Cyclone	12/00/30	Niuas	n.a.	n.a.
Volcano	00/00/30	Niuafu'ou	n.a.	n.a.
Cyclone	02/18/41	Northern islands	n.a.	n.a.
Volcano	00/00/46	Niuafu'ou	0	2,500
Cyclone	03/16/61	Vava'u, Ha'apai	2	8,000
Cyclone	04/03/73	Ha'apai	3	700
Cyclone	12/10/73	Tongatapu	n.a.	n.a.
Earthquake	06/23/77	Tongatapu	1	5,000
Cyclone	12/27/77	Ha'apai	0	10,000
Cyclone	03/24/80	Ha'apai	n.a.	n.a.
Cyclone	03/03/82	Entire country	6	100,000
Cyclone	05/30/82	Tongatapu	0	n.a.
Cyclone	04/14/86	Ha'apai	0	n.a.

Source: Office of U.S. Foreign Disaster Assistance, Disaster History; and Tropical Cyclone "Isaac", Disaster Investigation Report, James Cook University of North Queensland.

3. Disaster Preparedness and Assistance

3.1 Host Country Disaster Organization

The earliest record of relief provided by the Tongan government was in 1909 when a cyclone struck Niuafu'ou. Since that time the response pattern has been characterized by a growing dependence on the government, even though it has only been since the early 1970s that the GOT began to take an active part in relief and rehabilitation, mostly in the form of food and housing. The government has relied increasingly on foreign aid to meet these responsibilities.

The Tongan people's ability to cope with disasters through traditional response patterns has waned. Safeguards such as inter-island trading networks, diversified cropping, food preservation, and community solidarity have virtually disappeared. Tongans can no longer rely on extensive family ties to move from one island to another, staying with relatives until their crops recover.

The present system of disaster response in Tonga has evolved over a period of years beginning in 1961 when organized relief was first introduced on a significant scale. A Hurricane Relief Committee was set up following Cyclone Juliette in April of 1973 and was reactivated following Cyclones Anne in December 1977 and Ernie in February 1978. A National Disaster Committee was set up in May 1979 which replaced the Hurricane Relief Committee. Its membership, chaired by the Prime Minister, included:

- Minister of Lands, Survey and Natural Resources
- Minister of Police
- Minister of Finance
- Minister of Health
- Minister of Labor, Commerce, and Industries
- Minister of Works and Education
- Governor of Vava'u
- Governor of Ha'apai
- Secretary of Government
- Director of Agriculture
- Director of Works
- Chief Planning Officer
- Assistant Secretary for Ministry of Works and Education (Secretary)

Following further discussions three subcommittees were formed:

- (1) Preparedness - responsible for public education, building regulations, preparedness.
- (2) Action Planning - responsible for formulation of disaster plans.
- (3) Relief - responsible for rehabilitation and relief.

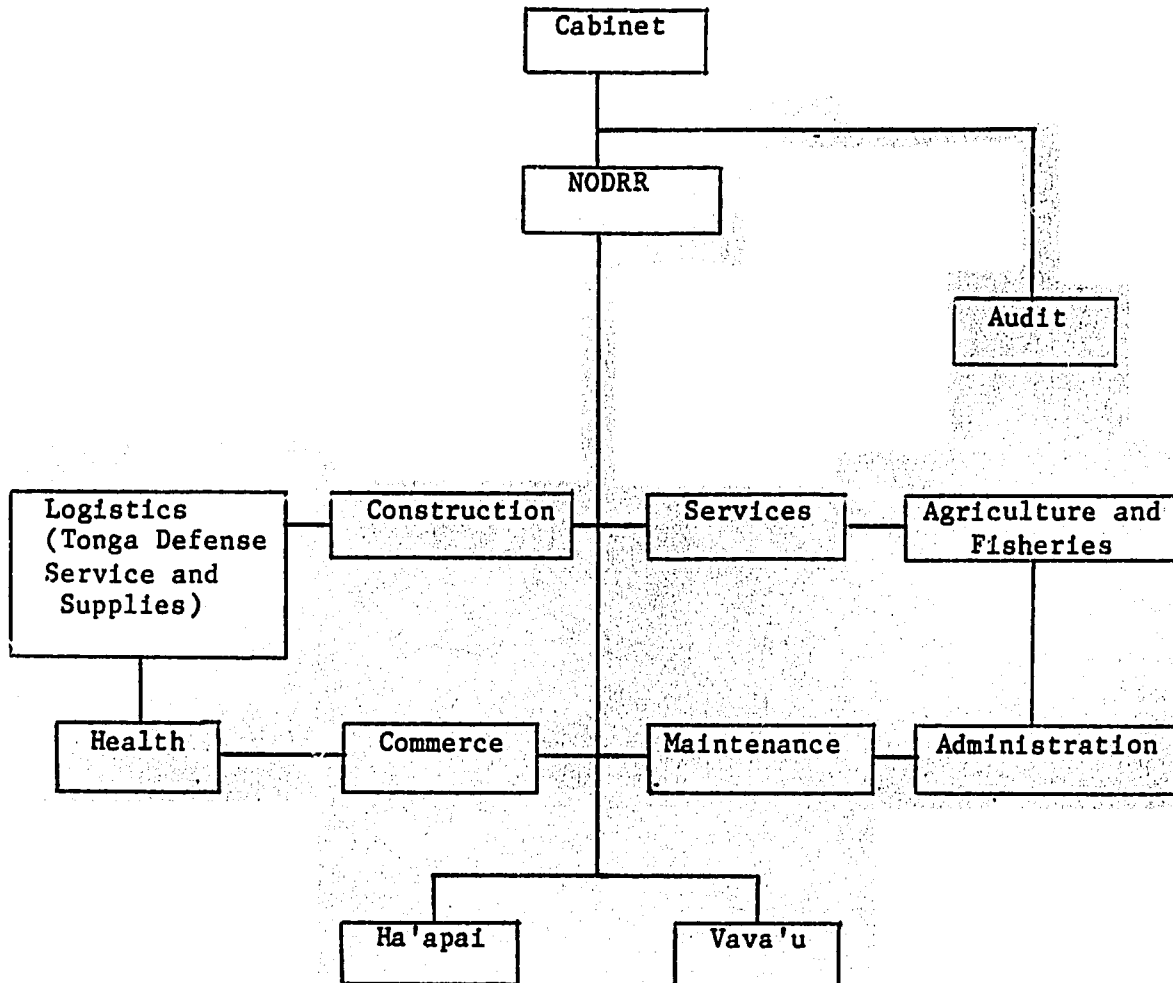
Soon after Cyclone Isaac struck in March 1982 it became apparent that the National Disaster Council needed to be streamlined. Cabinet itself became the National Council for Disaster Relief, Rehabilitation and Reconstruction and a unit called Central Operations replaced the Disaster Relief subcommittee. At the Central Operations Center, eight action desks were set up covering the areas of construction, transport, services, health, administration, maintenance, agriculture and fisheries, and commerce. Central Operations maintained direct contact with the Governors of Vava'u and Ha'apai.

Following the identification of longer term problems and needs resulting from Isaac, the GOT decided to retain the central operations structure in an advisory capacity. A smaller, more streamlined body was set up called the National Office for Disaster Relief and Reconstruction (NODRR). This office existed for two years and handled all programs stemming from Cyclone Isaac. Individuals were co-opted from other departments although no permanent staff were assigned.

At present, the NODRR exists only in theory, and when a cyclone is reported the Cabinet sets up the National Disaster Committee comprised of ministers, governors, and directors as described on page 23. The committee is chaired by Dr. Langi Hu'akavameiliku, Minister in charge of disasters, who is the primary actor whenever Tonga is struck by a disaster. The GOT would like a permanent, separate office for disaster response, headed by the Director of Works. It is planned that the Ministry of Works be moved to a new office, funded by Australian aid, that would include an operations center and permanent space for the NODRR. In February 1986, the GOT requested that the Australian Overseas Disaster Relief Organization (AODRO) send an expert to help set up the NODRR. An organization chart of the NODRR as it is presently conceived is shown in Figure 5 below.

Figure 5

Organization of the NODRR



The Tonga Defense Service (TDS) plays a major role in disasters. The 260-person force is comprised of a headquarters platoon and a light infantry company. TDS resources include a coastal naval unit of four small patrol boats and an amphibious landing craft normally used to patrol coastal waters and fishing zones. TDS's communications system provides a viable network in a disaster, particularly because it reaches remote islands. The TDS has a total of 25 radios (HF, VHF, and UHF) located on Tongatapu, Ha'apai, or Vavau as well as mobile substations. An impressive operations center is maintained at the main base in Nuku'alofa.

The Service's responsibilities during disasters include: field work, such as salvage and removal of downed power lines; receipt of items donated from overseas at wharves or airfields and transport to outer islands; and storage of donated goods. The role of the TDS in a disaster usually ends with the beginning of the reconstruction phase.

The TDS is partially supported by defense cooperation agreements with both Australia and New Zealand. Both countries support the TDS with small in-country detachments of military technicians. These existing commitments provide a well established rapport in times of disaster. The TDS training program presently includes wide ranging preparedness education. Trainees receive specific instruction in dealing with oil spills, earthquakes, floods, cyclones, and civil strife. The U.S. has recently instituted an annual aid program of military education and training.

The role of the Tongan police in a disaster is to maintain law and order. In addition, the 300-person force is responsible for search and rescue operations. However, because the police have no boats, they work in conjunction with the TDS during such operations. Police resources include 22 vehicles: 17 on Tongatapu; two on Vava'u; and one each on Ha'apai, 'Eua, and Niuatoputapu. The police maintain a small disaster coordination center in Nuku'alofa.

3.2 Warning System

Tropical Cyclones

Tonga's Meteorological Office is maintained under a grant from the New Zealand government. Meteorological officers take readings from GOES (U.S.A.) and GMS (Japanese) satellites, and have access to additional data from shipping or island-based weather stations. Although it maintains these functions, the office basically acts as a conveyor of information. It is responsible for notifying key persons and organizations that a cyclone problem is developing.

Special weather bulletins are issued from Nadi, Fiji and the Tonga Broadcasting Commission (TBC) is responsible for transmitting them to the public. In the case of Isaac, however, the TBC experienced a power failure and was unable to start the emergency generator. The station could no longer transmit and international contact was lost. In this event, Tonga requested that the Nadi Weather Forecasting Center in Fiji provide warnings to the Fiji Broadcasting Commission which were then broadcast in Tongan. The Regional Meteorological Center in Wellington, New Zealand may also be contacted for weather information.

In spite of the present antiquated transmitter that was installed in 1960, transmission of warnings to the public by the TBC from the sole radio station in Nuku'alofa works reasonably well (unless a power failure

occurs). Listening to the radio is an established daily activity in the Kingdom and is the usual method for transmission of instructions and information. Most households have a transistor radio and the habit of listening is well developed. The radio station normally broadcasts only during the day; during Isaac's onslaught, however, it remained on the air throughout the night. The GOT recognizes the need for transmitters in Tonga, especially for cases when both Nadi and the TBC are knocked out. Pending approval, one or two transmitters may be supplied in 1987 through Tonga's bilateral agreement with Australia. A standby generator may also be provided.

Tsunamis

The international tsunami warning system is based in Honolulu, Hawaii. It provides Tonga and other Pacific islands with warnings of tsunamis that are created by strong Pacific earthquakes. Unfortunately, earthquakes originating near Tonga may generate tsunamis that arrive before a warning can be issued by Honolulu.

Earthquakes

The government geologist at the Ministry of Lands, Surveys, and Natural Resources collects seismic data, but no precise techniques exist for predicting earthquakes at the present time. (See Section 3.3, Mitigation Efforts.)

3.3 Mitigation Efforts

Tropical Cyclones

The front pages of the Tongan telephone directory contain some basic rules and illustrations for natural emergency situations but formal awareness programs to educate the public about cyclone preparedness do not exist.

To mitigate against storm surges associated with cyclones and storms, the GOT constructed a sea wall on Tongatapu to prevent erosion. Built over a period of 50 years, most of this wall was smashed by Cyclone Isaac and the government has borrowed nearly \$5 million for reconstruction.

Earthquakes

Seismological observations in Tonga are the responsibility of the Ministry of Lands, Surveys, and Natural Resources and in the past have been entirely supported by overseas aid. Seismological experiments have been carried out in Tonga beginning in the 1960s with the Lamont-Doherty Upper Mantle Project, and were later operated by Cornell University scientists until observations were suspended in the early 1970s. In late 1983, Cornell reinstalled a three-component short period seismograph in

Nuku'alofa at the request of the government geologist as part of the USAID-supported seismic hazard program (described in Section 2.4). The instruments were disconnected in May 1984 after Tonga's Cabinet decided that the project was no longer feasible.

Two strong-motion accelerographs provided by USAID are operating in Nuku'alofa and northern Vava'u. A third accelerograph may be made available by the British Geological Survey and installed at 'Eua. Other mitigation efforts have included scientific studies of the Tonga Trench subduction zone by researchers from the United States, Japan, New Zealand, Australia, West Germany, and the Soviet Union. The Tongan government geologist also conducts assessments of earthquake and tsunami hazards as part of his responsibilities.

3.4 Health

Medical services are available at four hospitals on Tongatapu (Vaiola Hospital), Vava'u (Nqu Hospital), Ha'apai (Niu'ui Hospital), and 'Eua (Niu'eiki Hospital). In addition, there are 14 health centers, 34 maternal child health clinics, and five "village committee" facilities. The latter are located in isolated communities and are staffed by a health worker who receives training, supplies, and technical supervision from the Ministry of Health. Health workers have been posted at Lofanga, Fotuha'a, 'O'ua, Tungua, Kotu, Mo'unga'one, 'Eueiki, 'Atata, and Tafahi.

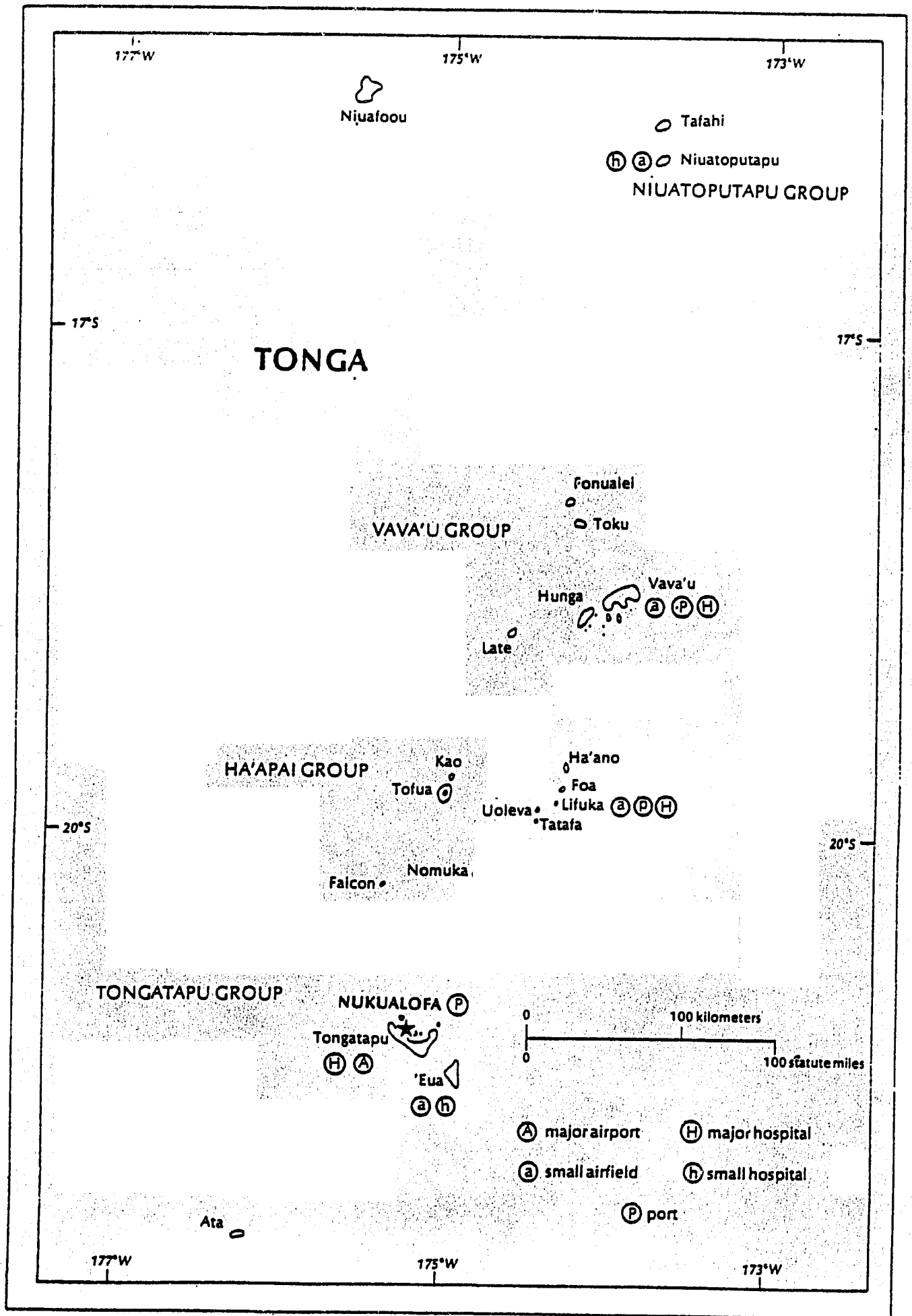
Table 3

Health Services and Population Served in 1984

<u>Island Division</u>	<u>Est. Population in 1984</u>	<u>Hospitals</u>	<u>No. of Beds</u>	<u>No. of Doctors</u>	<u>No. of Nurses</u>	<u>Health Centers</u>
Tongatapu	65,311	1	202	15	60	7
Vava'u	15,059	1	61	4	25	3
Ha'apai	8,554	1	28	2	16	2
'Eua	4,007	1	16	1	8	0
Niuas	<u>2,517</u>	<u>0</u>	<u>0</u>	<u>n.a.</u>	<u>n.a.</u>	<u>2</u>
Totals	95,448	4	307	22	109	14

Source: Report of the Ministry of Health for the Year 1984.

Figure 6 Location of Airfields, Hospitals, and Ports



Source: PIDP, Disaster Preparedness and Disaster Experience in the South Pacific, August, 1982.

Figure 6 shows the locations of hospitals and health centers. Vaiola Hospital is the referral hospital for the Kingdom and cases that cannot be accommodated are referred overseas, subject to funding availability. Civil servants are usually sent overseas for treatment at the government's expense; others must pay their own way.

The import and distribution of drugs, supplies, and equipment is the responsibility of the Central Pharmacy. It has a manufacturing unit that produces antibiotic preparations, creams, ointments, ear drops, and eye drops. All drugs are supplied by tender from Australian and New Zealand companies. Although the GOT attempts to keep a 6-month stockpile, usually only a 3-month supply is available. WHO also supplies drugs as well as equipment and storage containers that are used for the village health worker scheme. Cold storage facilities in Tonga are limited, and hospitals and health centers must rely on small refrigerators.

The Ministry of Health conducts an ongoing vaccination program that includes diphtheria, whooping cough, tetanus, measles, and polio. Access to vaccinations in outer islands such as Niuatoputapu and Niuafu'ou is limited due to their remoteness and the lack of an efficient cold chain. WHO provides technical assistance to improve the immunization services in these islands.

The major causes of death in Tonga are infectious diseases and non-communicable diseases such as heart disease, diabetes, and cancer. Influenza remains the main notifiable disease with 20,116 cases reported in 1984. Other leading notifiable diseases were pneumonia, gastroenteritis, conjunctivitis, and infantile diarrhea. Dengue fever, endemic in Tonga, often becomes a problem following extremely wet weather. However, in recent years the incidence of dengue and other communicable diseases has been substantially reduced due to successful prevention and control programs.

3.5 Water Supply

Water is a considerable problem in coral atolls like Tonga. Ground water tables are insufficient and water quality is poor. Moreover, many existing schemes are not well maintained. Responsibility for water supply is split between the Tonga Water Board (urban) and the Ministry of Health (rural); difficulties in coordination have hindered the development of the country's water supply system.

Urban Water Supplies

Water in Nuku'alofa is generally safe to drink from the tap. Supplies in Neiafu (Vava'u) are very limited but a reservoir construction program is underway that will use the existing wells and provide reticulation to the surrounding area. The Pangai-Hihifo water scheme

(Ha'apai) has been unsatisfactory because of salinity and high chloride content of the well water.

Nuku'alofa (Tongatapu) has three windmills at Mataki'eua. Two of these were damaged by Cyclone Isaac but later restored with a grant from UNICEF. Recent extensions connecting the villages of Ma'ufanga, Popua, and Pa-'a-Tongata-'o-Mailefihi have made piped water available to every settlement around Nuku'alofa. As of 1983 a total of 28 pumping stations were located at Mataki'eua and Tongamai. The Tonga Water Board plans to purchase a standby generator in 1986 to run the pumps in case of power failure.

Rural Water Supplies

The Ministry of Health estimates that 99.2% of Tonga's population has access to safe drinking water either through household connections or close proximity to protected and organized water sources. However, in some rural areas water supply is inadequate for household chores, hygiene, and sewage disposal. The Ministry estimates that 60% of villages in the Kingdom have reticulated water systems.

In rural areas where the well water systems are not suitable, tanks and catchments are relied upon for water supply. In the past, water tanks for private rural homes have been supplied by various donors. The use of tanks requires routine inspections by public health officers to ensure that they are properly enclosed. A large program to improve wells and equipment in villages on Tongatapu and Vava'u is underway, but progress has been slow due to limited skills and unserviceable equipment. The water supply on 'Eua and Ha'apai is extremely limited and past improvement schemes have been riddled with problems. In comparison, schemes in the rural areas on Tongatapu have been more successful. The Ministry of Health estimates that 6,000 rural households (44,000 people) on that island have access to adequate amounts of clean water.

3.6 Sanitation

Sanitation and hygiene problems in the villages relate mainly to deficiencies in water supply. Following disasters, health problems exacerbated by insufficient sanitation are not likely to be severe due to low population densities.

3.7 Communications

The Tonga Telecommunications Commission (previously the Telephone and Telegraph Department) is responsible for national telephone and telegraph services. The internal communication network consists of HF and VHF radiotelephone links. Exchanges are located at Nuku'alofa, Mu'a,

Masilamea, Vava'u, and Ha'apai. To improve the inter-island network, the GOT is considering either a thin-line tropospheric scatter system or a smaller dish satellite system to permit speech channels between Nuku'alofa, 'Eua, Ha'apai, and Vava'u.

Many villages surrounding Neiafu and Nuku'alofa have telephone connections to the two towns. 'Eua is served by two direct VHF links to manual assistance switchboards at Nuku'alofa. Ha'apai has telephone offices on three islands (Lifuka, Ha'afeva, and Nomuka) which have HF radio links to Nuku'alofa. Niuatoputapu and Niuafu'ou have only SSB/HF radio communication with Vava'u. Tafahi has a VHF radio link to Niuatoputapu. A point-to-point HF link connects Niuatoputapu to Nuku'alofa.

International telecommunications are provided by Cable and Wireless, Ltd., a 10-year franchise that uses a "B" class earth station for satellite communications.

3.8 Road Transport

Most of the newly constructed roads are on Tongatapu. During the period 1980-1983 an average of 77% of total annual road construction expenditures were for roads on Tongatapu, where 65% of Tonga's population lives. However, the government is making an effort to focus on roading needs in other islands. But, because the outer islands are great distances from Nuku'alofa, the transfer of construction capacity must be carefully planned. Examples of coordinated programming in the outer islands include a project in the Niuafo'ou (wharf, airfields, and roads), and more recently in Vava'u (wharf and roads). With the exception of maintenance, Tonga's entire roading program is financed by grants and soft loans from overseas. The number of vehicles in 1983 was 2,886 including 443 cars, 340 motorcycles, and 1,343 trucks.

3.9 Air Transport

The Kingdom is served by five international airlines. Air Pacific, Fiji's national airline, stops twice a week on flights from Suva to Auckland and runs a weekly service (Suva-Apia-Tonga-Suva). Polynesian Airlines and Air New Zealand operate between Auckland and Apia via Tonga four times a week, and Air Nauru has a weekly flight from Noumea to Tonga. South Pacific Island Airways operates a weekly flight between Honolulu and Tonga via Pago Pago.

Domestic services are provided by Friendly Islands Airways Ltd., which has a 22-seater "CASA 212" and a smaller "Islander." The company was created in December of 1985 as a joint venture with the GOT but is now solely owned by the government. The airline has not been called upon for disaster related flights but is prepared to provide medivac services if necessary. The manager of Friendly Islands is also the chairman of the Tonga Red Cross Disaster Committee. (See Section 3.13, Voluntary Agencies).

Fua'amotu International Airport on Tongatapu is the major airport in the Kingdom. The government plans to eventually upgrade it to full international standards. Other airfields are located at Vava'u (Lupepau'u), Ha'apai (Salote Pilolevu), 'Eua (Kaufana), Niuatoputapu (Mata'aho), and Niuafu'ou (Lavinia). Customs entry points are at Fua'amotu, Lupepau'u, and Mata'aho airports. Figure 6 on page 29 shows the location of Tonga's air landing facilities. Runway details for the airfields are listed below.

Table 4

Runway Surfaces in Tonga

<u>Airfield</u>	<u>Sealed Runway</u>	<u>Length</u>	<u>Grass or Coral based Runway</u>	<u>Length</u>
Fua'amotu	X	2,071 x 45m	X	1,828 x 152 m
Lupepau'u			X	1,067 x 23 m
Salote Pilolevu			X	701 x 18 m
Kaufana			X	731 x 30 m
Lavinia			X	731 x 30 m
Mata'aho			X	867 x 27 m

Source: Pacific Islands Yearbook, 1984.

3.10 Ports

Points of entry to Tonga are Nuku'alofa, Pangai, Neiafu, and Niuatoputapu as shown in Figure 6 on page 29. Nuku'alofa is enclosed by coral reefs and islands. Pilotage is compulsory and 24 hours notice is required. Queen Salote Wharf is located at Nuku'alofa and is currently undergoing extension work that will involve a berthing length of at least

182 m, enabling a cruise ship, cargo vessel, and an island trader to berth simultaneously. Presently, the wharf is 100 m long and has an apron of 10 m.

At Pangai in Ha'apai, large ships anchor about one mile from the wharf which measures 15 m and has a depth of 2 m. At Neiafu in Vava'u, the wharf is in an enclosed inner harbor. Ships drawing less than 7 m and no longer than 120 m may berth. Those of larger tonnage and draught may anchor 2 km from the wharf.

3.11 Energy

The Tonga Electric Power Board is responsible for electric services in the Kingdom. Electricity extends throughout urban areas and into some villages and is provided by four generating units. The largest station, installed in 1974, is located on Tongatapu and has a capacity of 5,850 kW. Vava'u has the second largest station that supplies power to Neiafu and nearby villages. It was installed in 1970 and has a capacity of 600 kW. The Ha'apai station, installed in 1982, has a capacity of 112 kW and provides services only in Pangai. A fourth station on 'Eua began operating in 1983 and has a capacity of 112 kW. This station supplies power to 'Ohonua. Aerial reticulation was being extended in 1986 under Australian aid to include 'Eua's hospital, college, airport, timber mill, and wharf.

3.12 Housing

The primary threat to housing in Tonga is from cyclones and earthquakes and, to a lesser extent, flooding. Each time a major cyclone passes over Tonga, thousands of homes are destroyed. The worst destruction to housing in recent memory was caused by Cyclone Isaac in 1982. Figure 7 shows the extent of damage to dwelling houses on Tongatapu following the storm. In total, around 2,000 homes were destroyed including 900 on Ha'apai. Some of the worst building failures were churches while commercial and industrial buildings fared reasonably well.

The damage sustained by most of the buildings during Cyclone Isaac underscored the lack of engineering input during their construction. The Tongan Ministry of Works had begun to introduce building regulations in 1981 but when Isaac struck, most buildings would not have been constructed to those regulations. This was particularly true for houses in villages outside of Tongatapu. Moreover, most houses in Tonga are built by the owner and his family who usually have little or no formal training. Building techniques are adopted mainly by copying from previously constructed buildings that may not be soundly built. A few local building firms are located on Tongatapu and are mainly engaged in

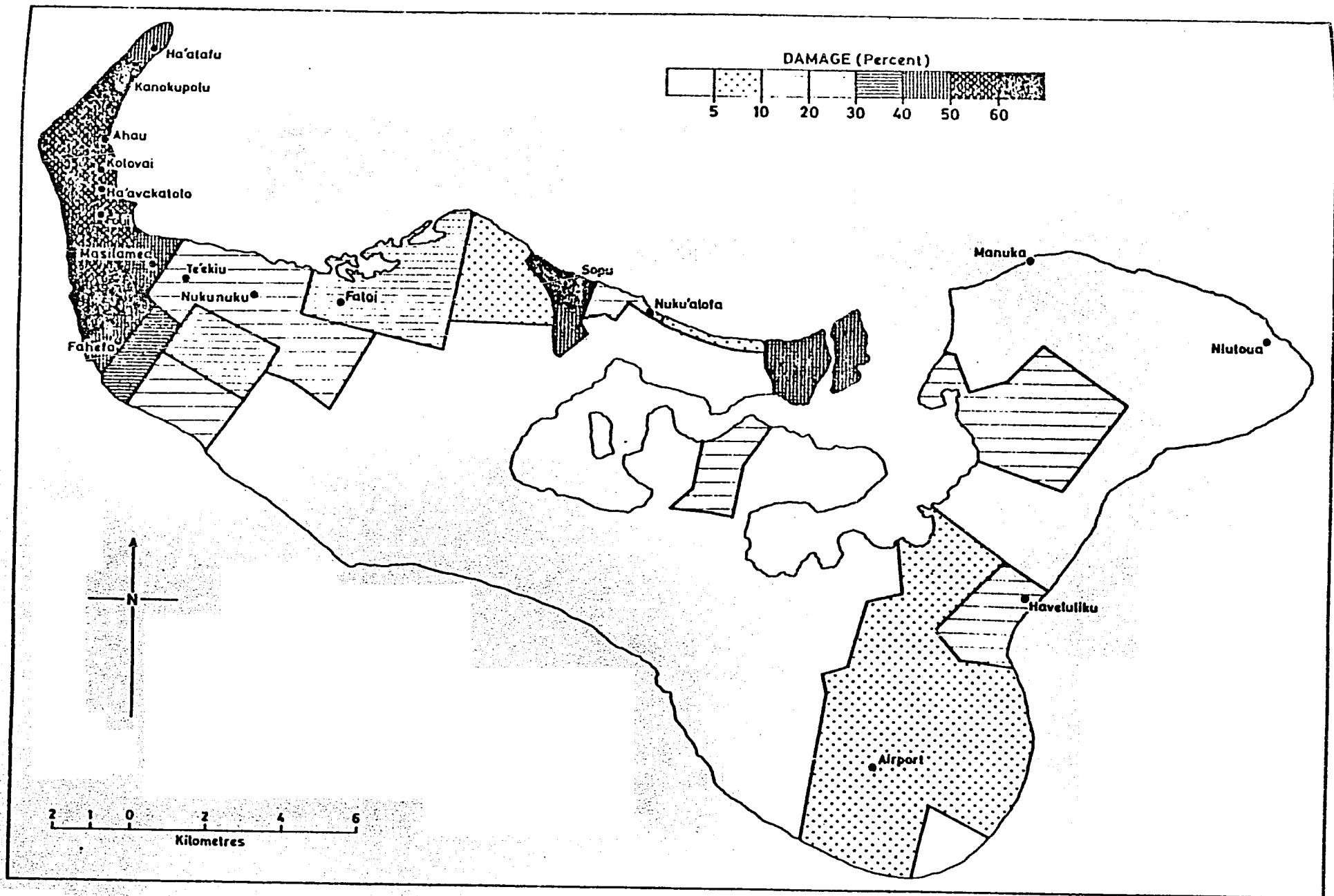


Figure 7: Variation over the island of Tongatapu of the percentage of dwelling houses destroyed or severely damaged. Based upon a Government survey covering 62 divisions of the island. In the map, areas with similar class intervals have been consolidated into single areas.

Source: Tropical Cyclone 'Isaac', Disaster Investigation Report No. 5, James Cook University of North Queensland.

commercial construction. Supervisors may receive overseas training but the workers generally learn on the job and never receive any formal training.

In Tonga, houses are constructed using a variety of materials. They are made of wood, concrete block or panels, corrugated iron roofs with pandanus thatch walls, wood frame with corrugated iron sheet walls, or entirely of bamboo, reeds, and pandanus thatch. The latter are known as "fales" and when properly built provide a strong, hurricane-resistant design. Unfortunately, these traditional houses no longer remain in Tonga except for a few in the more remote outer islands. A variation of the fale is more common although fewer are built each year. These have corrugated iron sheeting for walls instead of pandanus. If properly built, these modern fales will provide moderate safety in cyclones. A similar structure has woven pandanus walls and a corrugated iron roof. This is the most popular style of building in rural Tongan villages.

Wood frame houses are also popular in Tonga, usually with corrugated iron roofs. The wind resistance for this type of structure is moderate, provided it is properly built. Concrete block houses can be very dangerous in windstorms if the roof frame and walls are poorly connected. In cases where houses have louvered windows, pressure can build up inside the house, resulting in loss of the roof. However if a block house is built securely, it will provide excellent resistance to cyclones. Experts from James Cook University of North Queensland who conducted a survey in Tonga following Cyclone Isaac observed that roof structures on concrete block houses performed better than other structures. They also noted that, of the houses destroyed, half were timber framed and the remainder were equally divided between concrete block and fale.

Following Cyclone Isaac, the GOT began to formulate a longer term reconstruction program to build approximately 2,000 new houses, plus school classrooms, over a period of two years. The Ministry of Works and the UK Building Research Establishment (BRE) combined efforts to design a cyclone-resistant house for this program. The Cyclone Testing Station at James Cook University provided additional specialist advice. A demonstration house was built and supplies of timber and building materials were provided by international donors. The 35-m houses cost around \$1,900 of which the owners contributed \$450. Details of the house design were in accordance with New Zealand standards. It was decided that windload tests on a prototype house would be invaluable, and a collaborative project was set up by BRE and the Cyclone Testing Station with financial contributions from several governments. The components of one house from the production line in Tonga were shipped to Australia and tested successfully, after some modifications.

Considerable damage to buildings in Tonga occurred following the earthquake in 1977. Although strict codes do not exist, construction of public buildings must be approved by the Ministries of Works and Health. The largest office buildings and hotels are designed by overseas engineering firms, and generally include some earthquake loading

criteria. These are the buildings that are most susceptible to damage from earthquakes, especially the multistory structures and those made of concrete. The Land and Environment Act, currently under consideration by the Tongan government, would require review of all development projects by the government planner. Application of building codes, largely adapted from New Zealand, is expected to follow.

The houses most vulnerable to earthquakes are unreinforced or poorly constructed concrete block and concrete panel buildings. Some block houses do use adequate iron reinforcement but the quality of the blocks in many areas and the workmanship are very poor.

For a comprehensive study of the vulnerability of the housing sector in Tonga, see Improvement of Low Cost Housing in Tonga to Withstand Hurricanes and Earthquakes, prepared by INTERTECT for OFDA in 1982.

3.13 Voluntary Agencies

In Tonga, the Red Cross Disaster Committee coordinates PVO relief activities and donations. Created in 1982 in the aftermath of Cyclone Isaac, the Disaster Committee has been chaired for the last two years by Bob Moin, manager of Friendly Islands Airways. Three subcommittees cover the areas of medical care, transport, and communications. In a disaster, six radiotelephones keep the members in the field in contact with the chairman. Other resources include a large tent donated by New Zealand that can be used for temporary shelter, and 30 medical kits. The committee also has a small fund for local procurements.

The Tonga Red Cross (TRC) maintains a constant focus on disaster preparedness and performs most of the operational work for the Red Cross Disaster Committee. The TRC is the only PVO that sits on the National Disaster Committee and the Director, Pamela Lino, closely follows activities at the national level. In the past, the TRC has provided blankets, lanterns, water containers, clothes, and food to disaster victims. Food has often been a priority and is purchased from local shops as needed.

The TRC Headquarters is located in Nuku'alofa with two additional offices at Pangai and Neiafu. Volunteers participate in an annual Red Cross course to upgrade their skills in disaster relief and first aid. In 1985, the TRC sponsored the South Pacific Youth Conference. The event focused largely on disaster preparedness and was attended by youths from rural areas of several Pacific islands. The youths participated in a disaster simulation and listened to presentations of disaster related issues.

Another TRC effort was a six-month radio program initiated several years ago that focused on disaster preparedness. It was broadcast for 15 minutes every month but eventually failed due to lack of funding. The

Queen of Tonga is President of the TRC and continues to maintain strong support for such disaster preparedness efforts. Nevertheless, the TRC could benefit from more guidance and interaction with the GOT and the international community.

Tonga Red Cross
P.O. Box 456
Nuku'alofa
Tonga
Tel.: 21-360

The Foundation for the Peoples of the South Pacific (FSP), based in New York, has supported a wide range of programs in several South Pacific countries. FSP's projects in Tonga have included agricultural training, women in development, small business training, and the installation of solar powered electrical fencing. The Foundation also provides technical assistance and resource materials through the Regional Nutrition Program headquartered in Tonga. FSP was directly involved in relief efforts following Cyclone Isaac and received a grant for \$64,000 from OFDA to conduct small relief and reconstruction projects.

Foundation For the Peoples of the South Pacific
P.O. Box 519
Nuku'alofa
Tonga
Tel.: 21-494

Various churches and church groups in Tonga can also be expected to provide assistance in disasters.

3.14 Regional Organizations

The South Pacific Bureau for Economic Cooperation (SPEC) is a regional organization with 11 South Pacific country members including Tonga. SPEC's role is to encourage and promote regional cooperation in the expansion of trade and economic development. In 1977, SPEC was given a mandate by member governments to coordinate a regional disaster relief and preparedness strategy, and a regional disaster fund was set up to supplement locally available relief resources. However, the evolution of SPEC as a regional disaster focal point has not occurred, although a disaster advisor was hired in 1984 on a short-term contract to disseminate information and set up preparedness programs.

SPEC
Ratu Sukuna Road
Suva, Fiji
Telephone: 312600 (Suva)

3.15 USAID Mission and other Resources

The USAID program in Tonga is under the direction of the USAID/South Pacific Regional Development Office (SPRDO) located at the American Embassy in Suva. In addition to Tonga, SPRDO administers the USAID program in nine other Pacific countries. SPRDO assistance is focused on agriculture (including fisheries), health, and development administration. Training and private enterprise development are major themes in these programs. To date, the bulk of SPRDO assistance to the Pacific nations has been implemented indirectly through PVOs, regional organizations, and a small grant "Accelerated Impact" program with the Peace Corps. SPRDO has a continuing relationship with OFDA, given the region's proclivity to natural disasters.

The Peace Corps is active in Tonga with 30 volunteers as of September 1986. On an informal basis, volunteers in the past have been involved in disaster relief work, either in their home villages or in conjunction with a local voluntary organization. In 1982, the Peace Corps Director in Tonga acted as coordinator for USG aid. Volunteers assessed and surveyed damage, erected tents, and helped to restore water supplies.

Mission Disaster Relief Plan

A South Pacific Regional Mission Disaster Relief Plan was written in 1983. The plan identifies the responsibilities of the Chief of Mission, Mission Disaster Relief Officer (MDRO), and the Emergency Action Committee. The current SPRDO staff also attempt to maintain an updated list of resources and local contacts in Tonga in times of disasters.

3.16 U.S. Disaster Relief and Preparedness ActivitiesEmergency Activities

Since the establishment of the Office of U.S. Foreign Disaster Assistance in 1964, the USG has responded to three disasters in Tonga. Emergency assistance has included blankets, food, tents, plastic sheeting, and light sets. The following list provides more details of U.S. disaster relief in Tonga:

Table 5

U.S. Disaster Assistance to Tonga 1964-1986

<u>Year</u>	<u>Disaster</u>	<u>Commodity/ Service</u>	<u>Provided Through</u>	<u>Cost</u>
1977	Earthquake	Amb. Auth	Govt.	\$25,000
1978	Cyclone	Amb. Auth	Govt.	\$25,000
1982	Cyclone	Airlift	TransAmerica	\$159,487
		Airlift	ADRA	\$19,622
		Amb. Auth	Govt.	\$25,000
		Blankets		\$1,675
		Food		\$33,718
		Grant	FSP	\$64,000
		Light sets		\$2,377
		Personnel Support	PCV	\$0
		Plastic Sheeting		\$43,000
		Tents		\$257,862
		Transport		\$16,200
	Water containers		\$800	
	Grand Total		\$673,741	

Preparedness Activities

In an effort to improve Nadi's cyclone early warning system for the South Pacific including Tonga, OFDA funded the installation of a satellite direct readout station at the Nadi Weather Forecasting Center at Nadi Airport in Fiji. High resolution satellite receiving equipment was provided which processes analyses, and displays data from GOES and GMS satellites. The installation was completed in August 1986.

In 1984, OFDA gave a grant to the East-West Center's Pacific Island Development Program for a community preparedness and development program in the South Pacific. The project objectives were to provide written reports on the state of preparedness and vulnerability of island nations such as Tonga and to conduct workshops geared toward assisting national governments in planning and developing their own disaster response programs.

OFDA also gave a grant to Cornell University for an evaluation of seismic risk in the Fiji-Tonga-Vanuatu region of the Southwest Pacific. The objective of the project was to develop a seismicity information base to help in regional earthquake prediction, building design, and civic planning. The project began in 1978 and was completed in 1985.

APPENDIXTONGA - Cyclone

Date: March 3, 1982 (FY 82)

Location: Nationwide - Vava'u, Ha'apai, and Tongatapu

No. Dead: Six confirmed

No. Affected: Entire population (estimated at 100,000); almost 50% were homeless immediately after the disaster

Damage: Total damage was estimated at \$21,199,997.

Agriculture/Forestry/Fisheries:	\$7,257,142
Subsistence Crops (roots, bananas, trees, vegetable and animal products):	\$3,610,989
Cash Crops (vanilla, bananas, coconut):	\$3,387,912
Forestry/Fisheries:	\$258,241
Building/Construction:	\$9,508,791
Residential:	\$5,865,934
Tongatapu:	\$3,221,978
Ha'apai:	\$2,289,010
Other:	\$354,946
Non-Residential:	\$3,642,857
Commerical/Business:	\$4,434,064

The Disaster

Cyclone Isaac originated in an area northeast of Western Samoa and southeast of Tokalau. It then traveled south past Samoa and at 4:00 a.m. on March 2, 1982, a cyclone alert was issued for all of Tonga. By 10:00 a.m., Cyclone Isaac was centered about 544 km northeast of Vava'u with winds at 60 knots and intensifying.

At about 1:00 a.m. on March 3, the center was 64 km east of Vava'u, and by 5:00 a.m., it had moved to 32 km northeast of Lifuka Island in the Ha'apai group. Isaac continued its southwesterly movement through Nuku'alofa, the capital of Tonga. Then Isaac gradually weakened and moved off to sea.

As the storm passed over the Ha'apai group, low-lying areas were flooded by a combination of high tides and tidal swells. The severity of Cyclone Isaac and the associated sea surges caused the worst damage in Tongan history. Agricultural and building damage was particularly ruinous and dramatic. The Tonga Minister of Health estimated the following food losses due to the cyclone:

Taro:	30% (6,179 long tons)
Cassava:	60% (6,482 long tons)
Sweet potatoes:	40% (173 long tons)
Yams:	50% (1,386 long tons)
Bananas:	Up to 90%
Breadfruit:	Up to 90%
Vanilla:	35%
Coconut:	100% for export; 50% of local
Manioke:	60%
Poultry:	16%
Pigs:	8%

Below is the estimated damage sustained by region:

Ha'apai -	95% of the buildings damaged or destroyed; 10-20% of the coconut palms felled; ground crops damaged
Vava'u -	40% of the houses damaged or destroyed; 20% of the coconut palms felled; ground crops damaged
Tongatapu -	80% of the buildings damaged or destroyed; 5-10% of the crop destroyed; ground crops damaged
Nuku'alofa -	10-15% of the buildings destroyed; 50-60% of the buildings heavily damaged; power station destroyed; harbor, jetty, and shoreline heavily damaged

In addition, the wharf in Vava'u sustained severe damage as did a number of yachts and fishing boats in Neiafu harbor. Thirty-two boats and numerous canoes were reported destroyed in Ha'apai and a considerable amount of fishing equipment was lost. One ship was overturned and another ran aground in Nuku'alofa harbor. In addition, numerous smaller boats were smashed or sunk.

Action Taken by the Government of Tonga (GOT)

The GOT set up the National Office of Disaster Relief and Reconstruction (NODRR) under the direction of the Minister of Health to coordinate and implement relief and reconstruction programs. NODRR coordinated the distribution of relief supplies and conducted surveys to establish the extent of the damage and both immediate and long-term needs. Sub-offices of NODRR were established in Ha'apai and Vava'u.

The Tongan Red Cross issued an appeal to the League of Red Cross Societies (LORCS) for additional aid, while the Tongan government also requested help from the international community. The GOT established a relief and reconstruction fund of one million Tongan dollars (approximately US \$1.2 million).

Health Department officials took care of the sick and injured and with the help of the Red Cross, they also treated affected water supply systems and polluted areas with chemicals. A work schedule was devised for rebuilding severely damaged water systems.

Crews of former Board and Post and Telecommunications linesmen restored cable and wireless services with assistance from the New Zealand and Australian armed forces within the days of the disaster. However, the restoration of communications among the islands was erratic and Nuku'alofa was cut off from the rest of Tonga for three days after Cyclone Isaac. After communications were restored, many areas faced some delay in receiving emergency food, blankets, shelter, and medical supplies.

Close to 15,000 people were mobilized into relief and reconstruction activities under the direction of NODRR. People were urged to begin replanting and rebuilding immediately and the Tongans responded enthusiastically. Seeds donated by various organizations were distributed with the emphasis on fast-growing vegetables to meet food needs for the first three months following the storm.

The state of emergency ended about a month later in early April, and the relief operation moved into the reconstruction phase, except for some temporary emergency feeding which lasted several more months.

Assistance Provided by the U.S. Government (USG)

On March 4, 1982, very shortly after Cyclone Isaac had ravaged Tonga, Ambassador Fred J. Eckert declared the situation to be of disaster proportions, and he used his Disaster Assistance Authority to donate \$25,000 to the Tongan Hurricane Relief Fund.

Within a week of the storm, the A.I.D. South Pacific Regional Development Officer (based in Fiji) arrived in Tonga to make an on-site damage assessment and advise the mission on an appropriate response. The Peace Corps Director in Tonga was designated the USG aid coordinator. Peace Corps volunteers served on a Tongan assessment/survey team, helped erect USG-supplied tents, and aided in restoring water supply facilities.

It was determined that providing food and temporary shelter, particularly tents, were top priorities. Thus, the USG contributed 500 tents and tent flies (valued at \$257,862); 200 rolls of plastic sheeting (worth \$43,000); 315 cotton blankets (with a value of \$1,675); and 520 five-gallon collapsible plastic water containers (\$800). These supplies were airlifted from the Guam stockpile at a cost of \$159,487. In addition, 456 hurricane lanterns, 144 chimneys, and 20 rolls of wicks and labels (all valued at \$2,377) were donated to the relief effort. The USG also arranged the transport of 300 tents donated by the Seventh Day Adventist World Service (SAWS) for \$19,622.

To alleviate the food situation, the USG provided 41 tons of taro in three shipments. The total value of the food and transport was \$33,718.

To help rehabilitation process, the USG donated \$64,000 to the Foundation for Peoples of the South Pacific (FSP) for small relief/reconstruction projects. (One projects assisted 65 families to develop and plant home vegetable gardens.)

TOTAL \$607,541

Assistance Provided by U.S. Voluntary Agencies*

Agricultural Cooperative Development International - worked with the Tonga Cooperative Association.

American Red Cross - contributed \$10,000 in cash.

California and Utah residents (U.S. citizens and Tongans) - provided 225,000 pounds of food and clothing, value not reported.

Church of Jesus Christ of the Latter Day Saints - donated food, value not reported.

Church World Service - contributed \$20,000 in cash and issued an appeal for \$500,000.

FSP - worked with the Peace Corps in restoring water facilities and performed other relief activities.

Hawaii residents (U.S. citizens and Tongans) - provided 65,000 pounds of non-perishable food and clothing, value not reported, and \$19,000 in cash.

SAWS - donated 300 family-size tents, with a value of \$72,000.

World Vision International - provided \$12,000 for the purchase of food, fishing nets, utensils, and kerosene lamps.

TOTAL \$133,000

Assistance Provided by the International Community*

International Organizations

European Economic Community - contributed \$82,304 in cash and made a representative available to coordinate information between donors and the government, at a cost of \$17,911.

Food and Agriculture Organization - sent a team to survey damage to the coconut crop, value not reported.

LORCS - donated 30 tons of rice, 10 tons of skimmed milk powder, and 10 tons of canned meat and fish, value not reported, through the Australian Red Cross.

U.N. Development Program - provided \$30,000 to be used for agricultural rehabilitation.

UNDRO - contributed \$30,000 to be used for emergency food crop replanting projects, and made a representative available to assist in relief operations and assessment surveys, value not reported.

UNICEF - gave \$50,000 for five water storage tanks, two tank stands, one windmill with replacement parts, and various medical supplies for maternal and child health centers; and donated seeds, fertilizers, and chemicals worth \$10,000.

World Council of Churches (WCC) and Caritas Internationalis - issued a joint appeal for \$500,000 for seeds, insecticides and community housing; WCC also gave \$20,000 in cash to the Tongan National Council of Churches and \$50,000 in cash for the purchase and transport of corn and potato seeds from Australia.

World Food Program - provided 954 tons of wheat flour and 96 tons of vegetable oils, valued at \$500,000.

Governments

Australia - sent three delegates and five Hercules aircraft transports with 400 tents, 25 tons of taro, 24 tons of rice, 3 tons of tinned and fish, medicines, electric generators, water purification equipment, two Huey helicopters, and 50 Army engineers and communications ex.

with equipment to assist in damage assessment, provided 640 MT of flour and 90 MT of sugar, worth \$317,460; set up a communications base station at the Tongan disaster relief headquarters and three stations on outlying islands; sent health inspectors to assess the potability of outlying water supplies; and donated a shipment of roofing iron. Total value of emergency relief supplies was \$1,144,179.

Canada - contributed \$83,507 in cash through LORCS.

Fiji - provided 100 disaster packs, value not reported, and \$28,558 in cash with the Fijian Red Cross.

Germany, Federal Republic of - gave \$21,505 in cash.

Japan - donated \$127,000 in cash.

Luxembourg - contributed 68 tons of rice worth \$27,200.

New Zealand - dispatched two aircraft loaded with medical supplies and helicopters for damage assessment in Vava'u and Ha'apai; provided clothing, tents, sheets, hospital supplies, generators, 200 liters of malathion and ten backpack sprayers; made a suitability assessment of runways and established a forward base at Ha'apai airfield; provided the services of an inter-island ship; and sent linesmen to help restore the potability of outlying water supplies. The value of these commodities and services was not reported.

Norway - gave \$5,914 in cash.

Papua New Guinea - contributed \$72,025 in cash.

Singapore - donated \$10,672 in cash.

Switzerland - contributed \$10,785 through UNDRO.

Tahiti - provided clothing, value not reported.

United Kingdom - provided medical supplies, the services of a structural engineer, and \$187,266 in cash. Total value was \$421,348.

Western Samoa - donated medical supplies, 33 tons of taro, 365 cartons and 160 bunches of bananas, 47 cartons of citrus fruit, and seven cartons of avocados, value not reported.

Voluntary Agencies

Auckland Lions Club - gave \$21,946 in cash.

Australia Red Cross - provided the services of five delegates, value not reported.

- Australian Council of Churches - donated \$22,046 in cash.
- Belgium Red Cross - contributed \$2,302 in cash.
- Brazil Red Cross - gave \$539 in cash.
- Caritas/Belgium - donated \$3,000 in cash.
- Caritas/Germany, Federal Republic of - provided \$21,505 in cash.
- Caritas/Italy - gave \$3,846 in cash.
- China, People's Republic of Red Cross - donated \$11,000 in cash.
- CIDA/Canada - contributed \$83,507 in cash.
- Denmark Red Cross - provided \$1,915 in cash.
- Fiji Red Cross - see listing under Fiji government.
- Finland Red Cross - gave \$5,392 in cash.
- Japan Red Cross - provided \$5,392 in cash, and 60,000 caps of tetracycline and 60,000 tablets of chloramphenicol, valued at \$8,833.
- Japan Shipbuilding Industry Foundation - contributed \$44,170 in cash.
- Luxembourg Red Cross - gave \$539 in cash.
- Netherlands Red Cross - donated \$39,131 in cash.
- New Zealand Red Cross - contributed 800 blankets, 150 sets of clothing, 20 cartons of canned fish, three tons of full cream milk powder, 20,000 caps of amoxyl, anti-tetanus vaccine, 500 mosquito nets, sanitary items, bedding, the services of three health inspectors with supplies, and a cash grant of \$8,143. The value of the commodities and services was not reported.
- Norway Red Cross - gave \$5,912 in cash.
- OXFAM/United Kingdom - provided \$1,873 in cash through LORCS.
- SAWS/Australia - contributed 200 bales of clothing, 50 bales (2,500) of blankets, and cash, with a total value of \$292,108.
- Singapore Red Cross - sent canned meat and fish worth \$10,672.

Sweden Red Cross - gave \$4,400 in cash.

United Kingdom Red Cross - contributed \$9,363 in cash.

TOTAL \$3,667,902

* Please note: the listings of assistance provided by U.S. Voluntary Agencies and the International Community are compiled from reports submitted voluntarily to OFDA. It is not always possible to verify the accuracy of these reports, nor the dollar value of in-kind contributions. As a result, the total dollar values indicated in these sections should be taken as representative figures.

InterviewsGOT

Sinilau Kolokihakaufisi, Chief Superintendent of Police
Major Fetu'utolu Tupou, Commander of Tonga Defense Services
Dr. Supi Faliaki, Director of Health
Lois Engleberger, Nutrition Planner
Central Planning Office
Tevita Pilimi Aho, Assistant Secretary for Works
Sione Taumoepeau, Director of Works
Tu'a Taumoepeau, Secretary for Foreign Affairs and Defense
Kaimana Fielakepa, Assistant Secretary to Foreign Affairs

PVOs

Bob Moin, Chairman of the Tonga Red Cross Disaster Committee
Pamela Lino, Director of the Tonga Red Cross

Tonga Broadcasting Corporation

Tavake Fusimalohi, General Manager

Tonga Water Board

Filipe Koloi, Manager

Tonga Electric Power Board

Juan Bernebe, Manager

High Commissions

Australia
Arthur Birch, Second Secretary for Development Assistance

New Zealand
Rolle T. Metge, First Secretary

Peace Corps

Tom Tichenor, Country Director

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