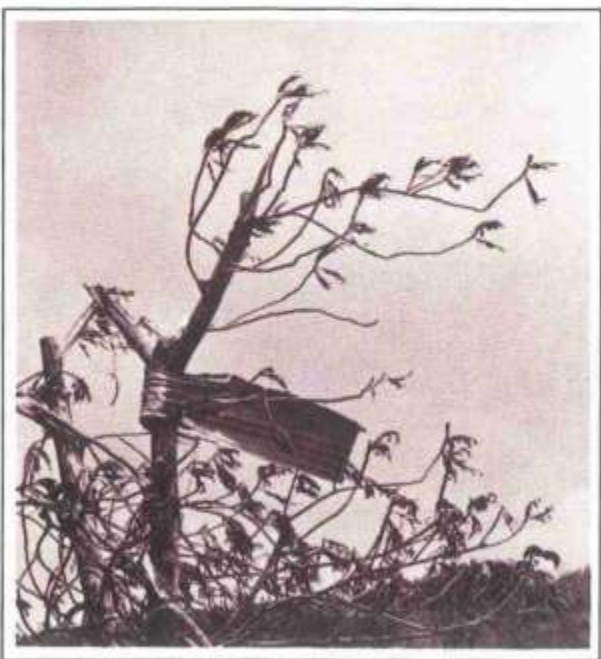


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DEALING WITH --- **DISASTER** ---

HURRICANE RESPONSE IN FIJI

JOHN R. CAMPBELL



GOVERNMENT OF FIJI • SUVA

PACIFIC ISLANDS DEVELOPMENT PROGRAM
EAST-WEST CENTER • HONOLULU

Dealing with Disaster

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Hurricane Response in Fiji

JOHN R. CAMPBELL

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Foreword

Every citizen of Fiji is aware, from personal experience, of the devastation of hurricanes. Shortly after independence Fiji was struck by Hurricane Bebe. It was clear that, to respond effectively to the relief and rehabilitation needs created by Bebe, a new organizational structure was needed. Such a structure had to be able to efficiently guide and monitor the relief and rehabilitation programmes necessitated by Hurricane Bebe.

On 31 October 1972 I convened the first meeting of the Prime Minister's Hurricane Relief Committee. It was my belief that this committee could bring together individuals from the public and private sectors to think through and plan Fiji's rehabilitation effort.

The committee, which was renamed the Prime Minister's Relief and Rehabilitation Committee, worked tirelessly for a decade to assist the nation in dealing with disasters. Many lessons were learned by the committee, the government, and our own citizens, and it is my hope that this book will bring those lessons to both the peoples of Fiji and of other countries and territories of the Pacific. It is also my hope that this book, as a case study of Fiji's response to hurricanes, will contribute to the endeavours of the Pacific Islands Development Program in its efforts to provide policy assistance and training for the region.

I am pleased to be able to record here the gratitude of the people and Government of Fiji for the assistance we have received from individuals and governments overseas towards our relief and rehabilitation programme during the last decade or so.

K.K.T. M a r a
Prime Minister

PREFACE

When Cyclone Bebe struck Fiji in October 1972 the devastation it wrought was on such a large scale and spread across such a wide area of Fiji that it was soon clear that the restoration of normalcy from the chaotic conditions would be a lengthy process. Within only six days of the storm's occurrence, Prime Minister Ratu Sir Kamisese K. T. Mara assembled a group of people from both the private and government sectors, each of whom had a relevant field of expertise to offer, for the purpose of coordinating the relief and rehabilitation programmes that were to follow. (A list of Committee members may be found in Appendix 1.) At its first meeting, the group, which was to become known as the Prime Minister's Hurricane Relief Committee, was charged with the responsibility of receiving all contributions of monetary and material assistance and with the determination of policies upon which the allocation of these resources would be based.

The Committee's role was to deal with the longer-term problems of relief, rehabilitation, and recuperation. The short-term problems of disaster management, from the warning stage through the event and immediately afterwards, remained the responsibility of the Emergency Services Committee (EMSEC), the governmental emergency management organization. The task of the Committee was to ensure that adequate resources were at the disposal of EMSEC during its phase of operations and then to take over its responsibilities once the initial period of disruption had abated. A pattern became established, especially for major disasters, in which the Committee met very frequently immediately after each event and convened at less frequent intervals as things fell into place.

Throughout the decade in which it operated the Committee, whilst retaining its original role as post-disaster policy maker, broadened its range of activities and depth of involvement. By early 1980 its workload had become such that a government department was established as the secretariat for the Committee,

which was also renamed the Prime Minister's Relief and Rehabilitation Committee. In 1982 the organization formed and developed by the Committee was taken over by the government as the Department of Relief, Rehabilitation and Rural Housing. When the Committee met for the last time it was the sixtieth meeting in ten years. During this period it had participated in the relief and rehabilitation programmes for seven major disasters and six less devastating storms.

As the term of the Prime Minister's Relief and Rehabilitation Committee was coming to an end it was decided that its activities in assisting communities to deal with disaster should be placed on public record. The original intention was to provide a chronological account of the relief and rehabilitation activities orchestrated by the Committee in the ten years between October 1972 and September 1982. It is, however, difficult to view these activities solely from the perspective of events that occurred during the "decade of the Committee" or in isolation from the total range of disruption caused by tropical storms and hurricanes of which only part was the responsibility of the Committee. The scope of the book gradually expanded to its present breadth.

This book is mostly about official response to disaster in Fiji and focuses very much upon one organization, the Committee, and the role it has played in establishing policies regarding relief and rehabilitation and in administering the implementation of these policies. As such the book is more a review of centralized, governmental response to disaster than of the responses of the victim communities themselves.¹ This in no way suggests that studies of disaster response at the local level are unimportant. Indeed, as is suggested in the final chapter of this book, it is most likely that if success is to be achieved in reducing the impact of hurricanes in Fiji, it will result from an improved understanding of the resources communities already have at their disposal for coping with disaster and of how these may be best implemented. Furthermore, this book does not deal in detail with the immediate problems of coping with the emergency or crisis phase of disasters, but looks more towards understanding the long-term processes of relief and rehabilitation. Again, this is not to down-

1 For studies at this level in Fiji see the reports of" Bayliss-Smith (1977), Bedford (1976), Bedlörd and McLean (1978), Brookfield (1977), and Campbell (1977).

play either the significance of planning for, and managing this phase of, disasters or the very important role of EMSEC in the whole counter-disaster process. At the same time, however, the author's opinion that the need for such activities could be substantially reduced through the development of sound mitigation measures, a number of which could be implemented during the rehabilitation phase, should be placed on record.²

The book is arranged in three parts. The three chapters in Part 1 provide the context within which the Committee's programmes may be placed. Chapter 1 deals specifically with the hurricane hazard itself with particular emphasis given to outlining patterns of temporal and areal variation as well as the magnitude of hurricane occurrence over the past century. Though highly irregular in many ways, tropical storms and hurricanes are clearly part and parcel of the Fiji environment. The social and economic impacts of hurricanes in Fiji are outlined in Chapter 2. While relief and rehabilitation programmes may ameliorate, at least temporarily, many of the problems caused by hurricanes, the economic costs of lost production, especially in agriculture, remain extremely high and death, injury, food shortages, and destruction of homes are still very significant risks. Chapter 3 gives a historical review of changing ways of coping with disaster in Fiji from the relatively localized self-sufficiency of earlier times to the increasingly centralized programmes for post-hurricane recovery in the present century. This process of change formed the basis for the establishment of the Committee in 1972 and for the increasing breadth and depth of its involvement in post-disaster relief and rehabilitation in the years that followed.

Part 2 deals specifically with the "decade of the Committee." The growing trend, outlined in Chapter 3, of growing costs to government (and centralized relief organization) certainly continued through that decade. Chapter 4 deals with the financial aspects of post-hurricane recovery programmes: while the role of the Committee was very important, the costs of recovery were borne by a wide variety of sources including the government and the hurricane victims themselves as well as the Committee, which received

2 It may also be noted that Carter has prepared for the Pacific Islands Development Program, Easi-West Center, a manual outlining procedures and guidelines for planning this phase of counter-disaster operations (see Carter, in press)

support from local and overseas contributors. The bulk of the Committee's involvement was in orchestrating and administering (and eventually actively participating in) the reconstruction of homes and schools. As Chapters 5 and 6 indicate, these programmes were sometimes massive in nature and not without their problems, especially in the early years when shortages of funds threatened their completion. The greatest priority in relief and rehabilitation, however, is in ensuring that the food needs of all disaster victims are adequately met. In Chapter 7 the food relief programmes undertaken during the decade of the Committee are discussed. Although the Committee, or its funds, were not directly involved in the provision of rations, the Committee played an active role in coordinating the distribution of food relief and maintaining sufficient stocks in case they should be needed.

In Part 3 some conclusions are developed from the preceding chapters and attention is drawn particularly to the apparent increasing dependency upon relief of the rural areas in Fiji. While relief may help offset immediate hardship the long-term role it plays is questioned. It is argued that although the major problem underlying the vulnerability of rural areas is a structural one, the ideal of the self-sufficient community is something that outer islanders in Fiji may strive for. A number of possible strategies for reducing the vulnerability of such areas are discussed briefly in this section.

Given the relatively limited original intent of this study it was initially to be based upon a dissection of the minutes of all of the Committee's meetings and a number of relatively widely circulated conference papers, press releases, and progress reports prepared by the Committee's secretariat. These sources did not, however, provide a comprehensive enough coverage of the full ten years of the Committee's programmes — there were simply too many gaps—and left numerous questions unanswered. As a result the study was expanded to include the files of the Committee which were made freely available. Although some gaps remained in the information a relatively comprehensive coverage of the decade of the Committee was obtained.

However, it soon became clear that this information would prove much more useful if presented in its historical and contemporary context. Numerous documentary sources were consulted

in this phase of the investigation. Among the most important were the *Fiji Times*, which provided over a century of coverage of events in Fiji, correspondence files of the Colonial Office in London, and official papers of the Fiji Legislative Council and Parliament. All of these materials were available, mostly on microfilm, in the Hamilton Library, University of Hawaii at Manoa. In addition a wide variety of published works were consulted during the course of the study.

It should be made clear at this point that this study has been largely carried out from within the confines of the city of Honolulu, far from the scene of action. Only two short trips were made to Fiji, where interviews were carried out with personnel from the staff of Department of Relief, Rehabilitation and Rural Housing and the records of the Committee were surveyed. In addition, as time permitted, some short spells were spent in the National Archives of Fiji where some clarification of historical information was possible. While this degree of dependence on secondary sources seems to be a major constraint to this study, it may be noted that the author spent a year in Fiji in 1975/76 and spent several periods in villages in eastern Fiji, investigating amongst other topics the impact of Cyclones Lottie and Val upon those communities (see Campbell, 1977).

The main purpose of this investigation has not been to develop a set of recommendations or guidelines for reducing vulnerability to disaster in Fiji, but to describe the Committee's activities. However, it is hoped that the study will also contribute towards understanding the processes by which the present high levels of vulnerability in Fiji might have come about, and that it will shed some light on possible ways of countering the trend. To date there have been a number of studies of response to natural hazards — of both official relief and rehabilitation organizations, and victims, to single disasters — but very little attention has been paid to long-term trends involving a number of disasters over an extended period. Similarly most studies of disasters have been in areas outside the Pacific region. It is hoped that this book will help to offset these imbalances in the disaster literature.

A number of people have assisted in the preparation of this report and in making the following acknowledgements it is sincerely hoped that there are no inadvertent omissions. From the outset I

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have had considerable assistance from Michael *Hamnett*, Research Coordinator, Pacific Islands Development Program, who not only suggested that I undertake this study but also did not fail to continue with encouragement and suggestions throughout the period of its preparation. Mike also played the crucial role of courier on his frequent trips between Honolulu and Suva. Temo Stewart, Toga Wailevu, and Filemone Mekemeke, of the Department of Relief, Rehabilitation and Rural Housing, not only answered all of my questions with candour and interest, but also made the records of the Committee freely available to me. At the Pacific Islands Development Program, Filipe Bole, James Makasiale, Macu Salato, Titi-lla Barbour, and Kini Suschnigg all gave valuable advice on matters Fijian, and Soane Hurrell and Major Sio Maiasa were useful sources of information on counter-disaster planning and disaster impact in the Pacific region. Michael Barnes gave valuable assistance on the many questions I had concerning building designs. Parts or all of the manuscript were read by Tupeni Baba, Filipe Bole, John Connell, Mike Hamnett, Steven Levine, Brian Murton, and Temo Stuart. While their comments and criticisms have been very useful, responsibility for the statements and views expressed remains my own. Harriet Yoshizaki typed much of the manuscript and Linley Chapman edited the final draft. Finally I would like to thank my wife for her assistance and encouragement throughout this project.

CONVENTIONS

SPELLING AND PRONUNCIATION OF PLACE NAMES

The standard form of Fijian spelling is used throughout this book. While most readers will be familiar with this system, which is used throughout Fiji, some may be more familiar with the somewhat cumbersome 'anglicized' version. This anglicized version is still used for place names in Fiji Meteorological Service publications, on some maps still in current use, and in some of the international disaster literature. To avoid confusion the equivalent forms and their pronunciations are given as follows:

<i>Standard Spelling</i>	<i>Anglicized Spelling</i>	<i>Pronunciation (as in)</i>
b	mb	timber
c	th	thy
d	nd	hand
g	ng	singer
q	ngg	finger

Some examples of place names used in the text are:

<i>Standard Spelling</i>	<i>Anglicized Spelling</i>
Ba	Mba
Beqa	Mbengga
Buca	Mbutha
Cakaudrove	Thakaundrove
Kabara	Kambara
Kadavu	Kandavu
Lakeba	Lake mba
Laucala	Lauthala
Nadi	Nandi
Nadroga	Nandronga
Qamea	Nggamea
Vanuabalavu	Vanua Mbalavu

‘THE COMMITTEE’

Although the Prime Minister’s Hurricane Relief Committee changed its name to the Prime Minister’s Relief and Rehabilitation Committee in 1980 its membership was not altered and most of its activities remained essentially unchanged. To avoid confusion, especially when a general reference is being made which includes the periods both before and after the name change, the term ‘the Committee’ is used. In Fiji the Committee was widely known by its abbreviations —PMHRC and PMRRC respectively —and these are used when documents specifically from either before or after the name change are cited.

NAMES OF TROPICAL CYCLONES

The names assigned to tropical cyclones by the World Meteorological Organization are used throughout this report. This system has been in use for the area in which Fiji lies since the beginning of the 1970s and covers the entire duration of the “decade of the Committee.” Table 1.3 lists the names and dates of occurrence of all the tropical cyclones that affected Fiji during this period. References to earlier tropical cyclones are usually by month and year (e.g. the cyclone of March 1886) or, in the event that only one tropical cyclone occurred, and in subsequent references, by the year alone (e.g. the storm of 1910, the 1895 cyclone).

CURRENCY

The term pounds (£) is used for the period prior to the end of World War II, when sterling currency was in use. For ease of comparison all currency references after that date are in dollars although Fiji did not convert from pounds to dollars until 1969 (£F1 = \$F2). When dollars are used they always refer to Fiji dollars unless specifically stated otherwise.

The value of the Fiji dollar is presently linked to a group of currencies of the country’s main trading partners, but prior to 1974 it was related to the pound sterling and for one year after that to the American dollar. The accompanying table gives the average rates of exchange between the Fiji dollar and those of the

main relief-donating countries for the decade in which the Committee operated.

	\$US	\$A	\$NZ
1972	1.16	1.00	1.00
1973	1.13	0.88	0.93
1974	1.27	0.86	0.89
1975	1.21	0.93	1.06
1976	1.11	0.91	1.11
1977	1.13	0.98	1.12
1978	1.17	1.02	1.12
1979	1.20	1.08	1.17
1980	1.23	1.08	1.25
1981	1.16	1.01	1.35
1982	1.06	1.06	1.43

Sources: South Pacific Commission (1977, 1983);
Fiji Bureau of Statistics (1983).

UNITS OF MEASUREMENT

The metric system, which is in official use in Fiji, is used throughout the text except in quotations and some historical references. Abbreviations and conversion factors for the metric units used in this report are:

<i>Metric Unit</i>	<i>Abbreviation</i>	<i>Conversion to Commonly Used Units</i>	
millimetre	mm	1 mm	= 0.039 inch
centimetre	cm	1 cm	= 0.394 inch
metre	m	1 m	= 39.370 inches
		1 m	= 1.094 yards
kilometre	km	1 km	= 0.621 mile
		1 km	= 0.534 nautical mile
gram	g	1 g	= 0.035 ounce
kilogram	kg	1 kg	= 2.205 pounds
tonne	t	1 t	= 0.984 long ton
millibar	mb	1 mb	= 33.864 inches of mercury at 0°C

PART I
BACKGROUND

TROPICAL STORMS AND HURRICANES IN FIJI

LAND AND POPULATION

The Dominion of Fiji covers a relatively large portion of the South Pacific Ocean between Rotuma ($12^{\circ} 28' S$) in the far north and Ono-i-Lau ($21^{\circ} 20' S$) in the south, and from Viwa ($176^{\circ} 53' E$) in the west, across the 180th meridian, to Vatoa ($178^{\circ} 13' W$) in the east (see Figure 1.1). Between these extremities lie more than three hundred islands (excluding small islets, rock islands, and sand cays) with a total land area of 18,272 km², dispersed over an ocean area of 1,290,000 km² as defined by the 200-mile (320 km) economic zone (South Pacific Commission, 1980). The ratio of land to sea area is less than 1.5 per cent, although 87 per cent of the land area is accounted for by the two major islands of Viti Levu (10,380 km²) and Vanua Levu (5,530 km²). These two islands, which are of volcanic origin, are characterized by steep mountainous topography (67 per cent and 72 per cent of Viti Levu and Vanua Levu respectively) with only limited areas of flat land in the valleys of the major rivers (most of which are found on Viti Levu), river deltas, and coastal plains (17 per cent and 15 per cent respectively) (Twyford and Wright, 1965). Generally speaking most of the smaller islands are also of volcanic origin and relatively rugged, with most flat land located along their coastlines in low narrow coastal plains. A number of them have a limestone component and some islands are composed totally of limestone. Most of Fiji lies within the zone of south-easterly trade winds with a marked differentiation in precipitation between the leeward

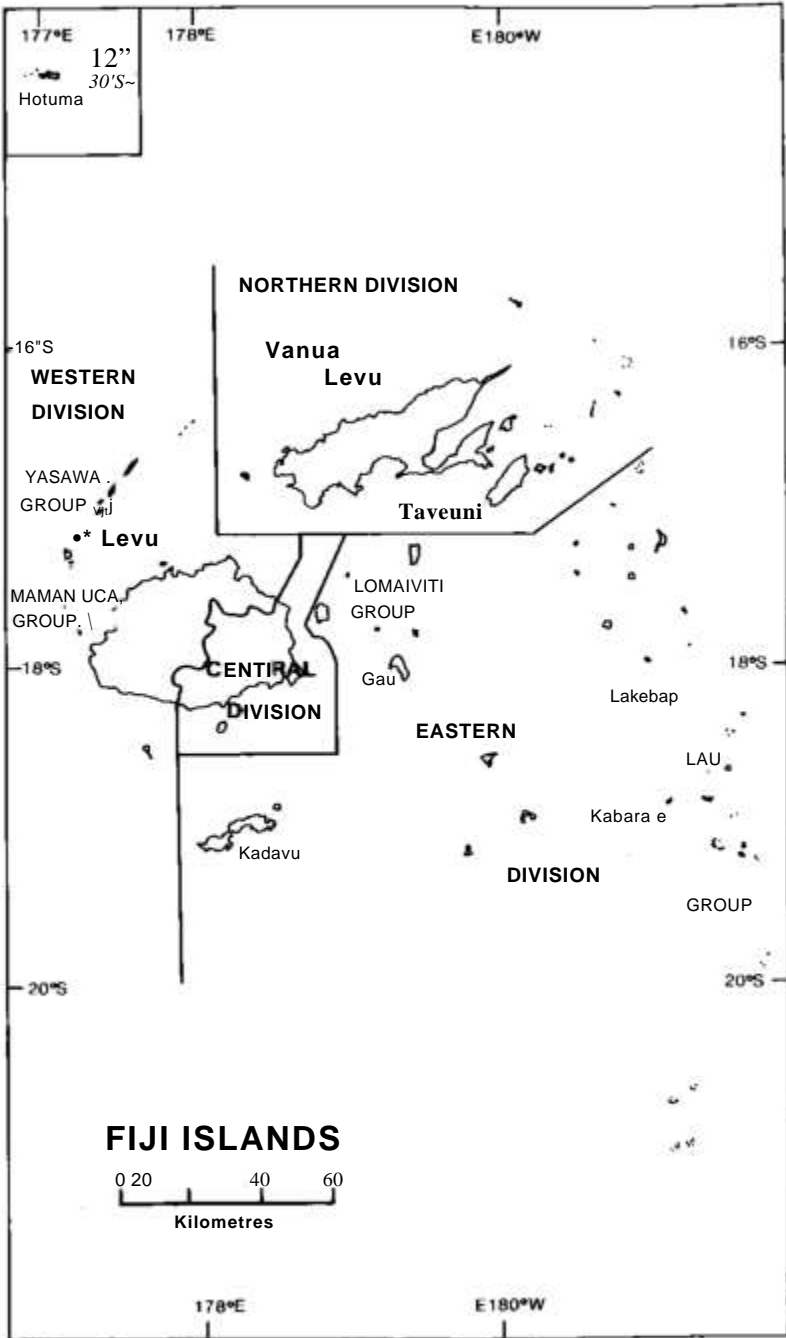
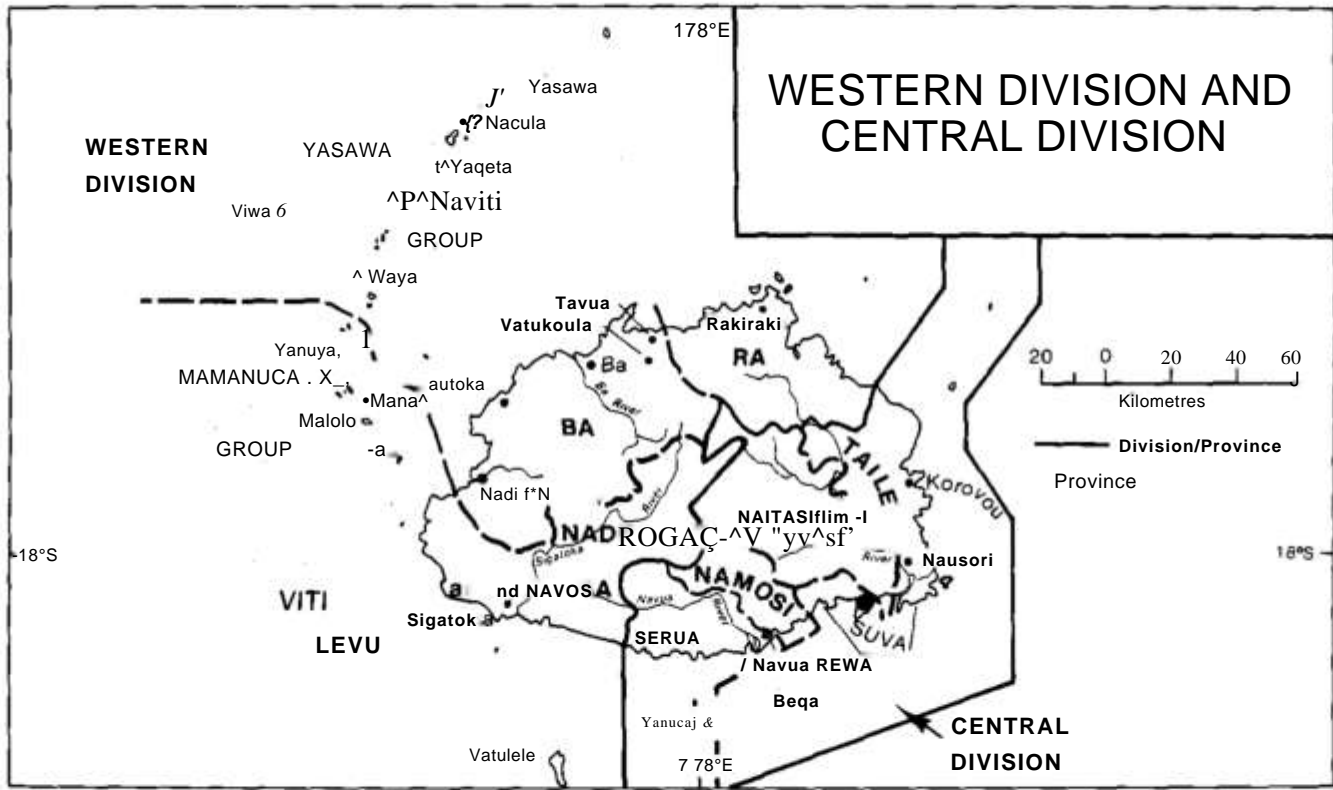
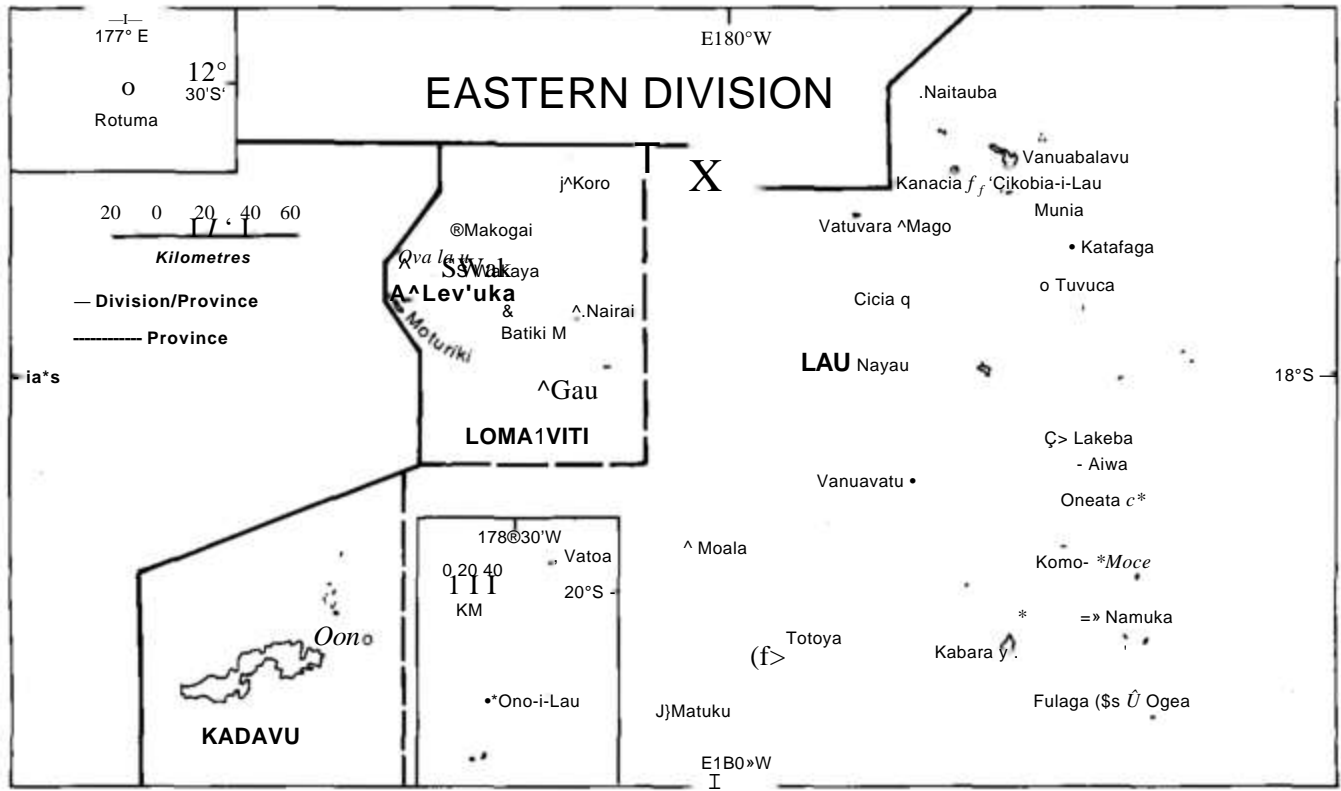


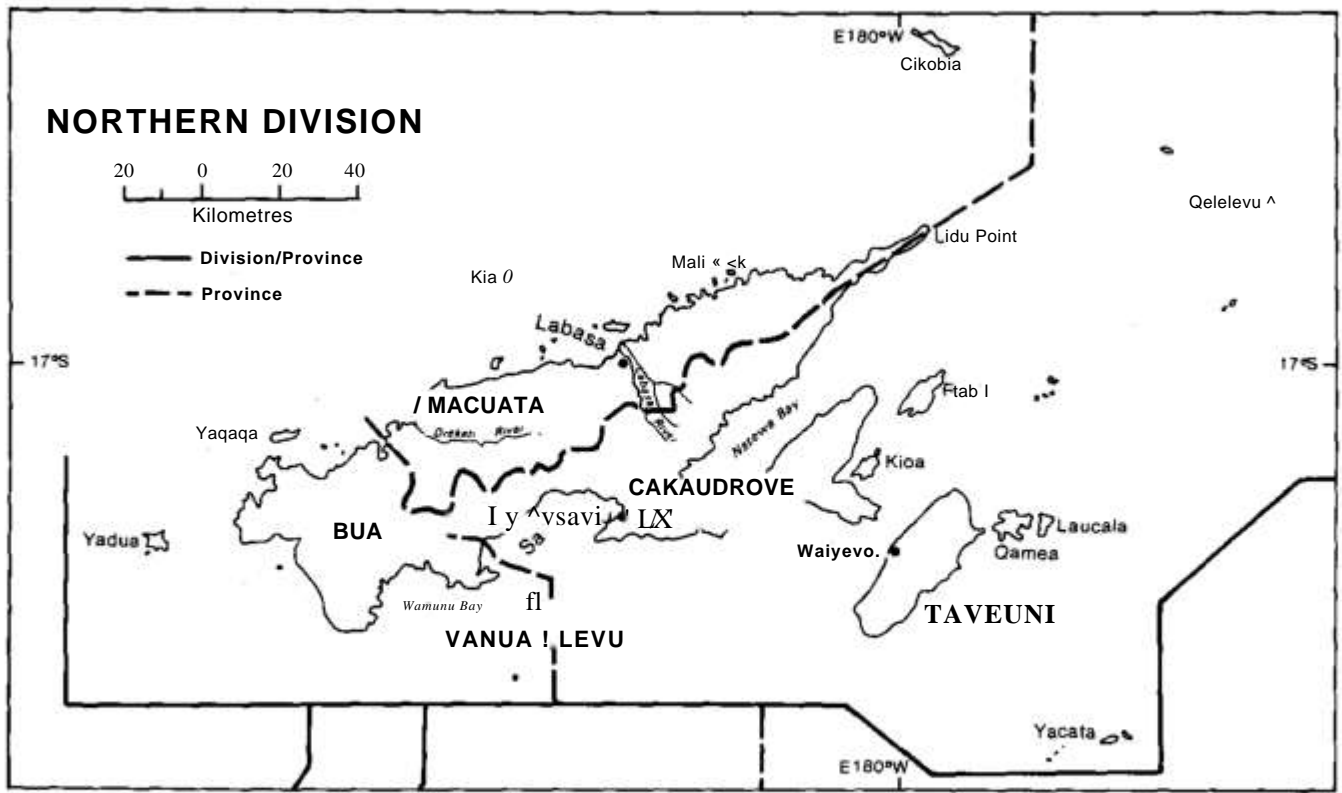
Figure 1.1 Location map of Fiji



WESTERN DIVISION AND CENTRAL DIVISION

Tropical Storms and Hurricanes in Fiji





(dry) and windward (wet) sides of the larger islands. Most of the lower islands receive relatively low rainfalls. Rainfall in Fiji can be quite variable and drought is a relatively frequent hazard on the limestone islands in particular and also on the dry sides of the larger islands, where it periodically reaches very serious levels.

The most recent census of Fiji was conducted in 1976 when a total of 588,068 persons were enumerated. Recent estimates indicate that by the end of 1981 the total had reached 650,000 (Lodhia, 1977; Fiji Bureau of Statistics, 1983). The population of Fiji is distributed over some 97 islands although in 1976 over 75 per cent of the total resided on Viti Levu, which accounted for at least 67 per cent of the rural and 90 per cent of the urban dwellers. The largest urban areas are Suva, with a 1976 population, including peri-urban areas, of 117,827, and Lautoka (28,847). Fiji has a predominantly rural economy and 63 per cent of the population lived in rural areas in 1976—especially along the fertile flood plains of the main rivers in the large islands and in coastal locations throughout the group. These areas suffer some of the greatest destruction when tropical storms and hurricanes visit Fiji.

CHARACTERISTICS OF TROPICAL STORMS AND HURRICANES

Fiji may be affected by any one of a number of extreme environmental events including earthquakes, tsunamis, and droughts, but the most frequent and widespread destruction is caused by tropical cyclones. These low-pressure weather systems form over warm ocean surfaces usually between 5° and 30° north or south of the equator. They may range in intensity from tropical depressions where winds are less than 62 km/hr (34 knots), through tropical storms with winds ranging from 62 to 117 km/hr, to hurricanes in which winds exceed 117 km/hr (63 knots). Not all tropical cyclones reach the intensity of tropical storms and even fewer develop into hurricanes before losing intensity. There is considerable variation in the terms and definitions used to describe tropical cyclones. In this discussion, we follow Kerr (1976) who used the term 'tropical cyclone' in a generic sense to "include tropical disturbances of all intensities" and employed the World

Meteorological Organization classification. However, in the remainder of the book the terms are used more loosely, to reflect local and general usage and to avoid tedious and frequent repetition.

Unlike mid-latitude type cyclones, tropical cyclones occur much less frequently and regularly but are often many times more powerful. Although tropical storms and hurricanes are usually considerably smaller than cyclones originating in the mid-latitudes, they are characterized by very steep pressure gradients giving rise to winds of sometimes enormous velocity, which whirl around and towards a very low-pressure centre. One of the lowest pressures recorded in Fiji was in March 1886 when 932.5 mb were registered on an aneroid barometer at Vuna in southern Taveuni. At nearby Salialevu a pressure of 935.6 mb was recorded, also using an aneroid barometer which like the one at Vuna was "corrected for Index error by comparison with the mercurial barometer at Suva" (Holmes, 1887b). It is assumed that all other minimum pressure observations presented here were registered on mercury barometers. At Suva the lowest recordings were made in January 1952 (956.4 mb) and February 1941 (964.7 mb) and at Levuka 955.1 mb were registered in November 1930 (New Zealand Meteorological Service, n.d.; Fiji Public Relations Office, 1952). More recently 940 mb were recorded on Lakeba when Cyclone Val struck the island in January 1975 and during Cyclone Bebe (October 1972) the minimum pressure at Yasawa-i-Rara was 945 mb (Krishna, 1981). Sustained wind speeds of 160 km/hr are not uncommon and gusts may peak at much higher levels. McLean (1977) cites a wind velocity of 204 km/hr reported from Ogea in January 1943 and in January 1952 a peak gust of 213 km/hr was recorded at Laucala Bay immediately before the anemometer was blown down (Kerr, 1976). Table 1.1 indicates the average frequency of extreme gusts at Suva and Nadi.

Rapid upward movement of the spiralling air often causes extremely heavy rainfall during tropical cyclones. The heaviest rains are most commonly found in the area surrounding the centre of the storm and where the winds, even at some distance from the centre, are forced to rise over mountains. Thus, it is not surprising that the greatest downpours have generally been recorded on the two large islands of Viti Levu and Vanua Levu. One

TABLE 1.1 Average Frequency of Extreme Gusts at Suva and Nadi

<i>Average Return Interval (years)</i>	<i>Suva^a (km/hr)</i>	<i>Nadfi (km/hr)</i>
10	144	139
20	163	157
30	174	169
50	189	172
100	209	200

Source: Gabites (1979a).

a. Based on statistical analysis of wind records from 1943—1979.

b. Based on statistical analysis of wind records from 1954—1979.

of the earliest measurements of such rains was made during the cyclone of 1871, which caused 380 mm of rain to fall in twenty-four hours at Delanasau, Bua on 20 March ; totals of 510 mm and 745 mm were recorded for the forty-eight hours and six days ending 21 and 22 March, respectively (R. L. Holmes in *Fiji Times*, 7 April 1886). Even heavier rains were experienced on Vanua Levu eighteen years later, associated with the cyclone of January 1889, when Governor J. B. Thurston reported that parts of the island had experienced as much as 1500 mm in one week (UK, CO 83/50, No. 33). On Viti Levu, sustained torrential rains have been experienced on numerous occasions, among the most noteworthy being the cyclones of 1889, 1929, 1931, 1965, Bebe in 1972, and Wally in 1980. Tropical storms and hurricanes do not always bring downpours, especially to the smaller islands. During the cyclone of December 1948, a fall exceeding 350 mm in two days drenched Taveuni. But as McLean (1977:15) stated of the numerous events that have affected the eastern islands of Fiji, "some have brought deluges; others have been accompanied by falls little different from those normally expected during summer weather depressions." One of the best illustrations of the difference in rainfall between large and small islands is from the cyclone of 1912 in which the Labasa, Rewa, and Navua rivers were all reported to be in high flood (*Fiji Times*, 30 January 1912). The Yasawa Group was also badly affected —it was described by a government official as "the worst hurricane ever" — although it was reported that there was very little, if any, rain (UK, CO 83/106, No. 74).

The very low atmospheric pressures experienced during tropical storms and hurricanes often cause the sea-level to rise as much as several metres. Where the storm approaches or passes close to land, storm surges may occur as winds drag the already higher-than-normal surface waters against the coastline, causing inundation of low-lying areas. The most notable accounts of storm surge date back to 1886 when it was reported by government officers that places in Gau, some "440 fathoms" (800 m) from the coastline, had been inundated by the sea. They estimated from marks left on trees near the beach that the sea-level had risen by more than 5 metres (UK, Parliament, 1977: 129, 143). It is more probable that the inundation was caused by the run-up of high waves that would have been able to pass over the protective reefs which were temporarily submerged by the storm surge. During Meli in March 1979, the surge on Nayau is reported to have reached between 2 and 3 metres above sea-level, although the waves were able to reach 6 metres up the coastal slopes of the island (Gabites, 1979b: 1). At sea, conditions during tropical storms and hurricanes become very rough with huge waves whipped up by the strong winds. Despite being located some 80 km from the centre of the January 1958 cyclone, one vessel found itself caught among waves up to 22 metres in height (Kerr, 1976).

Because the centres of tropical cyclones are steered away from their points of origin by upper-atmosphere winds, the course they are likely to follow is difficult to predict. Kerr's (1976) analysis of directions of storm movement for the three decades from 1939 to 1969 shows that slightly more than half of the storms (53 per cent) left the Fiji area east or south-east of their point of entry, 28 per cent moved in a westward or south-westward direction, and the remaining 19 per cent changed direction from westward or south-westward to eastward and south-eastward and vice versa in equal numbers.

THE DESTRUCTIVENESS OF TROPICAL STORMS AND HURRICANES

These characteristics of tropical storms and hurricanes — high winds, heavy rains, dangerous sea and coastal conditions, and unpredictability — provide them with an extremely destructive po-

tential. The worst events are often labelled for posterity in terms of their spectacular effects: the 1886 storm surge, the floods of 1931 and the “Wally Floods,” the stormy seas of Cyclone Lottie in which the *Uluilakeba* perished, or the vicious winds of Cyclone Meli in 1979. Yet it is rare for tropical storms and hurricanes to confine their destruction to only one of these forces.

Hurricane-force winds pose a formidable threat to any obstacle, of natural or human origin, that may stand in their way and few reports of the effects of tropical storms or hurricanes are complete without descriptions of the wind’s might. Houses can be lifted bodily to sit atop their neighbour, hefty safes may be carried several metres or more, and villages are left with their crops absolutely flattened. Often the scenes of devastation move observers to record extremely lucid descriptions of the wind’s legacy and perhaps no one more so than one Captain Crawshaw who visited Taveuni soon after the cyclone of 1886.

The general appearance of the island is melancholy, and the contrast with its usually verdant aspect but the more strongly marks the change. From the coastline to the tops of the hills it seems as if the country has been swept and devastated by fire. Nothing remains but bare sticks and the blackened, torn and twisted relics of what once constituted graceful and abundant foliage. (*Fiji Times*, 10 March 1886)

While the natural vegetation is not spared the impact of hurricane winds, the damage to it is often less severe than that sustained by gardens and settlements (see Chapter 2).

Rarely, however, does the wind act alone and in Taveuni in 1886, it was accompanied by the sea as Captain Crawshaw observed.

Then, as though the worst had come and gone, a lull ensued which steadied to a delightful calm. The sky cleared, the stars came out, and as this lasted for over an hour many congratulated themselves that things were not as bad as they might have been, Suddenly the calm was dispelled by the shriek, the roar, the rush of the wind as it burst on the place from the opposite quarter, the westward. This completed the utter wreck which had before began. The wind bore down everything which would yield to its fury and the sea swept in and carried away the debris, or buried it out of sight feet deep in sand and shingle. (*Fiji Times*, 10 March 1886)

The effects of storm surge and high seas are often as significant as the wind itself in coastal areas, devastating villages, destroying coastal installations, vessels, and stores, eroding shorelines and depositing sediments and debris inland, and contaminating the soils and water supplies of low-lying areas (McLean, 1977). The storm surge experienced on Gau during the 1886 cyclone is perhaps the worst on record, and had a spectacular result.

The towns of Vadravadra, Yadua, Ureta and Malowai [Malawai] were completely washed away. Lamati [Lomati] [was] partially destroyed and at Vanuaso a shark was killed among the houses. (*Fiji Times*, 13 March 1886)

While storm surge is a considerable threat to the smaller islands, they are largely free of widespread river flooding, although flash flooding of small or intermittent streams may occur. On Viti Levu, the Rewa (and its tributaries), Navua, Sigatoka, Nadi, and Ba rivers have all been the scene of disastrous floods. During the 1929 cyclone the Rewa is reported to have risen 19 metres at Vunidawa, and further downstream, when the water had subsided "dead cattle hung from the forks of trees" (*Fiji Times and Herald*, 13 December 1929, p. 8). The most tragic of all the recorded tropical storms and hurricanes in the past century occurred in 1931 when 206 lives were lost mostly from drowning. All of the rivers on Viti Levu were in flood but the toll was highest in the west, especially in Ba where 111 persons perished.

At nightfall on Saturday, the 21st February, the Ba river was rising steadily and heavy rain had been falling throughout the week, but there was no serious anxiety. The sudden rise of the river during the night, the darkness, the absence of boats, and the violent wind causing such heavy damage that wading and swimming were alike impossible were the causes which combined to swell the total of casualties. (Fiji, Legislative Council, 1931: 3)

In the Lautoka district there were 82 victims of the storm, including 13 who died when a landslide diverted the course of a river through Nagaga village. "Boulders up to 100 tons in weight passed through the town" (Fiji, Legislative Council, 1931: 6). The danger of landslides triggered by heavy rains is indeed high during tropical storms and hurricanes and they are more likely to occur where there has been considerable modification of the nat-

ural environment, such as bush clearing for agriculture or slope modification in the construction of roads. Following Cyclone Wally, "45 huge landslides" blocked the road between Navua and Yarawa, a distance of only about 20 km (*Fiji Times*, 7 April 1980).

During Cyclone Lottie, the loss of the *Uluilakeba* and 75 of those on board and the sinking of the *Makogai* in which 5 perished, dramatically illustrated the dangerous conditions at sea during tropical storms and hurricanes. In fact, with these exceptions, marine casualties have been comparatively light in the past four or five decades. One of the earliest recorded disasters at sea occurred in 1840 when thirteen canoes left Lakeba for Ono-i-Lau. After leaving Vatoa, "a storm arose in which four canoes with about one hundred men were lost" (Henderson, 1931: 172). During the latter part of the nineteenth and early twentieth centuries, the shipping toll was invariably high during hurricanes and lengthy lists of lost and wrecked vessels always accompanied the reports of hurricane damage in the local newspapers. In the March 1886 cyclone some 50 vessels were reported by the *Fiji Times* as wrecked, although a number of these were subsequently recovered and repaired (Holmes, 1887b). Following the 1910 cyclone, 17 vessels were officially listed as lost, disappeared or wrecked, 13 as foundered, grounded, or stranded, and three as damaged (UK, CO 83/95, No. 83). The decline of inter-island shipping since the Second World War, particularly the discontinued operation of numerous locally owned small vessels, together with recent improvements in forecasting, have greatly reduced the toll of marine casualties. Nevertheless, tropical storms and hurricanes still impose a considerable risk to shipping and during Cyclone Meli at least 11 vessels were affected, being either lost, sunk, run aground, or damaged (Waygood, 1980).

TEMPORAL DISTRIBUTION OF TROPICAL STORMS AND HURRICANES IN FIJI

A total of 121 tropical storms and hurricanes have been recorded in Fiji between 1880 and 1980 (see Appendix 2). For the earlier years in particular, the record may be both inaccurate and incomplete depending upon the event having been recorded, observer objectivity in describing the events, and variations in the use of

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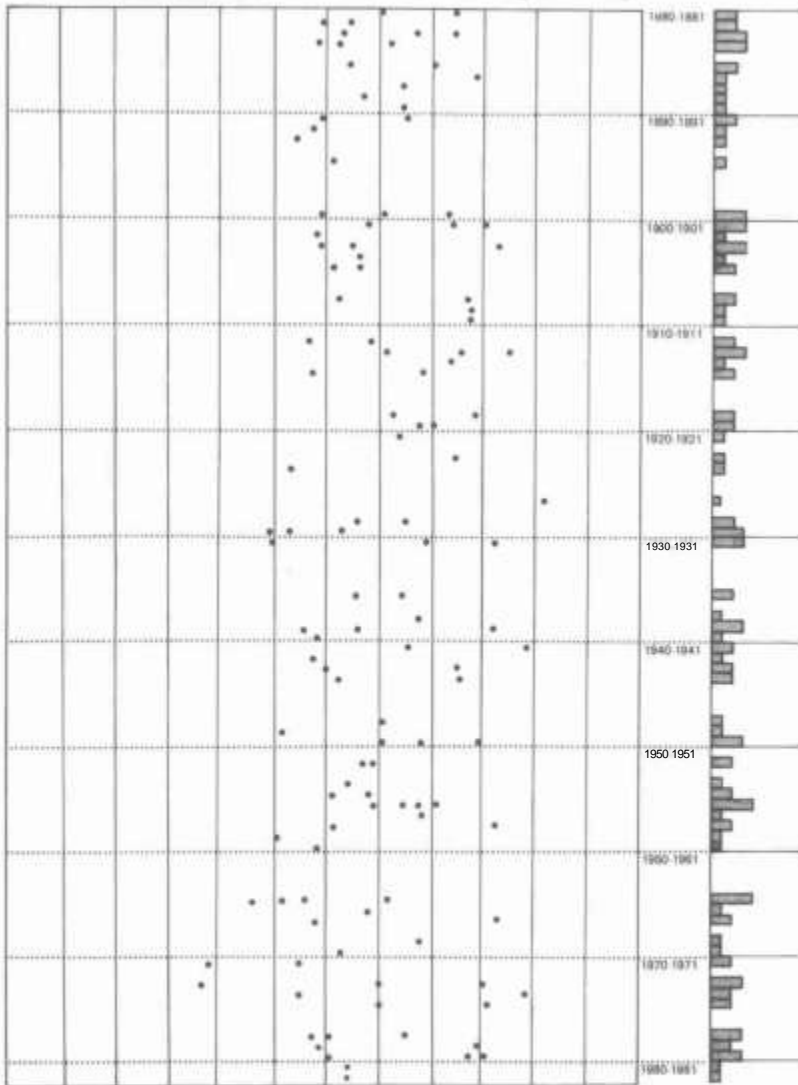


Figure 1.2 Summary of tropical cyclones in Fiji, 1880-1982

terminology. Nevertheless, a number of inferences may be drawn from analysis of this information, which is presented in Figure 1.2. The framework for the analysis and discussion presented here generally follows a similar pattern to McLean's (1977) analysis of hurricane incidence in eastern Fiji.

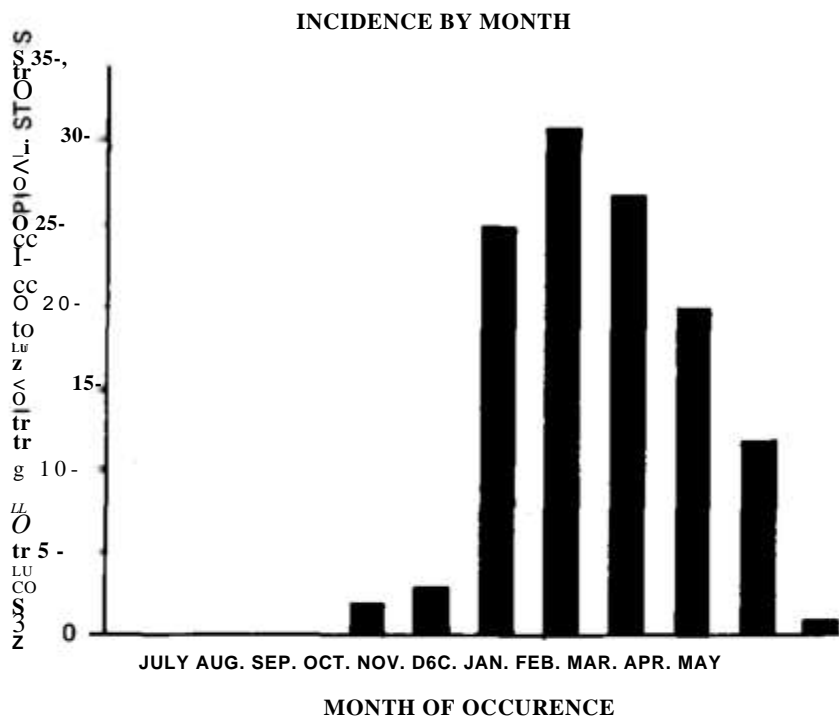


Figure 1.3 Incidence of hurricanes by month, 1880/81 to 1979/80

Figure 1.2 also indicates the seasonality of tropical storm and hurricane incidence in Fiji and, as Figure 1.3 shows, most events occur during the months from December through April although some have occurred earlier, during the months of October and November, and a later one has been recorded for May 1926 (New Zealand Meteorological Service, n.d.). (Storms that extend over the end of one-month into the next are assigned to the month in which they spent the most days over the Fiji area.) Perhaps the most notable early storm was Cyclone Bebe which occurred in October 1972. The existence of a hurricane season is well recognized in Fiji although many were taken by surprise when Cyclone Bebe appeared. The possibility of such early events, and late ones, should certainly be taken into account in disaster preparedness planning.

From Figure 1.2, it is clear that the distribution of tropical storms and hurricanes through time is highly irregular, ranging

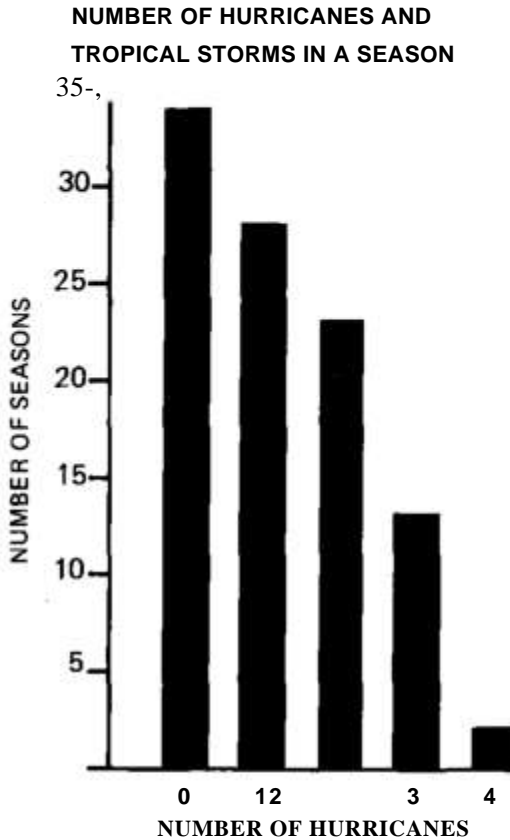


Figure 1.4 Number of hurricanes in a season, 1880/81 to 1979/80

from only 8 to as many as 17 per decade. Although the average incidence of storms is 1.2 per season, this figure masks the variation from one season to the next. No fewer than 34 seasons have passed without any part of Fiji experiencing a tropical storm or hurricane, whereas at the other end of the spectrum, four such events were observed in both the 1955/56 and 1964/65 seasons although not all of these were severe. The longest storm-free periods are those in which four consecutive hurricane seasons passed uneventfully, which happened only three times in the hundred year period. Figure 1.4 summarizes the range of storm incidence per season.

MAGNITUDE OF TROPICAL STORMS AND HURRICANES IN FIJI

The intensity of tropical cyclones (measured in terms of maximum sustained wind velocities) varies considerably and only a few go through all of the stages, developing from a tropical depression into a tropical storm before becoming a hurricane. Not all of those that affect Fiji and are classified as tropical storms or hurricanes are at that stage while over or near the country — some may already be losing intensity and others may not attain that status until after they have left the group. On occasion, tropical storms have intensified into hurricanes while in the Fiji area. The impact of tropical cyclones upon Fiji is thus quite variable. Furthermore, the damage and destruction they cause is not necessarily directly linked to the storm intensity but may depend upon the location of the cyclone's path in relation to the islands of the Fiji group, the cyclone's diameter or the range of gale, storm, or hurricane-force winds away from its centre,¹ the speed of the storm's movement, or the duration of its stay in the vicinity of Fiji.

Kerr (1976) and Waygood (1980) have classified tropical storms and hurricanes according to the magnitude of damage or destruction they caused (see Table 1.2). Less than a quarter of the 52 storms in the period from 1939/40 to 1979/80 were classified as severe and half of them were listed as minor. As Kerr pointed out, these categories should be used only as indicators of the relative impact of storms as they tend often to be based on very subjective assessments reflecting the amount of publicity given to various storms, and that is likely to be greater in cases where the cyclone path crosses or comes close to heavily populated areas or large towns. Indeed, of the five events classed as severe between 1939 and 1969, four affected Suva.

SPATIAL DISTRIBUTION OF TROPICAL STORMS AND HURRICANES IN FIJI

Given the widely dispersed nature of the archipelago, it is extremely rare for a tropical storm or hurricane to affect all of Fiji

¹ Gale-force winds (forces 8 and 9 on the Beaufort Scale) have sustained winds from 60 to 85 km/hr, storm-force winds (forces 10 and 11) range from 85 to 120 km/hr, and hurricane-force winds (force 12) exceed 120 km/hr.

TABLE 1.2 Storm Magnitude, 1939/40 to 1979/80

	<i>Minor</i>	<i>Moder- ate</i>	<i>Severe</i>	<i>Total</i>	<i>Sources</i>
1939/40-1968/69	19	8	8^a	35	Kerr (1976:73-74)
1969/70-1979/80	7	6	4	17	Waygood (1980: 1-4)
Total	26	14	12	52	

a. Three of these storms were classed as “moderate to severe.”

and it is likely that the early records of hurricanes affecting “entire Fiji” are exaggerated; the only storm since 1931 to affect all four divisions was Cyclone Bebe in 1972, although four were recorded between 1886 and 1929. Most tropical storms and hurricanes have had a much more limited impact. More than half of the 116 events in the century for which we have information affected only one division, and only 14(12 per cent) affected three or four divisions (see Figure 1.5).

The frequency with which different areas of Fiji are affected by tropical storms and hurricanes is shown in Figure 1.6. The Eastern Division clearly appears to be the most vulnerable of the four administrative divisions but this is largely due to the wide area covered by the numerous islands of that division,² especially the islands in the Lau Group, which has experienced the effects of 62 of the 116 storms. However, as McLean (1977:15) remarks, very few storms affected all of the islands in the group although “probably all of the islands have an equal chance of being struck by a severe hurricane and of experiencing less severe storms more frequently.” The other divisions of Fiji, each of which has a greater land area and population than the Eastern Division but is more compact, all experienced fewer storms, although the number to affect Viti Levu, irrespective of divisional boundaries, was actually greater than the total for Lau. It is reasonable to infer from the information that, as with McLean’s conclusions for the Eastern islands, all locations in Fiji are probably equally likely to experience a similar number of tropical storms and hurricanes of a similar range of magnitudes.

2 The island of Rotuma, which is included for administrative reasons in the Eastern Division, is excluded from this analysis. The discussion here refers to the present divisional boundaries.

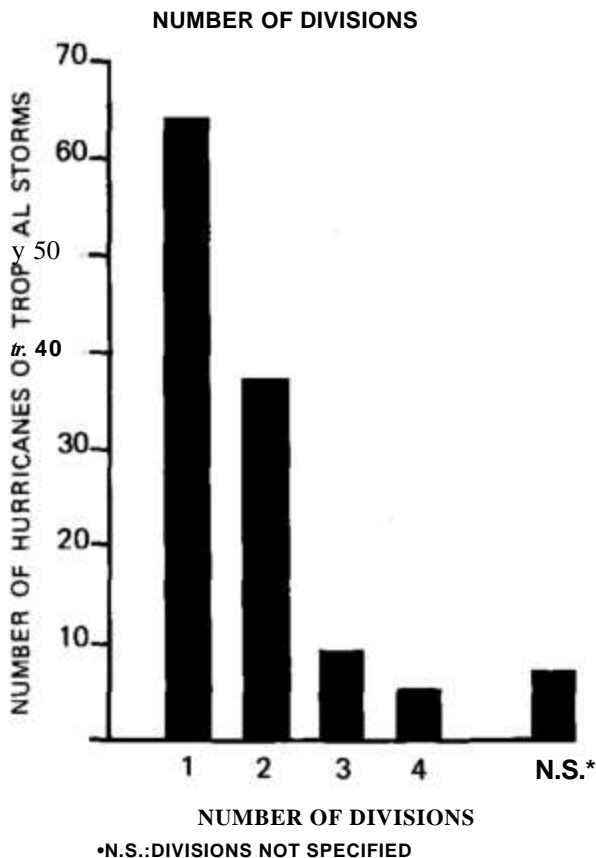


Figure 1.5 Number of divisions affected per hurricane, 1880/81 to 1979/80

TROPICAL STORMS AND HURRICANES FROM 1972 TO 1982

In the ten years from 1972 to 1982, in which the Prime Minister's Committee operated, 17 tropical storms or hurricanes occurred. Details of these events are summarized in Table 1.3 and their tracks are shown in Figures 1.7 and 1.8. Of these storms, 9 reached hurricane intensity, 5 were classified as causing severe damage and destruction, 7 were classed as moderate, and the remaining 5 were minor events.

The most noteworthy storm during the period was Cyclone Bebe, which affected almost all parts of Fiji, with hurricane-force winds being experienced in Rotuma, the Yasawa Group, central

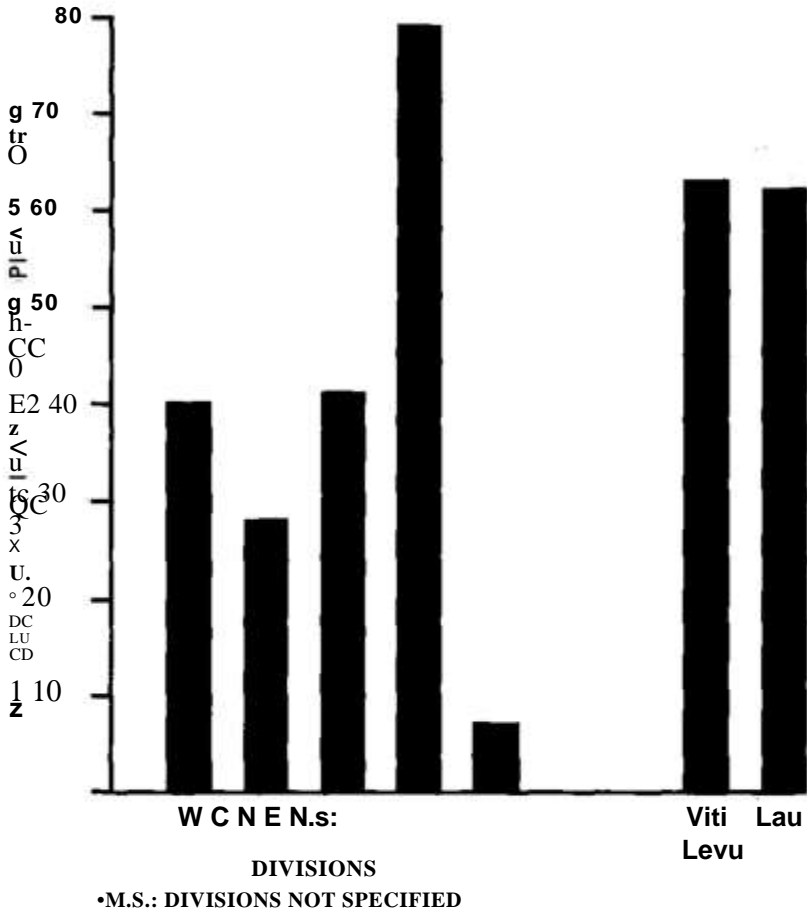


Figure 1.6 Number of times divisions and selected areas affected by hurricanes, 1880/81 to 1979/80

Viti Levu, Beqa, Ono, and Eastern Kadavu, and storm-force winds in the remaining areas of Viti Levu, the Mamanuca Group, Vatulele, and some islands in eastern Fiji. Most other areas experienced gale-force winds. Furthermore, heavy rains were recorded at a number of locations (see Table 1.4) and serious flooding affected many parts of Viti Levu. Viti Levu was badly affected by two other storms —Cyclones Wally and Arthur. Cyclone Wally was characterized by only gale-force winds but, as Table 1.5 shows, was accompanied by extremely heavy rains in the central and south-eastern parts of the island. The “Wally Floods” which

TABLE 1.3 Summary of Tropical Cyclones, 1972—1982

<i>Name</i>	<i>Date</i>	<i>Intensity</i>	<i>Damage</i>
Bebe	23—29 Oct 1972	Hurricane	Severe
Henrietta	2 Feb 1973	Storm	Moderate
Juliette	3—4 Apr 1973	Storm	Minor
Lottie	9-10 Dec 1973	Hurricane	Moderate
Tina	26 Apr 1974	Gale	Minor
Val	31 Jan—2 Feb 1975	Hurricane	Severe
Betty	5—6 Apr 1975	Hurricane	Moderate
Anne	25—26 Dec 1977	Hurricane	Moderate
Bob	4—5 Jan 1978	Hurricane	Moderate
Ernie	18-19 Feb 1978	Storm	Minor

<i>Areas with Hurricane-force Winds</i>	<i>Areas with Storm-force Winds</i>	<i>Areas with Gale-force Winds</i>
Central Viti Levu, Rotuma, Yasawa, Eastern Kadavu, Ono	Remaining Viti Levu, Remaining Kadavu, Mamanuca, Vatulele, Oval au, Wakaya, Gau, Totoya, Ono-i-Lau	Almost all remaining parts of Fiji
	Udu Point, Cikobia, Qelelevu	Remaining eastern fifth of Vanua Levu, Rabi, Naitauba, Vanuabalavu, Munia, Cikobia-i-Lau
	Central SW Vanua Levu	Yasawa, SW half of Vanua Levu, Taveuni, Koro, Naitauba, Kanacea, Mago, Katafaga, Vanuabalavu, Tuvuca
Matuku, Totoya, Fulaga, Ogea	Kadavu, Ono, Kabara, Namuka-i-Lau	Vatulele, Moala, Beqa, Komo, Moce, Vatoa
		Udu Point, Taveuni, Cikobia, Naitauba
Lakeba, Nayau, Tuvuca, Katafaga, Oneata, Moce, Komo, Vanuavatu, Kabara, Namukari-Lau, Fulaga, Ogea, Totoya, Matuku, Kadavu, Ono	Vanuabalavu, Mago, Cicia, Munia, Vatoa, Ono-i-Lau, Moala	Extreme south of Viti Levu, Vatulele, Beqa, Gau, Yacata, Naitauba, Kanacea
Western third of Kadavu	Remaining Kadavu, Ono, Vatulele, Ono-i-Lau	SW Viti Levu, Beqa, Matuku, Vatoa
	Naitauba, Vanuabalavu, Munia, Katafaga, Cikobia-i-Lau	Cikobia, Udu Point, Rabi, E Taveuni, Qamea, Laucala Is., Yacata, Kanacea, Mago, Cicia, Nayau, Lakeba, Oneata, Moce
	Western Viti Levu, Yasawa, Mamanuca	Remaining Viti Levu, Kia, Ovalau, Makogai, Koro, Batiki, Gau, Beqa, Vatulele, Ono, Kadavu
	Cikobia, Udu Point	Eastern third of Vanua Levu, Rabi, N. Taveuni, Qamea, Laucala Is.

TABLE 1.3 (continued)

<i>Name</i>	<i>Date</i>	<i>Intensity</i>	<i>Damage</i>
Fay	29-30 Dec 1978	Storm	Moderate
Meli	26-28 Mar 1979	Hurricane	Severe
Peni	2-5 Jan 1980	Hurricane	Minor
Tia	24 Mar 1980	Storm	Moderate
Wally	3-5 Apr 1980	Gale	Severe
Arthur	13-15 Jan 1981	Hurricane	Severe
Hettie	23 Jan 1982		Minor

Source: Krishna (1981).

Note: All place names within each section are listed in order from north to south and west to east See Figures 1.1, 1.7, 1.8, 1.9.

*Areas with Hurricane-
force Winds*

*Areas with Storm-
force Winds*

*Areas with Galeforce
Winds*

**Eastern two-thirds of Remaining Vanua Levu, Koro,
Vanua Levu, Kia, Vanuavatu, Kabara, Fulaga,
Cikobia, Taveuni, Rabi, Vatoa
Qamea, Mago, Laucala
Is., Yacata, Naitauba,
Kanacea, Munia,
Vanuabalavu, Katafaga,
Cikobia-i-Lau, Tuvuca,
Cicia, Nayau, Lakeba,
Oneata, Moce, Ogea,
Namuka-i-Lau**

**Kadavu, Ono, Nayau, Narrow strip of SE
Lakeba, Cicia, Tuvuca, Viti Levu, Nairai,
Moala, Gau**

Katafaga, Oneata

**Remaining SE half of Viti
Levu, Ovalau, Batiki, Wakaya,
Koro, Vanuabalavu, Kanacea,
Munia, Yacata, Mago,
Cikobia-i-Lau, Moce, Koro,
Namuka-i-Lau, Kabara,
Fulaga, Ogea**

**Mamanuca, Extreme west of
Viti Levu**

**Western three-fourths
of Vanua Levu,
S Koro, Yacata, Cicia,
Tuvuca, S Vanua-
balavu, S Qamea**

**Remaining Vanua Levu,
northern third of Taveuni,
N Qamea, Rabi, Kioa,
Naitauba, Munia, Kanacea,
Katafaga, Lakeba, Oneata**

**Korolevu-Navua area,
Vatulele, Kadavu, Beqa**

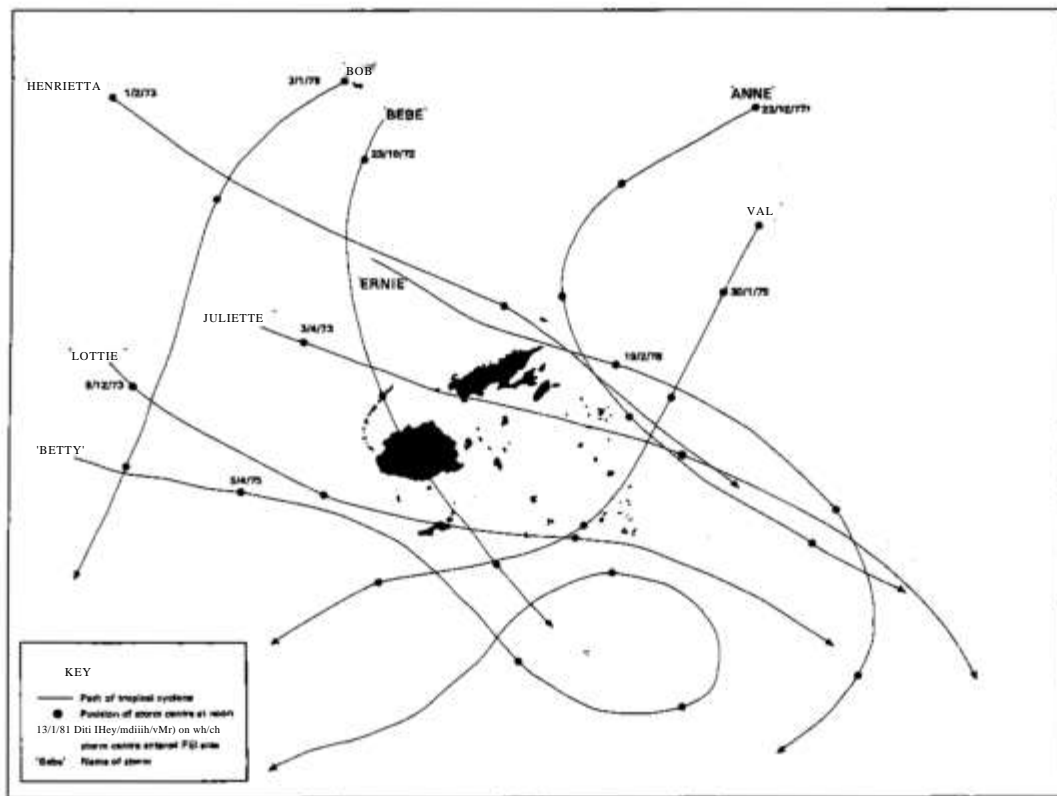


Figure 1.7 Paths of tropical cyclones, 1972-1978

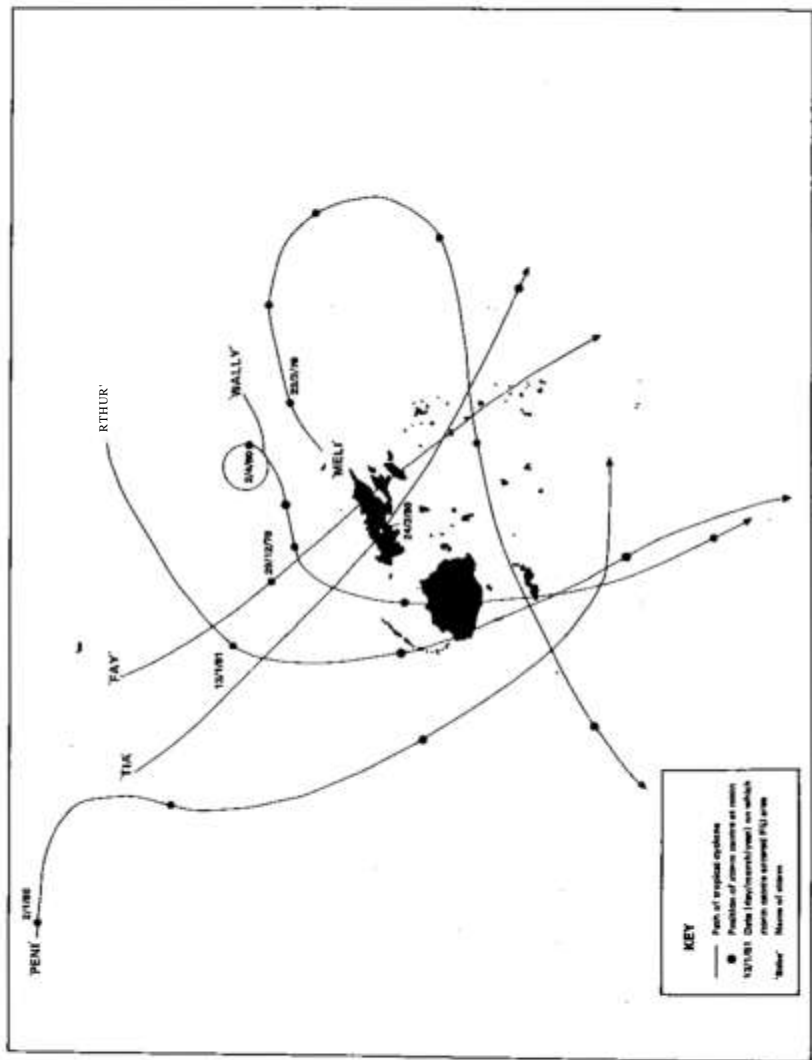


Figure 1.8 Paths of tropical cyclones, 1978 -1982

TABLE 1.4 High Rainfalls Recorded During Cyclone Bebe, 1972

<i>Location</i>	<i>48 hrs (mm)</i>	<i>24 hrs (mm)</i>
Naseuvou (Waidina River Valley)	753	466
Wainikavika Creek Headworks (Navua)	668	444
(Upper Ba River)	632	-
Waibau (Waimanu River Valley)	620	—
Koro	-	464
Nausori Highlands	-	360
Nadi Airport	-	265

Source: Anfinson and Harris (1973).

TABLE 1.5 High Rainfalls Recorded During Cyclone Wally

<i>Location</i>	<i>48-hr Rainfall (ending 9 AM, 5 April 1980) (mm)</i>
Sakisa	1,139
Wainiboro	1,057
Wainikavou	961
Nabukavesi	897
Tamavua	720
Wainitakoto	708
Laucala Bay	570
Lami	530
Naboro	529
Koronivia	511
Nasinu	492
Wainikila	470
Monasavu	417
Wailoa	336
Vunidawa	331
Nayavu	221

Source: Fiji Bureau of Statistics (1981).

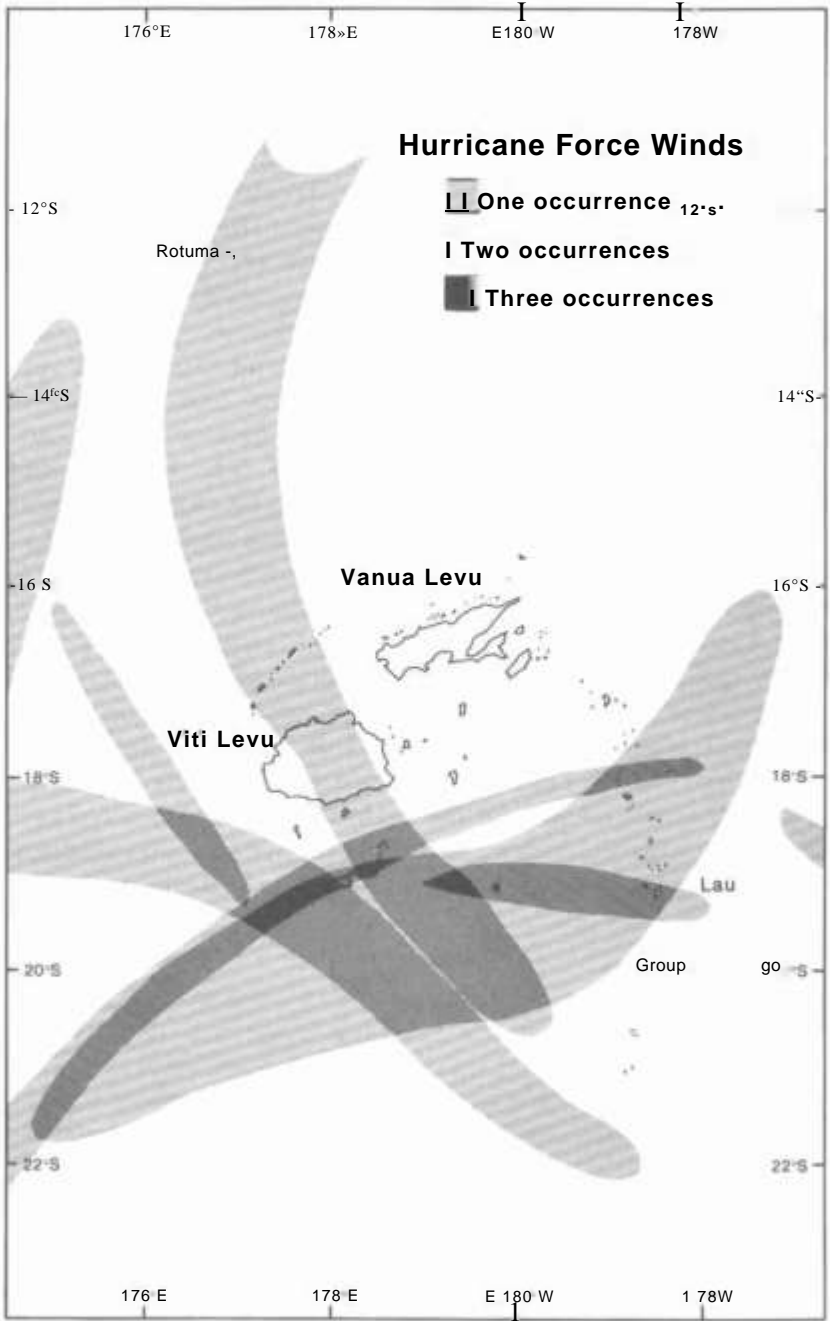


Figure 1.9 Areas affected by hurricane-force winds, 1972 -1982

resulted brought rapid devastation to a number of villages in the Serua-Namosi area.

The Northern Division was the least affected part of Fiji during the decade : although storm- or gale-force winds were experienced in parts of Vanua Levu and the islands of Cakaudrove on eight occasions, only Cyclones Fay and Tia caused significant disruption. In contrast, islands in the Eastern Division were badly affected many times. All areas of Kadavu received hurricane-force winds at least three times, from Cyclones Bebe, Val, Betty, or Meli. In the Lau Province, Cyclones Lottie, Val, and Meli caused the most significant damage and a number of islands were badly affected by at least two of these events. The frequency of hurricane-force winds in different parts of Fiji during the decade of the Committee is shown in Figure 1.9. The highest wind speeds during the period were estimated to be around 205 km/hr at Lakeba during Cyclone Val and near Kadavu during Cyclone Meli. Storm surge is known to have affected parts of Fiji during seven of the events including Cyclones Val, Betty, Bebe, Meli, Fay, Tia (Krishna, 1981), and Lottie (Campbell, 1977).

The decade during which the Committee was involved in hurricane relief and rehabilitation was the most eventful on record in Fiji and on occasion resources were fully stretched. Relief operations were carried out in all divisions and the costs of damage and destruction caused by the cyclones were extremely high. Tropical storms and hurricanes can be very potent forces indeed, wreaking havoc upon the communities they strike in many and varied ways.

2

THE SOCIAL AND ECONOMIC COSTS OF HURRICANES

The extreme conditions which tropical storms and hurricanes initiate can have a severe impact upon the life and livelihood of the people affected. As Figure 2.1 indicates, hurricanes pose a broad range of threats, not only to the safety of people in the area stricken, but also to the welfare of often very large numbers through the devastation of shelter and economic operations and the disruption of communications and transport.

LOSS OF LIFE AND INJURY

The most immediate, tragic, and irreplaceable costs of tropical storms and hurricanes are measured in their toll of lives lost. The list of known numbers of fatalities for storms from 1886 to 1982 given in Table 2-1 is by no means complete: data are not available for many of the early events and most of those for which there is information are significantly underestimated, as few fatalities were recorded in areas remote from Levuka and Suva. From the available information, it is possible to determine that at least 607 deaths resulted from tropical cyclones in the hundred years ending in 1982. Given the inadequacies of the data, a total of 800 would probably be more reasonable, if not still a conservative estimate.

Hurricanes cause human fatalities in both direct and indirect ways, as indicated in Table 2.2. Accurate and detailed information about the relative importance of these factors is even less readily available than that for the total number of deaths. How-

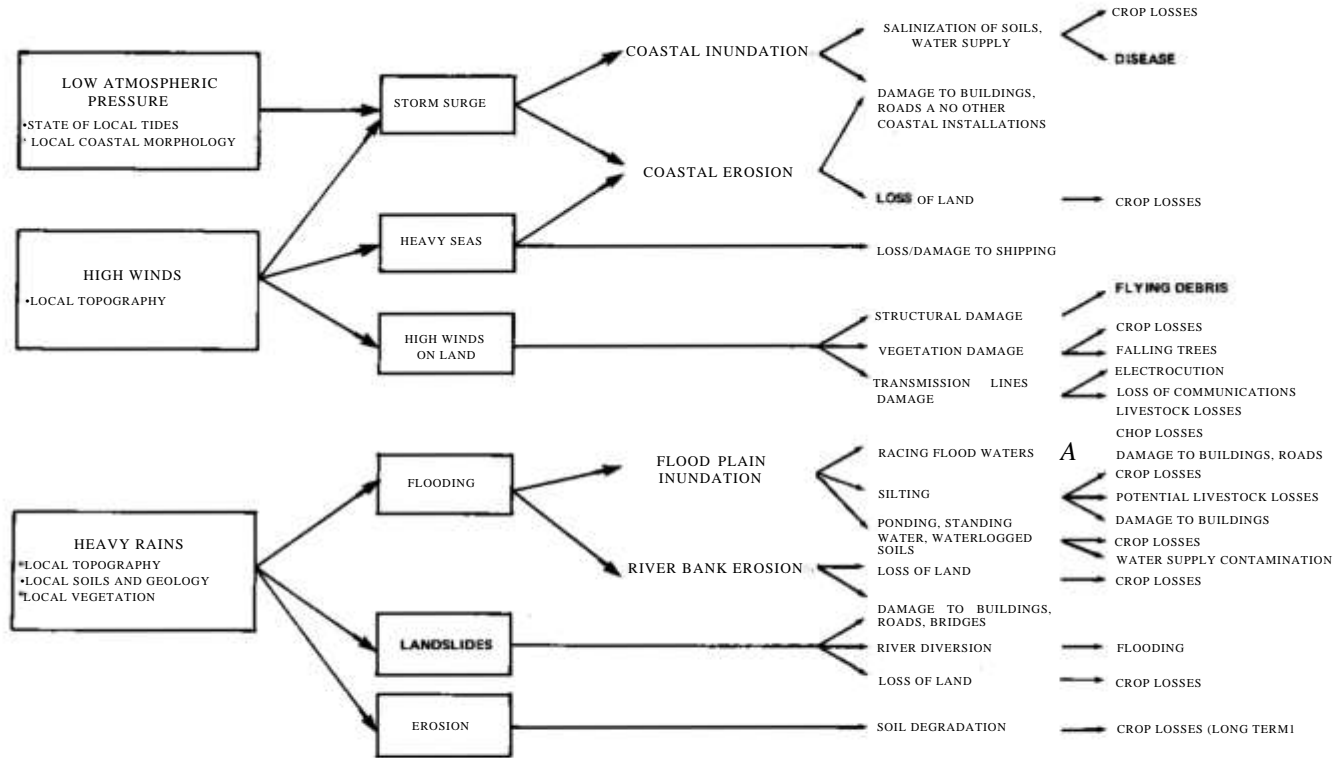


Figure 2.1 Damage-causing factors of hurricanes in Fiji

TABLE 2.1 Hurricane Fatalities in Fiji, 1886—1982

<i>Incomplete Data</i>		<i>Complete Data</i>		
<i>Year</i>	<i>Fatalities</i>	<i>Year</i>	<i>Name</i>	<i>Fatalities</i>
1886	64	1972	Bebe	20
1901	4	1973	Lottie	80
1904	18	1979	Meli	53
1905	8	1980	Tia	4
1910	26		Wally	18
1912	18	1981	Arthur	5
1913	1	1982	Hettie	3
1929	20		Total (1972-1982)	183
1930	10			
1931 (Feb/Mar)	206			
(April)	1			
1936	1			
1941	6			
1952	24			
1956	2			
1959	1			
1964	2			
1965	12			

Sources: Burrows (1952); UK, GO 83, various numbers; *Fiji Times* (various dates); Franco, Hamnett and Makasiale (1982); Holmes (1887b); Legislative Council (1931).

ever, it would appear that the most common causes are drowning, both at sea and in river flooding, building collapse, and engulfment in landslides. Up to the second decade of the twentieth century, drowning at sea was by far the greatest cause of recorded fatalities, but since then it has waned considerably, except for the *Uluilakeba-Makogai* disaster in 1973. The decline has been a consequence of the steady reduction in locally owned shipping since the 1930s, a gradual decline of inter-island shipping since the Second World War, development and enforcement of maritime legislation, and more recent improvements in forecasting and warning systems. As drowning at sea declined, drowning in river floods seems to have assumed dominance as a cause of deaths between the 1920s and 1960s. In part, this reflects the number of very severe storms on Viti Levu during this period — the most notable being the 1931 cyclone in which over 90 per cent of the 206

Direct Causes

Injury

- Collapsing buildings**
- Falling trees**
- Flying debris**
- Blown over by wind**
- Electrocution**

Drowning

- In ships lost at sea**
- Swept away by storm surge and heavy seas**
- Swept away by river flood waters**

Landslides

- Buried in debris**

Exposure

- To wet and cold conditions**
-

Indirect Causes

Disease

- Contaminated water supplies**
- Dead animal carcasses**

Starvation

- Loss of food sources**

deaths were due to drowning (Fiji Legislative Council, 1931). However, the expansion of sugar-cane farming and smallholding along the river plains of Viti Levu, which accelerated in the 1920s, is probably of equal significance.

In the decade from 1972 to 1982, 6 of the 17 tropical cyclones resulted in loss of life, from causes detailed in Table 2.3. Despite the severe flooding during Cyclones Bebe and Wally, the number of drownings was remarkably low. Among the factors which may have contributed to this decline are improvements in emergency procedures, transport, and communications which have enabled relatively rapid evacuation and other forms of preparedness. Although the figures for this decade are high, they should be considered in the light of three important factors. First, if the *Uluilakeba* toll is omitted the total for the decade would be much closer to "average"; second, the decade was one in which an unusually high number of serious events affected Fiji; and third, Fiji's population has increased steadily since the 1930s, the current total being approximately three times greater than in 1936 and almost five times greater than at the turn of the century.

In addition to fatalities, hurricanes are also responsible for a great many injuries. The 1952 cyclone, in which 24 people died,

	<i>Bebe</i>	<i>Lottie</i>	<i>Meli</i>	<i>Tk</i>	<i>Wally</i>	<i>Arthur</i>	<i>Hettie</i>	<i>Total</i>
Building Collapse	11	—	22	1	—	—	-	34
Landslide	-	-	—	2	12	-	-	14
Drowning (River)	-	-	—	-	1	2	-	3
Drowning (Sea)	-	80	2	-	-	3	-	85
Flying Debris	2	-	1	-	-	-	-	3
Falling Tree	1	-	2	-	1	-	-	4
Exposure to Cold	1	-	—	-	1	-	-	2
Electrocution	1	-	1	1	-	-	-	3
Other	2	-	—	-	-	-	—	2
Not Available	2	-	25	-	3	-	3	33
Total	20	80	53	4	18	5	3	183

Sources: *Fiji Times* (various dates); Franco, Hamnett and Makasiale (1982).

Note: A number of lists of fatalities and causes of death during hurricanes may be found in different sources, and more often than not they differ. In constructing this table, every attempt was made to use figures that could be verified in some way.

TABLE 2.4 Casualties of Cyclone Bebe (as of 10 November 1972)

<i>Location</i>	<i>Deaths</i>	<i>Major Injuries</i>	<i>Moderate Injuries</i>	<i>Minor Injuries</i>	<i>Total Casualties</i>
Ba	6	21	96	394	517
Labasa	-	—	2	24	26
Lautoka	2	—	7	179	188
Nadi	1	1	3	36	41
Rakiraki	3	1	3	15	22
Rewa	1	-	-	—	1
Sigatoka	1	1	-	7	9
Suva	1	-	-	-	1
Taveuni	1	—	2	3	6
Tavua	3	1	-	133	137
Total	19^a	25	113	791	948

Source: Fiji Times, 10 November 1972 (government release),

- a. The discrepancy between this total and that given in Tables 2.1 and 2.3 is due to a fatality, resulting from injuries sustained during Cyclone Bebe, reported on 25 November 1972 (*Fiji Times*).**

also caused 44 serious and around 1,000 minor injuries (*Fiji Times*, 5 February 1952). The data for Cyclone Bebe presented in Table 2.4 indicate a very similar ratio of between 1 and 2 serious injuries and around 50 moderate or minor injuries for each fatality. In earlier times the number of fatalities resulting from injuries may have been significantly greater as emergency services were not so well organized. For example, the use of helicopters in the past decade has been of considerable value in bringing medical experts to seriously injured storm victims and for moving the victims to hospitals without undue delay. Following most severe tropical storms or hurricanes, medical services and hospital facilities are thus often stretched to their limits.

All of the data presented thus far refer to direct consequences of tropical cyclones. As Table 2.2 shows, two indirect threats to life must also be considered. The infiltration of stagnant water (ponded for days following flooding), salt water, or water contaminated by rotting carcasses into damaged water-reticulation systems is one example of how diseases such as typhoid and diarrhoea may break out following hurricanes. In recent years, immunization teams have made considerable effort to limit the possibility of such

occurrences. Within two weeks of Cyclone Wally, over 16,000 people in Navua-Namosi and Rewa-Waidina had been inoculated against typhoid and tetanus by five medical teams operating from temporary health posts in flood-affected areas (*Fiji Times*, 18 April 1980). Post-disaster preventative medicine has been an important aspect of emergency operations for a number of decades, and since the 1940s at least, there is no evidence of widespread epidemics or disease-related fatalities. This may well not have been the situation in the early colonial period. For example, 25 cases of diarrhoea or dysentery (7 of them serious) were recorded in Noco after the 1895 cyclone, and following the 1912 cyclone 6 children died from dysentery believed by some to have resulted from contamination of damaged water pipes in the Rewa area (Fiji, CSO 724/1895; UK, CO 83/106, no. 74).

The second indirect threat to life is that of famine resulting from the destruction of food resources. It is very unlikely that post-hurricane famines have occurred in Fiji, for traditional societies had numerous strategies for coping with crop losses and in recent times food relief has served to offset any possibility of starvation that might otherwise exist (see Chapters 3 and 7).

IMPACT OF TROPICAL STORMS AND HURRICANES UPON AGRICULTURE

Agriculture plays an extremely important role in Fiji's economy, accounting for 44 per cent (76,886 persons in 1976) of the employment of the economically active population and 91 per cent of total domestic exports. The most important export crops are sugar (in 1978 valued at \$107 million), and copra (coconut oil exports in 1978 totalled \$10 million) (Ward and Proctor, 1980). The farmers of Fiji grow a wide variety of crops for both cash and subsistence purposes. In many rural locations, especially the outer islands (Rotuma, Kadavu, and the Lomaiviti, Lau, Yasawa, and Mamanuca groups), domestic garden production is the dominant food source and money earned from copra production, while usually very little, is nonetheless the most important source of cash. On the main islands of Viti Levu and Vanua Levu, sugar production (in the Western Division and Labasa region) is the main agricultural activity, and near the main centres market production assumes importance.

Hurricanes destroy and damage crops in a number of ways. Where the storm strength is greatest, the combined effects of wind, rain, and salt spray often cause the total loss of production. The stems of root crops are torn and twisted, and where the plants are not uprooted, the damage inflicted commonly causes the roots to rot in the ground. This process is quickened when soils become waterlogged, a frequent occurrence in consequence of the high intensity rainfalls often associated with hurricanes. While perennial tree crops such as coconut palms and breadfruit are often able to endure hurricane-force winds, they usually sustain such damage that they are unable to bear fruit for several years.

Few, if any, plants can survive the full impact at the centre of a very severe hurricane, but not all crops are equally vulnerable. This differentiation becomes significant when factors such as distance from the eye of the storm and variations in storm intensity are considered, as is amply demonstrated in Table 2.5. Cyclone Meli is reported to have passed very close to Nayau, which suffered total losses for all crops except yams, which had a mere 20 per cent survival rate. However, on islands increasingly distant from Nayau, crop losses decreased at varying rates for different species.

Other factors may also affect the extent of agricultural damage, including site considerations such as topography. For example, differences in slope aspect in relation to wind direction are often reflected in great variations in the extent of damage within very short distances, and localities at higher elevations are less vulnerable to flooding and storm surges. The stage of maturity of crops in the ground at the time of a storm and variations in agricultural practices in response to environmental and cultural factors are also likely to produce significantly different rates of damage. At present, many of these factors are poorly understood and less is known of ways in which they might be exploited to minimize vulnerability.

The impact of hurricanes upon livestock farmers is also often very severe. Livestock losses are usually greatest following flooding on Viti Levu, reflecting to a large degree the concentration of dairy farming on the lower-lying pastures of the major river flood-plains. While drowning is the major cause of stock deaths during storms, a very important secondary factor is silting of pas-

Island	Distance Root Crops from Nayau (km)	Root Crops							Tree Crops			
		Cassava	Alocasia	Sweet Potato	Taro	Xantho- soma	Yam	Kawai	Pan- danus	Ba- nana	Coco- nut	Bread- nut
Nayau	0	100	100	100	100	100	80	100	97	100	100	100
Cicia	30	100	100	80	96	56	54	65	59	100	91	100
Lakeba	30	94	88	87	55	28	48	20	20	82	75	50
Vanuavatu	45	75	50	75	—	25	-	20	-	75	60	50
Oneata	67	60	50	10	—	-	10	-	-	50	40	40
Komo	86	60	-	10	-	-	-	—	20	40	30	40
Moce	88	60	-	10	-	-	10	-	20	50	40	40
Namuka	99	50	—	20	-	—	-	—	-	50	15	30
Kabara	99	60	-	10	—	-	10	-	10	50	40	-
Fulaga	129	50	-	5	-	-	-	-	-	40	10	30
Ogea	142	50	-	10	-	-	-	—	4	40	10	30

Source: Extracted from damage reports in the records of the Committee.

ture lands, which often causes starvation and a variety of stomach disorders in animals. Livestock losses in the Tailevu, Rewa, Navua, and Naitasiri areas resulting from Cyclone Bebe were assessed at \$153,000 and in the Nakelo, Bau, and Sawakasa *tikina* (districts) alone, 581 animals perished (Hackett, n.d.). Following Cyclone Wally, the Fiji Pastoral Company in Navua was reported to have suffered huge losses including 1,500 head of cattle, 600 pigs, and about 1,000 ha of pasture (*Fiji Times*, 9 April 1980). However, the losses in livestock are by no means all confined to the large islands. In the aftermath of Cyclone Meli on Nayau, 430 of 490 pigs, 1140 of 1190 chickens, 105 of 120 cattle, and 11 of 28 horses were reported lost.

Lost food-crop production not only affects subsistence farmers but may be felt throughout the nation, especially in the towns. Fiji's growing urban population has been very fortunate, during the past decade, that only Cyclone Bebe has caused widespread damage in areas that supply most of the market produce. Following Bebe, prices for all root crops rose dramatically and the very high prices continued until mid-1973. This was especially so for yams and taro, but even cassava, which was not a consumer staple of great popularity, tripled in price (Fiji Department of Agriculture, 1973; Fiji Ministry of Agriculture, Fisheries and Forests, 1976). In such a situation, extension efforts by the Department of Agriculture are directed not only at supporting the rehabilitation of victims but also at encouraging greater output by those whose gardens remain intact and for whom the hurricane may bring a windfall. In contrast, for subsistence farmers who are dependent upon copra for cash and whose crops have been destroyed, the outlook is bleak indeed.

Hurricanes and the Copra Industry

Although coconut trees are usually not totally destroyed by hurricanes, they do sustain considerable frond damage and often become almost totally defoliated. Destroyed fronds may take several years to regenerate and during this period there is no nut growth. Copra producers may face one or two years virtually without a crop and may have to wait as long as five years before production reaches pre-damage levels. The effects upon the national copra

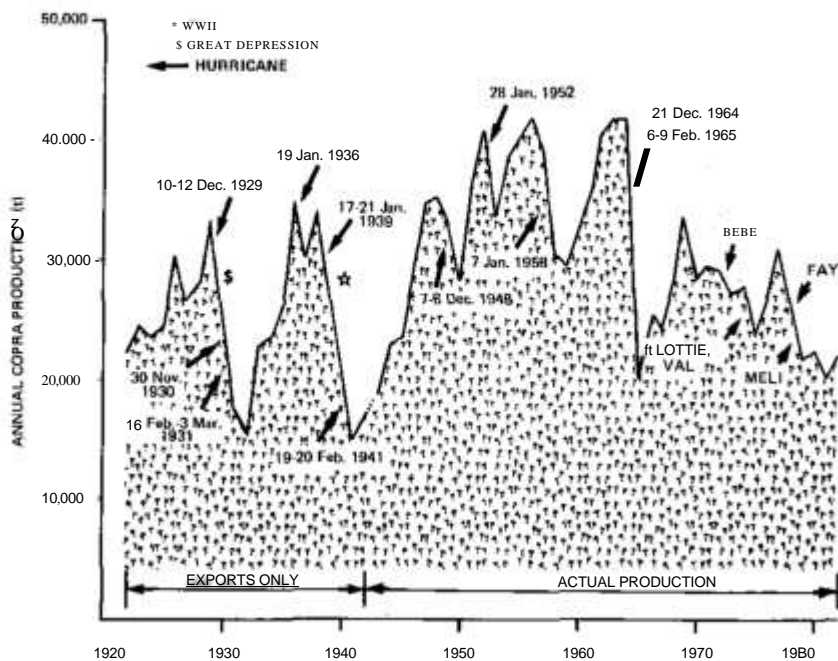


Figure 2.2 Copra Production in Fiji, 1922 -1982

industry can be far reaching, as Figure 2.2 shows: a sharp decline in production follows every major storm, and in the sixty years storms probably accounted for well over a quarter of a million tonnes of lost production.

At the regional and local (i.e., island) levels, hurricane-caused losses in copra production create even wilder fluctuations than those experienced at the national level (Figure 2.3 and Table 2.6). For example, in 1981, Kadavu produced only 92 tonnes of copra (a mere 7 per cent of its 1969 output), worth around \$25,000 at Grade 1 prices in Suva, but worth considerably less to the people of Kadavu after the costs of shipping were deducted. According to the 1976 census, the population of Kadavu totalled 8,699 (Lodhia, 1977), and some 3,250 ha are under coconuts (Fiji Ministry of Agriculture and Fisheries, 1978).

It is extremely difficult to calculate the losses in copra production due to storm damage and even more so to place some kind of dollar value upon them. One can make only gross estimations but even these are useful indicators of the seriousness of the impact of

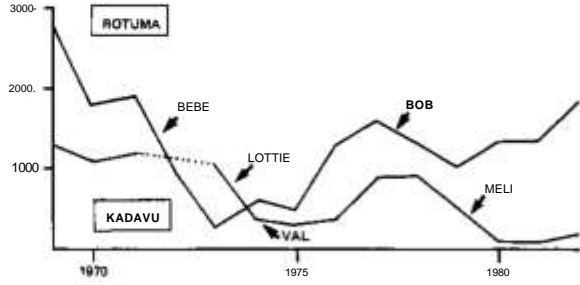
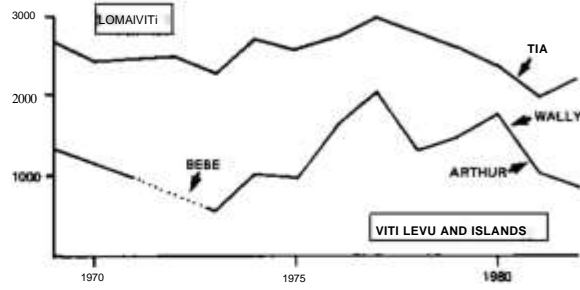
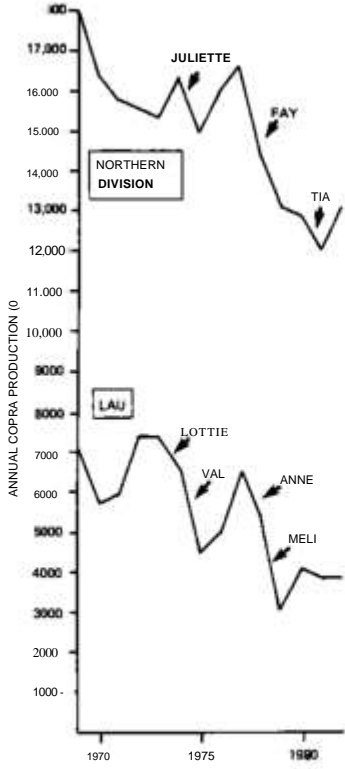


TABLE 2.6 Copia Production in the Lau Group, by Island

<i>Island,</i>	<i>1973</i>	<i>1974</i>	<i>1975</i>	<i>1976</i>	<i>1977</i>	<i>1978</i>	<i>1979</i>
Naitauba, Mago, Kanacea, Munia, Katafaga	1,236	1,466	994	1,304	1,441	1,121	612
Vanuabalavu, Yanuca, Cikobia	1,338	1,145	725	885	1,067	607	388
Cicia, Tuvuca	715	776	552	721	787	740	258
Lakeba	1,031 ^a	1,132 ^a	506	312	665	594	339
Nayau	-	-	209	274	373	315	76
Oneata, Moce, Namuka	556	495	225	155	386	396	187
Kabara, Komo	206	99	43	46	149	100	67
Ogea, Fulaga	152	45	27	68	97	78	45
Moala	320	211	217	305	430	385	199
Matuku	429	152	78	62	234	288	250
Totoya, Vanuavatu	367	210	99	91	228	260	182
Ono, Vatoa	553	611	401	716	646	546	365
Total	6,903	6,342	4,076	4,939	6,503	5,430	2,968

Sources: Ministry of Agriculture, Forestry and Fisheries (annual reports) ; Ministry of Agriculture and Fisheries (annual reports).

a. Figure includes production in Nayau.

storms upon a large proportion of the rural population. For example, Cyclone Lottie caused significant falls in copra production in a number of islands in the southern Lau group, but the storm occurred very late in 1973 and did not affect production figures until the following year. Over the next six years copra production in the Lau group was further set back by Cyclones Val, Anne and Meli. If production in this group had continued at the average rate of the five storm-free years up to and including 1973, production for the following eight years, from 1974 to 1981 inclusive, would have been around 53,500 tonnes. The actual total was 38,276 tonnes or 28 per cent less. It is possible that the losses may have been even greater, especially in 1974 and 1978 when prices peaked at very high levels. Similar estimates may be made for other parts of Fiji, based on the assumption that the average production figures for the longest hurricane-free period would have continued had no storm occurred. As the results shown in Table 2.7 indicate, Rotuma and Kadavu lost almost half their production for the ten years under review.

The economic costs of these production decreases are clearly very significant, affecting not only the victim communities but the entire national economy. Between 1970 and 1980, the total production for Fiji was almost 15 per cent less than might have been expected, although other factors including low prices and aging trees also contributed to the fall in production. However, while areas such as Taveuni, the large islands of Lomaiviti, Kadavu, and other areas of Vanua Levu have the potential for agricultural diversification away from dependence on copra, many of the small islands that bore the brunt of most of the hurricanes in the decade have little such opportunity.

One of the most unfortunate ironies of the period under review is the coincidence of high prices with post-hurricane lulls in productivity. Meagre returns during periods of low prices provide little incentive for village agriculturalists, but when deprived of infrequent opportunities for higher rewards, they must often feel deep despair and frustration. Venturing even further into the realm of estimation, we can place a rough cash figure on the costs of the losses (Table 2.7). In Rotuma, total earnings may have fallen by as much as \$2.8 million, or by \$100 per capita per year! In Lau where the total losses sustained were greater than for any

other part of Fiji, the average yearly losses amounted to \$30 per capita per year and in Kadavu, \$20 per capita per year. These losses in cash income are very significant to Fiji's lowest income groups. Furthermore, the ten-year averages hide much more severe problems. On Matuku, in southern Lau, copra production in the three years following Cyclone Lottie averaged less than a quarter of that of 1973, and lost earnings amounted to more than \$250,000 (\$100 per capita over the three years). Such losses are difficult to offset at the best of times, but combined with the need to rebuild destroyed or damaged homes and feed families, they create a critical situation.

Hurricanes and the Sugar Industry

Little published information is available on the ways in which hurricanes affect sugar-cane, Fiji's most important export crop, but a number of reports, available in the Committee's records, indicate that damage is often very much dependent upon the age of the crop. Physical injury is more likely to be suffered by older, taller cane, which is most exposed to the high winds. In conjunction with the heavy rains common to hurricanes, the wind also flattens the crop, and this in turn encourages insect infestations and other crop diseases; harvesting is often made more difficult and so more expensive. Younger shoots may be uprooted by the wind and leaf damage and salt-spray damage may occur in areas relatively close to the sea. Generally, damage to younger cane tends to be less extensive than that sustained by older crops and good post-storm conditions will facilitate steady regrowth of the crop, as happened when Cyclone Bebe affected the Western Division, where a large proportion of Fiji's cane is grown. The unharvested, mature crop, which was only 15 per cent of the total, suffered wind damage, but the more recently planted cane and ratoons escaped with little effect from the storm (Prasad, 1982). However, more serious consequences can be expected when very heavy rains cause strong leaching of fertilizers from the soil. In addition to crop losses, the cane farmer will pay more for harvesting and have to provide additional fertilizers and pesticides as well. Moreover, the infrastructure of the sugar industry itself may be adversely affected. Damage to factories and railway lines, for

	<i>Northern Division</i>	<i>Lau</i>	<i>Lomaiviti</i>	<i>Rotuma</i>	<i>Kadavu</i>
<i>A. For the Period 1972—1982 (11 years inclusive)</i>					
Production in tonnes					
Actual ³	158,677	56,660	27,457	11,898	5,942
Predicted* ³	173,188	74,236	29,003	23,423	12,217
Estimated loss ^c	14,511	17,575	1,546	11,525	6,275
Estimated loss as percentage of predicted production (%)	8	24	5	49	51
Estimated gross value of lost production (\$) ^	4,400,000	5,100,000	400,000	2,800,000	1,800,000
Gross value of lost production (\$) ^e					
Per capita	43	350	32	997	206
Per household	262	2,286	186	5,812	1,189
Annual average gross value of lost production (\$) ^e					
Per capita	4	32	3	91	19
Per household	24	208	17	528	108
<i>B. For the Years of Lost Production Only</i>					
Period during which copra production reduced	78-82	74-76 78-82	80-82	72-81	74-77 79-82
Number of years in which copra production reduced	5	8	3	10	8
Annual average gross value of lost production (\$) ^e					
Per capita	9	44	11	100	26
Per household	52	286	62	581	144

Note: These are gross valuations only, made on the basis of Suva prices. The figures were derived simply by multiplying the lost production in tonnes by the average price for each year, assuming that production would remain constant throughout the year. Prices received on the islands are considerably lower than those quoted in Suva because of shipping costs.

- a. These figures were obtained from annual reports of the Department of Agriculture, Ministry of Agriculture, Fisheries and Forests, Ministry of Agriculture and Fisheries and The Coconut Board for the various years. Because production figures were not available for Kadavu for 1972, the average of the totals for the four years 1969 to 1971 plus 1973 was used.
- b. These very approximate amounts were derived on the assumption that the average production of the five preceding (hurricane-free) years would have been maintained had hurricane damage not occurred.
- c. The difference between predicted and actual production.
- d. Calculated on an annual basis taking into account the estimated lost production and average Suva prices during each respective year of lost production. The prices were obtained from the *Annual Report of the Coconut Board, 1982* (Appendix III), and weighted according to “actual pattern of production by grade” of copra delivered to Suva. This weighting may in fact not be representative of deliveries made to other grading stations or from the selected areas given in the table even if delivered to Suva. Likewise, these gross figures do not take into account shipping and handling charges, which are very high. To the producers, net losses would be much lower than indicated here.
- e. Population and household data obtained from 1976 Census (Lodhia 1977).

example, is frequently reported following hurricanes in the west and north of Fiji.

However, it is droughts, in combination with hurricanes, that appear to be the greatest threat to the sugar industry. In 1983, Cyclone Oscar (which compared with Cyclone Bebe in terms of areal impact and severity, though not timing) was followed by a particularly severe drought. Because there was little opportunity for the damaged crop to rehabilitate, the losses were staggering. More than 14,000 cane farmers lost most of their crop and export losses for Fiji were estimated at over \$70 million. In addition more than 30,000 persons were provided with rations (*South Seas Digest*, 29 July 1983). The implications of such a sequence for the national economy are clearly very serious.

Fortunately, such combinations and such prolonged severe droughts are not frequent occurrences. Devastating losses do not occur as often in the sugar industry as in the copra industry. Post-hurricane drops in cane production and sugar production are difficult to detect in the national records following storms in the west or northwest of the country. Several factors may help to cushion storm impact, including the seasonal nature of the crop's vulnerability; the non-perennial nature of the crop, which means that damage to a plant does not result in several years of lost production; the ability to salvage some of the damaged cane; and the relatively widespread distribution of cane farming. Nevertheless, given the dominance of the sugar industry in Fiji's economy, even relatively slight losses in production may be significant: a 10 per cent loss in sugar exports would be roughly equivalent to a total loss of copra production in national economic terms. For the farmer, totally dependent upon the family's crop for cash, hurricane (and perhaps more important, drought) damage can be crippling especially when housing and other property is destroyed as well.

IMPACT OF TROPICAL STORMS AND HURRICANES UPON INDUSTRY AND COMMERCE

After agriculture, tourism is one of Fiji's most important industries. The impact of hurricanes upon the tourist industry results from damage to hotels and resorts, road and airport closures, and

adverse publicity in Australia and New Zealand (the major markets) when particularly severe storms gain widespread media coverage. In November 1972, the month immediately following Cyclone Bebe, visitor arrivals fell by 11.7 per cent over the figure for the same month in the previous year. It was reported that this was the first time for many years that a monthly total had shown a decrease and in fact, the eleven months from January through November had shown an increase of 10.5 per cent over the corresponding period for the previous year (*Fiji Times*, 27 March 1973). A similar pattern is, however, not evident in the monthly visitor arrival statistics for the remaining years through 1981 and it would appear that only a major storm (such as Bebe, which was extremely highly publicized and affected a large area of Viti Levu) is likely to have a significant impact on the tourist trade. This observation is confirmed by the events following Cyclone Oscar in March 1983. The number of hotel rooms closed by the storm reached 14 per cent of the national total, but one week after the storm most had been quickly recommissioned. Nevertheless, the storm did receive very considerable publicity, especially in Australia, and consequently, in a year in which tourism was expected to improve steadily, visitor arrivals for the first six months of 1983 dropped by more than 15 per cent. To counter this trend the Fiji Visitors Bureau spent \$200,000 in a publicity programme assuring prospective Australian tourists that the industry was back on its feet. (*Pacific Business News*, 10 October 1983).

Just as the infrastructure of the sugar industry, the mills and transport systems, is often affected by hurricanes, so are those of all industries in Fiji. Wind damage to buildings and losses of plant and stock in damaged and flooded buildings can be very serious. Transport disruptions, through road closures and the like, can also bring about significant setbacks to business firms. However, whereas hurricane damage in rural areas may result in long-term, drastic cuts to income, there is little evidence that similar reductions in the availability of jobs in manufacturing in Fiji are brought about.

One consequence of hurricanes that is most difficult to assess is the effect of reduced spending power in rural areas upon retailing and other commercial activities. Small businesses and cooperative stores often sustain heavy losses to both buildings and stock and

then, if they recover, must endure prolonged periods of very slow business. This situation is often exacerbated where relief rations serve to further reduce the need for continued patronage by regular customers. In the event of very widespread devastation, the reduction in retail trading may cause a relatively severe decline in wholesaling and in the commercial sector in general.

THE DESTRUCTION OF BUILDINGS

Buildings are susceptible to the entire range of destructive forces that characterize hurricanes and after severe events only the sturdiest structures remain fully intact. High winds literally push over many buildings in their path and buildings of more robust construction are often destroyed when pressure differences between their windward and leeward sides cause the walls on the downwind side to explode outward. When a structure is not sufficiently airtight, pressure may build up inside the building (see Figure 2.4), accentuating the pressure differentials between its interior and exterior. In these circumstances, the loss of the roof as well as the downwind walls is not unlikely. Many buildings are crushed by falling trees, and loosened building materials, especially roofing iron, may become lethal objects when propelled by the high winds. River flood waters and storm surges carry away or flatten buildings that block their flow and even the most soundly built structures may be lost if their foundations are undermined by erosion of river banks or coastal lands.

Every time a major hurricane passes over Fiji, thousands of homes are destroyed. In 1910, 2,127 homes were destroyed in Tailevu, 767 in Rewa, 898 in Lomaiviti, and 750 in Naitasiri and for Fiji as a whole, probably well over 6,000 homes were lost (UK, CO 83/95). Many of these areas were struck again only three years later, in 1913, when 787 and 794 dwellings were destroyed in Tailevu and Rewa respectively (UK, CO 83/114). Undoubtedly, many communities were affected twice in this short period. One of the best early examples of the devastation brought to housing is the cyclone of 1912, following which only 7 per cent of the homes in the Yasawa group were left standing and 85 per cent were totally destroyed (see Table 2.8). Figures are unavailable for the 1929 and 1931 cyclones but it would seem that, for the latter in

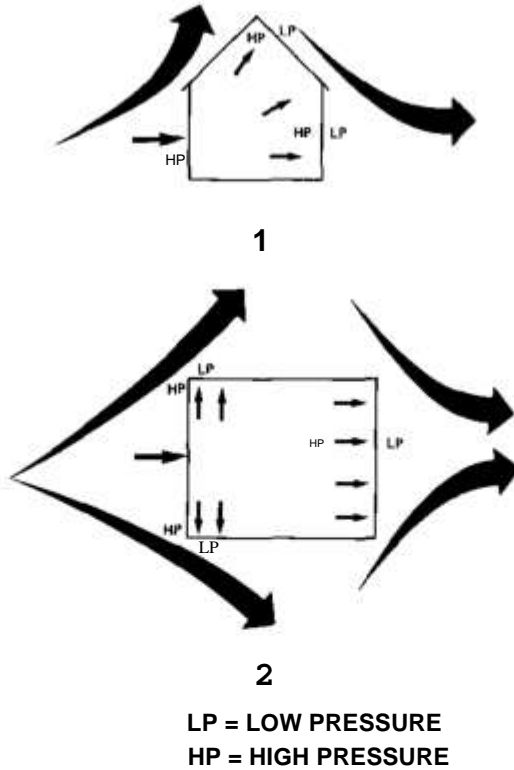


Figure 2.4 Wind-induced pressure differentials in relation to houses during hurricanes

particular, the numbers may well have approached 10,000 destroyed or badly damaged homes. The 1952 storm was probably responsible for similar figures: in the Wainibuka, Verata, Tailevu, Sawakasa, Bau, and Nakelo areas, the rates of destroyed and severely damaged homes accounted for 97, 80, 77, 77, 72, and 68 per cent of all dwellings respectively. In Navua, three villages were absolutely obliterated when flood waters burst through a dam created by landslides (*FijiTimes*, 6 February 1952). Following the cyclone and subsequent flooding in 1965, 5,771 houses were totally or more than 50 per cent destroyed (*Fiji Times*, 22 February 1965).

The vulnerability of houses to high winds depends upon a wide variety of factors among the most important of which are design and construction characteristics of the buildings themselves (see

TABLE 2.8 Housing Losses in Yasawa, 1912

<i>District</i>	<i>Houses Left Standing</i>	<i>Houses Damaged</i>	<i>Houses To tally Destroyed</i>	<i>Churches Destroyed</i>
Waya	13	27	97	5
Nacula	11	7	174	6
Naviti	16	4	204	7
Yasawa	12	6	171	6
Viwa	—	6	55	2
Total	52	50	701	26

Source: UK, CO 83/106 no. 74 enci. 2.

Table 2.9). House shape (especially roof shape), strength of connections between structural units (especially between roof and walls or posts and at corners), airtightness, and security of foundations are some of the key considerations. Although it is highly unlikely that any home, especially a single unit, low-cost dwelling, can be made absolutely “hurricane proof”, some types of houses are more resistant to high winds than others. In Table 2.10 the different vulnerable and non-vulnerable features of various types of homes found throughout rural Fiji are outlined.

Bure or traditional Fijian houses (of which there are a great variety of types) are generally reasonably resistant to high winds, especially if built along truly traditional lines. Deeply buried, strong hardwood posts, steeply angled and hipped (four-sided) roofs, and secure *magimagi* (sennit) binding are features that contribute positively to *bure* stability, but key problems include the lack of strong connections between roof and cornerposts and the lack of rigidity in the walls and excessive spaces for air to enter. Modifications to *bure* construction, such as the use of nails, iron roofing, and the reduced use of some traditional hardwoods because of their reduced availability, render many recently built *bure* more vulnerable than their predecessors. During the 1976 census only 12.3 per cent of the population lived in *bure* although the percentage of the rural population who did so, especially in the outer islands, would undoubtedly be much greater.

The remaining Fijian families and virtually all Indo-Fijian families live in a variety of “temporary” (lean-to, *vale vakakenani*) and “permanent” (bungalows, *vale tudei*) dwellings. *Vale vaka-*







TABLE 2.9 Some Characteristics of Houses that Influence Their Vulnerability to Damage from High Winds

	<i>Features that REDUCE Vulnerability</i>	<i>Features that INCREASE Vulnerability</i>
Configuration of roof	Hipped (4-sided) Small eaves 30°—45° slope	Gabled Overhanging eaves Flat or slightly pitched
State of structural connections	Binding—sennit —wire Bolts Metal straps	Nails
State of connection between wall and ground	Treated timber posts Deeply sunk posts “Anchors”	Stilts Concrete piers Untreated posts Shallow posts or foundations
Airtightness	Window shutters Closed spaces between wall and roof	Louvres Open spaces between wall and roof Gaps in walls
Masonry features	Adequate reinforcing and use of rebars	Poor quality blocks Insufficient mortar between blocks Insufficient reinforcement in poured columns Insufficient rebars inside block walls Poor concrete mix
Attachments		Verandahs

Source: Extracted from Intevtect (1982).

kenani tend to be the most vulnerable type of buildings — perhaps a function of their “transitional” status between traditional and “modern” homes, their frequent adoption by “squatters” (to whom lack of title to land is a disincentive to make improvements), and the low incomes of many of their owners. Flat roofs, corrugated iron and masonite sheets poorly attached to wooden frames (nails are frequently too short), walls poorly tied together

TABLE 2.10 Vulnerable Characteristics of Common House Types in Fiji

<i>Type of House</i>		<i>Example</i>
<i>Fijian Terminology</i>	<i>Technical Terminology</i>	
<i>BURE</i>	TRADITIONAL	
		
<i>VALE VAKAKENANf</i>	TRANSITIONAL	
<i>VALE TUDEI</i>	FORMAL	<i>Vale lalaga bitu</i> 
		<i>Vale kau</i> 
		<i>Vale simede</i> 

Source: Extracted from Intertect (1982).

<i>Materials</i>	<i>Common Characteristics of Houses in Fiji</i>	
	<i>Features that REDUCE Vulnerability</i>	<i>Features that INCREASE Vulnerability</i>
Posts: indigenous hardwood Walls: woven bamboo reeds Roof: thatched pandanus, reeds, palm leaves	Strong hardwood corner posts Deeply sunk posts Steeply angled roofs Hipped roofs Small or no eaves Secure sennit bindings	Lack of rigidity in walls (with increasing distance from corners) Excessive spaces for air to enter Weakness in connections between corner posts and roof
<i>Modifications to Traditional</i> Posts: downgrading of timber used (reduced availability of some hardwoods) Roof: corrugated iron	Wire bindings	Sure Nails Increased size of eaves Iron sheets poorly fastened to roof trusses
Frame: local woods, sawn timber Walls: corrugated iron, masonite Roof: corrugated iron	Strong corner posts deeply sunk into ground (occasionally only)	Flat roof Short insufficiently anchored concrete or wooden piers Louvred windows Iron sheets poorly fastened to roof trusses Overhanging eaves Space between roof and walls
<i>Wood Frame with Bamboo Walls</i> Frame: local woods, sawn timber Walls: Bamboo (<i>bitu</i>) mats (also other types) Roof: corrugated iron	Posts anchored into ground Shutters Bolts, metal straps Walls securely attached to frame Can be made relatively airtight	Short piers (concrete and wood) Louvred windows Nails Iron sheets poorly fastened to roof trusses Gabled roof Space between roof and walls Walls poorly fastened at corners
<i>Wood Frame with Wooden Walls</i> Frame: local woods, sawn timber Walls: sawn timber Roof: corrugated iron		
<i>Concrete Block</i> Frame: reinforced corner columns (not always) Walls: concrete blocks Roof: corrugated iron	Corners well fastened Use of reinforcing and rebars (not always)	Poor connection of wooden roof frame to walls Unreinforced or poorly reinforced walls Louvred windows Large overhanging eaves

at the corners, and the use of short piers as foundations are all common characteristics of "temporary" homes and contribute to their vulnerability. *Vale tudei* include both wood-frame and concrete-block homes. The low-angled, gabled roofs with large overhanging eaves are perhaps the most vulnerable features of most of these types of homes. Other factors depend very much on the construction methods used. For example, deeply sunk corner posts versus concrete piers, the use of metal straps to tie the roof to the frame, and the use of reinforcing and reinforcing bars in concrete-block houses are practices that make houses more resistant to hurricane damage.

Relatively simple modifications that would significantly improve resistance to hurricanes can be made to all of these types of houses (see Chapter 8). However, surveys of damage to housing following recent storms tend to indicate that *vale tudei* are the least vulnerable dwellings and *vale vakakenani* the most vulnerable. As Table 2.11 indicates, only 5 per cent of *vale tudei* in Yasawa and

TABLE 2.11 Damage and Destruction of Homes in Yasawa and Mamanuca by Cyclone Arthur

	District				Total	Per Cent
	Vuda	Malolo	Naviti	Yasawa		
Number of houses surveyed	82	219	511	451	1,263	
House type						
<i>Vale Tudei</i>						
Undamaged	24	111	253	216	604	88
Damaged	13	7	23	3	46	7
Destroyed	2	-	33	1	36	5
<i>Bure</i>						
Undamaged	4	27	53	187	271	56
Damaged	13	11	37	14	75	15
Destroyed	4	51	71	15	141	29
<i>Vale Vakakenani</i>						
Undamaged	14	4	10	14	42	47
Damaged	7	3	5	-	15	17
Destroyed	1	5	26	1	33	37

Source: Extracted from PMRRC, unpublished post-disaster survey results (26 Jan 81-5 Feb 81).

Mamanuca were destroyed by Cyclone Arthur (7 per cent damaged) compared with 29 per cent (15 per cent) for *bure*, and 37 per cent (17 per cent) for *vale vakakenani*. Although *vale vakakenani* accounted for only 3 per cent of the pre-disaster housing, they contributed over 14 per cent of the homes totally destroyed.

In addition to dwellings, many other important buildings are destroyed and damaged by hurricanes. Schools and churches, although often (but not always) of more permanent materials, are rarely spared from some degree of damage and destruction (see Table 2.12). Kitchens and outhouses, which are usually much less sturdily built than the homes themselves, are frequently almost totally wiped out. Flying debris from these structures (occasionally even entire units become airborne) often causes severe damage to houses that might otherwise have weathered a storm. Jetties, stores, water supply systems (Table 2.12), and warehouses (e.g. *co-pra* stores) and their contents may also be included in the toll of damage, adding further to the disruption that hurricanes bring.

TABLE 2.12 Destruction of Churches and Water Supply Systems by Cyclone Meli

<i>Island</i>	<i>Churches</i>		<i>Water Supply</i>	
	<i>Number Destroyed</i>	<i>Estimated Costs (\$)*</i>	<i>Number Destroyed</i> ^b	<i>Estimated Costs (f)</i> ^c
Tuvuca	1	9,314	--	--
Nayau	3	27,940	2	10,320
Lakeba	-	—	-	-
Cicia	3	27,940	3	15,480
Vanuavatu	1	9,314	—	—
Moala	—	—	4	20,640
Gau	—	-	4	20,640
Kadavu	38	353,897	20	103,200
Beqa	—	-	4	20,640

Source: Documents of PMHRC.

- a. Estimated by the PMHRC for the "theoretical" replacement value of an "average" sized church; they include materials, transportation, and construction supervision costs.
- b. Water supply systems (mostly roof rain catchments and storage tanks) that needed to be replaced after the storm.
- c. Based on the materials, transport, and supervision costs if the systems were to be replaced

TABLE 2.13 Destruction of Homes and School Buildings, 1972—1982

<i>Storm</i>	<i>Houses Destroyed</i>	<i>School Buildings Damaged or Destroyed^a</i>
Bebe	11,770	251
Juliette	n.a.	13
Lottie	1,373	62
Val	758	38
Betty	n.a.	1
Anne	84	n.a.
Bob	180	n.a.
Fay	317	n.a.
Meli	1,322	263
Tia	605	31
Wally	269	31
Arthur	569^b	22^c

Source: Documents of PMHRC, PMRRC.

- a. These figures may be overestimates as they refer to the number of buildings constructed as replacements rather than the number damaged or destroyed. In many cases, two smaller buildings were constructed to replace one destroyed.
- b. This figure may be an underestimate as it does not include housing losses in Nadroga.
- c. This figure may be an underestimate as it refers only to the number of schools affected rather than the number of buildings.

During the ten years between Cyclones Bebe and Arthur, structural damage, especially to homes and schools, continued to be a major problem. Table 2.13 lists the total for each hurricane for this period, in which almost 17,000 homes were destroyed and 700 school buildings including classrooms, dormitories, and teachers' quarters damaged or destroyed. Cyclone Bebe was clearly the greatest cause of destruction to buildings, accounting for 69 and 36 per cent of housing and school losses respectively. As Table 2.14 shows, most of these losses were in the Western Division. Most of the other destruction to homes and schools occurred in the Eastern Division (Cyclones Lottie, Val, Anne, Fay and Meli), although the Central (Wally), Northern (Anne, Wally) and Western (Bob, Arthur) divisions all suffered some losses.

The impact of hurricanes upon both the safety and welfare of those affected is clearly very severe. In addition, the government is often severely affected. With the steady growth in the size of

TABLE 2.14 Destruction of Homes and School Buildings by Cyclone Bebe

<i>Location</i>	<i>Homes Destroyed</i>	<i>School Buildings Damaged or Destroyed^a</i>
Western Division		
Lau toka	1,209	15
Yasawa	584	9
Ba/Tavua	4,067	41
Nadi	570	25
Nadroga/Navosa	2,869	7
Ra	659	21
Subtotal	9,958	118
Central Division		
Tailevu	469	39
Rewa/Suva	409	5
Namosi/Serua	302	26
Naitasiri	345	7
Subtotal	1,525	77
Eastern Division		
Rotuma	274	6
Kadavu	n.a.	17
Lomaiviti/Lau	13	33
Subtotal	287	56
Total	11,770	251

Source: Documents of PMHRC.

a. Refers to number of school buildings constructed as replacements and therefore only approximates actual losses.

central government during the twentieth century, the costs of damage to government services and infrastructure have also grown. Moreover, the responsibility for coping with the losses caused by disaster has been increasingly taken over by the government and centralized relief organizations.

3

COPING WITH CRISIS: A REVIEW OF DISASTER RESPONSE IN FIJI

TRADITIONAL DISASTER PREPAREDNESS

A number of elements in the economic and social life of Fiji in pre-European times and well into the present century were of considerable importance in reducing the impact of tropical storms and hurricanes. Among the most important of these were the maintenance of a wide range of food resources, the application of food storage and preservation techniques, intra-community and inter-community cooperation, and sound settlement locations. Although hurricanes undoubtedly brought great hardships, that communities survived through centuries of periodic devastation is perhaps the greatest testimony to the efficacy of traditional disaster mitigation and relief systems.

Throughout the Pacific region, communities in all but the most marginal environments were relatively self-sufficient in food resources. In part their self-sufficiency was achieved through the use of a diverse range of food crops and wild plants (Clarke, 1977; Thaman, 1982), the latter being gathered mostly from the forests. The islands of Fiji were no exception and many early accounts refer to the great "variety of cultivated produce" as well as numerous "bush foods" —roots, tubers, nuts, fruits, and leafy greens — that were important supplements to the daily diet (Seeman, 1862; Thomson, 1908; Williams, 1858).

Yams in the drier areas and taro in the wetter ones were the predominant crops throughout Fiji. Other staples such as breadfruit, plantains, and coconuts were all important components of

traditional agriculture, in addition to a variety of greens such as taro leaves and *bele* (*Hibiscus manihot*). This diversity was augmented by supplementary crops that in many areas were rarely consumed during times of plenty, the so-called famine crops. *Via* (*Alocasia*) and *kaile* (*Dioscorea bulbifera*) are but two examples of roots that were maintained as emergency reserves but not frequently eaten because of the treatment necessary to improve their edibility. By maintaining a large array of crops with differential vulnerability between species and varieties to extremes of wind and water, the likelihood of total devastation was greatly reduced. Agricultural practices also tended to reduce the impact of hurricanes. Shifting cultivation systems "in which small plots isolated by stands of natural vegetation tend to be less prone to wind damage" were found throughout Fiji and agricultural terracing, which helps to "minimize runoff erosion and landslides resulting from hurricanes," was important in a number of areas (Thaman, Meleisea, and Makasiale, 1979: 83-85).

During hurricanes the forest provides numerous advantages to plants by providing important shelter from the wind (Thaman and Clarke, 1983) and by occupying higher, inland sites safe from the impact of storm surges and flooding as well as from the highest intensity winds on larger islands. Forests also help maintain watershed stability by reducing the likelihood, magnitude, and speed of onset of floods and lessening the possibility of landslides. But perhaps more important in the past was the role of the forest as a provider of food. Among the most significant of the "bush foods" were the edible roots of the *tivoli* or wild yam (*Dioscorea nummularia*), and *qai* or *masawe* (*Cordyline terminalis*). The *ivi* or Tahitian chestnut (*Inocarpus edulis*) is perhaps the best known of the nuts that were commonly consumed but is only one of many. Ferns and leaves such as *ota* (*Athyrium esculentum*) and *duruka* (*Saccharum edule*) added to the variety of wild foods eaten fairly regularly and became extremely important when gardens were devastated by hurricanes or drought (Parham, 1942; 1972).

The "bush" or "famine" foods were in essence a living store, a bank against shortfalls in crop production wrought by climatic extremes. Such a store was essential, for most of the traditional crops are very perishable with only the yam varieties having a lengthy post-harvest life (Baxter, 1977). Yams were a very impor-

tant staple crop in pre-contact and early post-contact Fiji and were particularly well suited to the hurricane-prone environment. Table 2.5 indicates that yams were the least vulnerable food crop during Cyclone Meli, and in 1886, when Taveuni had been devastated (see Chapter 1), a government official reported that there would be little food scarcity: “. . . , the yams are very well forward, and with the bush food etc., the [people of] Taveuni will probably be able to feed themselves” (C-5039: 125).

Yams may be stored for lengthy periods and, judging from the writings of many of the early visitors to Fiji, yam houses were ubiquitous features of the cultural landscape throughout the archipelago (e.g., Patterson, 1925; Wilkes, 1854). Preservation techniques were employed to enable storage of the more perishable food items. Breadfruit, bananas, taro, and *ivi* were often preserved by fermentation to make various forms of *madrai*, which according to the methods used, could last from several days to more than a year (Seeman, 1862; Thompson, 1940b; Wilkes, 1854). Both Thompson and Hocart (1929) noted that *madrai* was made to ensure against scarcity, and its use following hurricanes, including those of 1886 and 1895, is well documented (UK, Parliament, 1887; UK, CO 83/62).

This making of *madrai* as a reserve for times of scarcity was very important, especially in drought-prone areas with poor soil resources such as Fulaga and Kabara. However, it is likely that the practice of making *madrai* was at least equally important following hurricanes when most of the crops salvaged could not be consumed before they rotted.

Destructive gales sometimes sweep over the cultivated grounds, cutting off the ripening fruits, which, however, in their green state are fit for bread-making; and thus in another way the *madrai*. . . serves to keep off famine, otherwise inevitable. (Williams, 1858: 97)

This was the case on Vanuabalavu following the 1886 hurricane (UK, Parliament, 1887). Of equal significance was the usefulness of *madrai*, along with yams, as a food that could be transported for long distances without fear of decay.

Rarely was a community under stress from storms or drought (or indeed at any time) totally dependent upon its own resources. Inter-village and inter-island trade flourished in pre-European

Fiji and in some areas well into the twentieth century. Numerous social bonds facilitated the exchange of goods in widespread but well-integrated economic systems. The cornerstone of this economic integration was in the locational variations in resource availability (Thomson, 1908; Thompson, 1949), with each area being a centre of craft specialization and monopolizing the production of certain items (Sahlins, 1962). However, the degree of specialization often exceeded that necessitated by an area's ecological underpinnings.

[But] it [was] not irrational. A monopolistic position in particular craft goods sustains an island's trading potential, both in good times and bad. A sudden and severe food shortage — for example, in consequence of a hurricane — could be mitigated by trading the local craft goods for food. (Sahlins, 1962: 422)

Such inter-island trade was most notably conducted in the form of ceremonial exchange or *solevu*. In the late 1920s thousands of yams from Moala were exchanged for wooden trays and bowls from Kabara in response to a request from the Tui Kabara to the Tui Moala (Sahlins, 1962). It is most probable that food shortages on Kabara occasioned the request.

Less formal exchanges, also based on inter-island kinship, were probably even more important in the alleviation of post-disaster food scarcity than *solevu*, which took several months to organize. In the mid-1880s, the people of Matuku suffered a prolonged drought just before the 1886 hurricane and sought relief from various communities in Lomaiviti: "During the past year the *Ului Burotu* has been four times to Sawaieke (Gau); four times to Vanuaso (Gau); twice to Nairai; and twice to Koro, each time filling up with yams, madrai, yaqona, etc." (UK, Parliament, 1887: 142). Not only were food supplies obtained, but planting materials, so necessary for the re-establishment of gardens, were often procured. Another alternative was to move temporarily to a location where garden production was not severely curtailed by the storm. Hocart (1929), for example, recorded that at one time, people from Kabara planted crops in Lakeba.

Although traditional *bure* designs are characterized by both positive and negative features in terms of hurricane resistance, destruction of *bure* (even if total) would seem to be less likely to

cause fatalities and serious injury than would that of contemporary dwellings with their corrugated iron materials. Furthermore the weakness of the connection of the roof to the remainder of the building may have been a benefit to numerous hurricane victims over the years. During hurricanes, *bure* roofs are often blown off in one piece and deposited on the ground nearby, where because of their shape they provide a very safe and stable haven for people who crawl underneath and sit upon the rafters. In traditional times, this process was frequently hastened and made less hazardous by removing the roof before the wind did the job. Traditional homes can be relatively quickly and easily replaced where the expertise (e.g. traditional carpenters) and labour (the community) are readily available, both of which conditions were present in previous eras. Where there was widespread destruction building materials (e.g. reeds, pandanus, or bamboo) may have become scarce, but access to them through inter-community linkages was undoubtedly a common occurrence.

Community cooperation was clearly a key to post-hurricane rehousing in traditional times where the political structure existed for the mobilization and organization of relatively large numbers. Similar cooperation would have been necessary in virtually all facets of disaster response. Probably one of the greatest of the needs for cooperation was simply to share the burden of hardship that hurricanes brought. When Wilkes (1854: 314) visited Viwa in 1840 he was told by the people "that in times of scarcity each person was allowed no more than three coconuts a day." Similar accounts of "rationing" are included in reports of hurricanes in the 1880s (UK, Parliament, 1887).

REDUCTIONS IN TRADITIONAL SYSTEMS OF PREPAREDNESS

Since the days of early European contact with the islands, Fiji has experienced a wide variety of social, economic, and political changes, many of which have contributed to a reduction in the importance of the traditional methods for coping with environmental extremes. Probably the most significant modifications have been brought to the agricultural systems in which the traditional diversity has been replaced by a much narrower range of food crops overlain by a cash-cropping monoculture. The expansion of

coconuts as a commercial crop has diverted both land and time from subsistence activities, especially in the outer islands and some areas of the two large islands. In addition, the characteristics of subsistence agriculture have also changed, one of the most noteworthy features being the predominance achieved by cassava in all parts of the country (Thaman and Thomas, 1980). While this crop has a high rate of production with relatively minimal labour inputs and soil requirements (both very advantageous properties in view of the expansion of cash cropping), it is also one of the most vulnerable food crops in the face of hurricane conditions (Table 2.5). It is perhaps an irony of agricultural change in Fiji that the ascendancy of cassava has been achieved to a very large extent at the expense of yams, which are much more resistant.

Cash cropping provided an important alternative to the importance of both food storage and the utilization of bush and famine foods. Cash reserves, and indeed in earlier times the windfallen abundance of coconuts, could be applied to the purchase of rice and other foods when local scarcity arose. *Madrai* production and use declined relatively rapidly in the twentieth century. Hocart (1929: 139) revealed one reason for the lapse of this practice as early as 1929 when he observed that "fermented food, excepting Tahitian chestnuts have disappeared from Lau, as it is no longer necessary to lay in stocks of food." However, Thompson (1940) describes the use of large pits on Fulaga and Kabara for the storage of preserved cassava some five years later in 1933. Other influences also caused a reduction in the use of traditional post-disaster strategies. For example, government demands for tax payments often were not relaxed following hurricanes despite lost copra production, and alternative sources of tax payment had to be found. Following the 1886 hurricane in Lau, the people found that *bêche de mer*, which they had often turned to in times of want, had been set aside for tax payment (Fiji, CSO 86/1542).

Numerous factors have worked to reduce the importance of traditional inter-island trade. Production for the cash economy and increasing consumption of imported goods have reduced the necessity for offsetting disadvantages in the local availability of resources and official attitudes in the colonial period led to the prohibition of *solevu*. In addition, the means for conducting inter-island exchange have mostly gone: most islands owned a

schooner or cutter such as the *Ului Burotu* before the turn of the century and these came to replace the ocean-going canoes with which inter-island trade was formerly conducted. Increasing maintenance and replacement costs, especially for boats lost or wrecked during hurricanes, resulted in the decline of locally owned shipping, and government restrictions further hastened its demise (Sahlins, 1962: 423). The nature of trade has also changed. With the development of cash crops in exchange for consumer goods, the lines of trade are now directed along contemporary shipping routes, which focus upon the main centers, especially Suva. The implications for disaster relief are important. Regional alternatives for the alleviation of local scarcity have been lost and the increasing dependence of the economy of rural areas upon linkages to the national centres of the market economy has been accompanied by a corresponding increase in dependence upon the central government for disaster assistance.

The first recorded instance of government relief being given to disaster victims took place in the mid-1880s and in the following century the amount of post-disaster assistance to victims of hurricanes steadily increased. To a large degree, this growth in government intervention was a response to a perceived reduction in the ability of communities to cope with the impact of disaster. However, the increased provision of relief may have been as important a factor in this process as any other. Whatever the major causes of the changes in post-disaster coping methods were, by the time the colonial era came to a close in Fiji, the expectation of central assistance had become institutionalized as a “coping strategy” throughout the country.

GOVERNMENT RELIEF IN THE NINETEENTH CENTURY

The observations of colonial officials who inspected the areas visited by the hurricane of March 1886 indicate that many of the traditional strategies for coping with disaster were in operation. Nevertheless, in May, the decision was made to provide food relief to the worst affected communities. “To assist Moala, Matuku and To-toya, until supplies of yams can be sent them, I have distributed five tons of rice and fifty tins of ships biscuits [50 lb each] among the villages most in need” (Thurston to CO, 19 May 1886, UK,

Parliament, 1887: 132). Ten bags of sugar (80 lb each) were also included in the shipment and in the following month, Fulaga, Kabara, Komo, Moce, Namuka, Ogea, and Ono-i-Lau all received unspecified amounts of rice and in most cases, biscuits (UK, Parliament, 1887: 146-148). If the issue was made on the same per capita basis as that given to Moala and Matuku (which received less than Totoya) the total amount provided to southern Lau may have been approximately 3 tonnes of rice and 0.75 tonnes of biscuits.

In addition to supplying food, the government promoted the planting of quick-maturing crops, in particular, sweet potatoes, maize, and cassava, and it is possible that this program heralded the introduction of cassava as a crop in some areas. Thurston reported that at Komo "I gave them rice for use until the sweet potatoes bore, and directed them how to grow manioc, the white (non-poisonous) variety, of which I promised to send them plants" (UK, Parliament, 1887: 148). On top of these measures, a program was initiated to supply seed yams to all affected locations throughout Lomaiviti and Lau, using surplus crops grown in Colo West, Colo East, Ba, Nadroga, and Tailevu for the 1886 *Bose Vaka Turaga* (Council of Chiefs), which was cancelled on account of the hurricane. Some details of this operation are presented in Table 3.1. It was the Governor's intention "to supply all, or nearly all, the wants of those standing in need" and by mid-May he expected "in the course of a few weeks ... to have at least 70 tons at disposal for general distribution" (UK, Parliament, 1887: 132). Government food supplies were sent only to the islands in which food scarcity was, in the eyes of the colonial administration, most severe — the islands in Lau, such as Totoya, where the hurricane followed a two-year drought. James Blythe, secretary of native affairs, wrote to Thurston

The *Bulisays*, that but for the drought there would have been a sufficiency of food notwithstanding the strength of the gale. The supply of rice and biscuits is needed here. It might be too much to say that the people would have died of famine if no food had been sent, but it is not too much to say that without this supply lives would have been in danger, more especially the lives of the young and the old, not to say the sick and the weakly. (UK, Parliament, 1887: 142)

However, Blythe found less cause for alarm in Lomaiviti, which had borne the brunt of the storm, and observed that the matter of

<i>Costs of relief programme</i>			<i>Provinces that received relief</i>		
	£	s. d.		£	s. d.
Rice	65	0 0	Lau	339	19 9
Rice and sugar	37	18 4	Cakaudrove	45	3 4
Rice and biscuits	107	1 8	Macuata	70	3 4
15 bags of maize	7	10 0	Lomaiviti	56	0 0
Yams (1,000)	5	0 0		511	6 5
Yams (53,629)	253	10 0			
<i>Chalter of Suva</i>			<i>Provinces that supplied yams</i>		
Lt. Governor's trip	60	0 0	Tailevu	3,000	
Governor's trip	76	0 0	Nadroga	19,000	
	612	0 0 ^a	Colo West	14,150	
			Colo East	6,479	
			Ba	11,000	
				53,629	

Source: Fiji, CSO 87/1311.

a. The total given here minus the cost of transportation for the Lt. Governor's trip is £552, which is the sum that should, according to the source, have been charged against the respective provincial tax refunds. The sum actually charged was that given in the total for relief received. The discrepancy is apparently due to a mathematical error in the original source.

sending yams from Tailevu to areas in need should be left for the "Roko Tui [administrative head] of both provinces to settle ... in their own fashion" (UK, Parliament, 1887: 146). Although some government rations were issued to Lomaiviti, the amounts were relatively small. On parts of Kadavu, where great shortages were reported, no government assistance of any kind was given (Fiji, CSO 86/876).

After the establishment of this precedent for government intervention in post-disaster relief and rehabilitation, another ten hurricanes or tropical storms affected Fiji during the remaining years of the nineteenth century. However, the government found cause to become involved only on two occasions and in each instance the response differed significantly. The first of these hurricanes occurred in January 1889, when extremely heavy rains caused widespread flooding and landslides. Despite the destruction of food crops in many places, government supplies of food were deemed unnecessary although some planting materials were distributed.

I have maintained a careful watch upon . . . food supplies and insisted upon extraordinary efforts being made to obviate scarcity by planting quick growing crops, such as sweet potatoes, maize, etc., etc. and I do not anticipate now any serious results from the total loss of the yam crop in many places. (Thurston to CO, 2 May 1889, UK, CO 83/50, no. 33)

The major problems of coping with post-disaster food scarcity and long-term agricultural rehabilitation were left in the hands of the traditional experts.

Immediately following the hurricanes of January 1895, surveys of the damage found on a wide front throughout the eastern portions of Vanua Levu and Viti Levu, and in Lau and Lomaiviti, indicated that a government food relief programme could again be avoided.

I am . . . of the opinion that Lau will be able from its own resources to assist itself; while Bua and Macuata will be able, under arrangements directed by Government, to assist the neighbouring provinces of Cakaudrove and part of Lomai Viti, Kadavu, and all the uninjured part of Viti Levu including the hill districts will be able, if necessary, to assist Rewa, Bua and part of Lomai Viti. (Thurston to CO, 21 January 1895, UK, CO 83/61, no. 5)

However, the government was not to escape so lightly, for food scarcity threatened communities on the mouth of the Rewa River in the following month, when crops decayed in soils left waterlogged and contaminated with salt by the storm surge associated with the hurricane.

The ensuing food relief programme far outstripped that of 1886 in terms of the volume of food supplied and the high degree of organization involved. In early March, it was estimated that 2,500 people would receive "partial" food rations from government, supplemented by traditional foods supplied from other parts of Fiji, for approximately 100 days at a cost of £2,200 (UK, GO 83/61, no. 24). A ration schedule was fixed at "1 lb rice, maize meal or biscuits or H lb of each—two of the articles only—and 2 oz of sugar for every adult. . . . In the case of small children two were counted as being equal to one adult" and the programme was carefully monitored (UK, CO 83/62, no. 66, encl. 1). As Table 3.2 shows, the programme was to run for much longer than expected

in some areas, especially in the Noco Tikina. However, fewer people than expected received government food and the ration contents were halved as the crops came to maturity. Further savings were made possible by the contribution of almost 4 tonnes of biscuits received by the Wesleyan mission from “neighbouring colonies,” probably the first foreign contribution to hurricane relief in Fiji. By the end of the programme, the costs stood at £1,019 3s 4d, less than half that first expected (Fiji, Legislative Council, 1896).

Was the government intervention following these disasters, especially the provision of relief, necessary? During the first eleven years of colonial rule in Fiji, 17 hurricanes or tropical storms occurred, 3 of which Visher (1925) classified as severe, but there appears to have been no government response in terms of relief or rehabilitation. By the mid-1880s, however, concern that traditional self-sufficiency in food had deteriorated was evident among the colonial population, a concern that Thurston himself expressed in 1885 (*Bose Vaka Vanua*, 1886: 7). Allegations that government policy had contributed to the perceived problem were contained in a petition, from members of the Levuka Chamber of Commerce to the secretary of state for colonies in January 1886, seeking a reduction and the eventual abolition of native taxes, which they contended had led to a decline in the welfare of the Fijian population (*Fiji Royal Gazette*, 1886: 133). After the hurricane, the *Fiji Times* gave vigorous support to the petition, and lobbied for a relaxation of the labour laws reasoning that wages earned could offset “bitter privation” whilst cheap labour would help offset the planters’ losses (*Fiji Times*, 10 March 1886). The government was not moved by these arguments, but a widespread famine following the hurricane may well have weakened its position.

However, the lack of urgency with which the relief operation took place, together with the limited volume of supplies the government contributed, indicate that fear of famine was not very great. The first supplies were not issued until nine weeks after the hurricane although within two weeks of its occurrence, Thurston had informed the Colonial Office that “the subject of food ... is receiving my careful attention” (UK, Parliament, 1887: 95). A month later, he sent officials to the worst-affected areas to “report to me whether government aid is likely to be re-

	<i>Number of Villages Rationed</i>	<i>Total Number of Rations^a</i>	<i>Duration of Rations</i>
<i>Relief Distribution</i>			
Rewa	9	58,999	23 Feb-29 June
Noco	9	118,979	25 Feb—24 Aug
Vutia	3	16,188	20 May—28 June
Nakelo	10		
Total	31	194,166	
<i>Sources of Supplies</i>			
Government			
Wesleyan Mission⁰			
Bua			
Lau			
Kadavu			
Nadroga			
Ra			
Naitasiri			
Beqa			
Colo East			
Total			

Source: UK, CO 83/62 no. 66.

a. Full rations and half rations are all counted as one in these figures which pertain only to non-traditional food items.

quired” (UK, Parliament, 1887: 124). A further three to seven weeks elapsed before supplies were dispatched.

If the supplies were slow in coming, the quantities that arrived would have hardly been sufficient to offset famine had it been imminent. Totoya received the greatest share of the relief at a rate of around 3 to 5 kilograms of rice and biscuits *per capita* which on the basis of the 1895 ration schedule would have been sufficient for a week! Even this meagre “dole” may have been unnecessary, as Thomson (1908: 336) asserted it was “consumed ... in one prodigal feast,” there being “quite sufficient” food for “every-day use.”

Items Supplied

<i>Rice</i> (t)	<i>Maize</i> (t)	<i>Biscuits</i> (t) (t)	<i>Sugar</i>	<i>Yams</i> (no.)	<i>Taro</i> (no.)	<i>Madrai</i> (baskets)	<i>Bananas</i> (bunches)
18.467	2.426	2.090	2.180	7,256	8,590	120	321
41.733	4.434	1.856	4.314	6,348	4,117	154	—
3.672	-	—	0.419	1,720	29,489	90	-
-	-	-	-	11,594	-	-	-
63.872	6.860	3.946	6.913	26,918 ^b	42,196	364	321
63.872	6.860	-	6.913	-	-	-	-
—	-	3.946	-	-	-	—	-
—	—	—	—	11,178	14,625	354	217
—	—	—	-	1,300	—	—	-
—	-	—	—	1,720	3,350	-	-
—	--	—	—	1,606	—	10	104
—	—	—	-	12,124	5,160	—	—
—	—	—	—	-	1,827	—	—
—	—	—	-	—	421	—	—
-	-	-	-	-	16,813	—	-
63.872	6.860	3.946	6.913	27,928 ^b	42,196	364	321

b. Discrepancy in original data source.

c. The biscuits were supplied to the Wesleyan Mission from “neighbouring colonies,” presumably Australia and New Zealand.

The costs to the administration were very small in both instances when relief supplies were given, even in 1895 when the programme ran for several months. On that occasion the expenses incurred for relief amounted to less than 1.5 per cent of government expenditure, or a little more than one-twentieth of the native taxes collected for the year. Government supplies were directed only to areas where the most dire hardship was perceived by the administration to be imminent, and by far the greatest contributions of food and planting materials came from Fijian communities unaffected by the calamities. In 1887 the costs of the previous year’s relief programme were charged against the tax refunds for the four provinces that received relief.

The total of £511 6s 5d even included £253 10s 0d, for the value of the yams that the government had received gratis from the non-affected areas! The colonial government was, however, pleased to assume the credit.

Your Lordship will, I am sure, regret to hear of the serious difficulty which has thus fallen upon the Colony, but . . . I have, thanks to the system of Native Government in force, every confidence that it will be overcome with little extra charge to the public revenue, while the confidence of the native population in the power and protection of the Government will be much strengthened. (Thurston to CO, 19 May 1886, UK, Parliament, 1887: 132)

The people . . . are in very good heart, very sensible of the benefits of an established Government. (Thurston to CO, 4 March 1895, UK, CO 83/61, no. 24)

The administration's real contribution was perhaps no more than to meddle with the existing, tested, and proven traditional system of post-disaster food redistribution and rehabilitation that had worked for centuries. Concerned with an apparent reduction in Fijian self-sufficiency in 1885, the governor in the following decade seemed quite willing to encourage its erosion, albeit unwittingly, by initiating a process of increasing post-disaster dependence upon government.

GOVERNMENT RESPONSE IN THE FIRST QUARTER OF THE TWENTIETH CENTURY

By the end of the nineteenth century the colonial government was beginning to expand its services and public works, largely in response to the colony's favourable finances during this period. However, the government recognized that hurricanes posed a serious threat to this expansion as well as to the colony's prosperity, and some time after the 1895 hurricane a "Hurricane Reserve Fund" of £9,000 was established. This fund was "to provide for extraordinary expenditure directly due to hurricanes, and ... to enable the numerous and extensive public works then in contemplation to be carried out, even if a shrinkage of revenue should be occasioned by the same cause" (UK, CO 83/79, Treasury). The fund, which was derived from budget surpluses, was expanded to

£20,000 in 1899 and then to £25,000 in 1900 (UK, CO 83/70, Treasury; UK, CO 83/71, no. 7). In 1904, presumably with most of the works completed, the fund was discontinued. There is no evidence of the fund having been used, although a number of hurricanes did occur during the time of its existence. It was clear also that in some quarters, government assistance was becoming expected. Following flooding in Rewa in February 1901, the 1895 programme was not forgotten by the Reverend Mr Small, who reported in the *Fiji Times* “that for some time to come the pinch of want will be felt by many No doubt the Government will come once again to the rescue, showing itself paternal in very deed” (27 February 1901).

Nevertheless traditional responses were still very important in most parts of Fiji, especially those most distant from the capital. Following a very severe hurricane in 1904, the government boat, *Ranadi*, found the food crop destroyed at Moce. “Immediate wants were supplied and a couple of boatloads of food stuffs were left at the island, as the inhabitants were in dire need, having dispatched their boat to neighbouring islands to obtain food” (*Fiji Times*, 10 February 1904). The administration’s response was indeed rapid, the first supplies reaching Lau within two weeks of the storm. There was little question in Governor Jackson’s mind that it was necessary, and might be for some time.

Whatever is given must be gratuitous, as the whole time of the people for the next twelve months will be fully occupied in rebuilding their houses and in re-establishing their food plantations. (Jackson to CO, 8 February 1904, UK, CO 83/79, no. 18)

The next severe hurricane occurred in late March 1910 and brought forth an unusual response from the government. While most food crops were destroyed, the yam crop, which was mature, suffered much less, and the value of a certain traditional response was recognized.

There is a most admirable Fijian custom, according to which the [population] of an uninjured district help from their abundance . . . any other district which may have been hard hit; and owing largely to this and to the saving of the yams, it seems probable that the . . . affected area will not suffer for want of food. (ImThurn, 1910; 3)

Instead attention was focused, for the first time, on the question of housing.

Every effort is already being made, and will be continued, to provide satisfactory temporary shelter . . . but it will probably be at least two years before permanent housing can be completed. In due course, that is when the necessity of the various cases have been ascertained and duly weighed, I propose to assist those . . . who could not otherwise replace their houses, by a grant of sawn timber and expert assistance in making of this timber house frames so braced as to withstand the effect of future hurricanes. (Im Thurn to CO, 16 April 1910, UK, CO 83/95, no. 83)

The damage to housing was heavy: Bau was “practically destroyed” and a grant of £1,000 supplemented by a loan of a similar amount was approved for the reconstruction of about 80 houses (Fiji, Legislative Council, 1910) although the programme was completed for much less, the final cost being £861 4s 2d (Fiji, Legislative Council, 1911).

In 1912, recourse to food relief was once again deemed necessary, supplies of rice being sent to Macuata and Bua, the costs being advanced from government funds on loan (UK, CO 83/106, no. 74). Victims in other areas were encouraged to use proceeds from copra sales and tax refunds to purchase rice and biscuits and government road work was promised for areas of Bua should great difficulties arise (UK, CO 83/106, no. 74, encl. 2). Certainly no gratuitous relief was to be given in 1912, but neither were traditional ways of coping with the crisis fostered. Instead, increased participation in the cash economy was promoted as a means by which post-disaster food shortages could be offset. When Lau was affected the following year, a similar government attitude prevailed. “This year [they] will have copra to buy food with; next year they will have food” (UK, CO 83/114, no. 229). A number of hurricanes affected Fiji in the sixteen years that followed, but none of them appears to have been particularly severe and no major relief programmes took place. The greatest devastation of this period occurred in March 1923 when a very localized, but intense storm passed over parts of Lau. Although relief supplies were subsequently issued, the amount distributed totalled only 20 sacks of rice (Twentyman, 1923). The calm was shattered, however, late in

1929, when the first of two hurricanes, only fifteen months apart and both among the worst on record, occurred.

1929-1967: COMMITTEES, FUNDS, AND INCREASING COSTS

During the sixteen years of relative tranquility a number of changes initiated in the previous century had taken hold. The commercialization of agriculture had steadily increased and growing populations of agricultural labourers and small farmers had become established, many on the fertile flood plains of Viti Levu's major rivers. The infrastructure of the colonial government had gradually expanded, with increases in public works and improvements in communications, also mostly on Viti Levu. These developments undoubtedly helped to accentuate the country's vulnerability by the end of the twenties.

When the hurricane and resultant flooding occurred on 11 and 12 December 1929, the news travelled rapidly and government emergency teams were soon in action evacuating flood victims and distributing emergency relief supplies. The *Fiji Times* followed the events closely and maintained for its readers a steady flow of information, under banner headlines, about the destructiveness of the storm and the plight of its victims, and opened, before the floodwaters had subsided, Fiji's first hurricane relief fund (*Fiji Times*, 13 December 1929). On the same day the government formed a "Central Relief Committee," comprised of senior government officers, to deal with "the question of relief" and direct the operations of four local committees formed a few days later. The voluntary relief fund was placed at the Central Committee's disposal and augmented by £5,000 from the government (Fiji, Legislative Council, 1930: 1).

The committee acted promptly, dispatching 15 tonnes of rice to Labasa within days of its inception, and by the end of the year it had distributed relief to islands in Lau and Lomaiviti. However, the bulk of its work was confined to Viti Levu, especially the localities near the large rivers (see Table 3.3). As the total in the table indicates, the costs of the relief programme fell well short of the amount made available, and in fact were much less, as £300 was contributed from the voluntary fund to cover the costs of immediate post-disaster relief and after 28 December 1928, all recipi-

District	Expenditure			Percentage
	l	s.	d.	
Lau	254	18	0	6.6
Kadavu	115	1	0	3.0
Nadi	90	15	0	2.4
Tailevu, Rewa, Naitasiri	1,738	9	7	45.2
Macuata	208	10	7	5.4
Savusavu	112	17	0	2.9
Colo East	81	8	0	2.1
Nadroga and Colo West	945	17	8	24.6
Navua	146	5	6	3.8
Lomaiviti	137	8	2	3.6
General	14	0	0	0.4
Viti Levu	3,002	15	9	78.1
Vanua Levu	321	7	7	8.3
Eastern Division	507	7	2	13.2
General	14	0	0	0.4
Total	3,845	10	6	100.0

Source: Fiji, Legislative Council (1930).

ents received rations on credit only. "The assumption underlying the adoption of this principle was that once it was realized that repayment would be required for relief given, only those in actual want of such relief would apply for it" (Fiji, Legislative Council, 1930: 2). Consequently, the net cost to government by early May, when relief measures were completed in all but a few locations, was only £1,245 10s 6d. The balance of the voluntary fund was used to purchase clothing for distribution in Rewa and for grants to the widows of three hurricane victims (Fiji, Legislative Council, 1930: 8).

It was perhaps as well that government savings were achieved because the expenses incurred because of damage and destruction of government property were greater than ever before. The equivalent costs in 1910, when the hurricane and flooding were similar in impact and areal extent, were £5,494 4s 6d (Fiji, Legislative Council, 1911). In 1929, the government was to pay £9,482 for repairs and replacement of government property including

roads, bridges, buildings, seacraft, seawalls, and wharfs. While the event of 1929 was among the ten or so worst disasters to affect Fiji in historical times, the hurricane and flooding that occurred only fourteen months later, in late February 1931, was probably the most destructive of them all.

In Fiji, as February 1931 began, thoughts of disaster were focused on New Zealand and subscriptions were being solicited by the *Fiji Times* for the victims of the Napier earthquake. A month later, Fiji was itself recoiling from calamity, and when the death toll was finalized at 206 only 50 fewer lives had been claimed than by the earthquake fifteen hundred miles away. The 1929 committee was promptly reappointed and the donations to the New Zealand subscription transferred to a local relief fund. Concentrating first on the Rewa area, the committee's resources became stretched as news of need came in from other parts of the country. On 28 February three ships left Suva for Lautoka, stocked with supplies of food that were "being dispatched as fast as [they] can be gathered" (*Fiji Times*, 28 February, p. 4). Included among the vessels was the SS *Karetu*, which had providentially just arrived in Suva from Australia with a cargo of rice (Fiji, Legislative Council, 1931). Special warrants of £5,000 each were issued for relief and repairs to government property respectively.

By the time relief operations had ceased £5,195 12s 1d had been spent (Fiji, Legislative Council, 1932). Costs of repairs and replacements of government property were estimated at £13,473 at the beginning of April, although the annual accounts for 1931 indicate that only £9,160 4s 1d was actually expended in "public works extraordinary" to repair the hurricane flood damage (Fiji, Legislative Council, 1931, 1932). These costs, accrued during a period of reduced government revenues on account of the Great Depression, were indeed heavy.

The degree of government involvement in post-disaster relief was much greater following these two storms than at any previous time, and the committee concept was to be continued for all major storms throughout the remaining years of colonial rule. In terms of improving the efficiency of relief operations it was clearly an important step and, unlike the previous half-century of colonial rule when government response was often hesitant, the remaining decades were marked by almost automatic govern-

ment action. The 1929 and 1931 hurricanes and floods also saw the initiation of public subscriptions, which similarly were to become part and parcel of relief operations for all of the major storms that followed. However, perhaps the most significant feature of the relief operations was that transferral of local food supplies from non-disaster areas to hurricane and flood victims was not considered, or at least adopted, as an alternative or supplement to government relief supplies of imported foods — again, another trend in all ensuing major storms.

What indeed is a major storm? Perhaps in the period of colonial rule it was a storm centred on or near the main population centres in Viti Levu and to lesser extent Vanua Levu. The hurricane of January 1936 was small in areal extent but in the islands of southern Lau which it struck, especially Komo, Oneata, Moce, and Kabara, the damage was very severe. There was clearly confusion in the relief process. The government, represented by the acting colonial secretary, seemed eager to act, and within a fortnight of the storm £205 worth of relief supplies (10.3 t rice, 2.75 t brown sugar) were dispatched (McLean, 1977: 44). In Lau, however, Ratu Sukuna, the district commissioner, was obviously less convinced that relief was necessary.

When the first report from the D.C. Lau . . . dated 12 February (o.s. 81/16/7) reached the Colonial Secretary it (i) expressed high appreciation of the prompt action taken to send out food supplies; (ii) explicitly stated for each island that no assistance in the form of food was desired. (McLean, 1977: 44)

The relief was eventually given and further supplies were provided to augment the original amount, the final cost of the operation being £418 14s 7d (Fiji, Legislative Council, 1937). Thompson (1940) indicated that in Kabara at least, the provisions may well have been unnecessary as many of the traditional strategies for coping were invoked following the destruction.

When the hurricane of February 1941 struck Suva, the primary concern of the government was to keep administration costs and imports down in support of the war effort. Readers of the *Fiji Times*, similarly preoccupied, were contributing to a patriotic fund. Consequently, no government supplies were provided free of charge to the disaster victims and no public relief fund was

established. Relief was distributed, but in relatively limited amounts, on a credit basis to be repaid within two years. Although the government avoided incurring the costs of a relief programme, it suffered heavy losses to public property, the repair of which cost £17,971 15s 8d (Fiji, Legislative Council, 1942). Parts of Lau and Lomaiviti also suffered from the hurricane but no relief appears to have been issued.

In contrast, the government acted promptly following the hurricane of January 1943, and for Lau at least most of the supplies provided were returned. It was intended to apply the same principles of repayment as in 1941, but it seems that the terms were unacceptable:

No price list was forwarded with the food, but, by reckoning on local wholesale rates, the cost of all food is a pretty staggering amount. I have therefore refrained from distributing much in the first instance, and am instructing the Roko to go easy, as the debt might prove too great a burden to pay back ... I hope that it will eventually be possible to return much of the foodstuffs unused. (DC Eastern, quoted in McLean, 1976: 8)

Lau was apparently one of the last places in Fiji where traditional responses to disaster remained relatively intact. However, its self-sufficiency was being sorely tested, and when the December 1948 hurricane inflicted nearly all of its destructiveness on Lau, government supplies were issued in an unprecedented fashion in terms of both rapidity and amount. A detailed review of the 1948 relief programme is found in McLean (1977), on which the following brief outline is primarily based. The government response was extremely swift, as a committee under the chairmanship of the governor decided to dispatch emergency rations immediately using an RNZAF Catalina flying boat. The "Lauan airlift" was from all accounts a successful operation but was probably never necessary. Throughout Southern Lau, to which the supplies were sent, it appears that sufficient food was on hand to last until mid-January (McLean, 1977: 54). An inspection tour of outlying islands in the Northern Division indicated that there, too, immediate relief supplies were hardly warranted and most were returned, although there was some question that the recipients might have to pay for them later.

Whatever line Government may take in regard to repayment, both the Roko and I felt that we must avoid anything in the nature of a "dole." While proper assistance must be given to a fine people, it is by reason of their standing up to such blows over the generations that the island folk *are* fine people and they should be encouraged in their independent spirit. (DC Northern, quoted in McLean, 1977: 55)

Distribution of relief to Lau by boat followed quickly after the airlift but McLean assumed that the pattern was probably the same as above. A lag then followed in the distribution of relief and further supplies were not dispatched to Lau until early February, when it became evident, following an inspection by Ratu Sukuna, that food shortages were becoming severe. Table 3.4 shows the amounts requested by Ratu Sukuna, which were valued at "something under £8,000," of which the government had agreed to meet half the costs (McLean, 1977: 58). If the process of post-disaster food dependency was initiated in Lau in 1886, the issue in 1948, some sixty-two years later, signalled the apparent demise of post-disaster self-sufficiency in that region. Food

TABLE 3.4 Relief Supplies to Lau, 1948—1949

	<i>Lauan Airlift^a</i> (<i>lb</i>)	<i>February</i> (<i>tons</i>)	<i>Distribution^b</i>
Lakeba	4,410	22	
Kabara	2,512	20	
Matuku	-	5	
Totoya	-	5	
Vanuabalavu	2,150	20	
Ono-i-Lau	6,016	5	
Cicia	-	6	
Nay au	-	4	
Oneata	1,256	4	
Moce	2,512	5	
Fulaga	3,610	15	
Vatoa	586	-	
Ogea	1,256	-	

Source: McLean (1977).

a. Actual amounts sent.

b. Amounts proposed by Ratu Sukuna.

relief was to become institutionalized as a response to disaster in all parts of Fiji from that time onward.

The 1952 hurricane caused destruction across a wide band of Viti Levu, and separate relief funds were established in western and south-eastern Viti Levu, administered by independent committees comprised of elected Legislative Council members, government officials, and members of the public. Public donations in both Fiji and New Zealand were considerable and the expenditures for the relief programme that followed totalled \$39,624, far higher than any previous relief operations. No summary of relief distribution is available but it is clear from the issue to Yasawa that the provisions were on a comparatively lavish scale (see Table 3.5). For the first time, large contributions from external governments, totalling almost \$60,000, were received and some \$64,000 remained after the relief had ceased. This enabled the government to broaden its involvement in post-disaster relief, setting up local committees to administer interest-free loans of up to \$100 for the reconstruction of dwelling-houses. The re-

TABLE 3.5 Rations Provided to Yasawa During the First Month of Relief Operations, 1952

<i>Item</i>	<i>Quantity</i>
Rice	43 (2-cwt) sacks
Flour	64 sacks
Meat (canned)	171 cases
Meat (salted)	4 casks
Milk	31 cases
Sugar	22 (2-cwt) sacks
Tea	80 packets
Kerosene	100 (4-gal) drums
Matches	10 gross
Soap	11 cartons
Clothing	More than 3,300 garments
Tapioca	3 truck loads
Fijian vegetables	4 truck loads
Kumara plants	50 sacks
Assorted implements	Cane knives, axes, digging forks, cooking utensils, fishing and sewing equipment

Source: Fiji, Legislative Council (1952:5).

TABLE 3.6 Expenditures of the Flood Relief Fund, 1964

	<i>Central Division (f)</i>	<i>Western Division (\$)</i>	<i>Total (!)</i>
Rations and provisions	25,767	37,040	62,807
Agricultural rehabilitation	8,653	2,320	10,973
Other	6,403	4,461	10,864
Miscellaneous			2
Total receipts			223,698
Balance			139,052

Source: Fiji, Legislative Council (1965a:8).

mainder, in combination with government funds, was used to reconstruct schools destroyed or damaged by the hurricane (Fiji, Legislative Council, 1952: 3). Despite the external aid, the government suffered heavy losses and in addition to providing \$35,026 for school rehabilitation, incurred losses to government property, for which repair and replacement costs exceeded \$272,000.

The following twelve years were relatively free of disaster but when widespread flooding occurred in Viti Levu in 1964 and again in 1965, the costs of relief, administered by a "Rehabilitation Committee" appointed by the governor and consisting of government officials and Legislative Council members, were again very high. Following the 1964 floods a rehabilitation fund was created with contributions from overseas governments (\$54,968) and public donations (\$83,780), the latter being matched by the government. As Table 3.6 shows, the bulk of the fund was not spent although over \$62,000 was used to purchase relief food.

When the hurricane of 1965 was followed by further flooding, subscriptions from the public were less readily forthcoming. This seems to have been a response to some severe criticism of the committee's actions in 1964, when \$50,000 was spent on relief food, widely reported to be lavish, in the first two weeks after the floods. The situation in 1965 was undoubtedly worse than in 1964, and by mid-February 32,000 people had received rations in the Rewa area. The committee was reappointed and estimated

Ration Schedule (per person/day)

- 1 lb rice, flour or sharps**
- 2 oz dahl or 4 oz tinned meat or fish**
- 1 oz milk powder**
- 2 oz sugar**
- 1 /5 oz tea**
- 1 oz fats**
- 1 lb salt/family/week**

Estimated Expenditure (\$)

Mid-February—mid-March	79,000
Mid-March—mid-April	36,000
Mid-April—mid-May	24,000
Mid-May—mid-June	12,000
Total	151,000

Source: Fiji Times, 22 February 1965, p. 2.

the total cost of rations (see Table 3.7) at \$150,500, with a further \$64,500 necessary for agricultural rehabilitation (*Fiji Times*, 4 March 1965). It appears that this programme was adhered to, the difference between the total needed and that remaining in the fund being met by a government contribution of \$66,000 and a grant from the British government of \$10,000. The price of relief had certainly soared since 1931.

The costs to government had increased no less rapidly, despite the considerable savings through the use of public donations and overseas assistance to the relief fund. Expenditures on account of the 1964 floods amounted to over \$470,000, and for the 1965 hurricane to \$284,000, a combined total of \$754,000 (Fiji, Legislative Council, 1965b, 1966, 1967). One further hurricane was to strike Fiji and be followed by relief supplies, in 1967, before the era of colonial rule ended. It was a relatively small event but relief operations cost the government more than \$50,000 (Fiji, Legislative Council, 1968).

Among the legacies left by the departing colonial power was a condition of critical vulnerability to disaster, particularly hurricanes. This vulnerability had been intensified through almost a century of replacing traditional responses to disaster and creating

a government infrastructure poorly equipped to handle the crises that hurricanes always brought. In the first dozen years of Fiji's independence, the elements were not particularly kind—a series of severe hurricanes tested the resources of the country, and new ways to face the crises had to be found.

PART 2
THE DECADE OF THE COMMITTEE

4

**THE COSTS OF POST-HURRICANE
RECOVERY**

The important trends in response to hurricanes that were initiated during the colonial era were well established by the time of independence. Disaster victims would be provided with considerable assistance from either the government or a centrally based, official relief authority, and the government itself had become increasingly vulnerable in consequence of the expansion of its infrastructure and services. These factors ensured that the costs of disaster-recovery programmes in the decade that began with Cyclone Bebe would be very high. Moreover, further increases in post-hurricane costs were fueled by high inflation rates during this period, which saw consumer and building-materials price indices more than double (see Tables 4.1 and 4.2).

In response to these high and growing costs, additional financial and material support from both within Fiji and overseas became a critically important element of post-disaster management in Fiji. International aid, including contributions from overseas governments, international agencies, and voluntary relief organizations, as well as donations from the general public of Fiji and numerous other countries, provided the extra funds. As Figure 4.1 illustrates, contributions were made to both the government and the Committee, which in turn allocated the resources available to various projects and programmes for post-hurricane relief and rehabilitation. The two initial steps of this process focused specifically on the costs of recovery and the sources from which those costs were met.

TABLE 4.1 Consumer Price Indices, 1968—1982

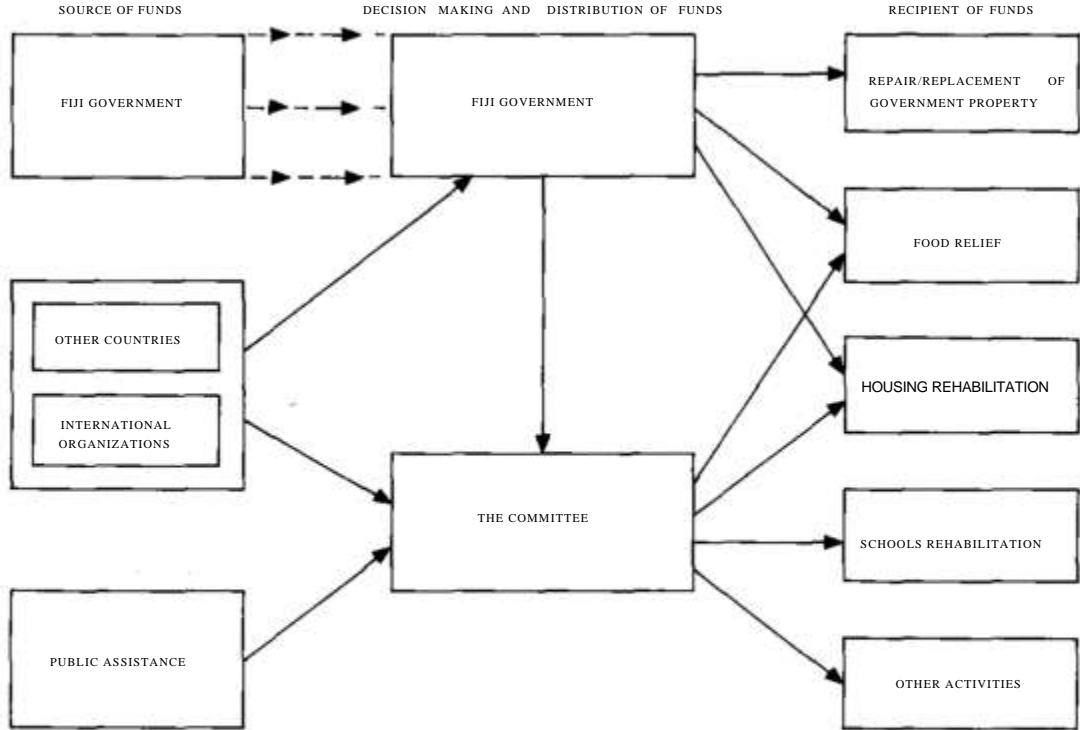
Year	Base: July 1968 = 100.0	% Change Per Year	Adjusted to 1972 Base to Cover Period of PMHRC
1968	100.2		
1969	103.9	3.7	
1970	108.2	4.1	
1971	115.2	6.5	
1972	125.7	9.1	100.0
1973	139.8	11.2	111.2
1974	160.0	14.4	127.3
1975	180.9	13.1	143.9
1976	201.5	11.4	160.3
1977	215.7	7.0	171.6
1978	228.8	6.1	182.0
1979	246.5	7.7	196.1
1980	282.2	14.5	224.5
1981	313.8	11.2	249.6
1982	343.1	9.3	272.9

Source: Fiji Bureau of Statistics (various dates), *Current Economic Statistics*.

TABLE 4.2 Building Materials Price Index, 1970—1982

Year	Base: August 1970 - 100.0	% Change Per Year	Adjusted to 1972 Base to Cover Period of PMHRC
1970	100.2		
1971	104.8	4.6	
1972	110.1	5.1	100.0
1973	120.6	9.5	109.5
1974	159.8	32.5	145.1
1975	187.3	17.2	170.1
1976	216.5	15.6	196.6
1977	231.9	7.1	210.6
1978	243.3	4.9	221.0
1979	258.3	6.1	234.6
1980	285.3	10.4	259.1
1981	309.6	8.5	281.1
1982	315.4	1.9	286.5

Source: Fiji Bureau of Statistics (various dates), *Current Economic Statistics*.



Arrows indicate directions in which financial and other support is distributed.

Figure 4.1 A simplified view of the post-disaster funding process

TABLE 4.3 Direct Government Expenditure due to Disasters 1972—1978 (\$)

<i>Year</i>	<i>Relief</i>	<i>Emergency Services</i>	<i>Damage to Government Property</i>	<i>Total</i>
1972	319,487	-	542,014	861,501
1973	156,383	-	149,032	305,415
1974	-	89,634	4,996	94,630
1975	-	224,529	-	224,529
1976	-	2,327	-	2,327
1977	-	199	-	199
1978	-	32,289	-	32,289
Total	475,870	348,978	696,042	1,520,890

Source: Ministry of Finance (various years), [Annual] Reports on the Accounts and Finances.

COSTS TO GOVERNMENT

Between 1972 and 1978, direct government expenditure on post-disaster relief, rehabilitation, and reconstruction was listed in the annual accounts under the general category of "Miscellaneous Services." Table 4.3 lists these annual costs as they were described. As the table indicates, total direct expenditure during the period exceeded \$1.5 million, although over three-quarters of this sum (\$1,167,000) was spent in the first two years as a result of Cyclone Bebe. Of the Bebe total, 59 per cent of the costs (\$691,000) were incurred in the repair and replacement of government property. Unfortunately, it is not clear whether the term "emergency services" included similar costs after 1974, or referred solely to relief and rehabilitation costs, although it is unlikely that government property sustained heavy losses in the later period, since the storms that followed Cyclone Bebe left Vitu Levu largely unaffected.

Government disaster-related expenditure was in fact much greater than these direct costs indicate. The Public Works Department alone sustained costs of approximately \$1.7 million due to hurricanes during this period (see Table 4.4). Extraordinary public works programmes resulting from hurricane destruction totalled almost \$880,000 during this initial period, with Cyclone Bebe responsible for almost three-quarters of this

TABLE 4.4 Public Works Expenditure due to Hurricanes, 1972—1981 (\$)

Year	Public Works Extraordinary	Maintenance of Roads and Bridges due to Storm Damage	Total
1972	429,734	177,705	607,439
1973 ^a	214,267	275,843	490,110
1974 ^a	75,794	n.a.	>75,794
1975	159,778	134,610	294,388
1976	-	243,000	243,000
1977	-	—	-
1978	-	-	—
1979	-	200,000	200,000
1980	122,198	1,500,000	1,622,198
1981	-	-	-
Total	1,001,771	2,531,158	3,532,929

Source: Public Works Department (various years), *Annual Reports*.

a. The costs in 1973 are due mostly to Cyclone Bebe and in 1974 to Cyclone Lottie, both events having occurred late in the previous years.

amount. Cleaning and maintenance of roads and bridges due to hurricane damage cost approximately \$830,000 more, and had to be taken from normal operating budgets. (Although the total spent due to hurricanes may have been less than this figure, which includes all "storm damages," the greater proportion is due to tropical storms and hurricanes.) After Cyclone Bebe a \$1-million, interest-free loan (augmented by \$500,000 from the Fiji National Provident Fund) was made available to the Housing Authority, which administered interest-free loans to victims on Viti Levu. Following Cyclones Lottie and Val, when the Committee's rehousing programme was enlarged (see Chapter 5), insufficient funds threatened its completion until the government took over by establishing a rural housing programme. The programme, in which only the materials costs were to be repaid on a long-term, interest-free loan basis, entailed a total government expenditure of \$1,544,000 by the end of 1978, although slightly less than one-third of the total sum was recoverable through loan repayments. During this period the government had made almost \$5.75 million available for post-hurricane relief and rehabilitation, and probably well over \$3 million of that amount was provided for

TABLE 4.5 Summary of EEC Exceptional Aid Grants

<i>Cyclone</i>	<i>Value of Grant (\$)</i>
Meli	2,990,000
Tia/Wally	1,151,439
Arthur	540,430
Total (1979-1981)	4,681,869

Source: Documents of PMHRC/PMRRC.

assistance to disaster victims (other than the government itself), about half being in the form of loans.

In 1979, following the destruction of housing caused by Cyclones Anne, Bob, Fay, and Meli, the European Economic Community made a substantial grant from its Exceptional Aid Fund to the Government of Fiji for the cost of building materials. Cyclones Tia and Wally and then Arthur resulted in further assistance, bringing the total contribution to almost \$4.7 million (see Table 4.5). The grants were made directly to government revenues rather than to the Committee, although the latter did administer the rehousing programmes for which the grants were earmarked. As a result, a high level of integration between the government and the Committee developed, and in the annual accounts the great bulk of government disaster-related expenditure was brought under a single heading, or programme within the "Office of the Prime Minister," to which the Committee was closely tied, instead of being under "Miscellaneous Services."

Unfortunately, no information is presently available about direct government expenditure on relief and rehabilitation in 1982, but the data for the three preceding years are summarized in Table 4.6. The total of almost \$7 million exceeds the EEC contribution by about \$2.3 million, yielding an average in excess of \$750,000 per year, a figure that would be much higher if 1982 government expenditure was included. Much of the excess is attributable to the cost of the government's share of food-relief programmes after each of the storms. For example, in 1979 around \$430,000 was spent from government funds in order to provide rations to Cyclone Meli victims. Other costs, over and above housing and school rehabilitation, included repair and replacement of government property, which was undoubtedly

TABLE 4.6 Direct Government Expenditure due to Disasters, 1979—1982

<i>Year</i>	<i>Relief and Rehabilitation (\$)</i>
1979	1,759,430.95
1980	3,177,193.23
1981	1,996,339.62
1982	a a.
Total	6,932,963.80

Source: Ministry of Finance (various years), [Annual] Reports on the Accounts and Finances.

higher following Cyclone Wally than for the other events, but for which no specific breakdown is yet available.

As with the initial period, not all of the costs to the government are indicated by this outline of direct expenditure alone. In 1980, the Ministry of Agriculture capital works programme included "Hurricane Rehabilitation-Drainage Works" for which a total of \$343,591.38 was spent to improve areas affected by Cyclone Wally. (The total costs of post-Wally agricultural rehabilitation will be much greater: Programme 21 of the agricultural sector in DP8, the Fiji Development Plan for 1981 to 1985, is titled, "Hurricane and Flood Rehabilitation Programme." The intention of the scheme is not only to "rehabilitate and develop areas that were damaged by the 1980 hurricanes and floods," but also to "assist farmers ... to capitalize on the rehabilitation works in order to increase productivity and improve their standards of living." The scheme was expected to cost \$11.91 million over five years, of which \$9 million was allocated to drainage works and the balance to agricultural production.) Public Works Department expenditure for 1979 through 1981 exceeded \$1.8 million, of which almost 90 per cent was for damage and destruction of roads and bridges caused during Wally. Further government expenditure on rural housing schemes continued in 1979 and 1980 and totalled over \$1.3 million, although it is not clear if this was for the continuation of previous rehabilitation schemes, if it included the more recent storms (Anne, Bob, and Fay), or if it was for post-disaster rehabilitation at all. (The rural housing scheme was inoperative for much of this period, from mid-1979 to August 1980.) Of the total of almost \$2 million in expenditure for 1981 (Table

4.6), \$460,000 was for rural housing. Assuming that the 1979 and 1980 rural housing expenditures were disaster related, a total of approximately \$5.75 million, over and above that received from the EEC, was spent by the government from 1979 to 1981. This represents twice the annual rate of expenditure for the initial period, which lasted slightly more than six years, and brings the total outlay for the decade 1972 through 1981 to \$11.5 million.

However, this total should be treated only as a lowest estimate, for it does not include the costs of many other disaster-related government activities that have been absorbed by various departmental budgets. These "hidden costs" include the temporary diversion of personnel from the Emergency Services Committee stage onward. Divisional staff and agricultural extension workers are often involved directly and indirectly in food rationing and agricultural rehabilitation programmes for many months following disasters, at considerable cost to ongoing activities and projects. Public Works Department building supervisors assisted in the reconstruction programmes and Marine Department vessels were used frequently for the shipping of food, building materials, and equipment. The costs of this involvement are much more difficult to quantify but were undoubtedly substantial and it is not unreasonable to estimate that with these included the total bill to the government for disaster relief and rehabilitation may well have exceeded \$15 million.

THE PRIME MINISTER'S RELIEF FUND

Considerable financial support and material assistance from numerous sources augmented government expenditures on relief and rehabilitation between 1972 and 1982. Much of the aid in kind (especially food) was made available directly to the government, but all cash contributions (with the exception of EEC aid) were deposited in a central fund, the administration of which was the responsibility of the Committee. This fund, known as the Prime Minister's Relief Fund, was opened immediately after Cyclone Bebe, in October 1972, and before the year ended had passed \$500,000. Contributions to the fund came from overseas governments and international agencies, voluntary relief organizations, and the general public of Fiji and many other nations.

When the fund was officially closed in March 1973, the total stood at \$560,000 although this was increased greatly by late donations and more importantly from the proceeds of the sale of unused material contributions, especially food stocks in excess of those needed for rationing programmes.

By April 1974, four months after Cyclone Lottie had affected southern Lau and parts of Kadavu, almost \$1.2 million had been injected into the fund in the one and a half years that had passed since Cyclone Bebe. Of this sum, well over \$500,000 remained unspent and by October, with most of the Committee's projects completed, a balance of \$300,000 still remained. The fund was then incorporated as a trust in order to enable investment of \$200,000 of that amount in government stocks. Unfortunately, Cyclone Val struck shortly afterward, leaving little time for interest to accrue before the fund had to be called on once again. Following both Lottie and Val contributions to the fund were not solicited and the Committee's programmes as a result of these storms were largely financed from earlier, post-Cyclone Bebe contributions. By May 1976 the fund was almost exhausted and Committee activities ceased when the housing programme it had initiated was taken over by the government. The Committee was not to meet again until January 1978 and did not become actively involved in post-disaster relief and rehabilitation projects until after Cyclone Meli in 1979 (see Chapter 5).

By the end of 1978 only \$31,000 remained in the fund although almost \$1.4 million had been deposited since 1972, the increase over 1974 resulting mostly from further sales of unused relief and rehabilitation goods. This modest balance nevertheless provided a useful seed for fund-raising efforts following Cyclone Meli, when contributions totalling over \$480,000 lifted the fund over the \$500,000 mark. A further sum of \$877,000 was made available to the fund in 1980 when Cyclones Tia and Wally caused further devastation. These contributions, which were administered from separate accounts, proved more than adequate and by August 1982, with the Meli and Tia-Wally projects virtually all completed, the accounts had credit balances of \$113,000 and \$60,000 respectively. No separate account was opened after Cyclone Arthur and it is assumed that the Meli and Tia-Wally funds were also used at that time.

The Prime Minister's Relief Fund received \$2.75 million in the ten years from 1972, of which all but \$173,000 was allocated to relief and rehabilitation activities (see Tables 4.7 and 4.8). Donations from the general public accounted for 35 per cent of total receipts. This very impressive sum included donations from individuals ranging from a few cents to thousands of dollars, collections raised by clubs, schools, churches, and employee groups and businesses, large and small, both in Fiji and abroad. The balance of the fund was almost entirely contributed by international aid — foreign governments, international agencies, and relief organizations — as most of the hurricane-relief stocks sold in the early years of the fund originated in the form of aid in kind from other countries. Relief and rehabilitation programmes between 1972 and 1982 accounted for over \$18.75 million in expenditure of government and non-government funds, as shown in Table 4.9.

CONTRIBUTIONS IN KIND

Even the very large amount in Table 4.9 belies the true cost of relief and rehabilitation programmes, for in addition to monetary expenditures, a substantial portion of the assistance given to disaster victims was received by both the government and the Committee as assistance in kind. Such assistance varied greatly from thousands of tonnes of rice to bundles of used clothing, and included air-photographic reconnaissance of devastated areas, building supplies, army personnel, emergency and medical teams, trucks for the transport of relief supplies, and international air charters. The jumbo jets and military transport planes engaged in airlifts after Cyclones Bebe, Meli, and Wally would have truly amazed the organizers of the Lauan airlift in 1948. Food aid in particular enabled great savings in the cost to government of ration programmes, and housing materials reduced the costs of the Committee's reconstruction programmes.

The cash value of assistance given in kind is very difficult to estimate. By January 1973, well over \$1.8 million in such assistance had been rendered by overseas governments (particularly the United States of America, Australia, and New Zealand) and international organizations alone (see Table 4.10). As the table indicates, a significant portion of this assistance was exclusive of

	<i>Bebe, Lottie, Val</i>	<i>Meli³-</i>	<i>Tia/Wally³-</i>	<i>Total Contributed.</i>	<i>Per Cent</i>
International aid* ³	382,773.59	224,418.22	439,595.30	1,046,787.11	38.0
Public donations ⁰	315,507.23	259,256.27	391,442.45	966,205.95	35.0
Sales of stock ^d	647,668.82	-	-	647,668.82	23.5
Miscellaneous	49,090.28 ^e	-	46,388.37 ^f	95,478.65	3.5
Total contributions	1,395,039.92	483,674.49	877,426.12	2,756,140.53	100.0
Balance carried forward	-	31,056.38^g	-		
Total value of fund	1,395,039.92	514,730.87	877,426.12		

Source: Documents of PMHRC/PMRRC.

a. Excludes EEC Exceptional Aid grants.

b. Includes foreign governments, international agencies, and relief organizations.

c. Includes public donations from within Fiji and from foreign countries and includes clubs, churches, schools, and social groups and public collections as well as individual donations.

d. Includes sales of contributions in kind, especially food, the bulk of which was donated by foreign governments.

e. Includes a variety of payments (e.g., insurance, loan repayments) made to PMHRC.

f. This amount does not have the source of origin stated and is the amount received by the fund after 10 December 1980.

g. Amount carried forward from Cyclone Bebe fund—the balance unspent as of 31 December 1978.

TABLE 4.8 Expenditure of the Prime Minister's Relief Fund, 1972—1982

	<i>Bebe, Val</i>	<i>Lottie, Meli^a</i>	<i>Tia/Wally</i>	<i>Total</i>	<i>Per Cent</i>
Wages, etc.	92,386	89,687	322,917	504,990	19.6
Reconstruction	941,069	142,310	240,879	1,324,258	51.5
Transport hire, fuel, and oil	196,803 ^b	37,860	112,164	346,827	13.5
Equipment, plant, and tools	44,905	105,908	67,453	218,266	8.5
Relief and rehabilitation	27,977	8,063	62,462	98,502	3.8
Miscellaneous	64,766	2,505	11,139	78,410	3.1
Total	1,367,906	386,333	817,014	2,571,253	100.0

Source: Documents of PMHRC/PMRRC.

- a. These figures exclude expenditure from the Cyclone Meli fund from 1 November to 31 December 1979, during which \$15,624.50 (3.9% of the total expenditure of \$401,957) was spent. Unfortunately, a breakdown of the nature of the expenditure is not available. Because of this, there is an error of less than 1% in the data given for total expenditure.
- b. This figure also includes some charges for "works" which should be listed under reconstruction costs, but are unfortunately not separable.

TABLE 4.9 Relief and Rehabilitation Funding, 1972—1982

<i>Major Funding Sources</i>	<i>Contribution (\$)</i>
Government of Fiji	11,500,000 ^a
EEC Exceptional Aid grants	4,700,000
Prime Minister's Relief Fund	2,570,000
Total	18,770,000

- a. This sum includes about \$2 million in interest-free loans, but excludes 1982 expenditure, which is presently unavailable. The total of \$11,500,000 must be treated as an estimate only as it does not include "hidden costs" to government, which are very substantial.

food and building materials, although the great bulk of almost \$600,000 worth of aid not allocated and later sold was in those categories, especially food. Details of non-cash assistance following Cyclones Lottie and Val are not available although it appears that the amounts were much lower than in 1972, in part reflecting the more limited areal impact of these storms, and in part the

TABLE 4.10 Value of Non-cash Contributions by Overseas Governments and Organizations after Cyclone Bebe

	<i>Amount (\$)</i>	<i>Total (\$)</i>
<i>Source of Contribution</i>		
Overseas governments	1,460,865	
Relief organizations	291,470	
Other agencies	107,953	
Total		1,860,288
<i>Mode of Distribution</i>		
Food	296,401	
Building materials	141,783	
Tents, clothing, aircraft charter, etc.	828,757	
Total		1,266,941
Balance (18 January 1973)		593,347

Source: Fiji Times, 18 January 1973.

reduced international awareness of their effects, a function of their having caused their havoc away from Viti Levu.

International agencies, especially the World Food Programme and the EEC, became increasingly involved in supplying food assistance following Cyclones Meli, Tia-Wally, and Arthur, in addition to the traditional donors. For Cyclones Meli and Tia-Wally well over 3,000 tonnes of food were received, of which more than 95 per cent originated from international donors (see Table 4.11). As the table indicates, many important non-food items were contributed to the relief and rehabilitation effort. However, the table does not indicate the value of other forms of assistance, such as helicopter services provided following Cyclones Meli and Wally for emergency services to stricken areas, or the cost of transporting emergency supplies into Fiji. Given the increases in air transportation costs since 1972, these would undoubtedly have been much higher than for the "Bebe airlift." Although it is impossible to calculate the monetary value of all non-cash aid provided to the government and the Committee, it was probably well over \$5 million in the decade under review. Given the assumptions made thus far in this chapter, the total costs of relief and rehabilitation programmes in Fiji during the period in which

TABLE 4.11 Non-cash Contributions after Cyclones Meli, Tia, and Wally

	<i>Overseas Governments and Organizations</i>	<i>Local Organizations and Businesses</i>	<i>Total</i>
<i>Food</i>			
(major items only)			
Flour	1,611,300 kg	1,250 kg ^a	1,612,550 kg
Rice	358,695 kg	2,250 kg	360,945 kg
Sugar	-	13,500 kg	13,500 kg
Canned fish	26,182 kg	3,511 kg	29,693 kg
Canned meat	11,847 kg	966 kg	12,813 kg
Biscuits	-	c. 5,000 kg	c. 5,000 kg
Vegetable oil	12,558 tins	-	12,558 tins
Tea	34 cartons	-	34 cartons
Root crops	619 sacks	—	619 sacks
Assorted foods	90 cartons	97 cartons	187 cartons
Milk products	-	44,000 kg ^b	44,000 kg
<i>Non-food</i>			
(major items only)			
Tents	1,401 ^c	-	1,401
Blankets	12,500	-	12,500
Clothing	61 packages	2,847 packages	2,908 packages
Clothing	-	5,545 items	5,545 items
Woodtex [^]	53,800 sheets	-	53,800 sheets
Plastic containers (5 gal)	2,673	-	2,673
Camp-beds	769	-	769

Source: Documents of PMRRC.

a. Includes sharps.

b. May include skimmed milk powder donated by overseas organizations through local chapters.

c. Includes 34 incomplete tents.

d. Panels used in low-cost housing.

the Committee was actively involved in post-disaster recovery probably exceeded \$25 million.

PRIVATE ASSISTANCE AND SELF-HELP

Estimates made shortly after Cyclone Bebe indicated that losses caused by that hurricane alone would possibly reach a total value of \$20 million (*FijiTimes*, 3 November 1972). In fact, as Table 4.12 shows, expenditure on "official" relief and rehabilitation (including government property) programmes reached less than a third of that amount. The very large difference in the two figures does not, however, necessarily indicate that the former was an overestimation. Rather, it suggests the extent of the costs that are borne by the victims themselves — either directly, from insurance claims, or through assistance from relatives or friends—or simply written off.

The destruction of homes is frequently accompanied by the destruction and loss of many of the contents as well, whether swept away by flood or storm-surge waters, broken by collapsing structures, or ruined by immersion in salt water. Clothing, furniture, cooking equipment and eating utensils, agricultural and other tools, transistor radios, sewing machines, and occasionally, even the family savings may all be destroyed, damaged, or lost. For many families with low incomes, these possessions may represent years of accumulation and although some items may be salvaged many must be replaced. Lost cash crop production, however, is irreplaceable and it is often many years before families can begin again to establish a modest inventory of household chattels. Small farmers specializing in livestock are frequently crippled when their herds, painstakingly developed through labour and reinvestment, are halved or worse, swept down the Rewa, or left to starve on pastures knee-deep in silt. Similarly, small stores, both privately and cooperatively owned, are often left with nothing but spoiled stocks and, on more than one occasion, with the safe washed out to sea.

Faced with these problems, in addition to the immediate post-disaster chaos and psychological stress as well as the longer-term prospect of an extended period with severely limited incomes, disaster victims must call on all of their resources to recover from

TABLE 4.12 Funds and Resources Made Available for Relief and Rehabilitation after Cyclone Bebe

<i>Source of Funds</i>	<i>Amount</i> <i>(approximate values</i> <i>thousands of dollars)</i>	<i>Total</i> <i>only, in</i>
<i>Government of Fiji</i>		
Direct expenditures ^a	1,150	
Provision of interest-free loans* ³	1,000	
Public Works Department ⁰	1,000	
		3,150
<i>Overseas assistance in kind (cash value) d</i>		
Foreign governments	1,450	
Relief organizations	200	
Other agencies	100	
		1,750
<i>PMHRC Fund (cash)⁶</i>		
Foreign governments	150	
Foreign companies	140	
Relief organizations	140	
Other (individual, club, church, etc.)	120	
		550
<i>Fiji National Provident Fund</i>		
Loan ^b		500
Total grants and direct expenditures		4,300
Total loans		1,650
Grand total		5,950

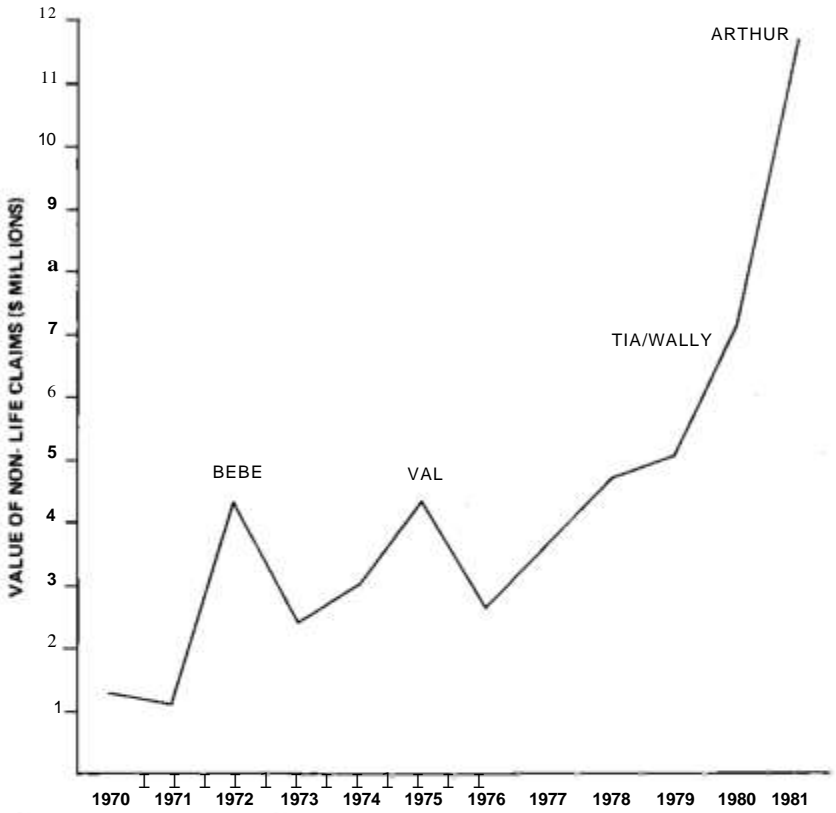
Sources: a. Report on the Accounts and Finances for the Years 1972, 1973. Parliamentary Papers no. 10 of 1973 and no. 15 of 1974; b. The Housing Authority: Report for the Year 1973, Parliamentary Paper no. 27 of 1975; c. Public Works Department, Annual Reports, 1972, 1973; d. Fiji Times 18 January 1973. Figures approximate—adjustments made from original figures for probable contributions made direct to PMHRC fund; e. Fiji Times (various issues in 1972 and 1973), analysis of detailed lists of contributors to fund in various issues—figures rounded and approximate because of ambiguities in lists.

the impacts. Savings, perhaps earmarked for such activities as childrens' education, have to be diverted to more immediate needs. In the nine months following Cyclone Val, over \$10,000 was withdrawn from the Kabara post office, a rate of withdrawal exceeded only in the months following Cyclone Lottie (Bedford,

1976: 28). Many of the residents on Kabara left the island to seek work on Viti Levu and New Zealand and those who remained produced handicrafts (for which the island is famous) for the Viti Levu tourist market, an enterprise which yielded poorer returns following Cyclone Val when the market became saturated and tourism declined. In the first half of 1975, average household expenditure at one of the island's cooperative stores exceeded incomes by \$98, compared to \$39 in the last six months of 1973 (Bedford, 1976). These figures, which provide a rough indication of the value of remittances to the island, reflect the role of monetary support from people from Kabara who lived elsewhere, mostly in Suva. Undoubtedly, such patterns are found throughout rural Fiji following disasters.

The role of insurance is also important in the processes of post-disaster recovery. Figure 4.2 shows the value of non-life insurance claims paid out in Fiji between 1970 and 1979. While many of these claims are not related to hurricane damage, there is a clear increase in the years in which the impacts of storms have been extensive and especially where Viti Levu has been badly affected. In the rural areas, where incomes are generally low, and particularly in the outer islands, few householders have insurance coverage. The Committee has insisted that all schools rebuilt under its aegis be insured, although it would appear from post-hurricane experiences during the decade that those schools that did have coverage were significantly underinsured. This is likely to remain a problem in view of the rapidly escalating increases in building costs.

It is virtually impossible to place an accurate value on the total cost of the capital losses borne by the victims themselves or "rehabilitated" in non-government or non-official ways, but they may well approach a figure similar to the total costs of relief and rehabilitation programmes — and that excludes the costs of lost earnings brought about through the disruption of economic activities as outlined in Chapter 2. Taking all of these considerations into account the total costs of the hurricanes during the decade may have been around \$70 million or more.



Source: Fiji Bureau of Statistics (Various dates), Current Economic Statistics.

FIGURE 4.2 Non-life insurance claims paid, 1970-1981

5

REHABILITATION: HOUSING

In the aftermath of destructive hurricanes there is perhaps nothing more poignant and saddening than the scene of a devastated village — a community stripped of possessions and shelter, often surrounded by no more than the tattered and strewn remains of what was previously an orderly and lively settlement. After very severe hurricanes only the most robust structures remain and the tasks of reconstruction become immense when hundreds of communities are left desolated. Although the provision of shelter for those whose homes have been destroyed is an urgent requirement, there was only one instance of relief assistance for house reconstruction in the ninety-eight years of colonial relief and rehabilitation efforts; in most cases communities were provided with food relief with the expectation that they would rehabilitate their homes and gardens themselves. The most significant feature of the decade of relief and rehabilitation under the Committee was the provision of shelter for hurricane victims. This involved first, the provision of immediate shelter in temporary accommodations such as tents, and second, the long-term reconstruction of permanent, durable, hurricane-resistant dwellings.

ASSESSING THE DESTRUCTION

The success of any relief or reconstruction programme depends upon prompt and accurate assessment of the extent of destruction. Allocation of resources, especially limited ones, becomes im-

possible without clear knowledge of what is needed, in what quantities, and where. Temporary shelter must be provided without delay and the mechanisms for sometimes massive rural rebuilding programmes must be initiated immediately— funds must be raised, materials obtained, transportation organized, and labour mobilized.

During the decade under review, the initial assessment of disaster-stricken areas was carried out by teams organized by EMSEC, the Emergency Services Committee. Post-disaster assessment is particularly difficult, especially when a hurricane has caused destruction across a broad front or in inaccessible areas. During and immediately following a disaster many needs are pressing — for evacuation of threatened communities, for restoration of communications, for search and rescue parties, and for attention to any casualties. The demands on personnel are substantial and where the impact of a disaster must be evaluated in numerous and scattered locations, a number of survey teams may be necessary. In addition to housing, survey teams are required to report on a wide range of matters, including the health of victims, food availability, and transport, communications, and water supply facilities. Frequently, the task of dispensing emergency relief supplies is added to the survey teams' responsibilities.

Initial surveys are usually completed within days of a disaster, and are essential for the efficient planning of relief and rehabilitation programmes. Once the magnitude of damage is clear, the process of seeking materials and developing plans of action can begin. However, much more detailed data ascertaining the actual damage or destruction to each home and the exact number of houses to be replaced are needed in the longer term. During the decade of the Committee, the major responsibility for collecting such data lay with the divisional commissioners who provided the Committee with a household-by-household compilation of the needs of affected areas, usually within a month of a disaster.

However, the problem of assessment was not always satisfactorily resolved. On occasions, conflicting reports prompted the Committee to establish its own survey groups to verify figures at first hand. For example, original estimates for Yasawa rehousing after Cyclone Bebe were given as 350, a figure which was reduced to 271 (23 per cent less than original) upon inspection ten

months later. Estimates made immediately after Cyclone Meli were reduced from 1,727 to 1,348 and finally to 1,322 (24 per cent less than original), and after Cyclone Arthur the initial Yasawa assessment of 280 was lowered to 210 (25 per cent less than original) after reassessment. Early assessments did not always err on the side of overestimation: following Cyclone Tia 55 homes requiring reconstruction in Taveuni were omitted from the original lists and not allocated until eleven months later. A major difficulty arises in distinguishing between houses that are so damaged as to need replacement and those that are not, as many cases are of a borderline nature.

Other problems have arisen from the inclusion of disaster victims who do not qualify for assistance because their homes are located on land to which they do not have title. Following Cyclone Tia some 272 homes in Macuata were earmarked for replacement, but this figure was reduced to 165 when it was discovered that there were 107 squatters among the applicants for assistance. Similarly, 16 of the originally surveyed victims of Cyclone Arthur were dropped from the Yasawa reconstruction programme, which originally listed 210 homes to be rebuilt. Obviously the opportunity for error is high — the job must be completed rapidly, often under difficult conditions and in isolated areas. As the decade progressed the Committee refined the processes of assessment and developed survey forms to help ensure that consistent and accurate information was collected.

Since Cyclone Meli, air-photographic reconnaissance has been employed, not only to locate areas of destruction, but also to quantify the extent of reconstruction necessary. With skilled application and interpretation such aids can be used as a valuable first check against claims received by the Committee. The amount of use made of air-photographic survey results by the Committee is unclear from the minutes, but the potential is great for early and relatively accurate diagnoses of housing and shelter requirements.

THE IMMEDIATE PROBLEM: TEMPORARY SHELTER

Irrespective of the organizational efficiency of rebuilding programmes, there will be a delay between the disastrous event and

the completion of the reconstruction of permanent homes. The length of this delay reflects a number of factors, including availability of funds, materials supply, transportation arrangements, and on-the-ground construction efficiency. An important requirement during the interim period is the provision of temporary shelter.

While the distribution of tents remained the responsibility of the Emergency Services Committee (EMSEC) in the immediate post-disaster phase, the Committee was from its inception responsible for maintaining supply and providing tents for individuals in need once EMSEC involvement had ceased. The availability of tents has always been a problem. Many are needed at immediate notice and sufficient stock must always be on hand. Since their use was intended only as a temporary measure, the plan was always that tents be returned as soon as possible so as to be properly stored and mended in readiness for the next occasion when they would be needed. But the idea of establishing such a stock of tents was never successful — rates of return were always slow and a great proportion were never used again in relief. The slow progress of the early reconstruction programmes (Bebe, Lottie, Val) was obviously a factor, but there were numerous instances of tents being put to other uses by recipients once their use as temporary shelter ended.

After Cyclone Bebe struck, it was estimated that well over 60,000 people were without shelter. A limited number of tents were immediately distributed but it was soon clear that more would be needed. Two weeks after the storm, a great many people were still without adequate accommodations (e.g. 2,000 at Tavua and 900 at Vatukoula). This problem was largely overcome, however, with the arrival from the USA of 2,050 tents that had been requested by the Committee (*FijiTimes*, 15 November 1972). The total number of tents issued is not known but it was well above that number. Following Cyclone Meli some 1,400 tents were received from foreign sources and a further 750 were contributed after Cyclones Tia and Wally. Information on the distribution of tents is not readily available but it appears that in the decade probably well over 5,000 tents were received by the Committee and redistributed to disaster victims.

The problem of tent supply hinders relief and rehabilitation work in two main ways. First, immediately after hurricanes, delays in providing temporary shelter once local stocks have been exhausted cannot be alleviated until further tents arrive as aid from donor countries. While tents are often among the first items received from external sources and the delay is usually relatively short, the victims nevertheless experience considerable discomfort at a time when alleviation of stress is of prime importance. Second, tents being brought into the country may displace other needed emergency supplies. Moreover the Committee was at times forced to divert funds from such other activities as long-term housing reconstruction, in order to maintain stocks at a sufficient level of preparedness for future disasters.

Throughout its decade of operation, the Committee was constantly concerned with problems of tent supply, and its attempts to encourage and direct tent returns met with little success. The consequent search for suitable replacements at economical prices proved a very difficult task. Tents have always been expensive and numerous types proved unsuitable when evaluated against their cost. While temporary shelter is an essential aspect of relief and rehabilitation, the task of coordinating the supply of tents was often a frustrating one for the Committee.

THE RECONSTRUCTION PROGRAMMES

The housing programmes of the Committee were as much a reflection of the availability of funds as of any other factor. Consequently two clearly distinct phases are apparent in the Committee's reconstruction activities. In seeking to rehabilitate the settlements destroyed and damaged during the first three hurricanes — Bebe, Lottie, and Val — the Committee was heavily restricted by inadequate financial resources. In the second phase, from 1978 to 1982, developments in the provision of aid following Cyclones Anne and Bob finally enabled the Committee to provide free housing to hurricane victims — a scheme it had envisaged but could not fulfill until six years after the initial meeting in October 1972.

When the Committee first met, it was confronted with what was undoubtedly one of the greatest tolls of destroyed and damaged homes in the country's history (see Table 2.14). At that initial meeting it was resolved to assist those people whose houses had been destroyed as the Committee's first priority, that the assistance would be in kind (in the form of building materials), and that all such assistance would be free. At this very early stage the Committee members had perhaps not grasped the magnitude of the task they had accepted, but nine days later, when they met for the second time, a note of resignation found its way into the recorded minutes. Realizing that it might not be able to help in providing houses, the Committee decided to provide both materials and supervision for the less expensive and less massive undertaking of rebuilding all damaged or destroyed schools (see Chapter 6). The third meeting, a week later, saw this policy becoming firm: the costs of rebuilding homes were considered likely to be prohibitive in view of the high materials costs compared to aid available at that time. It was decided to defer any consideration of assistance to homeowners, apart from providing tents as temporary shelter.

This policy continued until mid-December, although the Committee had allocated \$26,000 of its funds towards the reconstruction of homes for the destitute (\$100 per household). A major obstacle to launching a rebuilding programme stemmed from the fact that most aid received by the Committee was in kind and did not include building materials. For this reason a request by one community for the discontinuation of food rations so that the savings could be used for home reconstruction had to be refused. However, when the Committee met for the seventh time, the report of the commissioner of the Central Division on the situation in Rotuma included a suggestion that the people of this outlying community receive assistance in the form of building materials, the cost of which would be repaid when the rehabilitation of the island's cash economy was complete. The following week the Committee committed a maximum of \$60,000 (300 houses at \$200 each) from its funds for a five-year interest-free loan with no service charge to Rotuma. The loan was to be administered by the Rotuma Council which would also be the guarantor. By March of the following year arrangements had been made for

assistance from a New Zealand Army detachment in the Rotuma scheme. Despite a number of delays in shipping the materials the Rotuma programme was completed by the beginning of September 1973, when 333 homes had been rebuilt at a total materials cost of \$100,000.

At the first meeting of 1973, following the earlier decision to finance a loan for Rotuma reconstruction, the Committee decided to finance a similar loan system for Yasawa and Mamanuca. The Ba and Nadrogra Provincial Councils were to be responsible for guaranteeing these loans. In February sums of \$60,000 (for 350 homes) and \$8,000 were allocated for the two respective schemes. By August, when Yasawa was resurveyed it was found that only 271 houses needed to be rebuilt or repaired, but at a cost of \$100,000, an indication of rising construction costs. As will be shown below, this scheme was fraught with problems and considerable delay in its completion.

Two factors influenced the Committee in deciding to procure materials, ensure transportation, administer the building programmes, and provide the loans. Although there is no explicit statement in the minutes, the Committee had clearly refined its scope in terms of disaster reconstruction to serving those who might be defined as participating in the mixed cash-subsistence rural economy. In this way the Committee became committed to financing extremely soft loans to those who had no fixed or guaranteed cash incomes, and incomes which were also very low. Assistance was to be given to families who would be unable to raise housing loans from other sources. The second factor was the distance of these communities from regular outlets for building supplies and the expertise needed to construct relatively hurricane-resistant buildings.

The activities of the Committee after Cyclone Bebe, then, did not cater for the majority of those whose homes had been destroyed or damaged — the cane farmers of the Western Division. Indeed most of the loan assistance for home reconstruction following Cyclone Bebe came from a completely different organization, the Housing Authority. It appears that some 7,500 homeowners were assisted by that authority, which provided soft loans totalling \$1.5 million. In all cases, the loans went to individuals who could place a security against their mortgage — in the case of

cane farmers, who comprised two-thirds of the total recipients, the repayments were to be deducted automatically from future sugar-cane payments.

By the time Cyclone Lottie had added to the Committee's task, one year after Bebe, the Yasawa programme had yet to get underway. Indeed, the commencement of work in Mamanuca by the Committee's hurricane relief team was only beginning in May 1974, when the first estimates of reconstruction needs for Lau and Kadavu were being considered by the Committee: perhaps more than 1,300 houses requiring \$0.5 million in materials costs alone would have to be reconstructed. The Committee needed to act quickly, for the costs of materials were rising rapidly (see Table 4.2). The Committee's intention of following the same system of loans as applied to Yasawa was tempered by the amount, which seemed beyond the abilities of the Lau and Kadavu Provincial Councils to guarantee. As the Yasawa programme slowly progressed the situation in eastern Fiji seemed bleak.

However, in October 1974 the Committee received a much-needed boost with a transfusion from the New Zealand Government of \$200,000 in aid which, with \$300,000 in the Committee's fund, would enable the provision of materials for some 566 Woodtex houses valued at \$850 each. By now one year had elapsed since Cyclone Lottie, and two since Bebe. During this period considerable self-assistance had taken place, with people using salvaged building materials and local products. But early in the next year Cyclone Val was to bring more destruction to the east. Problems continued: in March 1975 the materials for the 566 Woodtex homes were available in New Zealand but there was still no guarantee for the loans. It seemed there would be no outlet for the supplies.

Prompt, firm action by the Committee was badly needed at this time if the reconstruction programme was to continue. This was a critical point for the existence of any such programmes should they be necessary in the future. It was decided to go ahead with the programmes to rehabilitate Lau, Kadavu, and Yasawa (where the original programme had floundered when the limit of the guarantee was reached before completion was achieved and 221 homes remained to be built). It was an extremely ambitious undertaking by the Committee, which had embarked on a pro-

gramme for which it had not yet raised all of the necessary funds. By this time, in mid-1975, the Committee had committed itself to the reconstruction of 2,329 homes in Rotuma, Yasawa, Lau, Kadavu, and Rewa through the soft-loan system, but only 425 had been completed and 333 of those were in Rotuma. As Table 5.1 shows, 1,904 homes located in the far east and west of Fiji remained to be rebuilt. The cost of the programme was estimated at almost \$1.4 million but by mid-1975 the Committee's fund stood at only slightly more than \$300,000.

The twenty-sixth meeting of the Committee was held in November 1975 and there was little cause for optimism. An application for a soft loan from the EEC had failed and while the Kadavu Woodtex scheme had progressed smoothly since its inception in July, and in Lau people were busy constructing homes of traditional design with materials and equipment supplied by the Committee, funds were getting dangerously low. The Committee's coffers were expected to run dry by the end of the first quarter of 1976 and the completion of the programme seemed unlikely unless further funds could be injected. The Committee had established a very large-scale and workable rehousing scheme for low-income rural communities. The need to complete the programme and rehabilitate all of the families affected by the disasters was paramount.

By May 1976 the programme ground to a halt with only 323 homes completed. A government grant of \$116,500 enabled the completion of those traditional houses already started in Lau and the continuation of the programme for 90 Woodtex homes in Kadavu and Matuku. Further government support was necessary if all reconstruction work was to be finished. At the Committee's request the government undertook to complete all of the reconstruction work with the formation, in 1 January 1977, of a rural-housing unit within the Ministry of Fijian Affairs and Rural Development. Charged with completing the rehabilitation schemes, this programme was also to serve all rural peoples who were unable to qualify for housing assistance under regular Housing Authority loan requirements. This programme evolved out of the Committee's work and was based on its organizational structure.

By the end of its involvement with the rehousing programmes that followed Cyclones Bebe, Lottie, and Val, the Committee had

TABLE 5.1 Allocation of Remaining Houses to be Rebuilt as of June 1975

Location	Relief House Types					Total ^a	Total Cost(\$)
	Woodtex	Concrete Block	Traditional	Standard Wood Frame	Other		
Yasawa							
Viwa	34	—	—	—	—	34	30,600.00
Waya	—	43	—	—	—	43	25,800.00
Naviti	74	5	—	—	—	79	69,600.00
Yaqeta	10	9	—	—	—	19	14,400.00
Nacula	21	14	—	—	—	35	27,300.00
Yasawa	35	11	—	—	—	46	38,100.00
Subtotal	174	82	—	—	—	256	205,800.00
Lau							
Kabara	—	—	—	—	28	28	13,904.16
Namuka	—	—	—	—	78	78	20,656.87
Nayau	—	—	2	—	—	2	1,370.00
Cicia	—	—	—	8	—	8	5,600.00
Tuvuca	—	—	2	—	—	2	1,370.00
Oneata	—	—	9	2	—	11	7,565.00
Moce	—	—	32	6	—	38	26,120.00
Komo	—	—	1	19	—	20	13,715.00
Fulaga	—	—	31	—	—	31	21,235.00
Ogea	—	—	—	8	—	8	5,600.00
Vanuavatu	—	—	—	18	—	18	12,600.00

Vanuabalavu	-	-	-	26	-	26	18,200.00
Lakeba	-	-	59	14	15	88	59,657.50
Totoya	-	-	81	-	-	81	55,485.00
Moala	-	-	114	-	-	114	84,940.00
Matuku	139	-	-	-	-	139	125,100.00
Subtotal	139	-	331	101	121	692	473,118.53
Kadavu	n.a.	n.a.	n.a.	n.a.	n.a.	956	714,800.00
Total	n.a.	n.a.	n.a.	n.a.	n.a.	1,904	1,393,718.53

a. The source of these data is a report of the Committee titled "The Plan and Needs of a Hurricane Relief Reconstruction Programme in Fiji (Situation as at 4th June, 1975)." The data given here are extracted from appendices to that report which list each house to be built by owner. The totals derived show a slight discrepancy from those given elsewhere in the same report. The figures here are assumed to be correct since they are consistent with the total costs that would be expected on the basis of unit costs for each house type.

financed and directed the construction of more than 1,100 homes from Rotuma in the far north to the islands of Lau in the southeast and Yasawa in the west. In addition it had created the framework and begun the process in which the government was to complete a similar number. Its failure to complete the programme was hardly a reflection of the Committee's efforts: the constricting shortage of funds throughout this period was an unyielding obstacle. The loan system, forced upon the Committee by a limited budget, had proven unsuccessful and very little was ever repaid. By mid-1975, only \$25 had been received from Yasawa and by the end of 1980 payment had still not been completed. Indeed, the loan scheme was probably destined not to work. The function of the Committee was to assist people whose cash incomes were variable and low — subsistence farmers dependent upon limited incomes derived mostly from copra production. In normal times such farmers have little if any surplus cash beyond that needed for education and household expenses and hurricanes not only destroy their homes but may deprive them of what little cash income they usually earn for several years before the coconut palms return to bearing and copra production can be resumed. It is unlikely even then that these farmers can afford repayments as they strive to satisfy demands accumulated over a sustained period of hardship. In such circumstances the likelihood of loan repayment seems remote.

The financial constraints imposed upon the Committee by the shortage of funds hindered the progress of the rebuilding programmes in other ways. Instead of being able to plan confidently for the longer term, and to coordinate programmes in their entirety, the Committee had to proceed step by step as funds became available. It was unable to establish any practical capability to facilitate rapid rebuilding. Dependent upon voluntary unskilled labour supervised by a limited pool of experienced carpenters the reconstruction proceeded relatively slowly. The Yasawa programme in particular suffered badly from such problems, and was still incomplete when Cyclone Arthur devastated the region more than eight years after Cyclone Bebe.

This slow progress had a number of ramifications over and above the obvious delays in ameliorating the hardship of hurricane victims. As Committee members recognized on a number of

occasions, some householders tended to go ahead and rebuild rather than wait, using building materials that were not always satisfactory (such as those salvaged from the hurricane wreckage) and constructing dwellings that were not only not resistant to future hurricanes but perhaps even dangerous. Moreover, because the more enterprising victims had provided permanent, if unsatisfactory, housing for themselves, they were often ineligible to receive assistance once the reconstruction work did proceed. The delays also subjected the programmes to the effects of inflation as the costs of materials increased — indeed much more rapidly than the Committee's funds.

Despite the substantial achievements of the Committee in these early years they were nevertheless early times. In addition to the ever-restricting lack of funds, large-scale post-hurricane rehousing was being carried out for the first time in Fiji. At all levels of the programmes undertaken by the Committee, from seeking and allocating funds to the selection of suitable house types as well as orchestrating the administration of the construction projects, the Committee was working from scratch and in essence learning on the job. In later years, unfettered by fiscal shackles, it was able to develop an organization capable of rapid and efficient rehabilitation anywhere in the dominion. Much of this success was rooted in the experience gained in the first four years of operation.

The Second Phase: 1978—1982

Although Cyclones Anne, Bob, and Fay, which occurred in a one year spell from December 1977 through December 1978, were classed as only moderate events, they were responsible for the destruction of 581 homes (see Table 5.2). The Committee met shortly after the first two of these storms, which occurred within ten days of each other, but it did not take responsibility for the rehabilitation of destroyed homes. Presumably the 264 dwellings that were lost were replaced under the Rural Housing Programme. At the next meeting, which followed Cyclone Fay, the situation relating to housing reconstruction was discussed more fully and the Committee directed that a full survey be carried out immediately, while it awaited results of a submission for aid from the EEC totalling \$1.55 million. It is not clear what had taken

TABLE 5.2 Houses Destroyed, 1977—1978

<i>Location</i>	<i>Anne</i>	<i>Bob</i>	<i>Fay</i>	<i>Total</i>
Rotuma	-	52	30	82
Western Division	-	115	-	115
Central Division	-	13	-	13
Macuata	-	-	58	58
Visoqo/Dogotuki area	-	-	42	42
Tunuloa	-	-	13	13
Cakaudrove	-	-	4	4
Wailevu	-	-	2	2
Rabi	-	-	20	20
Taveuni	—	—	28	28
Northern Division (not stated)	22	-	—	22
Vanuabalavu	62	-	34	96
Mago	-	-	2	2
Lakeba	-	-	35	35
Moce	—	-	8	8
Vatoa	—	—	1	1
Ogea	-	-	1	1
Fulaga	-	-	1	1
Nayau	-	-	1	1
Cicia	-	-	36	36
Tuvuca	-	-	1	1
Total	84	180	317	581

Source: Documents of the Committee.

place during the year since the previous meeting but it appears that the Committee had once again become involved in post-disaster reconstruction in rural areas. Perhaps even more significantly, EEC Exceptional Aid had become a likely source for the funding of post-disaster reconstruction. Only a few weeks after the meeting following Cyclone Fay, Cyclone Meli shattered parts of eastern Fiji in a concentration of violence rarely seen in Fiji before—entire villages were obliterated in some locations and elsewhere there was considerable devastation. An allocation of 300,000 European Units of Account (EUA) had been promised by the EEC for Cyclone Fay and the Committee promptly redirected these funds to post-Meli reconstruction work at its first meeting only days after Cyclone Meli had passed. By the end of

the month final field assessments indicated some \$2.5 million would be necessary to undertake and complete reconstruction of 1,348 homes and 26 schools (see Table 5.3). (This figure, although reduced from an earlier estimate, was slightly above the number of homes actually needed. When the reconstruction was complete the total number of homes built stood at 1,322.) Further EEC funds were to be supplied, in installments with six month deadlines, totalling almost \$3 million. The expenditure of these funds was to be directed, as much as was possible, to the provision of materials. Seven hundred Woodtex homes and a further 650 houses, produced locally by Union Marketing Ltd, were to be provided. With the deadlines, the Committee needed to act without delay in assessing damage, evaluating building material requirements and costs, and placing orders. A further stipulation of the EEC aid was that all buildings be constructed free of charge, with transport costs being covered by government, and labour and other costs by the Committee, which had opened a new fund (see Chapter 4).

Despite the availability of funds to support the programme all was not plain sailing, but once again the Committee was breaking new ground, operating with a rapidity and at a scale never approached before. As always the Committee was quick to re-evaluate its programmes and make adjustments in response to problems experienced. By tackling the most difficult areas first, where devastation was greatest and the communities most isolated, the Committee lost opportunities to debug the programme and work progressively towards greater efficiency as the obstacles increased. Furthermore, the decision to construct Woodtex houses in outer islands required large quantities of aggregates to be shipped from Suva, and this proved a source of considerable delay. (It is not clear that this decision was entirely the responsibility of the Committee. On Kadavu for example, the Woodtex homes were a popular choice of Cyclone Meli victims because those built there following Cyclones Lottie and Val had proven their durability.) Recognizing the problem of delay, the Committee directed that in the future timber-framed houses were to be constructed in the outer islands and that Woodtex buildings should be used on Viti Levu.

TABLE 5.3 Housing Rehabilitation, Cyclone Meli

Division, Province, and District	Number of Homes Rebuilt			Estimated Costs of Building Materials (\$)
	Union Marketing	Woodtex	Total	
Eastern				
Lau				
Tuvuca	-	34	34	41,211.06
Cicia	-	162	162	196,358.58
Nayau	-	122	122	147,874.98
Lakeba	9	-	9	16,645.50
Vanuavatu	2	-	2	3,699.00
Moala	234	26	260	464,297.34
Subtotal	245	344	589	8 70,086.46
Kadavu				
Ono	50	66	116	172,472.94
Nakasaleka	163	-	163	301,468.50
Yale	56	-	56	103,572.00
Naceva	112	-	112	207,144.00
S anima	60	-	60	110,970.00
Tavuki	53	-	53	98,023.50
Yawe	22	-	22	40,689.00
Ravitaki	49	-	49	90,625.50
Nabukelevu	19	12	31	49,685.58
Subtotal	584	78	662	1,174,651.02
Central				
Rewa				
Beqa	-	25	25	36,087.50
Western				
Nadroga-Navosa				
Vatulele	-	46	46	66,401.00
Total	829	493	1,322	2,147,225.98

- a. Data have mostly been extracted from a table in the files of the Committee dated 28 Feb 1981. In that table the estimated costs of materials supplied to that date were provided (\$2,097,289.48 for 1,295 homes). Materials for a further 27 homes were provided later (to Tavuki, Yawe, and Nabukelevu). Most summaries of Cyclone Meli rehousing indicate that 830 Union Marketing and 492 Woodtex homes were already on site. It has been assumed that all of the 27 remaining homes were of the Union Marketing type, which brings us as close as possible to achieving consistency with the summaries. The cost of these additional homes (building materials only) has been estimated at the then prevailing price of \$1,849.50 per unit, for a total of \$49,936.50. Thus the total cost of building materials for the Cyclone Meli home rehabilitation programme is estimated at \$2,147,225.98. If in fact the total number of Union Marketing homes built was 830, then the total cost would have been \$2,146,588.57.

The combined Tia and Wally disasters occurred almost exactly one year after Cyclone Meli, a period during which some fifteen meetings took place. The Committee had certainly been busy, and with good reason. It had entered into a sphere of activities that encompassed much more than simply providing for the reconstruction of homes. The Committee assisted in the development of new village plans, the levelling of village sites, and the construction of access roads between coastal landings and villages. In addition, the EEC funds needed prompt administration, new house types were developed (the "Nayau Block" and "Single Unit" structures), and a number of operating problems needed to be monitored and dealt with as reconstruction proceeded.

The year following Cyclone Meli was a period of considerable progress and evolution towards an efficient rehousing scheme, as is reflected in the wide spacing of meetings following Cyclones Tia and Wally. Housing needs were assessed and costed (see Table 5.4), EEC funds applied for, and the programme continued along with the completion of Cyclone Meli reconstruction. Woodtex homes earmarked for Cyclone Meli victims were diverted to Cyclone Wally areas in Central Viti Levu and Union Marketing homes were used to complete the Cyclone Meli reconstruction. Further Union Marketing homes were contracted for Cyclone Tia areas in the Northern Division. The Cyclone Meli programme was completed by mid 1981 as was the Cyclone Wally rehousing, although the Cyclone Tia schemes were not finished until the following year. In all they had accounted for some \$4.14 million in EEC aid (including schools—see Chapter 6) and well over \$1.2 million from the Committee's own funds (see Table 4.7). When Cyclone Arthur struck, the Committee was initially faced with a total of 210 homes to rebuild (later reduced to 194). This was the lowest total in its decade of involvement in housing rehabilitation, although a number of cane farmers in the Western Division were to be assisted with government loans as in 1973 following Cyclone Bebe. In fact the number of homes to be supplied was significantly less as 48 buildings originally earmarked for squatters in the Northern Division, following Cyclone Tia, were diverted to Yasawa.

The progress the Committee had made since its fledgling days was never more apparent than at this time. Meetings continued —

Division	Province	District or Island	Number of Homes Rebuilt		Total	Estimated Costs of Building Materials ^a (\$)
			Union Marketing	Woodtex		
<i>Cyclone Tia</i>						
Eastern	Lau	Vanuabalavu	73	—	73	135,013.50
		Lomaiviti	55	—	55	101,722.50
Northern	Cakaudrove	Qamea	30	35	65	97,908.15
		Taveuni^b	124	-	124	236,818.00
		Savusavu	56	—	56	103,572.00
		Macuata	138	—	138	255,231.00
		Bua	12	—	12	22,194.00
Total Tia			488	35	523	952,459.15
<i>Cyclone Wally</i>						
Central	Serua/Namosi		96	142	238	349,668.78
	T ailevu /N aitasiri		—	28	28	33,938.52
	Rewa	Beqa	-	3	3	3,636.27
Total Wally			96	173	269	387,243.57
Total Tia and Wally			584	208	792	1,339,702.72

a. Costs estimated on the basis of then prevailing prices of Union Marketing house at \$1,849.50 and Woodtex house at \$1,212.09 (materials only).

b. Of the 124 homes rebuilt on Taveuni, 55 were constructed much later, having been omitted from the original post-disaster survey of damages. The unit cost for these homes was \$1,985.50 (materials only).

reviewing the progress of the various reconstruction schemes, attending to applications from overlooked victims, coping with inflation in materials costs, and redirecting supplies in response to unforeseen surpluses. By August of 1982, only 27 homes (all under construction) remained to be completed of a total of 2,308 for the Meli, Tia, Wally, and Arthur disasters. With the impending incorporation of the Committee's work into a government department, the members had finished their task — an unparalleled decade of disaster reconstruction.

HURRICANE RELIEF HOMES

If the Committee was to be involved in rehousing, it soon became clear that some house-design standards would be necessary. Houses to be rebuilt would have to satisfy a number of criteria: they would have to be much more resistant to hurricanes than those they replaced, be livable, be designed so that construction could be easily achieved with only minimal inputs of skilled labour, be constructed of materials or prefabricated parts that were relatively easy to transport, and be reasonably priced. One of the first tasks given to the Committee, at the very first meeting, was to consider a number of possible low-cost house designs with these criteria in mind. This problem was to remain an area of concern for the Committee until 1979, when, after Cyclone Meli, one main design was settled upon. Until then the Committee's housing programmes incorporated a variety of styles.

The first homes to be built with Committee assistance, in Rotuma, had concrete-block walls and corrugated-iron roofs. A number of houses using this design were also constructed in some areas of Yasawa, in the programme that began soon after the Rotuma housing was finished. In Lau, many of the rebuilt houses were of a traditional style, with design and construction supervised by specialist traditional carpenters. In these homes a large proportion of the materials used were from local sources, with mobile sawmills and other equipment, provided when necessary by the Committee, which also made other building materials available. Most of these homes were built on concrete foundations and additional bracing was given to the roof and walls. In Lau, Yasawa, and Kadavu many rehabilitation homes were con-

structed on a standard wooden frame, with corrugated-iron roofs and walls.

A fourth, and perhaps most well known, type of hurricane-relief home during this period was the Woodtex house, which originated when Woodtex panels were donated by the New Zealand government. To make full use of this material a post-disaster rehabilitation house plan was formulated, and included reinforced concrete posts and eaves-bands upon which the Woodtex panels were placed to form the walls. Although structurally very sound, these houses did have some drawbacks, the most important being that the panels are not water resistant. This was countered by coating the panels with a half-inch layer of mortar and by raising the foundations of the home. Because of these adjustments, large quantities of cement and aggregate were required in the construction of this type of house, as well as considerable levelling before construction could commence. For the outer islands in particular, homes of this design required more materials and plant to be shipped and greater labour inputs.

Following Cyclone Meli, the Committee, once again involved with rehousing hurricane victims, considered a number of options including "block" style homes with several family units to one building. However, these styles were deemed unsuitable for the victims and single-unit housing was decided upon once again. With the EEC grant available, but with its time constraints, the Committee carefully considered a number of choices for prefabricated house designs. The design which was accepted became known as the Union Marketing house after the name of the local company that manufactured the house parts. This house design involved a wooden frame, corrugated-iron roof, and treated plywood walls. These homes formed the bulk of the reconstruction after Cyclones Meli and Tia-Wally, the balance being made up of Woodtex homes. After Cyclone Arthur all of the reconstructed homes were built with Union Marketing prefabricated buildings, and the designs were also used to rebuild damaged teachers' quarters and dormitories from Cyclone Meli reconstruction onward.

The rehousing programmes of the Committee were perhaps the most significant of all its contributions to post-disaster recovery. The Committee's activities heralded the introduction of

housing relief to Fiji and as the decade proceeded housing assistance was to become increasingly well organized. One of the main objectives of the rehabilitation programmes was to provide homes that will give greater security to their inhabitants when the next hurricane strikes, for sooner or later it surely will. The Committee evaluated, and applied, a number of house designs. In so doing, and in being quick to learn from trial and error, as well as operating within the constraints of its funding, it contributed immensely towards the development of appropriate and economical designs for hurricane-resistant houses that can be transported and constructed rapidly in large numbers. In the hurricanes of 1983 (Oscar and Sarah) it has been observed that the hurricane-relief housing, of both the Woodtex and the Union Marketing types, did stand up very well. While no home can be made totally hurricane-proof, the reduction of housing casualties in future storms will significantly reduce the costs and hardships brought by such events.

6

REHABILITATION: SCHOOL RECONSTRUCTION AND SPECIAL PROJECTS

SCHOOL RECONSTRUCTION

Most schools in Fiji are private schools that have been constructed (with government subsidies) at the expense and with the effort of the local communities they serve. Following hurricanes, the costs of rebuilding damaged and destroyed school buildings would normally create another burden upon communities that have already suffered the loss of homes, crops, and in many cases incomes. In such conditions the rapid return of schools to regular working conditions would seem unlikely. When the Committee recognized, at its second meeting, that it would be unable to provide relief housing, it quickly resolved to give top priority for the use of the Prime Minister's Relief Fund to the reconstruction of schools. Building materials and construction supervisors were to be provided at no cost to the school committees involved and classrooms, dormitories, and teachers' quarters were all included in the school reconstruction programmes. In the ten years from Cyclone Bebe through Cyclone Arthur the Committee never wavered from that early decision. In all reconstruction programmes schools have been begun and completed first, even during the later stages when the bulk of the expenditure and work organized by the Committee was for housing reconstruction.

Over 250 school buildings, including 142 permanent and 97 *bure*-type classrooms and 13 hostels, had been constructed at a total cost of \$271,000 when the Cyclone Bebe programme was finished. Under supervision from New Zealand Army engineers

and Public Works Department personnel, the programme ran smoothly and except for a few schools in very isolated areas all rebuilding was completed by February of the following year. Less than four months after the hurricane most of the children in the devastated areas were able to enter school again for the beginning of the new school year. School reconstruction programmes were also carried out following Cyclones Juliette and Betty. Following Cyclone Lottie, thirty Public Works Department carpenters and ten from the Fiji Master Builders Association supervised the completion of 62 school buildings in the Eastern Division by February 1974, and after Cyclone Val 38 school buildings were equally rapidly reconstructed, the latter at a cost of \$62,500. As Table 6.1 shows, the Committee had financed and supervised the reconstruction of some 365 classrooms, hostels, and teachers' quarters from 1972 to 1975. Although details of the costs for each scheme are not available it is likely that the total cost of these programmes exceeded \$500,000.

Repairs to the schools damaged during the second part of the decade were to follow the same pattern. In this period, the reconstruction of schools was tied to the EEC aid, as was the housing. Cyclones Anne and Bob affected only 12 school units (classrooms, teachers' quarters, and dormitories) and damage to the

TABLE 6.1 School Reconstruction Programmes, 1972—1975

<i>Event</i>	<i>Division</i>	<i>Buildings Replaced</i>			
		<i>Permanent Classrooms</i>	<i>Bure Classrooms</i>	<i>Hostels</i>	<i>Total</i>
Bebe	Western	76	37	5	118
	Central	45	31	1	77
	Eastern	21	28	7	56
Subtotal		142	96	13	251
Juliette	Northern	9	4	—	13
Lottie	Eastern	40	15	7	62
Val	Eastern	26	11	1	38
Betty	Western	1	-	-	1
Total		218	126	21	365

school system following Cyclone Fay was also limited. Rebuilding was quickly attended to. After Cyclone Meli the Committee was faced with a much greater task. In all, some 263 units were reconstructed or repaired, at a total cost approaching \$800,000 (see Table 6.2).

This programme took some ten months to complete — substantially longer than any other post-hurricane school reconstruction — for a number of reasons. It was a very large scheme, equivalent in magnitude to the Cyclone Bebe reconstruction, but differing in that most of the schools were located in much more isolated areas. Moreover, the Committee was now very actively engaged in housing rehabilitation work (involving 1,322 homes) as well as rebuilding the schools and its resources — of both labour

TABLE 6.2 School Reconstruction Programme, Cyclone Meli

Province	Island or Class-District	No. of School Buildings Reconstructed			Estimated Costs of Materials (\$)
		Teachers' rooms	Dormi-Quarters	Buildings	
Cakaudrove	Taveuni	2	-	-	10,800.00
Kadavu	Ono	7	11	9	69,752.00
	Yale	6	4	2	41,985.60
	Naceva	11	5	5	75,376.00
	Sanima	5	3	-	31,792.80
	Tavuki	2	5	-	18,788.00
	Nabukelevu	5	5	2	38,183.20
	Ravitaki	8	8	3	60,773.60
	Yawe	-	10	17	43,135.20
	Nakasaleka	9	11	8	78,954.40
Subtotal		53	62	46	458,740.80
Lau	Tuvuca	3	3	-	20,992.80
	Cicia	5	15	-	50,964.00
	Nay au	6	8	-	45,180.80
	Moala	22	20	11	168,325.60
Subtotal		36	46	11	285,463.20
Lomaiviti	Gau	4	-	-	21,600.00
Rewa	Beqa	3	-	-	16,200.00
Total		98	108	57	792,804.00

and machinery—were often fully stretched. Finally, the rebuilding of schools was now also supported by EEC aid and the need to await funds caused work to begin a little later than might otherwise have been expected.

Cyclones Tia and Wally caused further considerable damage and destruction to schools, but on a scale that was much more limited than Cyclone Meli's. As Table 6.3 indicates, 62 school units costing over \$213,000 (31 for each of the storms) were replaced by the Committee throughout the Northern, Eastern, and Central Divisions. The final school reconstruction phase during the decade of the Committee followed Cyclone Arthur, when 21 schools were repaired or replaced at a total cost of \$136,733.

An important aspect of the Committee's work concerned the question of insurance of school property. The Committee's construction teams undertook to repair and replace all schools free of charge to the school managements. However, those schools that were insured were given assistance only in the event that the insurance claims were sufficient to pay for all reconstruction costs. In *most* cases they were not, and in these instances the Committee assumed responsibility for the entire reconstruction of the school, with the school management paying whatever insurance monies they received to the Committee. In addition the Committee asked as a condition of its assistance to all schools that insurance coverage be obtained for the reconstructed buildings.

TABLE 6.3 School Reconstruction Programmes, Cyclones Tia and Wally

Province	No. of School Buildings Reconstructed			Estimated Costs of Building (\$)
	Class-rooms	Teachers' Quarters	Dormitories	
<i>Tia</i>				
Cakaudrove	9	6	2	61,380.80
Lomaiviti	2	-	-	10,800.00
Lau	6	6	-	41,985.60
Total Tia	17	12	2	114,166.40
<i>Wally</i>				
Serua-Namosi	13	14	4	98,956.80
Grand total	30	26	6	213,123.20

The reconstruction of school buildings between 1972 and 1982, valued at well over \$1.5 million, was one of the Committee's most significant achievements. In addition to the consistent success in ensuring the prompt return to normal of school activities, the programmes, which often improved the "hurricane resistance" of school buildings, ensured that disruption of education would be less severe in the future. If schools were severely damaged, the costs to relief and rehabilitation services would be substantially reduced, with insurance effectively taking over the Committee's role. A very important factor in the success of the school reconstruction programmes was the enthusiasm with which they were received by the local communities, which provided the all-important labour necessary to complete the work quickly.

SPECIAL PROJECTS

Although the Committee was primarily involved in repairing the damage wrought by hurricanes, its activities were not totally directed towards the post-disaster situation. In both housing and school rehabilitation programmes the provision of buildings that would better withstand future hurricanes was an important overlying theme to the immediate concern of alleviating distress. Furthermore, the Committee was involved in a number of smaller projects that were directed specifically towards improving disaster preparedness.

The problems of evacuating communities threatened by floodwaters from the lower Rewa, which had been encountered during the mid-sixties, were repeated again during Cyclone Bebe. In particular the lengthy distances between the flood locations and safe locations in the Nausori area, the need to find adequate accommodation for the evacuees once there, and to facilitate their quick return once the floods had subsided, placed heavy burdens upon emergency services: The Committee undertook to improve this situation by constructing four evacuation centres, which would also serve as community centres and school buildings, on suitable sites along the lower reaches of the Rewa. These centres, which were built on stilts, stood some three metres above ground level and would provide a safe and nearby location for people

living on flood-prone lands. The Committee provided \$48,000 for these centres, the costs of which were shared equally by the government and the school committees involved. The construction of the centres was carried out in a similar manner to other post-Cyclone Bebe programmes, with Public Works Department carpenters acting as supervisors to local volunteer labourers.

A substantial amount of hurricane-relief stocks remained unused when the Cyclone Bebe school-reconstruction and food-relief programmes had ended, just at the time when the possibility of making the Committee a permanent relief organization was firming. Clearly there was a need for safe storage of the Committee's equipment and stocks such as tents, chainsaws, clothing, blankets, and rations. Mindful of the wide front across which Cyclone Bebe had affected Fiji, the Committee decided that the stockpiling and storage of such reserves in preparedness for future storms would prove more beneficial if they were dispersed at more than one central depot. Three "Emergency Depots" were established in Suva, Nadi, and Labasa, at a total cost of \$40,000.

Other preparedness measures were undertaken by the Committee at the local level. For example, following Cyclone Meli the Committee assisted villages on Nayau in relocating at higher sites less likely to be inundated by storm surge. On the lower, limestone islands of Yasawa and Lau, where drought is a persistent problem, the Committee (with financial assistance from New Zealand's CORSO — Council of Relief Services Overseas) undertook to combine the construction of water catchment and storage tanks with hurricane rehabilitation works at a cost of \$10,000. There is little doubt about the importance of hurricane preparedness. Not only does a high state of preparedness help ward off the likelihood of tragedy, but also it helps make post-disaster programmes work more smoothly.

SHIPPING

Throughout its existence the Committee was involved in reconstruction programmes that were very large in scale. The success of the programmes depended not only upon obtaining the necessary building materials but also upon getting those materials to

the reconstruction sites and having the expertise and sufficient labour on the spot to erect the buildings.

The Fiji Marine Department boasts a sizeable fleet of government vessels, but demands upon this service are great, coming from all ministries and departments having responsibilities in the outer islands. In the immediate post-disaster period there is little difficulty in diverting shipping to relief work. But as the weeks and months passed and the apparent urgency of the need to rehabilitate affected communities receded the Committee seemed often to be placed in a position of competing with government departments in order to transport building materials to the outer islands.

From the outset this was a problem: the employment of New Zealand Army engineers in the Rotuma rehousing scheme was held up only by the delay in getting materials for 333 houses on site. There is little mention in the records of the Committee of shipping problems affecting other early programmes — in the Yasawas, Lau, and Kadavu, perhaps in part because of the slower, step-by-step nature of these schemes. The problems were not restricted to the availability of services, but were also encountered over mishandling of goods. Following Cyclone Val the seriousness of the situation prompted the Committee to charter its own vessel for the distribution of supplies. With the injection of EEC funds into the second phase of the Committee's reconstruction activities the efficiency of the transportation services was fully tested. The donor demanded prompt deployment of its aid and the number of buildings for which materials were to be supplied was very large. In addition, as with most of the hurricanes of the period, devastation was focused on the outer islands.

Following Cyclone Meli, the lack of coordination required to achieve the shipment of supplies to the islands seemed to reach a peak, with problems appearing at all levels of the supply chain. For example, in one instance, materials for a large number of pre-fabricated homes were reported to have arrived at a construction site all minus one necessary component. Construction would be delayed unless the construction teams could improvise with other, less satisfactory materials. Further problems arose because too few ships were available, and those in use were attempting to service too many islands with too many items of supply. As a result, no one island was able to obtain satisfactory amounts of the

materials needed. By August 1980 the shipping problems had not been resolved, and in response the Committee decided that the Marine Department should place three vessels under the control of the Secretariat in order to complete the relief work then in progress. The Committee would remunerate the Marine Department when it obtained the funds. By such means the Committee was able to facilitate the completion of its responsibilities, especially to the most isolated communities.

LABOUR

That the Committee could find itself directing shipping operations in 1980 is a measure of the organizational progress it had made. But perhaps no greater measure of this growth can be found than its development of a large reconstruction labour force over the years from 1972 to 1982. When the Committee first met, its responsibilities lay in the formulation of policy relating to relief and in obtaining and allocating the funds required to meet the demands created by its policies. The distribution of aid and the execution of policy were to be the responsibilities of EMSEC. However, it soon became clear that EMSEC was not set up to handle the long-term implications of the Committee's policies and the Committee became progressively more involved in the practicalities of its programmes.

During the Cyclone Bebe programme, construction of schools was supervised by a New Zealand Army engineers team of fifteen in the Western Division and the Yasawas, a number of New Zealand Ministry of Works supervisors handled the programme in the Central Division, and two teams from the Royal Fiji Military Forces worked in the very isolated settlements of the interior, and were later assisted by a team of thirty volunteers from the Fiji Public Works Department. These supervisory groups, consisting of skilled carpenters, were responsible for obtaining the necessary materials and overseeing the construction. Labour was provided voluntarily by the communities receiving assistance. In mid-May of 1973 a group of New Zealand Army engineers supervised the Rotuma rehousing scheme, and with the willing assistance of voluntary labourers from among the people of Rotuma some 333 homes were built in less than four months!

Following Cyclone Lottie the Committee employed 40 carpenters to supervise the reconstruction — 30 from the Public Works Department and 10 from the Fiji Master Builders Association. The work proceeded smoothly and by February of the following year, less than three months from the beginning of operations, their work was complete. The pattern was the same as had been used previously, with the Committee providing the expertise and the communities providing the labour.

In May of the same year work had begun on the reconstruction of homes in the Mamanuca area under the supervision of the Committee's own hurricane-relief team. Unfortunately we have no information as to the size of this team, although it was planned to split it into two for the Yasawa programme that was to follow, and two further carpenters were to be recruited to assist in that work. The Committee had established a system of on-the-ground operators. The teams were critical in ensuring not only that the rebuilding programmes pushed ahead, but also that the new homes would be sound of structure, a necessity in hurricane-prone areas. With the incorporation of Woodtex homes into the Lau—Kadavu reconstruction work and the Committee's resolve to provide the materials for 1,904 homes remaining to be built after the three early disasters — Bebe, Lottie, and Val —the supervisory team gradually grew in size.

In the Lau Group after Cyclones Lottie and Val it was found that a grass-roots reconstruction programme had already begun in response to delays in the Committee's programme. Under the supervision of traditional carpenters the people of a number of islands proceeded to rebuild homes using local materials. The Committee was prompt to encourage this show of independence by providing equipment, fuel, and nails.

With the massive EEC-funded programmes and the need for rapid reconstruction, the Committee found itself employing greater and greater numbers, establishing a very sizeable workforce under its employ. In early February 1980, some 500 people were involved in the reconstruction process —manufacturing housing units, working in supply, in shipping, and in construction, as well as administering the programme. It became clear after Cyclones Tia and Wally that even greater numbers would be needed to complete the reconstruction outstanding for three

hurricanes, including Cyclone Meli. Plans to expand the Royal Fiji Military Forces' rural development units to assist in the task proved unfeasible and it was decided to employ local people at casual non-union-member rates.

In 1981, the Committee joined forces with the Rural Housing Unit, which had originally grown out of the Committee's early programmes. The two organizations in combination comprised a formidable body directed towards post-disaster reconstruction. A permanent staff of 10 and some 178 temporary or casual employees made up the total work-force. As the programmes were completed the number diminished, many returning to departments from which they had been seconded. The growth of the Committee's organization in its decade of operation was phenomenal and as a result a very large pool of people, experienced at different levels in post-disaster reconstruction, has been created.

7

FOOD RELIEF

Despite the severe hardships and high costs of reconstruction resulting from hurricane damage to buildings, especially homes, the greatest potential for suffering, and threat to human life, comes from the disruption of agriculture. Where the might of the storm is greatest, community food supplies are consistently obliterated, and even at considerable distances from the centres of hurricane paths, agricultural production is often curtailed (see Table 2.5).

ASSESSING FOOD NEEDS

With the strong likelihood of considerable spatial variation in agricultural damage, from the regional to the local (village or settlement) level, the task of assessing the damage is an exacting one. Experience and knowledge of agricultural systems are prerequisites for a procedure that is often time consuming, detailed, and physically demanding. But the assessments must be made promptly and without delay. Hundreds of villages have to be surveyed by a limited staff and information passed on to the central relief coordinators, such as EMSEC and the Committee, in time for supplies to be obtained, organized, and forwarded before food shortages begin to threaten the health of hurricane victims.

Information is required on the number of people needing rations as well as the crop losses, including an estimation of the total area under each variety and the percentage loss. This informa-

tion is basic for planning the food relief operations (the number of rations required) and the crop rehabilitation programmes (amounts and types of planting materials and additional inputs such as fertilizer needed). The duration of the period of rationing must also be indicated, in terms of the expected time lapse before agricultural production resumes. This depends upon the rehabilitation programmes, crop seasonality, and environmental constraints, all of which must be included in the original estimations. In addition, the first surveys must determine the status of available supplies — how long they will last before being consumed or rotting in the ground — so as to specify a time for rationing to be initiated.

The groups for whom such assessment is considered most essential — subsistence farmers of the outer islands and the interior regions of the two main islands — are located in the most isolated parts of Fiji, requiring marine transportation or difficult overland journeys by assessment teams. Although these groups have the potential to be much more self-sufficient after disasters than might be assumed, the urgent need to assess their situation will remain until much of that potential, a great deal of which is rooted in past practices, is realized (see Chapter 8). The isolation of such areas, in view of the urgency of obtaining accurate assessments, places great constraints on operations. Time spent between disaster locations reduces the survey time available and demands that personnel must be divided into smaller than optimum-size teams. For example, the agricultural assessment in Lau, following Cyclone Meli began the day after the disaster struck, and was completed ten days later, the round trip from Suva taking in eleven islands and covering more than 800 km by sea alone. A total of 33 villages or estates were surveyed: each village was allocated an hour and a half for assessment — a total of 48 hours, or 20 per cent of the total period — an indication of the time costs of isolation (Memo of 17 April 1979 from Agricultural Officer, Nausori to EMSEC). Nevertheless, the information received from early assessment teams proved highly accurate in spite of the difficulties they faced. During the decade, the methods adopted by the survey teams ranged from on-the-ground observation, usually limited to samples in view of the time and staff constraints; interviews with individuals; community meetings;

and discussions with village representatives (e.g., *Turaga niKoro*, village head), provincial *mata* (representatives on Provincial Councils), and where possible, government officers stationed in the disaster areas. The use of aerial photographs was rather limited, though their potential is considerable, not only for the evaluation of crop damage and destruction, but also for monitoring progress in agricultural rehabilitation.

Because of the immediacy of the problems caused by agricultural disruption, survey teams were usually assembled on an *ad hoc* basis; they generally revolved around the experience and knowledge of a senior district or divisional agricultural officer but included a wide selection of other personnel such as Divisional Administration staff and medical officers. More often than not, the teams were expected to make use of their diverse talents — compiling information not only on agricultural damage, but also on structural damage, injuries, water supply problems, and threats to public health.

Long-term estimates of ration requirements are invariably grossly derived (and periodically reviewed by Agricultural Department officers monitoring rehabilitation progress) and adjustments can be easily made from time to time. However, the earliest figures were extremely important in ensuring the adequacy and timely arrival of the first ration provisions and in enabling the Committee to orchestrate the acquisition of food stocks from overseas and local sources for the longer term as well as the Agricultural Department to organize rehabilitation. Most assessments, like the housing evaluations, tended to be overestimated. For example, it was calculated that following Cyclone Bebe some 120,000 people would need rations for the first three months, although by the third month the figure had dropped to 60,000. After Cyclone Meli, the initial estimate exceeded 20,000 persons for 12 months, but in fact the maximum number peaked at slightly less than 17,000. Considering the difficulties under which the assessments were made, these errors of 17 per cent and 15 per cent respectively, compared with the total rations supplied for the periods indicated, are remarkably low, and few would disagree that erring on the safe side is surely preferable to the consequences of underestimation. There has been no reported death due to nutritional deficiencies in the aftermath of hurricanes

since the formation of the Prime Minister's Hurricane Relief Committee. For this credit is in part due to the people who worked outside the Committee's framework but were responsible for the provision of vital information that made the tasks of both EMSEC and the Committee possible.

FOOD RELIEF

Table 7.1 lists the maximum numbers of persons supported after each hurricane since Bebe, but the numbers give only a limited impression of the nature of the food-relief operations. What indeed is a "ration," how many such rations were provided, to whom, for how long, and at what cost? And what role did the Committee play in the food-relief operation? The term "ration" generally refers to a fixed allotment of items, usually food, during periods of general scarcity or specific shortages. In the context of post-disaster food-relief operations, a "ration" may be defined as the amount of food necessary to maintain adequate daily nutritional standards. This has always been the intent of those responsible for managing food-relief programmes in Fiji. However, no specific guidelines have been presented as to what such a ration should contain.

As Table 7.2 indicates, certain items have been included in all ration issues — namely, rice and/or flour, sugar, and tea. Other items such as skimmed milk powder and/or milk biscuits and canned fish and/or meat have been issued on most occasions, but not always. The issue of a very wide range of items following Cyclone Bebe was not repeated in subsequent operations. Following most of the hurricanes covered in this report, substantial supplies of local produce donated from unaffected parts of Fiji and through the National Marketing Authority have been provided to disaster victims, but they have tended to be used as rations only in the immediate post-hurricane period. The real confusion surrounding the composition of a ration is revealed by a closer examination of Table 7.2. Whereas there is considerable variation in the types of food included in rations, there is even greater variation in the amounts distributed. In all cases, rice and/or flour have formed the bulk of the ration issue, as a replacement for the destroyed staple carbohydrates such as taro, cassava, sweet po-

TABLE 7.1 Maximum Numbers of Persons Receiving Rations, 1972—1982

<i>Event</i>	<i>Number</i>	<i>Event</i>	<i>Number</i>
Bebe	120,000	Bob	5,178
Juliette	n.a.	Fay	n.a.
Lottie	15,000	Meli	16,982
Val	23,870	Tia	8,330
Drought	1,314	Wally	19,693
Anne	2,862	Arthur	10,313

Source: Documents of the Committee.

tato, and breadfruit. But the average daily per capita issue of these “ration staples” shows a remarkable lack of consistency, ranging from 53 to 242 grams (mean = 133.6 g) for the seven ration programmes for which data could be found (excluding the UN/FAO, World Food Programme “Food For Work” rations, which were issued to individuals involved in reconstruction programmes from Cyclone Meli onwards; if included, they would exacerbate the inconsistencies even further). Similar variations can be found for other items in the list of rations.

The reasons for the inconsistency are not clear, for they do not appear to result from differences in assessment of food needs. From time to time, the Committee noted the problem and emphasized the need to standardize the ration issue, based on Health Department established “dietary minimums,” but it seems that as late as 1980 no one knew the rationale behind the ration scale (Minutes, 32nd Meeting of PM HRC 12 April 1979; Minutes, 1st Meeting of PMRRC 13 Feb. 1980). It would seem to be imperative that the ration scale be standardized, notwithstanding the need for flexibility due to local availability of specific items. As Table 7.2 indicates, either the provisions have been excessive on occasion or there have been instances where the nutritional level of the supplies was inadequate.

THE RATION PROGRAMMES

The responsibility for ration distribution in the early post-disaster stages lies with EMSEC. However, following Cyclone Bebe, the Committee was responsible for maintaining the normal re-

**TABLE 7.2 Calculated Average Daily Per Capita Rations
(in grams)**

	<i>Flour</i>	<i>Rice</i>	<i>Sugar</i>	<i>Tea</i>	<i>Shimmed Milk Powder</i>	<i>Canned Fish</i>	<i>Canned Meat</i>	<i>Cook- ing Oil</i>	<i>Marga- rine</i>	<i>Salt</i>	<i>Yellow Split Peas</i>	<i>Curry Powder</i>	<i>Bis- cuit</i>
Bebe ^a	121	121	30	4.0	30	30	30	26	30	15	30	2.5	-
Lottie ¹⁰													
Val ^c	—	53	8	0.6	4	—	—	—	—	-	-	-	—
Val ^d	-	53	10	0.8	5	—	-	—	-	-	-	-	15
Anne-Bob ^e	—	156	18	4.0	—	—	74	-	—	-	-	-	-
Drought ⁶	—	152	14	3.0	—	—	71	—	—	—	—	—	—
Fay ^f													
Meli ⁶	—	200	30	6.0	30	62	-	-	—	-	-	-	-
Tia-Wally ^h	—	120	30	3.0	—	62	—	—	-	-	-	-	-
Arthur ⁱ	—	120	30	4.0	30	62	-	—	—	-	-	-	-
Food for Worki	400	-	-	-	-	60	-	40	-	-	-	-	-

a. Calculated from data extracted from Table 2 in PMHRC (1973), "Reconstruction and Development (Draft)." Sharps is also included under the column heading for flour.

b. Data unavailable.

c. Rations to Lau and Kadavu excluding rations given to day schools. Calculated from data extracted from attachment to report: PMHRC (1975), "Summary of Hurricane 'Val' Report (Situation as at 9 March 1975)."

d. Rations to Lau and Kadavu including rations given to day schools. Boarding schools (870 people) received the same average per capita daily rations as the rest of Lau and Kadavu (excluding day schools) but with an additional 11 grams of canned fish per individual per day.

- e. Calculated from data extracted from PMHRC (1978), "Request for Aid Food Assistance. Brief on the Drought, Cyclones 'Anne' and 'Bob' in Fiji (Situation—26 January 1978)."
- f. Data unavailable: twenty-ninth meeting report stated rations should consist of rice, milk, fish, tea, and sugar.
- g. Calculated from data extracted from PMHRC (1979), "Overall Position Paper (Second Draft) 12 April 1979."
- h. Calculated from data extracted from table entitled, "Cyclone Tia/Wally Ration—Rations for One Month Ration Issued on 29 December 1980." (In files of Committee)
- i. Calculated from data extracted from table entitled, "Southern Yasawas—Summary of Relief Ration—'Arthur'—One Month Ration." (In files of Committee)
- j. Taken from "Simplified Plan of Operations Agreed Upon between the Government of Fiji and the United Nations/FAO World Food Programme Concerning Food Assistance for House Reconstruction Programme."

serve of 50,000 rations in cooperation with the Department of Government Supplies (whose controller was a member of the Committee), monitoring demand following disasters, ensuring that all needs were met through appeals to foreign and domestic sources, and coordinating all aid received. After the initial phase of EMSEC involvement, the district administration assumed control of distribution, while the Committee coordinated rationing at the national level.

It was soon apparent after Cyclone Bebe that a huge number of people had been left without adequate food resources to support themselves. Although the original estimate that 120,000 people would depend on rations for three months was a slight overestimation, the total number of daily rations provided did peak at that number for virtually two months as Figure 7.1 illustrates. During these months, November and December of 1972, almost a quarter of the national population (some 22 per cent) was being supported by relief supplies. In January, the number on rations halved, and for the next five months only 18,000 remained as beneficiaries — those whose gardens had been most severely affected. The number of daily per capita rations supplied until the end of June totalled approximately 12 million, which was 9 per cent more than would have been required had the original estimate of 120,000 for three months held up. The wide variety of items issued as food aid were largely received as aid from overseas sources, given in response to PMHRC direction on items needed. By the end of the programme, food valued at almost \$650,000 had been distributed. Although the Committee was to become involved in much larger rehousing programmes than that which followed Cyclone Bebe, the scale of the Bebe food-relief programme was never to be repeated. The operation extended to almost every extremity on the map of Fiji, from Rotuma in the far north, to Yasawa and Mamanuca in the west, and to islands in southern Lau, but the bulk of rations were distributed to communities on Viti Levu.

Some rations were supplied to parts of northern Lau following Cyclone Juliette, a relatively minor storm. Although no details are available, it would appear that the food relief was of limited quantity and duration. Cyclone Lottie, however, was a much more serious event, causing such damage that some 15,000 people had

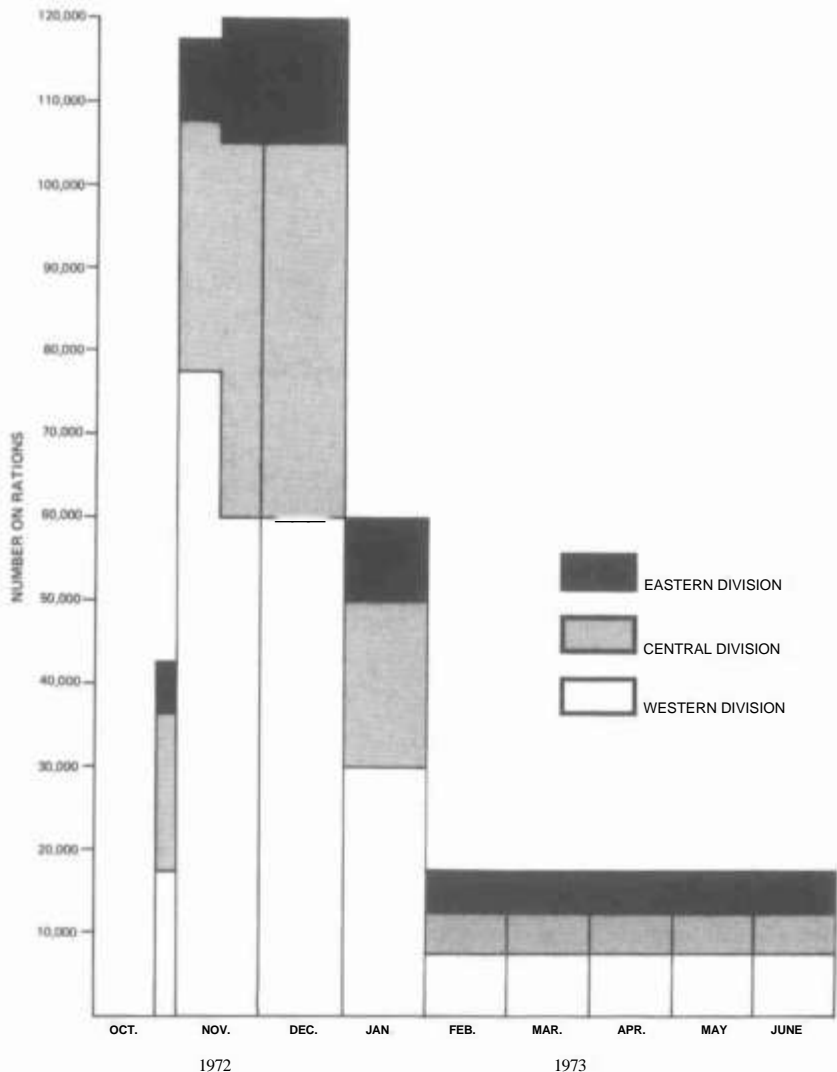


Figure 7.1 Persons rationed after Cyclone Bebe

to be rationed. Unfortunately no other information is presently available about the duration of the rationing programme or other details of its operation.

Cyclone Val, which followed Lottie by some fourteen months, also caused considerable damage to Lau and Kadavu agricultural systems. Information on the subsequent food-relief programme indicates that an early schedule was compiled for Lau only seven

	Population to Receive Ration	Rice		Tea	
		Amount (<i>kg</i>)	Av. ^a (8)	A mount (<i>kg</i>)	Ad. (<i>g</i>)
Lau	14,300	136,986	53	1,551	0.6
Kadavu	8,700	83,326	53	953	0.6
Day schools	6,384 ^b	0	-	694	0.6
Subtotal	23,000	220,312	53	3,198	0.8
Boarding schools	870 ^c	8,346	53	95	0.6
Total	23,870	228,658	53	3,293	0.8

Source: Compiled from calculations based on data extracted from attachment to PMHRC (1975), "Summary of Hurricane Val Report."

a. Average daily per capita ration.

days later; "full rations" (equalling the daily per capita rations as listed for Cyclone Val in Table 7.2) were to be issued for the first few months, and in the two following months, half these quantities were to be provided. Within a month a new schedule was adopted, extending the duration of "full rations" for the entire six months of the relief programme and deleting the two least severely disturbed islands from the schedule. Table 7.3 summarizes the Cyclone Val operations, which supplied 8,700 persons on Kadavu and 14,300 in Lau with rations for half a year. A further 870 boarding-school students also received rations as well an additional daily per capita allowance of 11 grams of fish, and an issue of biscuits, tea, sugar, and skimmed milk to day schools (enrollment 6,384) served to supplement the overall ration scale for the disaster area.

Although almost three hurricane-free years passed before Cyclone Anne traversed the north-east of Fiji, a severe drought had been affecting much of the nation for the second half of 1977. The effects of the drought were particularly severe on some of the outer islands and in southern Lau the period from May through December was the driest recorded in 27 years. The small, limestone islands of Fulaga, Komo, Kabara, and Ogea suffered badly, and late in the year, rations for their 1,314 inhabitants were approved for

<i>Sugar</i>		<i>Skimmed Milk Powder</i>		<i>Biscuit</i>		<i>Canned Fish</i>	
<i>Amount</i> (kg)	<i>Av.</i> (g)	<i>Amount</i> (kg)	<i>Av.</i> (g)	<i>Amount</i> (kg)	<i>Av.</i> (g)	<i>Amount</i> (kg)	<i>Av.</i> (g)
20,220	8	9,348	4	0	-	0	-
12,294	8	5,690	4	0	-	0	-
9,043	8	4,166	4	61,163	53	0	-
41,557	10	19,204	5	61,163	15	0	-
1,219	8	559	4	0	-	1,782	11.0
42,776	10	19,763	5	61,163	14	1,782	0.4

b. This figure is included in the Lau/Kadavu total of 23,000.

c. This figure is additional to the Lau/Kadavu total of 23,000.

three months. Cyclones Anne and Bob affected only limited areas of Fiji and it seems that their destruction of agriculture was relatively light. Three months' rations were supplied to the worst affected islands — Rotuma, Qelelevu, Vanuabalavu, the southern Yasawas, and Mamanuca. With the exception of Rotuma and Qelelevu, these islands would normally have been able to subsist, were it not for the already disruptive effect of the continued drought upon their agricultural systems. As a result of the cyclones, some 8,040 people received rations, a figure which may have been closer to 3,000 without the drought. In all, rations valued at \$133,704 were issued, a summary of which is given in Table 7.4.

Following Cyclone Meli, initial estimates indicated that some 20,584 persons in central Lau and Kadavu would require rations for twelve months at a projected cost of slightly more than \$1 million. However, the Committee felt that such across-the-board provision of rations should not be undertaken unless justified. It was believed that perhaps no more than 75 per cent of the initial valuation would ultimately be necessary. The issue of rations was therefore carefully monitored in accordance with Agriculture Department assessments of rehabilitation progress. In fact, the maximum number of persons on food relief peaked at slightly less than 17,000 and, as Table 7.5 and Figure 7.2 show, less than

TABLE 7.4 Ration Programme, 1977 Drought and Cyclones Anne and Bob

<i>Disaster, by Island or District</i>	<i>Number of People on Rations</i>	<i>Ration Schedules</i>	
		<i>Rice</i>	
		<i>Amount Capita (kg) (g)</i>	<i>Average Daily Per</i>
<i>Drought</i>		18,000	152
Fulaga	405		
Komo	201		
Kabara	595		
Ogea	113		
Subtotal	1,314		
<i>Cyclone/Drought</i>		112,860	156
Rotuma (Bob)	2,805		
Naviti/Malolo (Bob & Drought)	2,373		
Subtotal	5,178		
Nagelelevu (Anne)	20		
Vanuabalavu (Anne & Drought)	2,842		
Subtotal	2,862		
Total	9,354	130,860	155

Source: PMHRC (1978), "Request for Aid Food Assistance: Brief on the Drought, Cyclones 'Anne' and 'Bob' in Fiji. (Situation—26 January 1978)."

three-quarters of these, the inhabitants of Tuvuca, Cicia, Nayau, Moala, and Kadavu, received rations for the full twelve months. In total some 5,185,866 daily per capita rations were issued, amounting to only 69 per cent of the initial estimation. Assuming that the original individual ration scale was adopted at the same prices, the final costs of the programme were less than \$0.73 million — a considerable saving.

The Tia-Wally cyclone and flood disasters struck Fiji at the time when Cyclone Meli rations were being brought to a close. Unfortunately, we have very little information concerning these programmes apart from a schedule of ration deliveries made on 18 December 1980, which appears, apart from some school rations, to have been the last delivery. However, these rations were issued to 7,551 individuals located in Tia areas and 1,745 located

(3 months)

<i>Sugar</i>		<i>Tea</i>		<i>Canned Meat</i>	
<i>Amount</i> <i>(kg)</i>	<i>Average</i> <i>Daily Per</i> <i>Capita</i> <i>(g)</i>	<i>Amount</i> <i>(kg)</i>	<i>Average</i> <i>Daily Per</i> <i>Capita</i> <i>(g)</i>	<i>Amount</i> <i>(kg)</i>	<i>Average</i> <i>Daily Per</i> <i>Capita</i> <i>(g)</i>
1,650	14	408	3	8,389	71
13,250	18	2,817	4	53,520	74
14,900	18	3,225	4	61,909	74

in Serua-Namosi, a Wally area. The original estimates of persons who would require rations were 8,330 and 19,693 respectively for the two storms. We can only assume that the remainder had a shorter rationing period.

Following an immediate issue of emergency rations, the Cyclone Arthur relief programme was conducted in the six months between January and August 1981. The first round included the supply of rations to victims of the storm, both on the outer islands of the Western Division (Yasawa, Mamanuca) and on the mainland (Lautoka, Ba). In the remaining five rounds, supplies went only to the former group, which totalled over 6,800 recipients until May, when the number was almost halved for the final two allocations. By the time of the final distribution some 45,405 monthly rations, or approximately 1,360,000 daily per capita rations, had been issued. As Table 7.6 shows, the total value of the rations was \$167,493.19.

Island	Population Rationed ^a	Months	Total Individual Daily Rations	Rice	
				Amount (*)	Av. (g)
<i>Original Estimate</i> [^]	20,584	12	7,513,160	1,481.800	200
<i>Actual Distribution</i> ^c					
Tuvuca	196	12	71,540	14.109	200
Cicia	1,185	12	432,525	85.303	200
Nay au	490	12	178,850	35.273	200
Moala	1,946	12	710,290	140.085	200
Kadavu	8,699	12	3,175,135	626.206	200
Subtotal	12,516	-	4,568,340	900.976	-
Lakeba	2,067	6	376,194	74.398	200
Vanuavatu	253	6	46,046	9.106	200
Subtotal	2,320	-	422,240	83.504	-
Beqa	1,303	3	118,573	23.449	200
Vatulele	736	3	66,976	13.245	200
Yanuca	107	3	9,737	1.926	200
Subtotal	2,146	-	195,286	38.620	-
Total	16,982	-	5,185,866	1,023.100	-

Sources: a, PMHRC (1979), Application—EEC Exceptional Aid. 11 May 1979;
b. PMHRC (1979), Overall Position Paper (Second Draft). 12 April 1979;
c. PMHRC (1979), Minutes of the 37th Meeting, 12 June 1979 (Verified in Minutes of following meetings). Figures are approximations only based on the assumption that original individual rations were actually used The

A great boost to both the housing and the food-relief responsibilities of the Committee came with the assistance of the United Nations/FAO World Food Programme (WFP), which undertook to supply rations to workers involved in the reconstruction programmes for Cyclones Meli, Tia, Wally, and Arthur. The WFP food relief consisted of wheat flour, vegetable oil, and canned fish — to be issued in daily per capita rations of 400 grams, 40 grams, and 60 grams respectively — with each worker to be given six such rations for each day of work contributed to house construction. With the programme's support, some 2,287 homes were built and 8,089 workers received the rations provided.

<i>Sugar</i>		<i>Tea</i>		<i>Skimmed Milk Powder</i>		<i>Canned Fish</i>	
<i>Amount</i> (t)	<i>Av.</i> <i>(g)</i>	<i>Amount</i> <i>(t)</i>	<i>Av.</i> (e)	<i>Amount</i> <i>(t)</i>	<i>Av.</i> <i>(g)</i>	<i>Amount</i> <i>(t)</i>	<i>Av.</i> <i>(is)</i>
220.800	30	44.750	6	220.500	30	462.200	62
2.102	30	0.426	6	2.100	30	4.401	62
12.711	30	2.576	6	12.694	30	26.609	62
5.256	30	1.065	6	5.249	30	11.003	62
20.874	30	4.230	6	20.846	30	43.697	62
93.312	30	18.911	6	93.185	30	195.332	62
134.255	-	27.208	-	134.074	-	281.042	-
11.086	30	2.247	6	11.071	30	23.207	62
1.357	30	0.275	6	1.355	30	2.840	62
12.443	-	2.522	-	12.426	-	26.047	-
3.494	30	0.708	6	3.490	30	7.315	62
1.974	30	0.400	6	1.971	30	4.132	62
0.287	30	0.058	6	0.287	30	0.601	62
5.755	-	1.166	-	5.748	-	12.048	-
152.453	-	30.896	-	152.248	-	319.137	-

slight discrepancies found when rows and columns are cross-checked are due to rounding and the assumption of 30 days in one month in the process of calculating total tonnages for each island. These figures are lower than the product of the total daily individual rations and average daily per capita rations.

THE RATION PROGRAMMES: AN EVALUATION

A variety of factors need to be taken into account when evaluating the rationing programmes that operated under the Committee's guidance in the ten years from 1972 to 1982. Some important philosophical questions arise concerning the real need for rations, or the level of rations provided, and the possibility that rationing increases dependence on the government for food on the part of formerly largely self-sufficient communities also needs to be explored (see Chapter 8). Likewise, the problems concerning the size of the individual ration need to be resolved within the context of real needs and adequate nutritional stan-

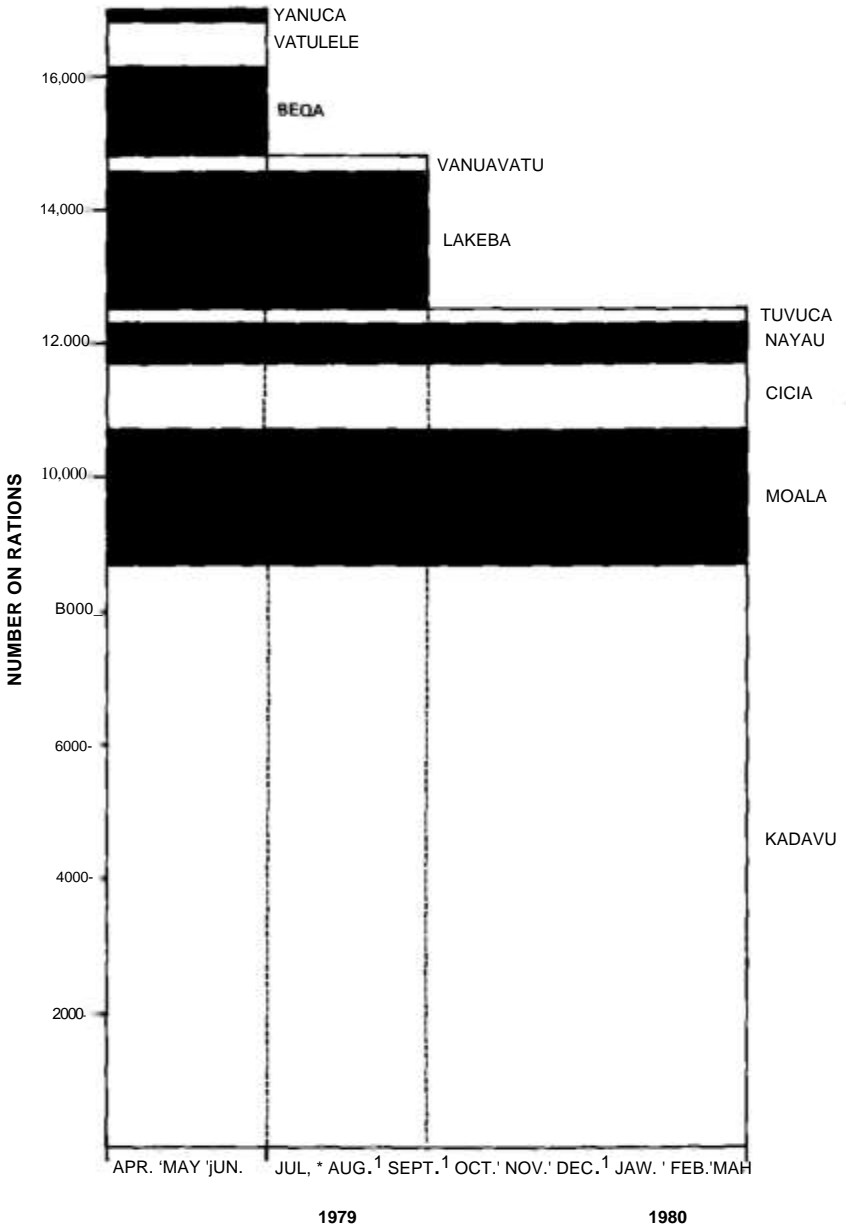


Figure 7.2 Persons rationed after Cyclone Meli

dards, and one may certainly question the nature of the contents of the ration issues in terms of their suitability for the recipients. Other practical concerns include the efficiency of delivery systems —an important factor on which the Committee has had very little feedback.

Table 7.7 (see also Table 7.1) compares the rationing programmes in terms of the number of recipients and daily per capita rations provided and the value of the food relief. The totals are impressive — an average of more than 50 daily rations (almost enough food for two months!) to every citizen of Fiji had the occurrence and impact of the disasters been equitable. As Table 7.8 shows, however, the areal distribution of the food-relief operations was not even; the Eastern Division, especially Kadavu, and the islands of the Western Division, Yasawas and Mamanuca, tended to be the loci of most rationing schemes. Roughly 53 per cent of the rations issued went to the inhabitants of the Yasawa, Mamanuca, Rotuma, Kadavu, or Lau groups, which in 1976 boasted a combined population of 31,162, only 5.2 per cent of the national total.

The successful operation of the rationing programmes has depended very much upon the provision of food as aid from overseas sources —governments and international organizations. Where there have been shortfalls, the Government of Fiji has assumed responsibility for procuring the necessary food items. Generally, the international response to disasters has been generous and swift, especially for the most devastating events, as indicated in Chapter 4. In the “lesser” storms (for example, Lottie and Val), the damage wrought upon those communities unfortunate enough to suffer was often no less than that suffered in the “larger extent,” better-publicized storms, the only difference being that much larger numbers of communities are affected by the latter type of event. Ironically, it is after the smaller-scale events that difficulties in procuring food aid are often greatest.

A further problem associated with the dependence upon international food aid is in the content of the aid. Usually food aid is in kind, particularly rice, flour, and skimmed-milk products. It is interesting that following Cyclone Bebe the Tavua Advisory Council sought the cessation of food relief in the hope of using the savings to assist victims with home rebuilding. It could not be

TABLE 7.6 Ration Programme, Cyclone Arthur

	Date	Numbers		Cumulative Total	Rice (kg)
		Yasawas/Mama-nuca Ba	Rationed Lautoka/		
1st Round	18-22 Jan	3,400	4,097	7,497	27,600
	23-30 Jan ^a	?	?	17,810	24,540
2nd Round	31 Jan -28 Feb	6,835	-	24,645	23,820
3rd Round	1-23 Mar	6,835	-	31,480	23,700
4th Round	24 Mar —13 May	6,849	-	38,329	675
5th Round	14 May—14 July	3,669	-	41,998	-
6th Round	15 July—24 Aug	3,407	-	45,405	-
Total (24 Aug 1981)				45,405	100,335

Sources: Summary of Relief Rations—Cyclone Arthur (periodic accounts of ration programmes produced by PMRRC).

Note: Figures in table shown here have some discrepancies with the original due to amendments made, such as adding rations given to boarding schools to the totals.

done — the food was part of aid that was supplied in kind (Minutes PMHRC, 6th Meeting 7 Dec. 1972). (In the light of such a request one might question the severity of food shortages in the Tavua area, despite the fact that rations were being supplied.) This dependence on food aid raises further questions — in particular, the suitability of rice and flour as replacements to the nutritious staple root crops generally consumed in rural Fiji. Certainly, rice and flour have advantages in that they are less perishable than the staple crops, but one wonders if, given more control over expenditure on relief food, it would be possible to inject more of the locally produced staples, from areas not affected by the storms, into the relief operation. Such a scheme, were it practicable, would certainly have benefits beyond the recipient communities. However, the problems with such a scheme include marketing arrangements, shipping, and costs (root-crop prices are higher than those of rice and flour). Furthermore, such a course would be impossible after a storm affecting a wide area, such as Cyclone Bebe, which was followed by a national shortage of taro and other root crops and high market prices until mid-1973 (Ministry of Agriculture, Fisheries, and Forests, 1976).

<i>Sugar</i> (kg)	<i>Tea</i> (kg)	<i>Milk</i> (kg)	<i>Canned Fish</i> (kg)	<i>Flour</i> (kg)	<i>Value (\$)</i>
7,300.0	892	7,125.0	14,025	—	33,633.90
6,250.0	694	6,050.0	12,060	—	28,788.35
6,262.5	764	5,912.5	12,135	300.00	30,775.35
5,962.5	764	5,912.5	12,015	300.00	29,050.49
6,321.5	780	6,337.5	12,840	24,831.25	25,395.31
3,312.5	418	3,375.0	6,878	13,350.00	13,553.84
1,537.5	194	1,562.5	3,196	6,200.00	6,295.95
36,946.5	4,506	36,275.0	73,149	44,981.25	167,493.19

a. These figures are calculated from the cumulative figures given for 30 Jan 1980 and the figures for 18—22 Jan 1980.

Given that relief aid *is* necessary, it is essential that it be supplied on schedule and distributed equitably. Unfortunately, little information is available about this side of the rationing operations. Generally, rations are issued in one-month lots beginning within a few days or a few weeks of the disaster. Although there is virtually no record in the minutes of the Committee of complaints about rates of supply, M. Brookfield (1977) wrote of the situation in Lakeba following Cyclone Val:

Almost without exception, the villagers said the first allocation came too late; they had long since run out of garden food, and could not get or could not afford all that they needed from the stores. Not enough wild food could be found and many were hungry. . . . Then when the first installment did arrive, it was too little to last until the next shipment, the date of which was uncertain. (M. Brookfield, 1977:128)

In view of serious shipping problems associated with the rehousing programme, it is not surprising that delays in delivery of rations have occurred in the outer islands. More recently, as inspection of the Cyclone Arthur rationing summary sheets for the Yasawas and Mamanuca indicates, deliveries for the six rounds (of one-monthly supplies) were actually stretched over seven months. A system enabling some kind of feedback to the relief-

TABLE 7.7 Estimated Total Daily Per Capita Rations Issued and Total Value of Food Relief, 1972-1982

	<i>Total Daily Per Capita Rations Issued</i>	<i>Value of Rations Issued* (\$)</i>	<i>Value of Per Capita Daily Ration (cents)</i>
Bebe	12,096,000	649,224	5.37
Juliette	n. a.	n.a.	-
Lottie	2,7U0,000^b	n.a.	—
Val	4,344,340	162,032	3.73
Drought	119,574	18,153	15.18
Anne	260,442	41,133	15.79
Bob	471,198	74,418	15.79
Fay	n.a.	n. a.	-
Meli	5,185,866	730,000	14.08
Tia	1,599,360^b	n.a.	—
WaJiy	3,584,126^b	il a.	-
Arthur	1,362,150	167,493	12.30
Food for Work	632,880	n.a.	--

a. Includes total value. The actual cost to the government may have been less depending upon the amount of food aid for each respective disaster.

b. These figures are estimations only as available data are insufficient to make an accurate assessment.

distributing organization from communities should they not be properly served, may help to avoid the occurrence of problems such as those experienced in Lakeba, indeed throughout Lau, in the 1970s. For example, a perusal of issues of the *Fiji Times* indicates that when there is confusion or delay in rationing programmes on Viti Levu, publicity is often immediately obtained. But for people in the outer islands, where the delays are often much longer, such recourse is not available.

	<i>Bebe Lottie Val</i>		<i>Anne Bob</i>		<i>Drought Fay Meli Tia Wally Arthur Total</i>			
Rotuma	x			x				2 ^a
Qelelevu			x					1
Qamea			x			x		2
Taveuni			x			x		2
Yacata			x					1
Savusavu						x		1
Bua						x		1
Macuata						x		1
Koro						x		1
Vanuabalavu		x	x		x	x		5
Tuvuca						x		1
Cicia		x				x		2
Nayau		x				x		2
Lakeba		x				x		2
Vanuavatu		x						1
Oneata		x						1
Moce		x						1
Komo		x			x			2
Namuka		x						1
Kabara	x	x			x			3
Fulaga	x	x			x			3
Ogea	x	x			x			3
Moala	x	x						2
Totoya	x	x						2
Matuku	x	x						2
Kadavu		xxx				x		4

^b

	<i>Bebc Lottie Val</i>	<i>Anne</i>	<i>Bob</i>	<i>Drought Fay</i>	<i>Meli</i>	<i>Tia</i>	<i>Wally</i>	<i>Arthur</i>	<i>Total</i>
Yasawa	x		x	x				x	3^a
Mamanuca	x		x	x				x	3^a
Tavua	x								1
Ba	x								1
Lautoka	x								1
Nadi	x								1
Nadroga/Navosa	x								1
Tailevu	x						x		2
Naitasiri	x						x		2
Rewa	x								1
Namosi	x						x		2
Serua							x		1
Navua							x		1
Be qa					x		x		2
Yanuca					x				1
Vatulele					x				1
Northern Division		x					x		2
Eastern Division	x	x	x	x	x				6
Central Division	x				x		x		3
Western Division	x		x	x				x	3^a

a. Rations issued for combined hurricane (Bob)/drought disasters.

b. Rations issued for combined hurricane (Anne)/drought disasters.

c. For the Eastern Division, Vanuabalavu received combined rations for hurricane (Anne)/drought, but other islands suffered from drought only.

PART 3
CONCLUSIONS

8

THE VULNERABILITY OF FIJI

THE COSTS OF DISASTERS

When the “decade of the Committee” began after the occurrence of Cyclone Bebe, the total costs of the relief and rehabilitation programmes that followed that single event amounted to almost \$6 million. In comparison, the post-disaster programmes subsequent to the 1952 cyclone, which, from all descriptions, was at least as destructive as Bebe, cost somewhat less than \$500,000. The costs of Cyclone Bebe alone were also six times greater than the entire post-disaster costs for the preceding decade! As the 1970s unfolded it soon became apparent that Cyclone Bebe had heralded an era of extremely high and rapidly increasing costs as a result of hurricane occurrence in Fiji.

However, whereas the 1960s were characterized as one of the lowest periods of tropical cyclone activity in the past century, the decade of the Committee was marked by a high incidence of tropical storms and hurricanes. Consequently, there was to be very little respite from the expenditure of large sums after hurricanes in Fiji during this time. A total of seventeen storms affected Fiji to some degree, although only a dozen of them resulted in Committee activities, and only nine were to be followed by comprehensive, centrally organized relief, rehabilitation, and reconstruction programmes. As was indicated in Chapter 4, these programmes probably accounted for around \$25 million of a total disaster toll of \$70 million. The Committee was responsible for administering the distribution of cash and materials, which totalled probably at

least half of this amount, the remainder being used in programmes administered by the government.

The Committee's post-disaster programmes were heavily oriented towards reconstruction, particularly the rebuilding of homes and schools. In all, the Committee's projects brought about the completion of around 3,400 rural homes and were responsible for the initiation of well over 1,000 more that were completed under other government programmes. These homes, in terms of materials alone, accounted for the expenditure of almost \$6 million. During the same period over 700 school buildings were reconstructed at materials costs of more than \$1.5 million. The costs of wages, transport, and equipment, which were shared by the Committee and the government, must be added to these expenses. The Committee was also closely involved with food-rationing programmes, which were usually run through the Government Supplies Department and Divisional Administration. These programmes distributed more than 30 million individual daily rations with an estimated value well above \$2.5 million.

In addition to administering relief and rehabilitation programmes, the Committee was responsible for developing policies regarding post-disaster recovery and recuperation. Such policies included the decision to give priority to the reconstruction of schools following disasters and to provide housing to rural communities where it was believed the members did not have the capital assets to rebuild or restore their damaged homes. This latter policy was the most important of all, for it created a new era in post-disaster operations in Fiji. Until Cyclone Bebe occurred, post-disaster housing rehabilitation was the responsibility of the home-owner, occasionally assisted by very small interest-free loans administered by centralized agencies. Following Cyclone Bebe, the homes were rebuilt by specialized teams of supervisors and local labour, but with the materials costs to be repaid by the recipients on an interest-free basis. After Cyclone Meli homes were provided free to those who qualified. By then hurricane victims, at least in the rural periphery of Fiji, could expect housing, food, and the replacement of local schools after hurricanes struck.

The final meeting of the Committee was held in September 1982. From this time onward the responsibility for the work it

had carried out for the previous ten years was taken over by the newly formed Department of Relief, Rehabilitation and Rural Housing, a section of the Ministry of Fijian Affairs and Rural Development. Essentially, the department continued with the organizational structure that the Committee had formed in its ten years of operation, and its foundation was clearly laid in the experience and knowledge developed by the Committee during that period. In fact a committee structure was to remain, with policy decisions being the responsibility of a new committee comprised of government department heads. What had begun as a voluntary organization was, in 1982, fully established as a government service.

THE EVENTS OF 1983

It was not long before the new service had an opportunity to begin post-disaster operations. In the month that the Committee met for the last time a dry spell was beginning that would last for almost a year and eventually cause great losses in rural areas. In March 1983, before the effects of the drought were being deeply felt, two tropical cyclones, one of which was particularly severe, caused considerable havoc in all but a few parts of the country. By the time the year drew to a close, many considered it to have been the most calamitous in the nation's history.

The first of the storms, Cyclone Oscar, was so destructive that it was compared to the cyclone of 1931 and was responsible for devastation across an areal extent similar to that of Cyclone Bebe. Nine people died during Cyclone Oscar and early estimates of damage indicated losses would amount to around \$80 million (*Fiji Times*, 9 March 1983). Some 4,733 homes were destroyed and 4,901 damaged, 288 classrooms, teachers' quarters, and dormitories required replacement, and a further 483 needed substantial repair. Food crops in the path of the storm were obliterated, pine forests badly battered, and sugar-cane severely damaged, although much of the sugar crop was confidently expected to recover provided good weather conditions followed the storm (*Fiji Times*, 7 March 1983, p. 13). Later in the month Cyclone Sarah affected parts of the Northern and Eastern Divisions. Although the scale of devastation was considerably less, a further

burden was added to the relief and rehabilitation task —109 homes were destroyed and a further 31 damaged, 30 school buildings destroyed and the same number damaged, and in parts of Lau food crops were badly battered.

These two storms served to briefly interrupt the prolonged drought, which continued to affect the country for much of the rest of the year. The sugar industry, already placed in a precarious state by Cyclone Oscar, was not able to recover and the national harvest was more than halved (see Chapter 3). Lost export earnings were expected to exceed \$70 million and many farmers, already severely affected (in terms of housing damage and food-crop losses), were placed in dire straits. With significant losses attributed to decreased tourist arrivals, and the temporary closure of some major hotels in addition to the massive sugar losses —not to mention the massive repair costs — natural extremes had, for the first time, placed the national economy in an extremely critical position.

As Cyclone Bebe far outdistanced the decade that preceded it in terms of relief and rehabilitation costs, so did the events of 1983. In the wake of Cyclone Oscar, the bill faced by the government for the Western Division alone exceeded \$30 million (*Fiji Times*, 10 March 1983). Following an initial high month when 200,000 persons received rations, food relief was continued for some 143,000 hurricane victims between March and November, in a programme for which the total costs were more than \$2.1 million. When the effects of the drought were finally felt some 237,710 persons received rations of various amounts valued at over \$800,000 to help offset their losses. By November 1983 over \$3 million in food relief had been distributed, more in dollar terms than all of the food relief given in the decade starting in 1972.

Early estimates of the costs of home replacement and repairs indicated that some \$15.4 million would be required. Such money was simply not available. A new programme was developed in which \$6,000 low-interest (8 per cent) loans were to be provided by the Fiji Development Bank and Fiji Housing Authority to farmers with “proven capability” to repay, and grants of \$500 would be made to those who did not qualify. Staff of the Department of Relief, Rehabilitation and Rural Housing were to assess applicants in terms of the types of assistance they would

require. By the end of October 1983, some 2,171 applicants had been provided with the \$500 grants, a further 1,602 had been approved for assistance, 1,169 were passed on to the Fiji Development Bank or Housing Authority for loan consideration, and a further 1,069 applications were still being processed. For the repair and replacement of school buildings a total of \$2,142,801 was allocated. The costs of the events of 1983 in relief and rehabilitation terms alone were clearly very high and by November 1983 the expenditure of the Department of Relief, Rehabilitation and Rural Housing was \$8,845,267. This figure does not include other costs to government programmes such as Public Works (c. \$700,000), Fiji Electricity Authority (c. \$1,300,000), Fiji Pine Commission (c. \$6,000,000), Telephone Services (c. \$366,000), and Drainage and Irrigation Works (c. \$770,000) (*Fiji Times*, 11 March 1983, p. 1). These costs probably amounted to well over \$10 million, but do not include the loans to be issued by the Fiji Development Bank and Fiji Housing Authority, which on the basis of the above figures would easily exceed \$6 million,

IS FIJI BECOMING MORE HAZARDOUS?

The perceived necessity for the Committee's wide-ranging programmes, the rapidly increasing costs of relief, rehabilitation, and reconstruction, and the growing dependence upon external assistance during and indeed since the Committee's term suggest that Fiji may be more vulnerable to hurricanes than it was in years past. As was indicated in Chapters 3 and 4, the trend towards expansion of assistance to disaster victims by centralized agencies and increasing costs for repair of government services has been continuing since the earliest government relief programme in 1886. However, it also seems clear from the information presented in Chapter 4 that since the seventies, the effects of inflation notwithstanding, the costs have increased at a rate far greater than had been experienced before.

The increasing post-disaster costs during the nineteen-seventies and into the eighties fall into two major categories. The first is related to the vulnerability of government services and property, and is to a large extent explained by the growth in these activities. The costs of reconstruction activities in the government sector do

not increase greatly through time when expressed as a percentage of the national budget. Most of the post-disaster costs incurred by the government sector are for public works (especially roads and bridges), telephone and electricity services, and so on. These services tend to be heavily concentrated on Viti Levu and the focus of post-disaster programmes in this respect is usually towards the national "centre." In contrast, relief and rehabilitation programmes tend to be mostly directed towards the rural sector. In particular, participants in the mixed cash—subsistence economy, located at the periphery of the nation, have made up the majority of recipients of this type of assistance. While the growth of government services and its attendant spread of vulnerability may be relatively easily explained, the apparent growth in vulnerability of the rural areas is a little more difficult to understand.

A commonly used definition of the term natural hazard, developed by Burton, Kates and White (1968), provides a useful perspective on this problem of increasing vulnerability. In their view natural hazards are part and parcel of the processes by which resources are obtained. Societies develop sets of activities (which in sum may be called a "human use system") through which they interact with the environment (which may be called the "natural events system") to obtain and use resources. This interaction also involves an element of risk, especially in the event that extremes, which occur in the natural events system from time to time, conflict with activities in the human use system. Often societies respond to this hazardousness by developing numerous and effective adaptations and adjustments to their human use system that serve either to mitigate the disruption caused by the extremes or to prepare them better to cope once disruption has occurred. The degree of vulnerability of any community is a function of the characteristics of the natural events system (especially with respect to extreme events), the types of activities incorporated into the human use system, and the adaptations and adjustments to that system.

In Chapter 1, a review of the frequency and magnitude of storm occurrence over the past century indicated that although the decade of the Committee was characterized by the highest rate of storm occurrence, it was not necessarily exceptional. The 1970s actually experienced only one more event than the first

decade of the review period, and two other decades during the century had fourteen storms recorded. If indeed Fiji is becoming more hazardous, the reasons will evidently be found, not in changing frequency of occurrence of extremes within the natural events system, but in changes in the human use system. In the first section of Chapter 3 it was shown that the human use systems which characterized traditional Fiji were relatively stable in view of the environment in which they existed. In addition a number of adjustments and adaptations served to further enhance community resilience in the face of environmental extremes. Many of these characteristics changed following the times of earliest European contact, as is indicated in the second part of Chapter 3: changing land-use practices (in both cash and domestic food production), reduced inter-community linkages, changing house-building styles, and changing patterns of social organization are but some of the main examples. While parts of the traditional systems remain, the contemporary human use systems of rural Fiji are largely characterized by a number of grafted innovations for using the natural events system, without the inbuilt sets of adjustments to the same patterns of extremes that still characterize the natural events system.

From this perspective the contemporary human use systems of Fiji are indeed much more vulnerable than in previous times. The provision of post-disaster assistance in increasing amounts may be seen as a response to that increased vulnerability. However, it may also be argued that the relief, rehabilitation, and other forms of post-disaster assistance are themselves factors that further serve to undermine or replace the adaptations and adjustments to the human use system for coping with environmental extremes. Unfortunately, the victims of hurricanes have no control over this type of adjustment, which at the same time removes the incentive for the continuation of other types of adjustments and adaptations, formulated independently and under localized systems of control. For present-day relief administrators a dilemma is created. The dangers of continuing a trend towards such dependency are obvious: if for any reason at some future point it was decided not to provide relief the hardships might indeed be very severe. On the other hand, in the immediate aftermath of hurricanes, the short-term needs of the victims may often seem much more pressing.

The relief and rehabilitation programmes provide a very important welfare function for a significant section of the national population that is seen by many as disadvantaged. The programmes are focused towards communities located on the periphery of modern Fiji, often in isolated and small natural events systems, with narrow resource bases, which provide for their occupants little opportunity to enter fully into Fiji's development progress. Such peripheral communities are becoming increasingly marginalized as the remainder of the nation enters more and more into the world consumer economy. Extremes in the natural events system add very heavily to their marginalization. After disasters, with their tenuous link to the cash economy shattered (for a number of years), regular food supplies badly damaged, and homes destroyed, the inequalities between the periphery and centre of Fiji are usually greatly exacerbated. In relative terms at least, hurricanes in Fiji have their most significant impacts on the rural communities of mixed cash-subsistence farmers. The programmes of relief and rehabilitation may therefore be seen as a means of redressing this periodically highlighted imbalance. (It is not suggested that this group is the only one that suffers excessively from disasters. Other groups, such as the rural poor—squatters, in areas of intensive commercial agriculture — are also marginalized by disaster impact. Likewise, squatters in urban and peri-urban areas, especially those without employment, are also seriously disadvantaged when their homes are destroyed by storms.) The highest rates of urban migration are from these locations and it is likely that these rates would increase significantly if it were not for the relief and rehabilitation. Bedford (1976) noted, for example, that a number of people living on Kabara only decided against moving to Suva in search of wage employment following Cyclones Lottie and Val because food relief was provided. From this perspective the relief, in addition to its purely humanitarian value, may help to offset the need for considerable expenditure in social and other public services in the main centres.

However, as with the previous explanation of increased vulnerability, it may be argued that these programmes, in the long term, serve only to increase the marginalization of the communities of the rural periphery by reducing the importance of their own

methods for coping with environmental stress. The problem here is that the underlying issues of inequality in access to cash and other services between the core and the periphery are not solved by such aid. Measures such as relief-giving may briefly counter the imbalance, or perhaps lessen its visibility, but the value of such programmes only lasts over the short term. Consequently, the rural areas, already dependent upon an economic system over which they have little control, find themselves at the end of a long line of decisions and transactions regarding their means of coping with disaster. From this viewpoint, assistance given with the purpose of reducing the marginalization of the periphery serves in fact to increase it.

The two explanations for vulnerability thus far presented (both of which are closely related) assume that the rural periphery of Fiji has indeed lost its ability to cope, that paradoxically, the one section of Fiji which still has many of its traditions (which were well adapted to the hazardous environment) somewhat intact, has apparently become less able to cope with hurricane occurrence. In response it may be suggested that in many instances communities could still cope independent of, or at least with much less, centrally organized assistance if it were necessary. The issue here relates to contemporary perceptions of hardship and contemporary aspirations to material welfare — many of the traditional means of coping are no longer seen as desirable or, when weighed against the almost certain expectation of relief and rehabilitation assistance, are seen as less desirable. From this perspective the vulnerability of the rural periphery is only apparent, because the capability for self-reliance is indeed still very strong but underestimated and therefore underused. In this case much relief assistance and other forms of aid are given on the basis of incorrect assumptions or perceptions of the distribution of devastation and community ability to cope. Nevertheless such aid as *is* given serves to undermine what self-reliance still exists by reducing the need for a continuing self-reliant perspective in rural areas.

Thus we have three lines of argument relating to the degree of vulnerability in rural Fiji. First, that vulnerability is increasing through changes in human-environment interactions, second, that the vulnerability is essentially a function of spatial inequalities in the distribution of resources and services, and third, that

the vulnerability is only greater because of different perceptions of what constitutes a reasonable coping system. From each of the perspectives presented the conclusion may be drawn that relief and rehabilitation do indeed serve to undermine local self-sufficiency in the face of disaster. If the present rates of this type of assistance are continued, or continue to increase, there is little doubt that the disaster and dependency syndrome thus fostered would place the rural periphery in a state of high vulnerability. However, those communities at present still have the cultural and physical resources to cope independently if necessary, although at levels of hardship greater than most are prepared to endure, especially in comparison with urban dwellers. The following sections outline some means by which this post-disaster hardship might be reduced, without the presently massive levels of assistance, and by which the rural periphery may attain an increased degree of self-reliance in the face of disaster.

REDUCING THE VULNERABILITY: "THE SELF-RELIANT COMMUNITY"

While it is relatively easy to identify the causes of the growing vulnerability, the solutions are much more difficult to determine. The contemporary vulnerability has its roots in the structure of the national economy, which is characterized by strong disparities between the centre and the periphery. While many communities and individuals on Viti Levu, especially in the urban areas, have access to modern coping methods (e.g. savings, insurance, sturdy homes, permanent wage earnings, etc.), the traditional means of coping have largely been undermined in the periphery and left without any adequate replacement. Redressing this regional inequality is an important theme of *DP8*, Fiji's eighth development plan (Central Planning Office, 1980), and is a prerequisite to reducing the rural vulnerability. Nevertheless, through forward planning the hazardousness of Fiji can be reduced and the hardship presently suffered by rural communities as well as the costs incurred by the nation as a whole, may be significantly lessened. At the same time, however, if the peripheral areas of Fiji are to maintain a high level of self-reliance in the face of disaster, the measures instituted must be consistent with their populations,

and their cultural and physical resources. Furthermore, many of the ideas presented below emphasize the return of responsibility for mitigation and preparedness to the potential victims themselves, thereby reducing the strong dependency presently found in their disaster coping mechanisms.

There are three main ways of dealing with disasters. *Prevention* measures focus upon the natural events system and attempt to modify the extremes so as to reduce their magnitude. Such measures tend to be mostly at a developmental stage, very expensive, and unpredictable. *Mitigation* measures involve modification of the human use systems to reduce the likelihood that they will be adversely affected when extremes occur. *Preparedness* measures stress improving the means of coping with disasters after they occur; such measures aim to make the processes of recovery and rehabilitation more efficient and rapid.

The discussion which follows emphasizes methods of reducing vulnerability that are drawn from the last two categories, as well as the importance of traditional adjustments or adaptations and their contemporary equivalents. Nevertheless, non-traditional considerations may also be usefully taken into account. It is not suggested that all of the options listed below are likely to be suitable for any particular community or area. Indeed most of them may not be, but they should provide a little food for thought and perhaps some ideas for other, more locally practicable schemes.

Traditional Means of Coping in Contemporary Fiji

Although the increasing vulnerability to disasters is in large part due to numerous traditions that formerly provided considerable security in a hazardous environment having fallen into disuse, these traditions are not necessarily inappropriate in the context of contemporary Fiji. Their underlying wisdom may be very relevant to the present day. These traditions include the value of community involvement and responsibility for coping with disaster, the importance of maintaining a diverse ecological-resource base, food preservation, storage, and salvage, and inter-community linkages. Our discussion of ways in which vulnerability might be reduced begins with a review of some of these traditional measures (and their contemporary analogues) for it is most likely that these, in principle at least, will be the most likely to succeed.

Community Involvement

From the onset of disasters, most communities in Fiji display considerable cohesion as members provide mutual assistance, share the burdens of lost property and even lives, and give to each other the very important psychological support necessary to cope in both the short and the long term. The cleaning up of debris, putting the village back into a livable condition, and the sharing of meagre resources are all aspects of this type of involvement. However, community solidarity is also an extremely important prerequisite for overall disaster preparedness and mitigation, not just recovery, in rural areas (e.g. Thaman, Meleisea, and Makasiale, 1979). Most rural communities still have well-defined systems of leadership that may be utilized to coordinate and mobilize human resources to foresee and prepare for natural disasters. For example, food preparation and preservation, a somewhat onerous task, may be more easily achieved if carried out on a community basis. Thaman, Meleisea, and Makasiale point out that given a disaster warning, mitigation measures such as propping up bananas or trimming cassava or banana leaves might be much more efficiently carried out on a coordinated community basis. They point out that the self-reliant community would have the props for supporting the bananas prepared and stored in advance.

This concept of community solidarity, leadership, and coordination was the underpinning of the successful traditional capability for coping with disasters. In contemporary rural Fiji it would seem pointless to promote measures for reducing vulnerability without promoting such community involvement, for they would probably struggle to succeed. That the strong tradition of community solidarity is still found in Fiji is without doubt, not only at the village level but in settlements, towns, and even on a national basis. The predictable, rapid, and generous responses within Fiji to the opening of relief funds after disasters provide adequate testimony to this point. Mobilizing and coordinating such community solidarity in advance would help to ensure that less would have to be given after disasters strike in the future.

These measures could comprise community involvement from the outset. Vulnerability analysis, including assessment of housing and agricultural activities, could enable communities to establish checklists of both long-term and short-term priorities for

mitigation and preparedness and to allocate responsibilities and develop contingency plans accordingly. Communities could develop their own programmes with assistance from the Department of Relief, Rehabilitation and Rural Housing, for example, which could make available instructional resources appropriate for this kind of community development and where necessary provide certain types of expertise. Such a process, however, need not be complex at all, and for effective results at any level, pre-disaster planning and preparedness should be kept relatively simple. The value of such a programme, which in its initial stages would need to be heavily promoted and given some institutional support, is that the disaster and dependency syndrome would be gradually undermined, and the state of community self-reliance established in its place could well spill over into other activities beyond the realm of disaster preparedness alone.

Agricultural Diversity

In Chapter 2 it was shown that different crops have different susceptibilities to the extremes of the elements exhibited during hurricanes. Some crops are more or less vulnerable, depending on the type of extreme — wind, salt, water, or wave — to which they are exposed. As the type of dominant extreme is likely to vary from storm to storm, even at the same locality, maintaining a variety of crops has several obvious advantages. Often the crops which seem most resilient are less productive or popular. Therefore the combination of diversity of crops, together with the maintenance of the forest ecosystem where possible (with all of its natural diversity), and perhaps the restoration or partial restoration of yams as a key crop within a diverse agricultural structure, would be an important hedge against total devastation of food supplies by disasters.

Unfortunately, similar principles may not be so easily applied to cash-cropping in many of the outer islands where the coconut dominates. Despite their high degree of vulnerability to hurricanes and pedestrian recovery rates, serious problems arise in terms of a lack of other suitable cash crops for the small and isolated islands. With this inbuilt vulnerability of the cash economy to disaster (in contradistinction to urban dwellers and, with rare ex-

ceptions, sugar farmers) the case for rebuilding the resistance of the subsistence economy is most important. In islands where there is potential for developing other cash crops the opportunities should be taken to diversify these activities. The fundamental distinction between wage earners and present-day mixed cash-subsistence farmers is that the former group may continue to obtain income as usual, in the weeks and months following a hurricane, while the latter group may not. Increasing agricultural and general resource diversity would help reduce the sharp centre-periphery contrast in this aspect of vulnerability to disaster.

Food Storage, Preservation, and Salvage

The importance of food storage — in particular the making of *madrai* and dried fish — was discussed in Chapter 3. Today, one of the key features of disasters is that communities very rapidly become short of food while most crops rot in the ground. Traditional systems of preservation, both before disasters and in the role of salvage, may also be supplemented by methods from other areas that serve the same purpose. Many such methods are quite labour intensive and time consuming and would require a good degree of community organization. There is also considerable potential for the application of new methods being developed for food processing at the local level in rural areas (Crawford, 1983). The promotion of both traditional and non-traditional methods could be developed through community awareness programmes and other types of extension work.

Intercommunity Linkages

It is extremely rare for all of Fiji to be smitten by disaster. With the traditional methods mentioned in this section alone it would seem that the crises of food supply in rural areas could be somewhat offset. By making use of surpluses in areas not affected by the disaster, the need for externally generated food relief items can be further reduced. This would require considerable organizational flexibility in the national shipping and marketing infrastructure. Nevertheless, present relief distribution practices do already overcome shipping and other logistical problems. The more important

problem lies in the nature of international aid, which is usually in kind. If funds could be obtained to finance such a programme, in particular the purchase of local crops, the national economy would benefit considerably and the supplies of rations given would be nutritionally superior and often much more culturally appropriate. Some other problems would also have to be overcome, such as the storage of taro and cassava. Steady developments in food processing, especially as they relate to root crops, may help overcome some of these difficulties and increase the feasibility of increasing the food independence of the country after disasters. If this type of response were to be developed, traditional linkages need not be the only ones reopened in the development of an integrated system of national self-sufficiency.

Non-Traditional Coping Methods

The value of traditional coping methods is clearly extremely important. If these methods were promoted there is little doubt that community self-reliance and national self-sufficiency would be considerably enhanced. Other, non-traditional aspects of disaster-preparedness and mitigation may also assist in this process and help reduce the rapidly escalating costs of disaster which reflect the growing vulnerability to disaster in Fiji.

Reduced Housing Vulnerability

The Committee made a very important contribution towards ensuring that at least those houses rebuilt with official assistance after hurricanes would have increased resistance when the next storm occurred. Moreover, through the rural housing programme, many other new homes built in rural areas of Fiji will have the same qualities as a result of the Committee's work. However, these houses represent only a small proportion of all houses in Fiji, even rural Fiji. For the great part most rural homes are built without much regard to the numerous means available for improving the strength of buildings in the face of hurricane-force winds. Many of the factors that reduce vulnerability were discussed in the later sections of Chapter 2 (see especially Tables 2.9 and 2.10). A programme of informing prospective house

builders of the mitigation measures they might incorporate into the construction of their new homes would help ensure that future disaster tolls on dwellings could be considerably reduced. However, the biggest reduction in housing losses after disasters would only occur if existing houses of all types were retrofitted. Most such improvements can be made to existing homes in ways that are relatively inexpensive, easily carried out, and that make considerable use of locally available materials. These measures could easily be carried out at the community level with minimal external assistance except perhaps for the development of instructional aids and other forms of community awareness programmes. The benefits in terms of reduced hardships and savings after disasters strike would be considerable.

Insurance

Insurance against natural hazards may be viewed as a means by which a large group of policy holders (including victims and non-victims) share the burden of repair or replacement costs after disaster. The importance of this type of adjustment to disaster, or preparedness measure, has grown steadily in Fiji since the early seventies and, as was shown in Chapter 4, insurance claims accounted for many millions of dollars in post-disaster payments when storms affected Viti Levu. Following Cyclone Oscar it was estimated by only three of the country's major insurance companies that their combined payouts alone would exceed \$3.5 million (*FijiTimes*, 4 March 1983).

While insurance is a very useful means of dealing with disaster losses it does not have much utility in the lowly monetized communities of the rural periphery. Furthermore, to the present there has been no crop insurance, which if it could be instituted would certainly help offset some of the heavy losses, at least for the commercial farmers such as the cane producers who suffered so heavily during the 1983 drought. Although crop insurance has been proposed for Fiji on a number of occasions through the years since 1906 (UK, CO 83/83, no. 101), the major constraint upon it is the smallness of the country, as insurance is based upon the expectation that the great majority of non-victims at any one time subsidize the losses of a much smaller number who actually

suffer losses. By working in combination with other countries (e.g. the countries of the South Pacific Forum) the proportion to be assisted at any one time might be substantially decreased. Such a scheme, proposed at one time for "Forum" farmers, has been carefully analyzed by Amerasinghe (1982) who outlined the many difficulties confronted by such a scheme, but nevertheless considered the effort and patience needed to overcome them well worth it in the long term.

The role of insurance for housing and other capital property investments is bound to grow, especially on the main islands and in the urban centres. In 1981 the commissioner of insurance noted that insurance companies in Fiji, through overly competitive promotion of policies, had in essence inadequately covered themselves. In the event of numerous, substantial payments being necessary, such as after a hurricane in a heavily populated area, such companies might fail (Fiji Bureau of Statistics, 1981). Another important aspect of insurance is that in many ways it promotes preparedness for recovery rather than mitigation. One way to counteract this tendency might be for insurance companies to establish lower premiums or bonuses for those who incorporate approved mitigation measures into their buildings. However, for rural dwellers as a group, disaster insurance is an expense most cannot afford. For this group mitigation measures are of supreme importance.

Alternative Crops

In 1889 Governor Thurston wrote to the Colonial Office outlining his plans for agricultural and industrial development in Fiji based on a set of primary economic activities that would be only minimally vulnerable to natural disasters, especially hurricanes:

The frequently recurring losses and constant annual risks incurred at present by agriculturalists ... and the means of reducing or avoiding them have been long under my consideration ... it would appear that planters should devote their attention to the culture of products that could be planted, gathered and dispersed of during the period of immunity from danger which three fourths of the year presents to them. (UK, CO 83/50, no. 22)

Thurston went on to mention a number of crops that he believed might be suitable and could be refined in Fiji and marketed elsewhere.

Should such be the case it will enable planters... to secure themselves in a large measure against the losses of crops and all its attendant difficulties so often experienced by those depending solely upon coconuts, and it will indirectly render the revenue of the Colony more certain. (UK, CO 83/50, no. 22)

Thurston's plans were not to have lasting effect. Clearly he was under a misapprehension as to the length of the hurricane season, but more fundamental issues make the likelihood of successfully changing Fiji's agriculture to crops more likely to resist hurricane damage doubtful. The economic viability of most cash crops is low, especially with respect to the smallest and *most* isolated islands. Further restrictions result from environmental restraints—even under non-extreme conditions, not all crops will grow in Fiji.

However, it would appear that the traditional array of subsistence food crops, both uncultivated and domesticated, is sufficient to ensure a well-balanced hedge against devastation. Certainly, there is no widespread range of disaster-resistant crops elsewhere in the world that could be grafted onto Fiji's present agricultural systems without substantial dislocation and disruption. Indeed, with respect to disaster preparedness and mitigation measures, this point cannot be too strongly made. The cultural, human disaster that would follow many radical programmes would probably be more devastating than any natural event. Nevertheless, ongoing appraisals of possible options for increasing crop stability would clearly be prudent. Similar appraisal of large-scale development proposals involving cash crops would also serve to help avoid the heavy losses that frequently set back such schemes, often at very considerable costs.

Land-Use Planning and Locational Considerations

In the same report as quoted above, Thurston noted that maintaining a diversity of locations is another way of minimizing a shattering of the national economy.

It is seldom that the whole of the Colony suffers from the visitation of cyclonic storms. When the Eastern part is injured the Western escapes and "vice versa." This being the case the more widely and profitably agriculture and other industries can be extended the more able would the aggregate prosperity of the colony be to bear particular losses. (UK, CO 83/50, no. 22)

As with his plans to change the commercial crops, this idea had numerous economic and environmental drawbacks, but in principle the concept is sound, not only at the national level but at all levels. At the local level, this tenet is often put into practice as farmers work land in more than one location. How this may serve to reduce the likelihood of total and widespread damage is unknown but may well prove to be a mitigation measure of no small importance.

Aside from agriculture, a broad range of other economic and settlement activities are often located on hazardous sites. River flood-plains have become the nub of agricultural activity on the large islands and throughout the outer islands, and in coastal areas on the main islands, most settlements are located on low-lying coastal plains. On Viti Levu and some outer islands tourist resorts are located on similarly vulnerable coastlines. While consideration is often given to flood probabilities by engineers constructing bridges and other hydrological installations, extremes are rarely planned for in coastal engineering schemes. Land use zoning and the development of standards for structures in zones considered to be vulnerable is another means by which vulnerability may be further reduced.

A number of possibilities may help to reduce vulnerability, especially (though not exclusively) in the rural periphery of Fiji. Just as diversity in agriculture has been promoted in this book as a very important hedge against disaster, so too is diversity in mitigation and preparedness measures. Any measures that are considered for reducing vulnerability should be carefully assessed against a number of criteria. Schemes to reduce vulnerability should be technically sound, culturally appropriate, economically viable, and environmentally suitable. Most important of all, any programmes designed to improve mitigation and preparedness capability must be set against the availability of technical, human, and financial resources to the community involved.

This has been a study of response, at the national scale, to disasters in Fiji: the Committee was a centralized agency formed to receive incoming disaster assistance, much of which originated overseas, and to coordinate its distribution. In post-disaster recovery operations such a centralized body is clearly quite necessary if relief and rehabilitation efforts are to proceed efficiently, without duplication or omission. From 1972 through 1982 the Committee played an extremely important role in reducing suffering and hardship once hurricanes had occurred. In so doing it established an impressive record in carrying out large and comprehensive relief and rehabilitation programmes. However, reducing the vulnerability which makes such programmes necessary in the first place can only be achieved through efforts at a different scale. While there will always be a need for assistance to disaster victims, it could be substantially reduced through an increased community orientation in the disaster preparedness planning process, especially in rural areas.

Appendix 1

Membership of the Committee

Chairman: * Rt. Hon. Ratu Sir Kamisese K..T. Mara, K.B.E.

Members: * Mr C.D. Aidney, D.F.C., O.B.E.
* Mr Dan Costello
* Mr Brian F. Derrick
Mrs Susan Douglas (joined at 32nd meeting, April 1979)
Mr Sethi Narain (joined at 2nd meeting, November 1972)
Mr Shiu Narain (joined at 25th meeting, November 1975)
* Hon. Livai Nasilivata, M.C.
* Hon. C.S. Pillay
* Mr Hari Punja, O.B.E., J.P.
* Mr Mosese Qionibaravi, C.M.G.
Mr Y.P. Reddy, O.B.E., J.P. (joined at 2nd meeting, November 1972)
* Mr Vivekanand Sharma
* Mr Dijendra Singh, O.B.E.
* Mr Wate B. Tagilala, M.B.E.
* Mr J.S. Thompson, C.M.G., M.B.E.
* Mr Tomasi R. Vakatora

Secretaries: Dr. I.Q. Lasaqa (October 1972-June 1974)
Mr J.D.V. Cavalevu (July 1974-July 1980)
Mr M.M.K. Yasa (August 1980-March 1982)
MrTemo Stuart (April 1982—September 1983)

*Original Members

Appendix 2

Catalogue of Tropical Storms and Hurricanes in Fiji

Note: Visher's data in particular have been checked where possible —against the information in Holmes' numerous publications and that provided by Twentyman, This has resulted in the deletion of some events listed by Visher (especially for 1922/23) and changes in the details he provided, especially for events in the late nineteenth century. While it was the aim in this compilation to include only events that caused significant damage in Fiji, and it is likely that the great majority were either tropical storms or hurricanes, some of those included may have been of lesser magnitude.

<i>Year and date</i>	<i>Location</i>	<i>Damage and other comments</i>	<i>Name</i>	<i>Source</i>
<i>Events Prior to 1880 (Record incomplete):</i>				
1831 21 Mar	Eastern Viti Levu, between Viti Levu and Vanua Levu	Two ships known to have been wrecked		Derrick, 1950
1840 25 Feb	Eastern Viti Levu	Flooding of the Rewa		Derrick, 1950; Visher, 1925
1840 Mar	Macuata	Crops reported to have been destroyed		Wilkes, 1854
1842 22Jan	Lau	Recorded as "severe"		Derrick, 1950
1844 c13 Mar	Somosomo	Reported to have been "severe"		Derrick, 1950
1848 13-16Jan	Details not given	Details not given		Derrick, 1950
1848 5-6 Apr	Widespread throughout group	Severe		Derrick, 1950; Visher, 1925
1854 17 Mar	Western Fiji, north-eastern Viti Levu	Details not given		Derrick, 1950
1856 Mar	Bua	Details not given		Holmes, 1877

	Northern Fiji	Severe	Visher, 1925
1860 28Jan	Details not given	Details not given	Visher, 1925
1864 29 Mar	Lau	One ship recorded lost with all hands	Holmes, 1877; Visher, 1925
1866 8Jan	Between Vanua Levu and Viti Levu	Widespread damage on both islands	Derrick, 1950
1866 10-12 Mar	Bua and Levuka	“Hurricane of extreme violence”	Holmes, 1877; Visher, 1925
1871 30 Mar	Yasawa, Bua, Ovalau, and Nairai	Heavy rains recorded at Bua and winds believed to have been stronger in the west of Fiji	Holmes, 1877
	Entire group	Severe, centre over the west	Visher, 1925
1873 3-7Jan	Bua Details not given	Minor Details not given	Holmes, 1877 Visher, 1925
1873 30 Dec	Details not given	Moderate, serious losses of shipping	Holmes, 1877
	Western Vanua Levu	Details not given	Visher, 1925
1874 15 Feb	Western Fiji (“not felt very severely on the east side”)	Minor, heavy rains at Bua	Holmes, 1877
1875 7-8Jan	Vanua Levu, Viti Levu, and Ovalau	Severe, serious damage to shipping and houses at Levuka.	Holmes, 1877

		Rotuma (January 4) and Yasawa	Details not given	Visher, 1925
1875	16-20 Feb	Details not given	Severe	Visher, 1925
1875	12-13 Mar	Details not given	Severe	Visher, 1925
1875	15 Nov	Between Vanua Levu and Samoa	Details not given	Visher, 1925
1876	10 Jan	Bua	Minor, heavy rainfall recorded in Bua, but little damage	Holmes, 1877, 1881; Visher, 1925
1876	16 Mar	Bua North-east coast of Viti Levu, south of Ovalau	Minor Details not given	Holmes, 1881 Visher, 1925
1877	31 Mar	Details not given		Visher, 1925
1879	11-12 Dec	Entire Fiji, especially north-west and west Viti Levu, Rotuma	Severe	Holmes, 1887a; Visher 1925
1880	21-26 Jan	Details not given	Severe	Visher, 1925
<i>Events From February 1881 to April 1939 (Details often incomplete):</i>				
1881	2 Feb	Vanua Levu, eastern Viti Levu and Ovalau	Minor	Holmes, 1887a; Visher, 1925
1881	Mar	West of Viti Levu	Details not given	Visher, 1925

1881 31 Dec	Bua	Minor, heavy rains recorded	Holmes, 1887a
1882 Jan	South-east of Viti Levu	Details not given	Visher, 1925
1883 12Jan	Eastern Fiji and Taveuni	Details not given	Visher, 1925
1883 24 Feb	Ovalau	Moderate, serious damage on land and sea with two known fatalities (due to house collapse) at Levuka	Holmes, 1887a
	Centre at Levuka, Taveuni	Details not given	Visher, 1925
1883 12-20 Mar	Details not given	Severe	Visher, 1925
1883 27 Dec	Bua	Minor, heavy rains recorded	Holmes, 1887a
1884 9Jan	Bua	Minor	Holmes, 1887a
	North--west Vanua Levu, centre at Bua	Details not given	Visher, 1925
1884 6-8 Feb	Bua	Minor	Holmes, 1887a
1886 Jan	West coast of Viti Levu	Details not given	Visher, 1925
1886 3-4 Mar	Widespread, especially northern and eastern Fiji	Severe	Holmes, 1887b
1887 30 Mar	Details not given	Details not given	Visher, 1925
1888 Feb	Taveuni, Ovalau	Details not given	Visher, 1925
1889 23Jan	Taveuni, Ovalau	Details not given	Visher, 1925
1890 15 Feb	Lau	Details not given	Visher, 1925

1890	24 Dec- 6Jan	Taveuni	Details not given	Visher, 1925
1891	18-19 Feb	Lau	Details not given	Visher, 1925
1891	24 Dec	Between Viti Levu and Lau	Details not given	NZ Met Service, n.d.
1892	Dec	North Vanua Levu and Yasawa	Details not given	Visher, 1925
1895	6-7Jan	East Vanua Levu and Viti Levu, Ovalau Centre over Levuka	Details not given	Visher, 1925
1899	31 Dec	Lau	Severe	Visher, 1925
1900	4 Feb	Lau	Details not given	Visher, 1925
1900	12 Mar	Lau	Details not given	Visher, 1925
1901	27Jan	Lau	Details not given	Visher, 1925
1901	13-14 Mar	North-east Viti Levu	Details not given	Visher, 1925
1901	2 Apr	Lau	Details not given	Visher, 1925
1901	26 Dec	Rewa	Details not given	Visher, 1925
1902	30 Dec	Ovalau and Nausori	Details not given	Visher, 1925
1903	17 Jan	Lau	Details not given	Visher, 1925
1903	10 Apr	Taveuni, east of Ovalau	Details not given	Visher, 1925
1904	21 Jan	Central Fiji	Severe	Visher, 1925
1905	6Jan	Taveuni and Lau	Details not given	Visher, 1925

1905 20Jan	Viti Levu and Lau	Details not given	Visher, 1925
1908 9 Jan	East Vanua Levu and Lau	Details not given	Visher, 1925
1908 23 Mar	West and south Viti Levu	Details not given	Visher, 1925
1909 25 Mar	Entire Fiji	Details not given	Visher, 1925
1910 24-25 Mar	Lau and Viti Levu	Severe	Visher, 1925
1911 22 Dec	West Fiji	Details not given	Visher, 1925
1912 28-29 Jan	Entire Fiji	Severe (west Vanua Levu)	Visher, 1925
1913 2-9 Feb	Details not given	Details not given	Visher, 1925
1913 17-18Mar	South-east Viti Levu, Taveuni, Lomaiviti, eastern Viti Levu	Details not given	Visher, 1925
1913 16 Apr	Lau	Severe	Visher, 1925
1914 13 Mar	Lau, Ovalau, and northern Viti Levu	Details not given	Visher, 1925
1914 24 Dec	Southern Lau, Ovalau, and north-east Viti Levu	Details not given	Visher, 1925
1915 26 Feb	Southern Fiji	Details not given	Visher, 1925
1919 9 Feb	Yasawa	Details not given	Visher, 1925
1919 28 Mar	Central Fiji, Taveuni, and Lau	Details not given	Visher, 1925
1920 24 Feb	Northern Lau	Details not given	Visher, 1925

1920	3-4 Mar	Details not given	Details not given	Visher, 1925
1921	13 Feb	Lau	Details not given	Visher, 1925
1923	15-16Mar	Lau	Details not given	Visher, 1925
1923	13 Dec	Eastern Fiji	Details not given	NZ Met Service, n.d.
1926	6 May	Yasawa	Minor	NZ Met Service, n.d.
1929	18-22Jan	Yasawa and south-west Viti Levu	Minor	NZ Met Service, n.d.
1929	18-19 Feb	Western Fiji	Minor	NZ Met Service, n.d.
1929	28 Nov	North-east Fiji	Severe over narrow belt, centred at Bua	NZ Met Service, n.d.
1929	10-13 Dec	Entire Fiji	Severe	NZ Met Service, n.d.
1930	11-12Jan	Lomaiviti	Small but severe	NZ Met Service, n.d.
1930	30 Nov	North-east Viti Levu	Severe	NZ Met Service, n.d.
1931	16 Feb- 3 Mar	Entire Fiji	Severe	NZ Met Service, n.d.
1931	7-8 Apr	South Viti Levu and Kadavu	Minor	NZ Met Service, n.d.
1936	19Jan	Central Lau	Small but severe	NZ Met Service, n.d.
1936	14-15 Feb	North-east Fiji and Lau	Minor	NZ Met Service, n.d.
1938	24-27 Feb	West of Viti Levu	Minor but heavy rain and moderate Hooding	NZ Met Service, n.d.

1938	21-22 Dec	West and south-west of Viti Levu	Minor but landslides and washouts blocked main roads	NZ Met Service,n.d.
1939	17-21 Jan	Viti Levu and Kadavu	Moderate	NZ Met Service,n.d.
1939	3-6 Apr	Rotuma and west of Fiji	Minor	NZ Met Service,n.d.
<i>Events from December 1939 to 1982:</i>				
1939	28 Dec	Western Viti Levu	Minor	Kerr, 1976
1941	20 Feb	Eastern Viti Levu	Severe. Serious disruption of communications and considerable damage in Suva	Kerr, 1976
1941	27 Apr	Eastern Vanua Levu and Lau	Moderate	Kerr, 1976
1941	26 Dec	Eastern Vanua Levu, Taveuni, and southern Lau	Minor	Kerr,1976
1943	1 Jan	Eastern Vanua Levu and Lau	Moderate	Kerr,1976
1943	17 Mar	Lau	Minor	Kerr,1976
1944	8-10Jan	Viti Levu and southern Lau	Minor	Kerr,1976
1944	18-19 Mar	North and west of Fiji	Minor	Kerr,1976
1948	3-4 Feb	North and west of Fiji	Moderate	Kerr,1976

	Eastern Vanua Levu and Lau	Moderate to severe	Kerr, 1976
1950 2 Feb	Northern Lau	Minor	Kerr, 1976
1950 25-27 Feb	Between Viti Levu and Vanua Levu	Moderate	Kerr, 1976
1950 30 Mar	Viti Levu	Moderate	Kerr, 1976
1952 24Jan	Vanua Levu and Lau	Minor	Kerr, 1976
1952 28Jan	Viti Levu	Severe	Kerr, 1976
1954 15Jan	North and west of Fiji	Minor	Kerr, 1976
1955 5-6Jan	North and west of Fiji	Moderate	Kerr, 1976
1955 27-28Jan	South of Viti Levu	Minor	Kerr, 1976
1956 30-31 Jan	West of Fiji	Minor	Kerr, 1976
1956 16 Feb	North of Fiji	Minor	Kerr, 1976
1956 25 Feb	Western Viti Levu	Moderate, heavy rains and flooding	Kerr, 1976
1956 6 Mar	Western Viti Levu	Minor to moderate. Further flooding although wind damage limited	Kerr, 1976
1957 26 Feb	Eastern Vanua Levu and Lau	Minor	Kerr, 1976
		Moderate to severe	Kerr, 1976

1958 9 Apr	Yasawa	Minor	Kerr, 1976
1958 2-3 Dec	Central Viti Levu	Severe	Kerr, 1976
1959 30 Dec	South of Fiji	Moderate	Kerr, 1976
1964 22-23 Nov	Eastern Vanua Levu and northern Lau	Minor	Kerr, 1976
1964 6-7 Dec	Rotuma, eastern Vanua Levu, and northern Lau	Minor	Kerr, 1976
1964 21 Dec	West of Viti Levu	Moderate to severe	Kerr, 1976
1965 6-9 Feb	North of Vanua Levu and west of Viti Levu	Severe	Kerr, 1976
1966 26-27Jan	North of Fiji	Minor	Kerr, 1976
1966 4-5 Dec	Viti Levu and southern Lau	Minor	Kerr, 1976
1967 9-10Apr	Vanua Levu and east of Viti Levu	Severe but small area	Kerr, 1976
1969 25-26 Feb	North of Fiji	Minor	Kerr, 1976
1970 11 Jan	North-eastern Fiji	Minor	Franco, Hamnett, and Makasiale, 1982
1970 29-30 Oct	Yasawa, Mamanuca, Viti Levu, Lomaiviti, and western Lau	Minor	Nora Franco, Hamnett, and Makasiale, 1982

1970 17-18 Dec	Yasawa, Mamanuca, south-western Viti Levu, and Kadavu	Minor	Priscilla	Franco, Hamnett, and Makasiale, 1982
1972 23-29 Oct	Entire Fiji	Severe	Bebe	Krishna, 1981
1973 2 Feb	North-eastern Fiji	Moderate	Henrietta	Krishna, 1981
1973 3-4 Apr	Vanua Levu	Minor	Juliette	Krishna, 1981
1973 9-10 Dec	Lau and Kadavu	Moderate	Lottie	Krishna, 1981
1974 26 Apr	North-eastern Fiji	Minor	Tina	Krishna, 1981
1975 31 Jan - 2 Feb	Southern and eastern Fiji	Severe	Val	Krishna, 1981
1975 5-6 Apr	Kadavu and southern Lau	Moderate	Betty	Krishna, 1981
1977 25-26 Dec	North-eastern Fiji	Moderate	Anne	Krishna, 1981
1978 4-5 Jan	Yasawa and western Viti Levu	Moderate	Bob	Krishna, 1981
1978 18-19 Feb	Northern Fiji	Minor	Ernie	Krishna, 1981
1978 29-30 Dec	Northern and eastern Fiji	Moderate	Fay	Krishna, 1981
1979 26-28 Mar	Kadavu and Lau	Severe	Meli	Krishna, 1981
1980 2-5 Jan	Western Fiji	Minor	Peni	Krishna, 1981
1980 24 Mar	North-eastern Fiji	Moderate	Tia	Krishna, 1981

1980 3-4 Apr	South-central Viti Levu	Severe. Only gale-force winds but extremely heavy flooding	Wally	Krishna,1981
1981 13—15Jan	Western Fiji	Severe	Arthur	
1982 Jan	Southern Fiji	Minor	Hettie	

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