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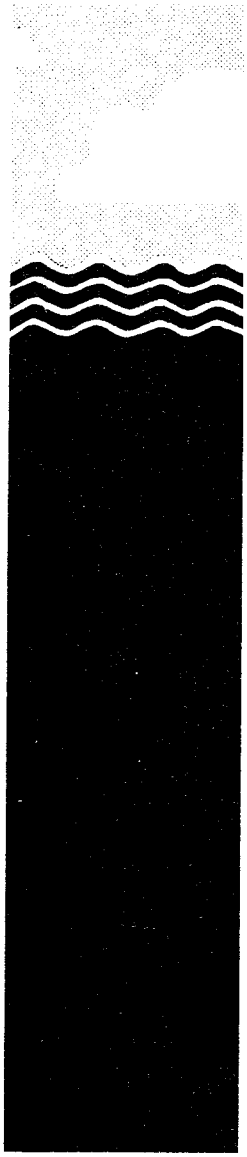

Commonwealth Fund for Technical Co-operation

A REPORT TO ESTABLISH GUIDELINES FOR THE MANAGEMENT OF A REGIONAL FUND TO PROVIDE INSURANCE FOR NATURAL DISASTER

Facsimile of the Report produced in 1976 and published by the South Pacific Bureau for Economic Co-operation

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COMMONWEALTH SECRETARIAT

A PROJECT TO ESTABLISH GUIDELINES FOR THE MANAGEMENT OF A REGIONAL FUND TO PROVIDE INSURANCE FOR NATURAL DISASTER

THE REPORT OF THE PILOT STUDY

PREPARED AT THE REQUEST OF THE COMMONWEALTH FUND FOR TECHNICAL CO-OPERATION

FOR

THE SOUTH PACIFIC BUREAU FOR ECONOMIC CO-OPERATION

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May 1976

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PREFACE

This Pilot Study, which was financed by the Commonwealth Secretariat under the Commonwealth Fund for Technical Co-operation, assesses the feasibility and conception of a Project to examine the establishment of guidelines for the management of a regional fund to provide insurance against natural disaster.

The geographical extent of the Study has been the region containing the nine members of the South Pacific Bureau for Economic Co-operation (SPEC) and the Study has been divided between:

Home based research.

Visits to the SPEC Secretariat and governments of member countries.

Report preparation.

Home based research has incorporated:

a. Discussions in London, an acknowledged centre of world insurance and reinsurance activity, with representatives of the insurance industry.

b. Considerable study of the results of research from the United Kingdom and the USA related to the insurance industry.

c. A preliminary appraisal of national schemes of insurance for natural disaster from some metropolitan countries.

d. A preliminary assessment of natural disaster occurrence in the region.

e. Considerable background study of the South Pacific region in general, and countries of the SPEC region in particular.

Visits to the SPEC Secretariat in Suva and the nine member governments commenced in early January and concluded in late February 1976. Countries and places visited were the Cook Islands (Rarotonga); Fiji (Suva and Nandi); Gilbert Islands (Tarawa); Nauru; Niue; Papua New Guinea (Port Moresby and Sogeri); Solomon Islands (Honiara); Tonga (Nuku'alofa); and Western Samoa (Apia and the island of Upolu). Additional discussions were held in Hong Kong, Canberra, Auckland and Honolulu.

The opportunity to undertake this Pilot Study and the visits in particular is acknowledged as a considerable privilege and I am greatly indebted to the Commonwealth Secretariat as the Commonwealth Fund for Technical Co-operation and the many representatives of the SPEC Secretariat and member governments that it has been my honour and pleasure to meet.

NOTE

A Report to Establish Guidelines for the Management of a Regional Fund to Provide Insurance for Natural Disasters (1976) Commonwealth Secretariat / South Pacific Bureau for Economic co-operation (SPEC - now the South Pacific Forum).

Reference Preface (p1):

Tuvalu became a member of the Commonwealth in 1978*, two years after the completion of this report. It is for this reason that the report, in it's original and published versions, makes no mention of Tuvalu, neither in the preface nor in the content or references. Nevertheless, probably in anticipation of Tuvalu's forthcoming membership, the Commonwealth Secretariat requested that a visit should be made to Tuvalu during the undertaking of this study.

See also: *Sea Level Rise: Tonga, Tuvalu (& Kiribati)* (1988)

1. INTRODUCTION

1.1. The Pilot Study has been made after the establishment of a fund and after some enquiry by SPEC towards the possible involvement of insurance industries in Australia and the United Kingdom. The fund was initiated by a donation from the Republic of Nauru of A$250,000 and has grown since on the basis of an agreement of an annual contribution from each member government of A$5000 from 1973 onwards. On its present basis and membership therefore, the fund will amount to approximately half a million dollars in about 1980. Contributions to the fund were agreed on the principle of equality amongst SPEC members, with the intention of using the income from the invested fund for the payment of premiums for insurance policies to cover losses incurred in natural disaster events within the region.

1.2. The region within the South Pacific covered by this Study comprises those nine countries which have achieved either independence or a form of self-government and who have therefore become eligible for membership of the South Pacific Forum, the economic 'arm' of which is the South Pacific Bureau for Economic Co-operation.

1.3. The geographic location of each member country within the South Pacific has only accidental relevance to the formation of any 'region' which in turn becomes only that area of ocean which happens to contain the member countries. Therefore, although the region can be said to be some 4,5000 miles West to East and some 2,500 miles North to South, not all countries within that area are members, so that the SPEC region is irregular and somewhat amoebic as its membership is likely to change and increase. For example, it includes Papua New Guinea and the Solomon Islands in the West, but not the New Hebrides or New Caledonia. It includes the Gilbert Islands and Nauru, but not the Tokelau Islands or Phoenix Islands (nor, at the inception of this Study, the Ellice Islands, now Tuvalu). It includes the Cook Islands and Niue, but not any of the islands of French Polynesia or the Kermadec Islands. The region is not therefore a geographical region in the true sense, but a region accidentally formed by political affiliation.

1.4. This political imposition over geographic formation includes many extremes in an overall area which, although irregular, is considerable. Distances may be reasonable - Tonga to Fiji: 430 miles, or considerable - Rarotonga to Fiji: 2000 miles, or Port Moresby to Fiji: 2500 miles. Port Moresby to Rarotonga is a significant 4000 miles. The land area of member countries is similarly extreme, ranging from 183,500 square miles for Papua New Guinea to 8 square miles for Nauru. The single island State of Niue is only 100 square miles in area, but that is greater than the total land area of the Cook Islands which, although extending almost 1000 miles from North to South, have a total land area of 93 square miles. Whilst Nauru and Niue are single island States, the Cook Islands have 15 inhabited islands; Tonga has 36; the Gilbert Islands have 37; and Fiji has 100. Population numbers are similarly extreme from almost 3 million for Papua New Guinea to 600 thousand for Fiji and to just over 4000 for Niue (compared to 20,000 for the Cook Islands). The total population of the nine countries of this Study is in the region of $3\frac{1}{2}$ million. Island origin and formation varies, often within the same group, from raised or low coral, often as atolls, supporting palm trees and not very much else, to high tree-covered and fertile volcanic mountains. A tabulated comparison of the nine countries is given in Appendix 2.

1.5. Some names of the member countries of SPEC have changed within recent years. Wherever possible the name in current use has been used in this report, but occasionally, the former name in use at a time referred to in the report is used or is given in parenthesis. In the case of the former Gilbert & Ellice Islands, now separately self-governing as the Gilbert Islands and Tuvalu, only the Gilbert Islands were included in the terms of reference for this Study. However, records for the Gilbert Islands do in fact belong to the period before separation and cover both the Gilbert Islands and Tuvalu. It has not always been possible, however, to indicate in which island group an event occurred and information used for the Gilbert Islands may in fact refer to the whole of the former Gilbert & Ellice Islands.

2. SOURCES OF INFORMATION

2.1. The result of the preliminary information survey carried out as part of this Study indicates that whilst there is relatively little published information on this area of the South Pacific which refers to natural disasters and their consequences, there is in fact more published material than that which is readily available in the countries themselves. It may be that with more time applied to searches for information in reports and statistics related to specific requirements (e.g. crop losses) more material could be located but such searches are likely to take considerable time.

There are, it appears, very few reports of very few disaster events in a very few countries and it is extremely rare for any of these to include financial estimates of losses.

2.2. From the material available on the South Pacific region generally, specific reference to disaster events is rare and is often only a mention in passing. When reference is made it is usually to one particular type of disaster event, either earthquake or hurricane or volcano, etc. and is usually in connection with one particular event or one particular place or country.

2.3. For specific or detailed reference it is necessary to turn to the few published documents or specific reports or papers produced by scientific bodies or government departments and offices. Whilst these are of greater value to a Study of this kind they are nevertheless restricted to a national coverage and to a particular disaster type. There is only one regional study of any kind of disaster occurrence in the South Pacific which is the 'Preliminary Catalogue of Tsunamis occurring in the Pacific Ocean', published by the Hawaiian Institute of Geophysics. Tsunamis are, however, regarded here with a scientific interest, their effects being only occasionally referred to and again only in passing. Little difference in attention is shown between a barely perceptible tsunami wave motion requiring instruments for monitoring, sensing and recording, and a major wave causing considerable damage.

2.4. Gutenberg and Richters 'Seismicity of the World' divides the world, and thus the Pacific area, into subregions of seismic activity and there are four regions each of which cover a part of the region defined for this Study. However, each region is principally ocean and co-ordinates of each earthquake location have to be examined to determine those occurring on or anywhere near land. There is no way of assessing from the information given whether the seismic phenomena caused a 'disaster' or not.

2.5. Furthermore, the sensing and recording of earthquakes has been undertaken 'remotely', and since 1889 it has been possible for sensing apparatus in one country to monitor seismic activity in another. Until the recent activity involving satellites, this has not been the case for hurricanes for which it has been necessary to rely on the local experiences of people on ships or land locations for news or record. Material recorded remotely at monitoring stations in Australia, New Zealand or even further away, is more readily available and in a more convenient form for scientific study and subsequent publication than material prepared (sometimes) and kept locally on hurricane experience. Moreover, events recorded remotely (and there is often no other record) have no way of determining the effect of the event on people even if there was the desire to do so.

2.6. With the exception of the more recent meteorological reports from observatories, it can be safely assumed therefore that hurricanes recorded from these sources of experience were of considerable impact and most probably damaging events, whereas remotely monitored and recorded earthquakes may not have been. Some caution has to be exercised therefore with all the collected 'evidence' but especially in any assessment of the predominately large number of seismic events.

2.7. Scientific attention, although separated between one type of event and another, has produced some invaluable material, but it is not always a simple matter to relate, for instance, tsunamis and their initiating local earthquake, or a hurricane and a consequent flood. In any case, with the exception of the two sources discussed above (2.3. and 2.4.), coverage is invariably national and it has been one aim of this study to examine the impact of disaster events in an international context. A principle source of national coverage has been the Colonial Reports from countries formerly administered by the British Government. Those from Fiji, Tonga, Gilbert and Ellice Islands (separated in 1975) and the then British Solomon Islands Protectorate are available in London and have provided a consistent and reliable record of experienced events. These reports are a rare, if not unique source (in respect of early events) of some effects of disaster occurrence. Any similar reports from Papua New Guinea, Cook Islands and Niue, countries formerly administered by Australia and New Zealand, have not yet been studied.

2.8. Even in the Colonial Reports there is no certainty that a hurricane was in fact a tropical cyclone with sustained windspeeds of over 73 miles per hour. Even if there was this certainty, what would be its value, given that a lesser storm striking a more vulnerable place might cause more damage? It is certainly true that accrued damage from a series of lesser storms can be greater than that sustained from one major event, and yet it is often the major event only that receives the attention and is recorded or reported. Extreme meteorological phenomena are referred to variously in the sources available to this Study as gale, storm, violent storm, intense storm, cyclonic storm, tropical storm, severe tropical storm, tropical depression, cyclone and hurricane. For the purposes of this Study, tropical cyclones have been referred to in the same terms as the source, but because of the absence of qualifying definition it has not been possible to determine any compatibility between sources.

2.9. In cases of earthquake, even if all those of a magnitude of less than 7.0 (on the Richter logarithmic scale of 1 to 10) are ignored as 'minor' it cannot be assumed that all those of 7.0 and above caused damage or loss and that all those of 6.9 and below did not. Information on earthquakes comes principally from Gutenberg and Richter or from material using their work as a principal source. Remote monitoring of earthquake depends upon a minimum magnitude of the event for the monitoring process and for this reason the majority of recorded earthquakes are in the higher magnitude Richter scales of 7.0 and above. Any further attempt in this Study to exclude events in the lower range of the scale would be unrealistic as has been discussed (2.4. and 2.5.).

It is not possible, therefore, to apply any realistic or practical differentiation between seismic events, as has been discussed in relation to atmospheric events (2.8.).

2.10. The Colonial Reports are valuable in another respect. Drought is a phenomenon where there has been an absence of any monitoring in the world at all until very recent years and then only in large scale occurrences. Drought is a slowly evolving indeterminate phenomenon arising out of and commencing with a shortage of water which in itself may be normal and endemic and therefore unrecognisable as a drought and of insufficient impact to be noteworthy. Periods of drought can be determined only in retrospect.

In no other reference source used is the occurrence of drought so easily recognisable nor, moreover the alternating occurrences of drought and heavy rain, often caused by a hurricane somewhere in the vicinity. Long periods of drought terminated by heavy rainfall are apparent from Reports from the Gilbert and Ellice Islands and a more rapid alternation of shorter periods of drought with heavy rain or hurricane is apparent in Reports from Fiji.

2.11. Records such as those used in this Study and described above could serve in the least as statistical evidence of occurrence in the past and used (with some circumspection as indicated) as a basis for a rough estimate of future probability. The chronological listing of events of any sort is, perhaps, a comparatively straightforward pursuit, but, to attempt a classification of damaging events is much more difficult if not ultimately impossible. However, for the purposes of this Study the term 'disaster' has been used for convenience for all identified events of whatever origin, size, speed, magnitude or consequence.

3. DEFINITION OF DISASTER

3.1. Clearly, to achieve a definition of terms for its own sake in a Study of this kind, would be academic and serve no useful purpose. It would, moreover, be counter-productive because of the impossibility of achieving compatibility between sources. But it is necessary to attempt a definition of disaster itself in order to be clear what it is the Fund is intended to serve.

3.2. First, without people there can be no disaster. That is one reason why all the results of scientific observation of natural phenomena cannot be regarded as evidence of disaster events (2.4.).

3.3. Second, events among and affecting people are not always disasters either. Numerous attempts have been made to provide a quantifiable definition of disaster occurrence. One source defined a disaster as where there was at least US$1000.00 damage and at least 100 dead and at least 100 injured. Even if an attempt was made to relate these figures to the context of this Study it is doubtful whether such a definition would be acceptable. It seems more to the point for the occurrence to be considered in relation to any capacity to absorb what has happened, for a disaster to be declared or not.

3.4. If people are an essential ingredient for disaster then the impact upon people and the consequent needs of people are the determining factor. The facility for provision of those needs is the test for determining a disaster event. Clearly if, say, three houses of a village are destroyed by a flood or a landslide for instance, a disaster has occurred to the inhabiting families. If all members of the stricken families are killed the disaster is one of immediate loss to the village and local community, more readily absorbed the larger that community is. If there are survivors, more usually the case, the disaster is compounded not only by the loss of those killed but of the need to provide for the needs of the injured and incapacitated. The requirements of the survivors are more varied and more complicated and longer term. If the local community can cope with these requirements, taking account at the same time of the resources of goods and manpower it has lost, it can be said to have absorbed the event and the immediate disaster is local in extent. If, however, say three whole villages are destroyed by an earthquake or hurricane then the situation is immediately more extensive but it may still be possible for provincial absorption. But further, if three islands of an island group were totally devastated by say a hurricane, then that may even exceed the national capacity to absorb the event.

3.5. Whilst this line of argument may be acceptable in itself, there can be no hard and fast rule relating to numbers of houses or villages or even people lost. Clearly the capacity to absorb the provision of requirements relates to available resources to deal with the event itself (the needs of survivors) and the effect of the losses sustained from it - deaths of people and animals, destruction of houses and crops. This capacity may be 'normal' or 'abnormal'. If one disaster event closely follows a previous event for instance, then the capacity to absorb would be abnormally reduced. Therefore, absorptive capacity has to be assessed in every case and every situation.

4. DISASTERS, REGIONAL AND NATIONAL

4.1. A total of 662 disaster events of all kinds (2.11) have been identified so far within the region of this Study. The latest year of occurrences is 1975, the earliest recorded event being a tsunami of 1768 in Papua New Guinea (New Ireland).

4.2. Whilst this overall period of 207 years is of significant extent, it is accidental in origin and erratic in content. Due to the time periods applicable in some sources of information there are far more events recorded for some shorter time periods than for remaining periods within the overall time span for material in the Study. For instance, Gutenberg and Richter analyse the period between 1900 and 1940 only, and hurricanes and storms have received much more detailed attention since around 1930 than in the years before.

4.3. Any possibility of assessing future probability of events is much reduced therefore by the very short periods in which there has been detailed and consistent recording, and any comparison of the occurrence of events in a particular period is severely hampered not only by the incompatibility of definition (2.8 and 2.9), but by the incompatibility of time periods during which records have been kept or of which study has been made.

4.4. Out of the total of 662 events within the region, there are a subtotal of 328 earthquakes accounting for almost exactly half the total (but refer to the need for circumspection in consideration of these figures - 2.6). Hurricanes account for 180 events (as recorded in any country affected), less than a quarter of the total. There are 74 tsunamis, 41 volcanic eruptions and 32 periods of drought. Tables showing a regional analysis of a card index of disaster events prepared during this Study are given in Appendix 3.

4.5. Whilst it is important to this Study to examine the regional occurrence and consequences (Section 5) of disaster events, it is certainly not the case that all disaster types affect all countries within the region. Papua New Guinea has experienced 224 earthquakes out of the total for the region of 328, and there is a marked reduction of earthquake experience as one moves across the region. The Solomon Islands has had 62; Tonga 23; Fiji 12, and Western Samoa has had 3.

4.6. A subtotal of 180 hurricanes is, by comparison, rather more evenly spread amongst a larger number of countries. Seventyfive have been recorded for Fiji, 38 for Tonga, 33 for Western Samoa, 19 for the Cook Islands, 5 each for the Solomon Islands and Niue, and 4 for the former Gilbert & Ellice Islands.

4.7. Papua New Guinea has had two-thirds of the regional total of tsunamis, 55 out of 74; and well over half of the regional total of volcanic eruptions, 28 out of 41. Obviously, the size of land mass has a considerable bearing on the number of events incurred in any one country, and the same is of course true for hurricane experience. If size (Appendix 2) is directly proportional to social and economic resources, a national capacity to absorb a greater number of events will also increase according to size (3.4. and 3.5.). The extent of any relationship between size and resources is a possible subject for continuation of this Project, but clearly, for the

time being and for statistical purposes only, the larger the land mass or more extensive a group of islands, the greater the likelihood of disaster occurrence within the country. Conversely, the greater the disaster experience is of a small country, the more significant it is, both in statistical terms and in any examination of absorptive capacity. In this respect, for instance, Niue's experience of 5 hurricanes between 1939 and 1945 is significant when compared with 19 throughout the Cook Islands between 1831 and 1972.

4.8. Clearly there are sub-regional areas where there is a greater occurrence of disaster events of various kinds than in others. A zone of seismic activity passes along the North of Papua New Guinea and forms an arc through New Britain, Bougainville and the Solomon Islands, to eventually link up with the Tonga Trench just South of Western Samoa. Tonga itself is in an area of more intense seismic activity than Western Samoa or Fiji which are both on the periphery of more intense zones - as is indicated by the figures obtained during this study (Appendix 3).

4.9. Generally speaking (where it is possible to speak 'generally' about hurricanes at all), tropical cyclones are active in a region roughly defined by latitudes 5^{o} to 20^{o} South and during an annual period between November and April. Their trajectories are usually curved at least once, either to the East or to the West, but usually in either case in an overall southerly direction. As far as the countries of this Study are concerned, it is more common for hurricanes to be in the earlier stages of their formation whilst in the northernmost areas of the region (5^{o} - 10^{o}S) and to be more clearly defined and more intense in the central areas. Moreover, curvatures towards the South appear to converge. Tropical cyclonic formations may form near the Solomon Islands or in the Coral Sea for instance and conclude their trajectories in the region of Tonga or the New Hebrides but more often than not appear to affect Fiji on the way in some degree when they are usually at their most intense phase. There are exceptions to this general pattern and there have been one or two serious tropical cyclones affecting the Gilbert & Ellice Islands (principally in the Southern group of Ellice Islands, now Tuvalu), the Solomon Islands and a 'rogue' called 'Hannah' which caused considerable damage to Tufi in North-Eastern Papua New Guinea in 1972. By far the greatest occurrence of hurricanes is however in Fiji, with Tonga and Western Samoa almost tying for second place.

4.10. Tsunamis are sea-waves initiated by seismic activity and are most common on the coastlines within and surrounding the Pacific Ocean. Tsunamis travel very fast but are almost imperceptible in the deep waters of the Ocean. As they approach land and shallower water their speed decreases but their height increases. The wave may be up to 100 miles in length and it seems to be the case that the small atolls of the Pacific rising sharply from the ocean bed on volcanic peaks offer little interruption to the wave in otherwise very deep water. The occurrence of tsunamis amongst the groups of small islands is very rare and much more common on the coasts of larger islands and land masses. It is also true to say that it is the larger islands and land masses (those of Papua New Guinea in particular) which are most seismically active and also true that the majority of tsunamis within the region for this Study are initiated by local seismicity. Some, however, have been initiated by earthquakes as far away as Chile. There are two such cases on the card index of this Study, both occurring at much the same time in May 1960, one at San Christobal in the Solomon

Islands and the other in what was then Northern New Guinea. It is interesting to note in this respect that whilst the Solomon Islands are very much more seismically active than Western Samoa, the occurrence of tsunamis in Western Samoa is greater than in the Solomon Islands. One interim conclusion from this Study is that tsunamis are very much more active in the region than appears to be generally realised and as will be seen from the following section, have been responsible for considerable damage (5.4.)

4.11. In the tables of disaster occurrence given in Appendix 3, the very high number of earthquakes recorded for Papua New Guinea contributes significantly to the largest total number of disaster events for any country within the region for this Study (311; with 224 earthquakes). It is highly significant however that in spite of a proportionately high number of earthquakes recorded for the Solomon Islands (62 out of a national disaster total of 79), it is Fiji that comes second in this 'disaster league' due to a very high (the highest) number of hurricanes - 75 out of a disaster total of 98. The Solomon Islands almost tie with Tonga for third place having a disaster total of 79 of which 62 events are earthquakes. Tonga with a disaster total of 78 has 23 earthquakes and 38 hurricanes - a more equal distribution of the principal disaster agents. Western Samoa's total of 46 is principally caused by 33 hurricanes. The significance of drought is seen in the Gilbert (and Ellice) Islands where 16 periods of drought are recorded out of a disaster total of 23, but hurricane takes over almost entirely again, in the Cook Islands claiming 19 events out of a total of 20.

4.12. Whilst it is tempting to examine numbers of disaster events in this way and whilst, moreover, it is comparatively easy to do so once data has been collected and analysed, it is of little significance if the <u>definition of disaster</u> is kept in mind (Section 3). To regard disasters as separate in origin and in time is to fall into the very same pattern of study that has been described above (Section 2). In order to be able to realistically and <u>usefully</u> compare disaster events it is essential to examine their consequences, their effect on people and their accrued losses.

5. THE CONSEQUENCES OF DISASTER

5.1. Even on making comparisons with events throughout the world, there have been some major disasters within the region of this Study from time to time, although detailed accounts of consequences are more readily available from the more recent of these (a tabulated summary of all accounts of consequences and losses is given in Appendix 5).

5.2. In spite of the very high number of recorded earthquakes, in Papua New Guinea and the Solomon Islands especially, there are only very few of these which have any accompanying descriptions of the event or of effects and consequences. It is quite clear that when it comes to descriptions of any event there is an almost complete reliance on the accounts of experience, and that remotely monitored events without corresponding descriptions can be regarded only in the abstract (2.4.). So much so that it might perhaps be sensible to take what little descriptive evidence there is and to multiply it by a number of similar earthquakes in the same country at the same depth and magnitude in an attempt to achieve a more realistic picture.

5.3. The earthquake which occurred at 03:53 on 1st November 1970, 30 km North of Madang in what was then Northern New Guinea, was recorded at a magnitude of 7.1 on the Richter Scale and was of shallow depth, its hypercentre (actual point of occurrence below the earth's surface) being at a depth of only 40 km. Its effects were felt over an area of 10,000 square kilometres and its damage assessed at the time at almost one-and-three-quarter million Australian dollars. Many landslides resulted causing damage to buildings, services and crops and a submarine cable was broken. Fifteen people lost their lives. On the 14th of September 1953, Suva and South-East Viti Levu of Fiji experienced an earthquake which was followed by a tsunami. The earthquake was felt over an area of 340 square miles and registered 6.75 on the Richter Scale. There was much damage to property and 60 miles of trans-Pacific submarine cable were carried away by a giant slide of the ocean floor. Suva wharf, badly damaged by hurricane in 1952 was again severely damaged. The accompanying tsunami, fifty feet high at the reef and generally 6 feet high thereafter created a 15 foot wave at Kadavu and killed two people and wrecked many boats. In June 1917 an earthquake on Upolu, Western Samoa, which registered 8.3 on the Richter Scale, caused considerable damage to buildings in Apia, causing fires, creating landslides and initiating a tsunami which demolished a sea wall at Lotofaga and flooded houses and plantations.

5.4. One of the tsunamis initiated by a Chilean earthquake and referred to previously (4.10) created sea waves of between one and two metres in height along the coast of Bougainville, New Britain and mainland coastlines of Papua New Guinea which commenced about twenty-two hours after the occurrence of the earthquake itself. There is no description of damage. Another tsunami to affect San Christobal had a recorded wave height of between four and twenty metres and destroyed eighteen villages killing fifty people. A tsunami in 1930 in the Ninigo Island group of Papua New Guinea caused waves up to ten metres high, wrecked villages and killed eleven people. In 1895 a wave of two metres in height struck Buna Bay in what was then East Papua and killed twenty-six people. But what is said to have been the most disastrous tsunami yet known in Papua New Guinea resulted from the volcanic explosion of Ritter Island in 1888 and has been compared to the overwhelming tsunami which followed the Krakatoa (Indonesia) eruption of

1883. There was evidence of waves up to 12 metres high along the North coast of New Britain, at Dampier Strait, and on North New Guinea from Cape King William to Hatzfeldhafen, but there is as yet no available account of the consequences. On no account could an event of this enormity be ignored in any assessment of damage and loss, and rather than resort to products of the imagination further searches must be made for descriptive details of the occurrence. A similar exercise is necessary to fully account for the effects of a tsunami in 1926 which is said to have swept right over the island of Palmerston in the Cook Islands.

5.5. Volcanic eruptions are, by no means, occurrences from ancient history. In the Solomon Islands in 1971, Tinakula Island erupted and lava poured down from the peak for two months. The population of 160 had to be evacuated. The population of Manam Island had to be evacuated in 1958 for eight months while flows of hot lava solidified to depths of 50 feet, and 12 inch deposits of ash ruined subsistence gardens. Probably one of the most catastrophic volcanic eruptions of recent times occurred in Papua New Guinea for six months in 1951 when Mount Lamington sent an avalanche of hot lava sweeping down its slopes with 'hurricane force velocities'. Ninety square miles were devastated and secondary 'micro' disasters were caused by the flooding of lava blocked rivers, mud flows and disrupted roadways and river crossings. Five thousand people had to be evacuated and another 4000 people died. In 1937 an eruption of Mount Matupi adjacent to Rabaul on New Britain caused the evacuation of Rabaul which was then the capital city and seat of the government of New Guinea. The island of Niuafo'ou in Tonga was severely damaged by volcanic eruption in 1945 and considerable damage was done to property and crops. Nearly all of government headquarters on the island was destroyed including a wireless station, copra sheds, lighters and £20,000 worth of copra awaiting shipment. The entire population of 1300 was evacuated to the island of Eua in the South (but by 1971 half of them had returned). Niuafo'ou was volcanically active in 1929 also when one town and a third of the cultivated land on the island were completely destroyed. In Western Samoa, Mount Matavanu on Savai'i erupted intermittently for six years between 1905 and 1911 damaging plantations and crops and causing evacuation of many villages.

5.6. One of the earliest records of serious effects of hurricane comes from the Cook Islands where a coasting schooner was picked up and carried inland over coconut palms at Rarotonga in March of 1846. How much other damage was sustained at the same time or how many people lost their lives has not yet been ascertained. In 1883 it is recorded that a hurricane at Apia, Western Samoa, carried seven ships onto the shore and that a 'slight' earthquake occurred at the same time. Indeed, accounts of damage from Western Samoa refer to loss of shipping on more than one occasion and a set of four postage stamps commemorating the hurricane of 1889 all show wrecked ships. Damage on land to dwellings and crops can only be imagined. One of the first severe hurricanes in Fiji with any detailed record occurred in December 1929 and caused serious damage on Vanua Levu, Rotuma, Mokogai and Gau. Several trading vessels were lost, twelve people died, crops suffered and there is a contemporary estimate of £60,000 worth of structural damage at Labasa. In February and March of 1931 Labasa was again severely damaged by hurricane which also destroyed Lautoka and 200 lives were lost in subsequent flooding. More recently in 1960 on Niue a hurricane demolished 750 of the 850 houses on the island, which again suffered severe hurricane damage in February of 1968. In March 1961, Tonga suffered extensive damage on the islands of Vava'u and Ha'apai where subsistence and export crops suffered severely, housing was damaged, two people died and

eight thousand others required emergency shelter. Two tropical storms struck Western Samoa (one with sustained wind speeds just short of hurricane strength and with gusts of 94 mph) in January 1966 and February 1968 causing severe damage to crops and long term reductions to agricultural exports. Winds of 100 mph occurred in a hurricane which severely damaged port facilities at Honiara, Solomon Islands in March 1967 and a number of villages were also destroyed. In December 1971 the Solomon Islands were again struck by hurricane 'Ursula' at Santa Anna and all houses on that island were destroyed leaving one person dead, and 2,500 homeless.

5.7. In October 1972 (earlier than the usual hurricane 'season') the trajectory of one hurricane formation, that of hurricane 'Bebe', affected four of the countries included in this Study. The island of Funafuti, the principal island of what was then the Ellice group of the Gilbert and Ellice Islands (now Tuvalu), was the first to be almost completely destroyed by 'Bebe'. With winds reaching 180 mph, 95% of all houses (all but two) on the island were destroyed, and 700 people made homeless, all generating and radio equipment was destroyed, five people were killed, four fishing vessels were wrecked and a large section of the coral reef was lifted and carried onshore. On the islands of Fiji, 'Bebe' was the worst hurricane for 20 years. Over 4000 bures and 2500 houses were totally or partially destroyed with another 1100 bures and houses slightly damaged rendering 120,000 people homeless (a fifth of the country's population) and in need of emergency feeding for six months. Eighteen people were killed. Airports were closed and out of action, bridges collapsed, roads were broken, telecommunications were disrupted and water pipelines fractured. 'Bebe' went on to cause lesser damage in the islands of Tonga and Niue. Before there had been anywhere near enough time to recover from hurricane 'Bebe', Fiji suffered hurricane 'Juliette' in April 1973 destroying almost 14,000 bures and houses and having a disastrous effect on the lives of 160,000 people (35% of the country's population). 'Juliette' went on to Tonga and caused severe damage to crops, housing, schools and churches on seven islands and in 17 villages. In December of the same year (1973), hurricane 'Lottie' struck Kadavu and the Southern Lau group of Fijian islands and destroyed 1400 homes and 40 schools. Fifteen thousand people had to be rationed and 10,000 of them experienced their second hurricane in eight months. Two inter-island ships were lost and 74 people were drowned. The Lau group of islands were again struck by hurricane 'Val' in January 1975 destroying 75% homes, severely damaging 25 schools, and causing 22,000 people to be rationed for six months. Ten thousand people suffered their <u>third</u> hurricane in less than two years.

5.8. Drought is by comparison a gentler and slower disaster agent but capable of comparable disruption and deprivation. In the Gilbert Islands (Northern group of the Gilbert and Ellice Islands) the year of 1916-1917 was a serious period of drought during which exports of copra were severely reduced. Another period of drought is recorded (amongst others) for 1934 when 'food producing trees practically ceased to produce and an outbreak of beri-beri and the lack of fresh food killed a number of natives'. It must be noted that a period of drought during 1973 and 1974 ended a season of particularly high coconut production affected by the high rainfall of 1972-1973 - no doubt drastically increased by hurricane 'Bebe'. The ending of one disaster for some was brought about by another disaster for others. It is of interest to note also the occasional reference to the positive effects of 'disaster'. The sucrose content of sugar cane (in Fiji) has been noted as being higher due to dry conditions and a record sugar crop was recorded for 1932 (also

in Fiji) 'partly due to the deposits of silt left by flooding'.

5.9. It is interesting to digress a little to examine another case of drought. Perpetual drought on Nauru is overcome by the importation of 36 million gallons of potable water from Australia and Japan by tanker at a cost of A$30.00 per ton. If these figures are anywhere near correct, the cost of perpetual drought to Nauru is almost 5 million dollars annually (A$4,821,428) for 6000 people and their industries.

5.10. Without reference to the preceding paragraph, and after making adjustments to all figures of financial loss to relate them to present-day values, total recorded losses for the 139 years (1836-1975) covered by the tabulated summary of accounts of consequences and losses (Appendix 5) amount to almost A$45 million (for the sake of these calculations estimates of loss have included figures of actual aid).

5.11. It is essential however to bear in mind the sporadic availability of records (2.1.) and the comparative rare reference to assessments of financial loss. This simple process of adjustment and addition cannot, by any stretch of imagination, be anywhere near the total financial loss from natural disasters within the region.

5.12. In an attempt to arrive at figures nearer the actual, if all losses before the ten year period 1966 - 1975 (inclusive) are excluded from these calculations the total for this recent ten year period comes to a fraction below A$37.5 million. Clearly, information for this more recent time period is more readily available. This sum can be represented as an annual average over the ten year period of A$3.75 million for the region, or taken further and divided by the nine member governments to show an annual average for each country over the ten year period of A$4.25 million dollars each year for each country.

5.13. These figures do not represent total losses. They are the summation of total available references to losses and must only increase as more material becomes available and the assessments become more accurate. Moreover, to these assessments of primary loss must be added assessments for secondary losses caused in particular by evacuation and migration resulting from or exacerbated by natural disasters. The overall resulting interruption, debilitation and postponement of plans for development are another important area of secondary loss that has yet to be examined in detail. Another most important element that it has not been possible to take account of in these calculations, is the increase in the amount of development since earlier disaster occurrences and the present, and the corresponding increase in disaster losses that would accrue due to increased development. As development increases so does vulnerability to losses from disaster.

5.14. Another aspect of loss from natural disaster is losses to subsistence and commercial agriculture. Losses to crops in some degree is almost bound to occur during heavy rain, high wind, flood, volcanic eruption or landslide, and yet there are very few references to crop losses. When reference is made it is usually to plantation losses. Another aspect is that crop losses only seem to be mentioned at all when there is little else to report. When losses to government buildings, infrastructural services or housing is at all serious, losses to crops is rarely mentioned. However, because crop losses are almost bound to occur it may be worth having a look at the possibility of crop insurance, although this is known to be an insurance

area possessed with even greater problems than other forms of insurance for natural disaster. The scheme before the Australian government (6.3) makes reference to problems related to crop insurance and implies that that aspect of insurance cover should be omitted.

6. THE ROLE OF THE DISASTER FUND

6.1. With figures of the size estimated in the foregoing section (5.11 and 5.12) and with additional reference to descriptions of disaster events and consequences referred to or included in the tabulated summary (Appendix 4) the idea of a Disaster Fund instigated by SPEC is clearly a very sound idea which achieves additional effectiveness from its application in a regional context. In its intention of involving the processes of the insurance industry, it is however in the view of this report, ahead of the current capacity or willingness of the insurance industry generally to cover losses from natural disasters in developing countries. A summary of the reasons for this view are as follows:

a. Most insurance policies and therefore the major activities of the industry are in covering anticipated losses to specific properties where loss will be confined essentially to individual events such as fire, motor vehicle accident or accidental injury or death.

b. Natural disaster insurance differs from fire insurance in that a large volume of damage to many properties results all at once from severe events affecting a whole region. This is known in the industry as 'catastrophe potential'.

c. For fire, catastrophe potential is of lesser significance than the average annual loss which can now be simply based on previous events within each year. This annual average is incorporated into calculations to determine premiums.

d. Natural Disaster Insurance premiums have to be determined, on the other hand, on the basis of losses over a much longer period of time, say twenty-five years or longer, for each type of event - flood, tropical cyclone, earthquake, etc. and the catastrophe potential is the dominant concern, while average annual loss is much less significant.

e. Clearly an insurance or reinsurance company will find it easier to bear smaller expected annual losses than erratic major catastrophe losses. In fact, it appears that the insurance industry incorporates certain restrictive devices to protect itself against catastrophe losses. These protective devices are logical in an industry with prime responsibilities to its premium holders and share holders. They are:

   i. To insure against natural disaster events only as an extension of fire insurance policies. In many cases some forms of natural disaster event are classed as 'acts of God' and not eligible for insurance cover at all.

   ii. To restrict the number of policies containing natural disaster cover to within a maximum for any particular region, community or neighbourhood.

   iii. To restrict natural disaster cover to certain types of construction and to less susceptible locations. This might be modified within properties covered, according to

methods of construction and whether or not building codes have been applied, and the premium scale adjusted accordingly.

f. Sophisticated methods of insurance assessment for natural disaster are hampered by the lack of reliable data on past disaster events upon which the average return period of future events and scale of losses may be determined.

g. Some attempt has been made in recent years by the insurance industry to meet the demand for cover for natural disaster events in a few major developed countries. In each case, in order that risks and premiums may be kept to within acceptable limits the governments of the country in question underwrites losses over a certain figure and/or natural disaster insurance is financed by a levy on other (e.g. fire) insurance policies. Not all the schemes are operating with total success.

6.2. In a paper read to an international insurance seminar, the Honorary President of the Reinsurance Offices Association said in March 1976:

'... earthquakes, hurricanes and floods ... inevitably involve reinsurers and constitute in practice part of their stock in trade. It is also fair to say, and should be admitted, that the degree of control that a reinsurer can exercise ... is strictly limited both in terms of the influence he can bring to bear on loss prevention and also in the degree of accuracy with which he can determine his own commitments.

There is much more however that could be done in the light of modern knowledge to ameliorate such situations. Indeed it becomes increasingly important to do so as more and more of the surface of the globe is developed and mankind spreads itself expensively in insurance terms. For control purposes sophisticated techniques of computer usage could provide us with all the information necessary to establish detailed and accurate records of target risks and commitments in areas subject to natural catastrophes. It is well within the capability of computers to provide the data needed to control accumulations on target risks and to enable reinsurers to handle aggregations of risk much more scientifically than is at present possible. This is not only well within technical possibility; it is also relatively easy to arrange and manage; the problem lies in the reluctance of insurers to co-operate in establishing the uniform system which would obviously be necessary and also some reticence in divulging information considered confidential for reasons which are sometimes hard to understand.

The fact is however that sooner or later insurers will be obliged to co-operate internationally and establish methods that enable these hazardous risks, both natural and human, to be brought under better technical control. It is much to be hoped that this can be achieved voluntarily and before it is forced upon reluctant insurers either by some super-catastrophic event or by the straight compulsion of governmental insistence.

By no stretch of the imagination however can insurers, or reinsurers,

be content that sufficient is being done by any of the many and various interests involved, technical, governmental, financial, human or any other concerned to investigate and reduce the progressive annual toll of catastrophic loss. In terms of economic interdependence the mounting wastage and human suffering and the legal complexity of modern disasters require superhuman efforts to maintain even the crude level of relief that can at present be afforded.

6.3. However insufficient, insurance methods at present are designed essentially for developed countries where there is already a widespread activity in insurance for fire risks, and where property form and construction qualifies for insurance cover against natural disaster events. In countries where there is some insurance activity, but where that activity is not widespread and covers only a small proportion of property owners, there would immediately be the question when proposals for a levy were introduced of why those who are insured and who do already pay a premium should in effect subsidise those who are not insured and do not pay premiums. Australia is the latest country to press for insurance cover for natural disaster, probably as a result of its recent series of major disaster events. A proposal has been made to Government (still under review) which includes the recommendation that 'any insurance fund should be established as part of a broader attack on the whole problem of natural disasters and be administered within such a framework'.

6.4. The quoted extract above (6.2.) indicates and acknowledges that, even in developed and metropolitan countries where insurance activity is widespread, there are considerable shortcomings in the contribution currently made by the insurance industry towards reimbursement of losses from natural disaster.

6.5. This pilot study has attempted to assess some of the particular problems of the developing countries visited in the course of this assignment and to consider where insurance might already be of use, where and how insurance might be encouraged to be further applied to natural disasters in developing countries and how in any case money might best be used to meet the needs arising from disaster events. Whether money is to come from a regional fund or as payment from insurance cover following disaster events it is necessary to examine how it might be used so that the usefulness of its availability can be assessed. In particular, it is necessary to examine the availability of supplies and resources on which money would be spent. Money itself will be useless if what it would be spent on is not available. In other words, it has been necessary to briefly examine the context in which disasters have occurred and will occur and what needs arose and will arise. An attempt has been made to examine 'the whole problem of natural disasters' within the region with particular reference to the role to be played by available money.

6.6. However sudden the impact of a disaster event itself may be, activities which follow it can be classified in relation to periods of time following the event. Thus, during and immediately after impact there will be an 'emergency period' during which it becomes imperative to make whatever immediate bodily response is necessary to save life and property - with emphasis on the saving of life and in all likelihood one's own life. The emergency period is likely to be relatively short and will be followed, when immediate danger has passed, by a period of 'rehabilitation', during which it becomes important to prevent further deprivation and loss of life due to shortages of food or water, lack of shelter, outbreak of disease due for instance to contamination of water supplies or from injury due to non-availability of treatment. The rehabilita-

tion period will depend on how long it takes to reconnect severed supplies of food and water and broken communications and may be weeks or even months.

6.7. It is quite beyond the capacity or intent of the present disaster fund to be a substitute for relief-aid from international sources. It is now reasonable to assume that relief aid from international sources will be available in some degree following a disaster event whether the stricken country be developing or developed. What is not so easily pre-determined is how much or how soon that relief aid may arrive. In an attempt to make a relationship of principle between the anticipated capacity of the fund and the phases of disaster activity, it appears that the resources of international relief-aid and of any payments from insurance cover might most usefully be applied to the reconstruction period, because of the time required for their assessment and delivery and the longer period and higher cost of these activities.

6.8. The crucial requirements of the emergency and rehabilitation phases have to be left to whatever the local capacity is of precautionary planning and resources. The period of time itself occupied by rehabilitative activity could actually be determined by locally available resources being usefully deployed towards the needs of the post-impact disaster situation. The resources of a Disaster Fund could be most effectively deployed in this particular phase.

6.9. Whilst aiming to avoid the superimposition of alien and external values in the assessment of the immediate problems which are created by natural disaster events, it is at the same time necessary to identify indigenous problems which do occur even though they be readily borne by people and therefore not readily or usually declared.

6.10. In the series of island or sea-shore communities which have been the subject of this study there clearly exists a relationship with the sea and other natural forces and elements upon which the very personality and culture of populations has been moulded. The degree of inate resilience to natural forces is markedly high and consequently the identification of problems occurring as a result of natural phenomena is obscured by familiarity with the occurrence.

6.11. A similar obscuring of the problems sometimes occurs in another way as a result of the predominant social system. In Western Samoa where the extended family system creates a marked degree of interdependence of nuclear family units, often over a very wide area, the sharing of resources is the way of life. So much so that no evidence from memory or from reports of any problem was declared as a result of the four-month gap in time between the hurricane of 1966 and the arrival of the first food relief supplies four months later.

6.12. Normal dependency on metropolitan aid sources also tends to obscure the identification of problems brought about by natural phenomena. Where it is the normal habit to turn to metropolitan aid donors it is normal to do so in times of disaster without the need to identify problems which exist or to marshal self-help to deal with them. This later consideration has sometimes produced situations where dependency on relief has been assumed to the extent of effectively obscuring the possibility of reliance on self-help relief supplies and services. The capacity for self-help in disaster situations is therefore worth examination in some detail. It is logical to assume that in any post-disaster situation there will be resources from within

the stricken community, province, nation or region which for want of co-ordination and mobilisation - dependent itself on resources - can be marshalled for effective self-help relief. If not from within the stricken area because of damage sustained, then they will come from adjacent areas. The scale of the disaster is immaterial to the principle but has to do more with the capacity of absorption (3.4. and 3.5.) and therefore the declaration of a disaster event. In any case, relief from these sources can be on hand and in use long before the arrival of external aid.

Capacity for self-help is not without its limits but the one prerequisite for the effective mobilisation of indigenous resources, for those in government hands as well as those in private ownership, will be money to pay for them. The great value of a disaster fund will be to make immediately available money with which to pay for goods and services available locally. The Disaster Fund is therefore a financial precaution and forms a part of precautions generally, which can be taken in anticipation of disaster events. It especially forms part of the preco-ordination of indigenous resources. With the knowledge that the resource of money will be available, other resources can be made available, and methods worked out and established to co-ordinate them. Thus, the capacity for self-help in the crucial phase of rehabilitation generated by the immediate availability or commitment of money becomes considerable. Furthermore, the fund will be spent within the region and much of it on regionally produced supplies and services thereby, in a small way, reinforcing and even invigorating economic activity countering what appears to be a debilitating effect of the arrival of gifts of food from metropolitan sources on local capacity to innovate and produce. Immediately available money from within the region would become the 'oil for the machinery' of the indigenous relief process, satisfying the social needs of the rehabilitation phase. International financial assistance and revenue from insurance belong more perhaps to economic and commercial needs of the later (and longer) reconstruction phase.

6.13. The crucial needs arising from disaster situations declared in the countries visited have been similar from whatever disaster event and can be expressed as either or all of the following:

Reconnaissance

Treatment of the injured

Shortage of water

Risk of epidemic

Shortage of food

Damaged and destroyed homes

Damaged crops

Damaged and destroyed government buildings.

Broken communications

Broken telecommunications

Damaged roads, bridges and wharves

It is important to note that insurance cover could only apply to the second group of headings, notwithstanding the qualifying requirements described

previously (6.1.), whereas the ready availability or commitment of money in sufficient quantities could greatly assist answering the needs of the first five headings and perhaps all of the second group as well.

6.14. Furthermore, the certainty of available money should be allowed to become the catalyst for further precautionary planning. The establishment of a disaster fund is a valuable financial precaution and one of a wide range of precautions that can be taken against the risk of natural disaster events. When integrated and co-ordinated into a cohesive planning policy related to the development process, precautionary planning can be the most effective instrument to mitigate the effects of extreme natural phenomena. Such precautionary planning can involve the long-term precautions incorporated into the processes of economic development; the medium-term precautions incorporated into the location and construction of buildings; and short-term precautions which will include indigenous resource scheduling and co-ordination, public information programmes, arrangements for emergency communication and transport and relief policy formulation (even where reliance on metropolitan relief sources persists, indigenous resources for distribution will be required and must be pre-planned). Stockpiling of food supplies and construction materials may be a direct result of indigenous resource co-ordination. In the countries of the South Pacific which incorporate larger islands (Fiji, Solomon Islands and Western Samoa) or considerable land masses (Papua New Guinea) this resource planning can and should usefully be undertaken on a national basis. The most powerful contribution towards precautionary planning within the context of this pilot study is in its regionality or perhaps more simply and effectively, its sub-regionality.

6.15. The consideration of the occurrence and risk of natural events caused by extreme natural phenomena in a non-natural 'region' accidentally created by political affiliation raises questions with regard to the effectiveness of a non-natural region in dealing with natural events. There is considerable precedent in ancient and recent history within which to explore sub-regional relationships on the basis of cultural origins, geography, proximity, common policy, disaster occurrence and mutual assistance, which may produce natural sub-regional groupings more closely compatible with precautionary planning for natural disaster events and the logistics of relief operations. There is also, happily, some precedent for the activities of SPEC having been of benefit to adjacent countries not formerly SPEC members. An examination of possible sub-regional activity therefore might indicate some mutual value in the inclusion of, for instance, the Tokelau Islands, New Hebrides and New Caledonia (assuming Tuvalu to be already included) (Appendix 1). Discussion of possible sub-regional arrangements, particularly in relation to proposals for continuation of this Project are contained in a subsequent section (Section 8).

7. INTERIM MANAGEMENT GUIDELINES

7.1. It is the understanding of this Study that the Disaster Fund was initiated in 1973 by a donation from the Republic of Nauru of A$125,000 and that there is agreement in principle for each member government of SPEC to make an annual contribution of A$5000 from 1973. On this basis and with a membership of nine at the time of this Study, the fund would amount to approximately half-a-million dollars in about 1980. The fund currently (1975) stands at something less than a quarter-of-a-million dollars but it is further understood that not all member governments have paid their subscription.

7.2. Recommendations of a continued Study can, for the time being, be anticipated for the purposes of this section as being based on an enlarged concept of disaster occurrence (Section 3) and as including payment of the cost of immediate services and supplies for the needs of disaster victoms (6.8. and 6.13). These immediate services and supplies are intended to include:

Reconnaissance of the stricken area.

Provision of food.

Provision of medical supplies for first aid and vaccination.

Transportation and distribution of food and medical supplies by air, sea and/or land transport.

Transportation of expertise (doctors, nurses, communications engineers).

The provision of expertise from one member country to another has been suggested as being gratis and as valuable experience for those involved. The transportation cost was regarded as either prohibitively expensive or in the least a hindrance to rapid and useful assistance. Whilst the cost of such emergency services will be nowhere near the cost of disaster itself (5.11) they can be expected to be considerable. Further work is required to assess their cost accurately, but it follows that, at the outset and until the fund has had time to grow, demands on the fund will be in excess of its size and that there is therefore a need for the fund to grow as rapidly as possible.

7.3. At the same time, the fund has been established for some years and some contributions have been made in good faith. No use has been made of the fund so far and more contributions might be forthcoming if the fund's usefulness could be demonstrated within constraining parameters which are proposed below. Therefore it appears sensible to establish guidelines which will permit some use to be made of the fund whilst at the same time enabling it to grow as much as possible.

7.4. It is proposed therefore on the assumption of a current fund of A$250,000, that two-thirds of the total should be set aside as a capital fund and invested to achieve as high an income as possible. Investment of a fund of this nature will by necessity be highly conservative. A larger portion of the capital fund could be available at one year at something like 7$\frac{1}{8}$% with perhaps a quarter of the fund in bonds maturing at 5 or 7 years and thus achieving a higher rate of interest, perhaps 8$\frac{1}{2}$% or 9%. Investment income will be used to enlarge the capital fund. Incidentally, we are also advised that there is a strong case for preferring currency expressed in US dollars at the present time. Approximately A$90,000 will therefore be

available as a working fund, also invested as favourably as possible, but subject to availability at a month's notice. This time period should permit some income to accrue at about 5⅜% but should not restrict rapid commitment when a disaster occurs.

7.5. Further, in an attempt to ensure that the working fund is not immediately used up by any one disaster or series of disasters, it is proposed that a ceiling of a third of the fund's value (A$30,000) be applied as a limit on the working fund's use in any one year. Thus, for any year and in any event or series of events, A$30,000 will be the maximum commitment for the working fund for the time being.

7.6. Other questions to be answered relate to how this annual available sum of A$30,000 might be made available to member governments - in other words, to member governments who have sustained a disaster. It might appear unreasonable for any one country, the first in the year to have a disaster, to be able to use the whole of that year's working fund. On the other hand, it appears equally unreasonable and somewhat impractical, to subdivide the working fund by nine to arrive at a secondary ceiling figure for maximum commitment to any one country. It cannot be assumed that every country will have a disaster every year (any assessment of such probability should await continuation of this Study). Therefore, it is proposed for the sake of these interim guidelines, that a further ceiling of a third the annual available working fund be introduced to set the maximum sum available to any one disaster in any one year of A$10,000. 'Disaster' is emphasised because it seems reasonable to suggest that a country might receive, say, two payments, each within the annual ceiling, for two or more disasters sustained by that country within any year.

7.7. These calculations assume for the time being therefore, an annual regional disaster occurrence of three, (the actual regional average of occurrence over the last 40 years, but excluding remotely monitored earthquakes, is 3.125).

$$3 \times 10{,}000 = 30{,}000$$

A$30,000 is the annual maximum commitment. The working fund could be used to this maximum for three consecutive years

$$3 \times 30{,}000 = 90{,}000$$

A$90,000 is the proposed sum available to the working fund.

7.8. Income to the Disaster Fund should amount to A$5000 from each of nine member governments

$$9 \times 5{,}000 = 45{,}000 \text{ p.a.}$$

It is proposed that this income be again divided to allow two-thirds (A$30,000) to be invested with the capital fund and one-third (A$15,000) to be placed with the working fund. Thus, whilst the working fund could be committed at the rate of A$30,000 per annum depending on disaster occurrence, there will be an annual income to the working fund of A$15,000.

7.9. It is to be emphasised that these proposals for the fund's management are interim and provisional and are included in this pilot study report to allow

the existing fund to be invested and used now, in accordance with the principles suggested for its use. It will be appropriate to propose alternative methods for the fund's management as part of continuation of the Study. But whilst an interim assessment of the principles of use and management for the fund are an important part of this Report, advice on where to invest the fund within those principles of use is regarded as being outside the scope of this Study. It is important to add that investment of the fund is a matter for constant professional advice if the fund is to be managed as effectively as possible.

7.10. The inclusion of alternative principles of management will, to some extent, depend on what use will have been made of the fund in the interim between this report and preparation of further reports of continued study. Alternative methods will also depend on the size of the fund and on the number of member governments and contributions. It is not being suggested at this stage that the size of subscriptions should be changed, nor that the principle of equal contributions should be questioned. It is important, however, and perhaps obvious, that subscriptions to the fund must be paid promptly if full advantage is to be taken of accrued interest and if the fund is to grow as fast as possible.

7.11. It will be apparent that the interim proposals outlined above incorporate considerable caution and emphasise the need for the fund to grow. They do not allow very much immediate financial resource and A$10,000 will not go very far. With a higher income, possibly from outside the region, there could be a case for a reversal of priorities with emphasis on commitment in times of disaster. After all, that is the motive for the fund and should be its ultimate aim. If metropolitan aid-donor countries outside the region could be encouraged to make very considerable donations to the fund either annually or as a lump sum, then the potential use for the fund could increase and it is even conceivable that the fund could develop its own insurance service. For this latter development, aid could be in the form of major injections of money into the fund and/or the underwriting of losses to allow risks and premiums to be kept to an acceptable level.

7.12. It is uggested that, both for the purposes of the interim management of the fund and for the operation of ultimate proposals, an element of trust will always be necessary for successful management. It will not be practicable to set out detailed principles for the fund's operation to deal with every situation caused by disaster occurrence. Particularly in the stages of declaration of disaster and calls on the fund, if immediate commitment of the fund is its motive, then inspection of each disaster situation by the administrators of the fund will not be possible - nor will it be appropriate. It is further suggested however that the principle of the fund's current application towards the cost of emergency services and supplies should be understood and rigorously applied.

7.13. It is also proposed that purposes for which the fund is used should be carefully examined and assessed after the disaster occurrence, as part of the monitoring of disaster occurrence which it must be the role of SPEC, as the fund's initiators and managers, to undertake. Advice on the post-assessment of losses and on the recording of effects and consequences of disaster occurrences within the region could be part of a continuation of this Study. In the same way as it has been made apparent how the lack of detailed information is likely to impede the continuation of this Study, for the future effectiveness of the fund information must be adequate, readily available and in an appropriate form.

8. PROPOSALS FOR CONTINUATION OF THE PROJECT

8.1. A summary of sub-headings under which continuation of the project should be undertaken are as follows. References to the text are given where relevant:

1. Sub-regional co-ordination of indigenous resources for emergency services and supplies (6.15, 8.9:1).
2. Social and economic analyses and comparisons (4.7, 8.9:2).
3. Information searches (Section 2, 5.4, 5.6, 8.9:3).
4. An assessment if probability of disaster occurrence and loss (7.7., 8.9:4).
5. Commercial insurance for natural disaster in developing countries (6.2, 8.9:5, 8.9:6).
6. Crop insurance (5.14).
7. Proposals for the development and operation of the Disaster Fund (7.12, 8.9:7).
8. Alternative methods of management for the Fund (7.10, 8.9:8).
9. Advice on disaster monitoring and collection of information following disaster occurrence (7.13, 8.9:9).
10. Expanded precautionary planning; sub-regional and national (8.7, 8.8).

These sub-headings for project continuation are grouped in logical sequence and headings within each group are mutually dependent except in the case of 1 and 2. Whilst each group could be undertaken separately there is some inter-reliance between all groups.

8.2. The sub-heading to explore sub-regional co-ordination of indigenous resources (1) and social and economic analyses (2) are grouped due to their operational similarity. Social and economic analyses are dependent to some extent on a knowledge of indigenous resources, but the former has a bearing on an assessment of absorptive capacity and therefore on the establishment of principles for the operation of the Fund (5).

8.3. Information searches (3) and an assessment of probability (4) are clearly related as the latter cannot ba dequately undertaken without the former. Assessments of probability are also required for a more sophisticated attempt at management guidelines for the Fund.

8.4. The third pair of sub-headings (5 and 6) include the exploratory and innovative programme of work it is hoped to undertake with commercial insurance companies in London which have already been identified and who have expressed an interest in extending the capacity of commercial insurance in relation to natural disasters. Because of the essential ecploratory and innovative

nature of this part of the project, a programme cannot be worked out in detail at this stage, but it is proposed that a short feasibility study be made in association with the insurance companies to establish a programme before the remainder of the work proceeds.

8.5. With results from any of the first three groups of sub-headings, the third group (7 and 8) can proceed to develop ideas for the fund's application and operation and to prepare alternatives for management methods.

8.6. The kind of information to be collected after disasters have occured, whether the Fund has been called upon or not, will vary in type and extent according to proposals for the operation and management of the Fund. Sub-heading (9) is therefore the last to be undertaken of the series so far.

8.7. As part of a broader concept of insurance for natural disaster, reference should be made to the opportunity which now exists, given the considerable awareness in the region to the problems created by natural disaster occurrence, of comprehensive precautionary and preventive planning against them. The financial precautions initaited by SPEC within the region and considered in this report are one aspect of precautionary and preventive planning and others could be undertaken simultaneously. Whilst considerable attention is being given nationally and regionally to the impact of natural disaster occurrence there is more that could be done, particularly in relation to plans for development generally, where attention by metropolitan aid-donors to natural disaster could be improved. With regard to national precautionary planning, whilst contingency plans exist in most countries, there is apparently no national plan for the Cook Islands and, because of its recent formation, it has been assumed that there is no plan for Tuvalu. Improved and expanded planning could be also of considerable benefit to the Gilbert Islands to take account of the economic impact of drought and the cost-effectiveness, therefore, of steps to combat it - as alternatives to evacuation and migration and consequent exacerbation of current population problems. It is, moreover, important to point out that although the conception of this Study is on a regional basis, until a country is equally and appropriately prepared for natural disaster it will be of little value regionally - in fact it is more likely to remain a liability to the resources of the Disaster Fund.

8.8. The relationship of the proposals contained in this report with comprehensive precautionary and preventive planning for natural disasters is one which should be explored and continued,given the considerable impetus created by and within this Study. Furthermore, whilst the Study has looked, as far as has been possible, at disaster in a regional context; there is nevertheless considerable variation to be found nationally, not only in type occurrence and consequences of disasters themselves, but also in the understanding of them, of what there is that can be done about them and in actual response to them. An attempt should be made to achieve a closer common understanding of natural disaster occurrence, prevention and precaution. One way of achieving this is for the provision of a 'forum' for an exchange of ideas, for discussion and for a sharing of experience and views. In addition, such a forum or seminar could contribute towards development of a common understanding of:

a. the principles involved in disaster prevention and precaution,

b. an awareness of the needs created by disaster occurrence,

c. government responsibilities before and after disaster occurrence,

d. methods of assessing government's capacity to respond to anticipated needs.

8.9. Each grouping of sub-headings will now be examined in greater detail.

1. Sub-regional co-ordination of indigenous resources for emergency services and supplies

Objectives: To assess sub-regional capacities for mutual assistance during and following the occurrence of natural disaster.

Elements:

a. Define sub-regional groupings.
An initial proposal for the first study of sub-regional resources, based upon disaster experience and geographical proximity amongst other considerations, is Fiji, Tonga and Western Samoa. Appendix 6 gives details of an assessment of regional groupings, and other groupings could be, for instance, Papua New Guinea and the Solomon Islands; the Gilbert Islands and Tuvalu.
The role of Australia and New Zealand must be examined and assessed in this context, particularly of another grouping centred on the Cook Islands (and possibly Niue in addition).

b. Define zones within countries of sub-regions.

c. Identify resources required.

d. Identify resources available.

e. Establish methods for scheduling.

f. Establish ownerships, availability, methods for payment.

g. Relate to means of communication, transportation and manpower (these too are resources).

h. Establish methods for warning, mobilisation and distribution.

Execution: Home-based research:

a. Preliminary identification of resources required.

b. Preliminary assessment of methods for scheduling.

c. Preliminary assessment of methods of warning and mobilisation.

Extra-regional research:

a. Discussion in Canberra and Wellington with Australian and New Zealand aid agencies (according to sub-regional definition and selection).

Intra-regional research (according to sub-regional definition and selection):

a. Final identification of resources required.

b. Identification of resources available.

c. Final definition of methods for scheduling.

d. Establishment of ownerships, availability, methods for payment.

e. Assess communications, transportation and manpower.

f. Establish final methods of warning, mobilisation and distribution.

g. Identification of resources not indigenously available.

Outline Programme

Home-based preliminary research: Two persons : One month.

Extra-regional research: One person: One month (two countries)

Intra-regional research: Three persons: Three months.

Plus report production: Three persons: Two months.

2. Social and economic analyses and comparisons

Objectives: To assess and establish the relationship between a country's size, resources and capacity to absorb disaster events of a selected type and size in order to facilitate formulation of principles for the operation of the Disaster Fund.

Elements:

a. Selection of country or countries (possibly two or three) as representative of others, e.g. Papua New Guinea as a major land mass and large population; Western Samoa as a small group of larger islands; Cook Islands as a large group of small islands.

b. Analysis of predominant social and governmental system.

c. Analysis of probable effect of disaster.

d. Analysis of economic resources (in addition to (1) above).

Execution: Home-based research:

a. Preliminary selection of country and countries and proposals for consideration.

Intra-regional research:

a. Final selection of countries.

b. Analysis of predominant social and governmental system.

c. Analysis of probable effect of disaster.

d. Analysis of economic resources.

Outline Programme (in addition to (1) above)

Home-based research: One person: One month.

Intra-regional research: Two persons: One month.

Plus report production: Two persons: Two months.

3. Information searches

Objectives: To comprehensively and conclusively search for, find and examine all information relating to natural disaster occurrence in the SPEC region (occurrence, effects and consequences, financial loss).

Elements and Outline Programme

Home-based research: London and other UK sources: Two persons: One month.

Extra-regional research: Canberra, Wellington: One person: One-and-a-half months.

Intra-regional research: all country capitals, former capital, and provincial centres, University of the South Pacific, University of Papua New Guinea etc.
: Two persons: Three months.

Plus report production: Two persons: One month.

4. An assessment of probability of disaster occurrence and loss

Objectives: With the results of a comprehensive and conclusive information search, to assess probability per country of disaster occurrence of all types and of losses therefrom, in order to permit a more sophisticated and detailed assessment of future demand on the Disaster Fund.

Elements and Outline Programme:

Home-based research: One person: Two months; including report production.

5 & 6. Insurance for natural disaster (including crop insurance) in developing countries

Objectives: To work out with selected representatives of the commercial insurance industry in London, a programme for exploratory and innovative study to develop ways of applying the resources of the insurance industry to losses from natural disasters in developing countries.

Elements and Programme for Feasibility Study:

Home-based research: One person: One month, including report production.

7. Proposals for the development and operation of the Disaster Fund

8. Alternative methods of management for the Fund

Objectives: With the results of research under all previous headings to re-assess the role of the Disaster Fund and to propose principles for the operation of the Fund together with alternative methods of management for the Fund to meet demands made upon it within its redefined role.

Elements:

To take into account results of an assessment of absorptive capacity (2), an assessment of disaster probability (4), the results of exploratory and innovative research with insurance companies (5 & 6) and to consider and recommend additional sources of income for the Fund and a possible expansion of roles for the Fund in addition to that of providing for costs of emergency services and supplies (i.e. precautionary and preventive planning, rehabilitation and reconstruction).

Outline Programme:

Home-based research: Two persons: Two months, and, in addition, the possible incorporation of specialist advice to be determined; including report production.

9. Advice on disaster monitoring and collection of information following disaster occurrence

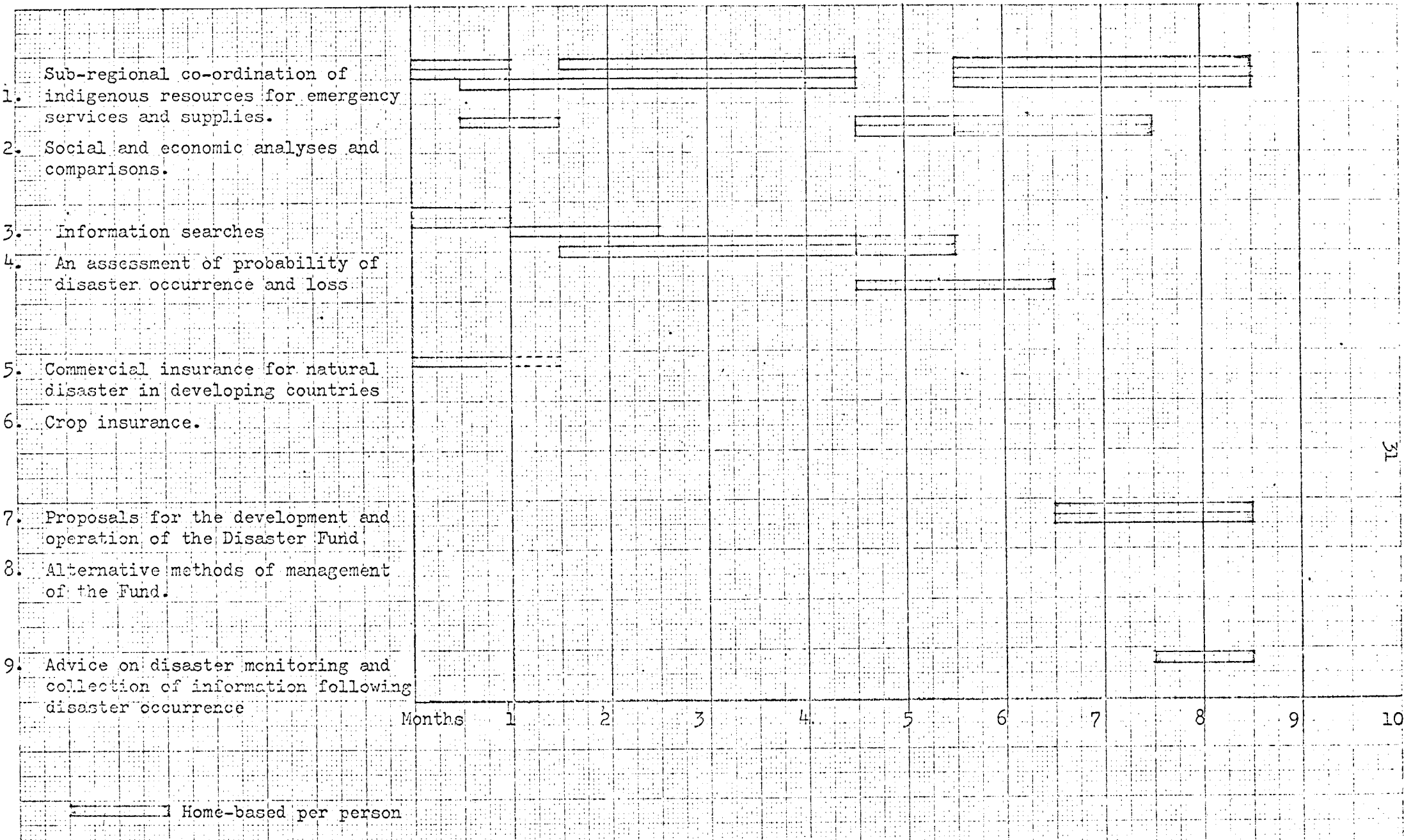
Objectives: To establish guidelines for the preparation, presentation, collection and assessment of information relating to each disaster occurrence, whether or not the resources of the Disaster Fund have been utilised.

Elements and Outline Programme:

To take account of the recommended role, operation and management of the Fund (7 & 8) based on information from post disaster occurrence and to facilitate and improve its operation and affectiveness for disaster occurrence in the future.

Home-based research: One person: One month; including report production.

8.10. The relationship in time between these five groups is shown on the following bar chart which indicates that three of the groups could, in theory, commence simultaneously. The chart does not however take into account the resources or their availability within the Disaster Research Unit. Some discussion of priorities is anticipated which will then take account of availability of personnel.

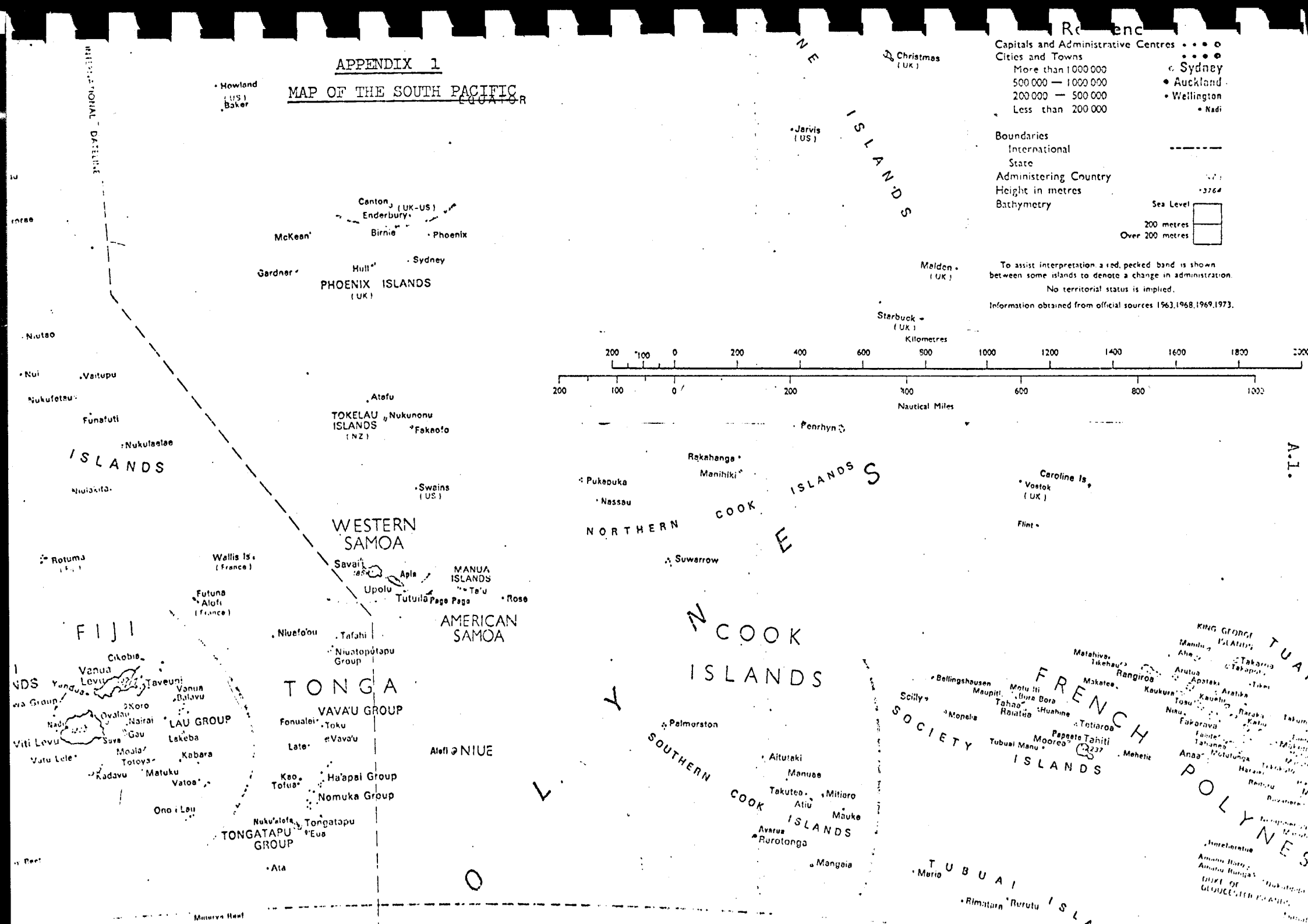


Proposals for continuation of the Project: Time scale.

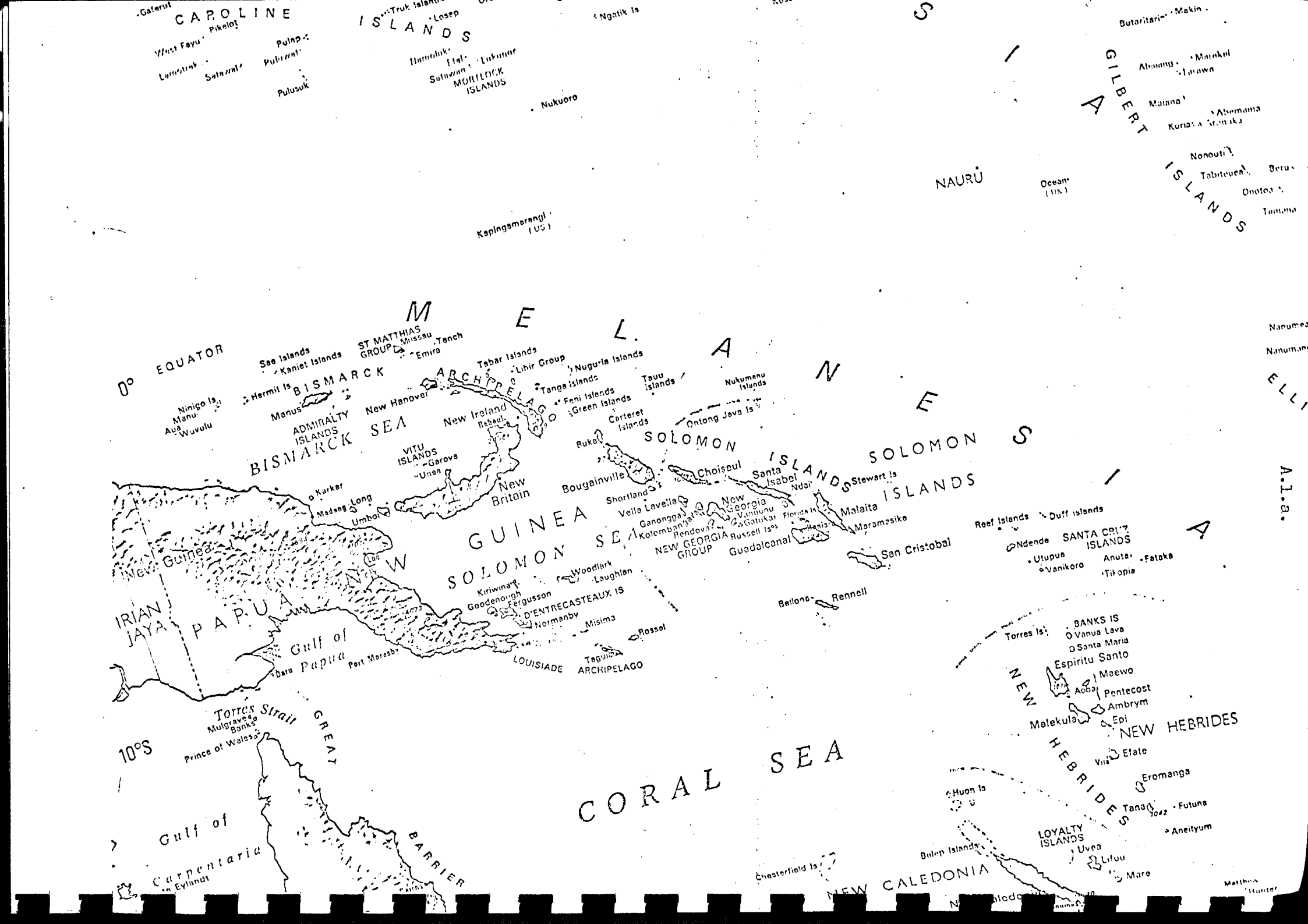
APPENDICES

APPENDIX 1

MAP OF THE SOUTH PACIFIC



A.1.


CAROLINE ISLANDS
Gaferut
Pikelot
West Fayu
Lamotrek
Satawal
Pulap
Pulusuk
Truk Islands
Losap
Namoluk
Etal
Lukunor
Satawan
MORTLOCK ISLANDS
Ngatik Is
Nukuoro
Kapingamarangi
NAURU
Ocean (US)
GILBERT ISLANDS
Butaritari
Makin
Abemama
Nonouti
Tabiteuea
Onotoa
Tamana
0° EQUATOR
Sae Islands
Kaniet Islands
Hermit Is
Manus
Ninigo Is
Manu
Aua
Wuvulu
ADMIRALTY ISLANDS
BISMARCK SEA
ST MATTHIAS GROUP
Mussau
Tench
Emira
BISMARCK ARCHIPELAGO
New Hanover
New Ireland
Rabaul
Tabar Islands
Lihir Group
Tanga Islands
Feni Islands
Green Islands
Nuguria Islands
Tauu Islands
Nukumanu Islands
Carteret Islands
Ontong Java Is
VITU ISLANDS
Garove
Unea
New Britain
Kavkar
Madang
Long
Umboi
New Guinea
IRIAN JAYA
PAPUA NEW GUINEA
Gulf of Papua
Port Moresby
Baru
Torres Strait
Mulgrave Banks
Prince of Wales
GREAT BARRIER REEF
Gulf of Carpentaria
Eylandt
10°S
SOLOMON SEA
Kiriwina
Goodenough
Fergusson
Woodlark
Laughlan
D'ENTRECASTEAUX IS
Normanby
Misima
Rossel
Tagula
LOUISIADE ARCHIPELAGO
CORAL SEA
SOLOMON ISLANDS
Bougainville
Buka
Carteret Islands
Shortland
Vella Lavella
Ganonggara
Kolombangara
Rendova
NEW GEORGIA GROUP
New Georgia
Vanunu
Gatukai
Russell Isles
Guadalcanal
Choiseul
Santa Isabel
Ndai
Stewart Is
Malaita
Maramasike
San Cristobal
Bellona
Rennell
Reef Islands
Duff Islands
Ndende
SANTA CRUZ ISLANDS
Utupua
Vanikoro
Anuta
Fataka
Tikopia
NEW HEBRIDES
Torres Is
BANKS IS
Vanua Lava
Santa Maria
Espiritu Santo
Maewo
Aoba
Pentecost
Ambrym
Malekula
Epi
Vila
Efate
Eromanga
Huon Is
Tanna
Futuna
Aneityum
LOYALTY ISLANDS
Uvea
Lifou
Mare
Bulup Islands
Chesterfield Is
NEW CALEDONIA
Matthew
Hunter

APPENDIX 2

COMPARISON OF COUNTRIES INCLUDED IN THE STUDY

Island	Area sq. mls	Islands (inhabited)	Population	Race	Independence (Alliance)	Capital (Island situate)	GNP (*=tentative)	Products	Formation	Hazard
Papua New Guinea	180,375		2,581,000 (1972)	Papuan Negrito Melanesian	1975 (Aust) ACP	Port Moresby	290	Copra Coconut oil Rubber Cocoa Coffee	Mountain	Volcano Earthquake Tsunami
Solomon Is.	11,500	9 + 3 groups	174,000 (1972)	Melanesian Polynesian	- (UK)	Honiara (Guadalcanal)	210*	Copra Coconuts	Volcanic	Volcano Earthquake Tsunami Trop. Cycl.
Nauru	8.25	1	6,056 (1966)	Nauruan (Polynesian) Chinese European	1968 (Aust)	-	-	Phosphate	Atolls: Volcanic	-
Gilbert Is.	281	37	46,453 (1967)	Micronesian (Polynesian - Tuvalu).	- (UK)	Tarawa	490* (NB.Gilbert & Ellice Is)	Copra (Phosphate Ocean Is)	Atolls: Coral	Trop.Cycl. Drought
Fiji	7,055	100	564,000 (Est. 1974)	Fijian (Polynesian) Indian (Hindu) European Chinese	1970 (UK) ACP	Suva (Viti Levu)	500*	Coconuts Sugar cane Bananas Rice Pineapples Cotton Taro Gold	Mountain Volcanic Coral	Earthquake Trop.Cycl. Flood Drought

/cont..

Island	Area sq. mls	Islands (inhabited)	Population	Race	Independence (Alliance)	Capital (Island situate)	GNP (*= tentative)	Products	Formation	Hazard
Tonga	270	36	93,000 (1972)	Tongan (Polynesian)	1970 (UK) ACP	Nuku'alofa (Tongatapu)	320*	Copra Bananas	Volcanic Coral	Volcano Earthquake Trop.Cycl
W. Samoa	1132	2 + 7	151,250 (Est. 1974)	Samoan (Polynesian)	1962 (NZ) ACP	Apia (Upolu)	150*	Copra Cocoa Bananas	Mountain	Volcano Earthquake Tsunami Trop.Cycl. Drought
Niue	100	1	4272 (1973)	-	- (NZ)	Alofi	-	Copra Bananas	Atoll: Coral	-
Cook Is.	93	15	20,348 (1973)	Polynesian	1965 (NZ)	Raratonga	-	Copra Fruits	Atolls: Volcanic (south) Coral (north)	Trop.Cycl.

ACP = Lomé Convention Signatories

Sources: Encyclopedia of Places, W.G. Moore, Penguin 1971.
World Bank Atlas 1974.
Times Atlas of the World.
World Atlas, Penguin 1974.
LRCS: South West Pacific Disaster Preparedness Survey, 1974.

APPENDIX 3

REGIONAL AND NATIONAL DISASTER OCCURRENCE. AN ANALYSIS OF A CARD INDEX OF RECORDED DISASTER EVENTS

Total number of events

1. Total number of:	earthquakes	1831-1975	328
	tsunamis	1768-1974	74
	volcanic eruptions	1781-1975	41
	hurricanes	1831-1975	180
	floods (separate references)	1893-1964	4
	drought periods	'early 1880's'-1974	32
	whirlwind (Fiji)		1
	tornadoes (Fiji)		2
			662

2. National sub-totals of earthquakes

Papua New Guinea	1900-1975	224
Solomon Islands	1900-1975	62
Fiji	1923-1975	12
Tonga	1911-1949	23
Western Samoa	1831 1917,1975	3
Gilbert Islands	1909(Ellice Islands) 1921 & 1927 (no location)	3
Niue	1975(no damage)	1
		328

3. National sub-totals of hurricanes, gales, storms, etc.

Papua New Guinea	1972	1
Solomon Islands	1952-1972	5
Fiji	1840-1975	75
Tonga	1848-1973	38
Western Samoa	1831-1975	33
Niue	1939-1973	5
Gilbert Islands	1891-1972 (Gilbert & Ellice group : 1; Gilbert Is.: 1; Ellice Is.: 2)	4
Cook Islands	1831-1972	19
		180

4. National sub-totals of tsunamis

Papua New Guinea	1768-1980	55
Solomon Islands	1899-1974	7
Fiji		-
Tonga	1865-1919	3
Western Samoa	1883-1960	8
Cook Islands	1926	1
		74

5. National sub-totals of volcanic eruptions

Papua New Guinea	1878-1975	28
Solomon Islands	1830-1971 (1830 & 1850 on Savo Is.)	4
Fiji		-
Tonga	1781-1946	7
Western Samoa	1902 and 1905-1911	2
		41

6. National sub-totals of drought periods

Fiji	1905-1968	6
Papua New Guinea	1909, 1941, 1972	3
Nauru	continuous	-
Tonga	1926-1953	6
Gilbert Is.	1910-1974 (Gilbert & Ellice group : 9; Gilbert Is.: 2; Ellice Is. : 1; Ocean Is. : 4)	16
Solomon Islands	1930	1
		32

7. National sub-totals of floods
(referred to as separate occurrences to hurricane)

Fiji	1893-1964	4

8. Miscellaneous:

Tornadoes:	Tonga	July 1938	1
	Fiji	Feb. 1930	1
Whirlwind	Fiji	Apr. 1941	1
			3

APPENDIX 4

NATIONAL DISASTER OCCURRENCE. AN ANALYSIS OF AN INDEX OF RECORDED DISASTER EVENTS

1. Papua New Guinea

earthquake	224
tsunami	55
volcanic eruption	28
hurricane	1
flood	-
drought	3
tornado, etc.	-
	311

2. Fiji

earthquake	12
tsunami	-
volcanic eruption	-
hurricane	75
flood	4
drought	6
tornado, etc.	1
	98

3. Solomon Islands

earthquake	62
tsunami	7
volcanic eruption	4
hurricane	5
flood	-
drought	1
tornado, etc.	-
	79

4. Tonga

earthquake	23
tsunami	3
volcanic eruption	7
hurricane	38
flood	-
drought	6
tornado, etc.	1
	78

5. Western Samoa

earthquake	3
tsunami	8
volcanic eruption	2
hurricane	33
flood	-
drought (NZ records. maj. indicate otherwise)	-
tornado, etc.	-
	46

6. Gilbert Islands (figures for Gilbert & Ellice Islands)

earthquake	3
tsunami	-
volcanic eruption	-
hurricane	4
flood	-
drought	16
tornado, etc.	-
	23

7. Tuvalu (where definitely ascribed and abstracted when possible from figures for Gilbert & Ellice Islands)

earthquake	1
tsunami	-
volcanic eruption	-
hurricane	2
flood	-
drought	1
tornado, etc.	-
	4

8. Cook Islands

earthquake	-
tsunami	1
volcanic eruption	-
hurricane	19
flood	-
drought (NZ records. maj. indicate otherwise)	-
tornado, etc.	-
	20

9. Niue

earthquake	1
tsunami	-
volcanic eruption	-
hurricane	5
flood	-
drought	-
tornado, etc.	-
	6

APPENDIX 5

TABULATED SUMMARY OF AVAILABLE ACCOUNTS OF CONSEQUENCES AND LOSSES. 1836 - 1973

Country	Date	Type and Name	Consequences	Deaths	Financial Estimate
Papua New Guinea	1972 Aug.	Tsunami	Locally damaging		
	1971 July	Tsunami	Waterfront flood damage. Rabaul		
	1971 July	Tsunami		2	
	1970 Oct.	Earthquake (Madang)	Submarine cable broken Landslides.etc. (ref. report)	15	A$1.7 million Loss.
	1968 Sept/ Oct.	Earthquake	Number of buildings damaged		
	1972 Jun/ Sept.	Frost/drought	Extensive damage to gardens of 150,000 in W & S highlands		
	1940/41	Frost/drought	General shortage of food In W & S highlands. Extensive damage to crops, extensive migration and consequent fighting		A$4 million Aid.
	1909	Drought	'Much suffering to natives'		
	1972 May	Hurricane (Hannah)	Hospital flooded at Kieta, Bougainville. Many raods washed out at Tufi and Dogura. Seven villages on S. coast New Britain total pop. 1417. 94 sleeping houses, 67 kitchens & 10 trade stores damaged. Tufi: 20 out of 60 permanent structures destroyed and 20 more so badly damaged need demolition. Remainder need repair.		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimate
Papua New Guinea	1972 May	Hurricane (Hannah) /cont..	Many trees and coconut palms stripped. Electric light poles damaged. 73 rubber trees blown down at Wanigela. 200 coconut palms blown down.		
	1930 Dec.	Tsunami	Ninigo Is.	5	
			Villages wrecked: Awin Is.	6	
	1919 May	Tsunami (Rabaul)	Whaling boat picked up and left on pier.		
	1906 Sept.	Tsunami	Widespread destruction	'a few'	
	1899 Nov.	Tsunami	Several houses wrecked		
	1895 Mar.	Tsunami	6 metre wave	26	
	1888 Mar.	Tsunami	Result of Ritter Is. volcanic eruption. Most disastrous tsunami in Papua New Guinea 12m wave	Fatalities but no. unknown	
	1856	Tsunami	Avalu village wrecked	Many drowned	
	1974 Oct.	Volcano (Ritter Is.)	Minor landsliding		
	1960 Mar/ Apr.	Volcano (Manam Is.)	Evacuation of some villages		
	1958 Jan/ Mar.	Volcano (Manam Is.)	Evacuation of island population 8 months. Subsistence gardens ruined.		
	1951 Jan/ Jun.	Volcano (Mt. Lamington)	90 sq.mils of country devastated. Secondary effects: floods, mud flows, closed roads. 5000 evacuated.	3000 - 4000	
	1937	Volcano (Rabaul)	Rabaul (capital) evacuated.		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Tonga	1973	Hurricane (Juliette)	Severe damage to crops, housing, water tanks, schools, churches on 7 islands and 17 villages. Several hundred homeless. 33% copra crop lost. Banana crop total loss.	3	T$120,000.00 Aid (relief fund) T$159.00 Aid T$1,770,100.00 Loss.
	1969	Gale	Banana crop severely affected		
	1961	Hurricane	Extensive damage Vava'u and Ha'apai to subsistence and export crops 8000 people required emergency shelter.	2	
	1953	Drought	Adverse affect on crop production		
	1951-52	Drought	Adverse affect on crop production Considerable damage bananas.		
	1949	Storm	Isolated: damage to coconuts Certain amount damage to food crops		
	1948 Dec. 1946	Hurricane Volcano (Niuafo'ou)	1300 evacuated to Eua. Considerable damage to crops		£20,000 copra awaiting shipment lost.
	1932	Hurricane	Continued fall in copra exports due Hurricanes over past three years.		
	1931 1930	Hurricane Drought Volcano (Niuafo'ou)	ditto. ditto. Tongatapu One town destroyed. One-third cultivated land on island destroyed.		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Tonga	1926	Drought	Depressed trade, copra output adversely affected.		
	1915	Hurricane	Affected coconut crop.		
	1914	Hurricane	Considerable setback cocobut crops.		
	1913	Gale	Coconuts in particular affected.		
	1909	Hurricane	Some damage to plantation (coconuts)		
	1865	Tsunami	Ship wrecked on reef		
Cook Islands	1972	Hurricane	Little damage, Aitutaki & Mauke.		
	1946	Hurricane	Widespread damage, Rarotonga Aitutaki.		
	1942	Hurricane	Suwarrow completely inundated		
	1926	Tsunami	Tidal wave swept over island (Palmerston)		
	1925	Hurricane	Considerable damage to bananas: Rarotonga		
	1846 Mar.	Hurricane	Coasting schooner taken over tops of coconuts and inland.		
Gilbert & Ellice Islands	1973-74	Drought	Copra exports fell 10,000 tons		
	1972 Oct.	Hurricane (Bebe)	Generating and radio equipment destroyed. 95% houses demolished. 4 fishing vessels foundered. 700 people homeless.	5	Est. 1½ million $ 'to put things right'.
	1963	Drought	Copra production affected		
	1954-55	Drought	Coconuts stored - not for copra. Loss of experts	'Beri-beri killed a number of natives'	

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Gilbert & Ellice Islands	1934	Drought	Coconuts stored - not for copra. Loss of exports	'Beri-beri killed a number of natives'	
	1928	Hurricane	Considerable damage to property and coconut trees.		
	1924-25	Drought	Coconut crop ruined. Yields of copra considerably reduced.	'great mortality amongst the natives' (Ocean Is.)	
	1914	Hurricane	Damage to cultivation Suspension of copra industry for two years (Union Group)	'Loss of a few lives'	
	1910	Drought	Copra exports very much affected. 'combatting famine'.		
Niue	1968	Hurricane	Houses demolished, crops lost. Exports of copra, bananas seriously affected. No bananas 15 months. Few coconuts for two years. Damage buildings, telephone lines.		
	1960	Hurricane	750 out of 850 houses destroyed.		
	1959	Hurricane	167 houses destroyed 156 beyond repair 116 repairable		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Western Samoa	1968 Feb.	Hurricane	70% all banana producing stems. Moratoruman loan repayments 25-35% reduction cocoa crop. 60% new cuttings destroyed. Copra: expected to be lower for 1969 than 1967 after 1966 hurricane (see below)		$191,860 damage to government property (buildings)
	1966	Hurricane	Banana industry temporarily wiped out. Copra 50% reduction. (1967 was the lowest production for 30 years) Cocoa: considerable decrease. Total exports 40% down (1966). 2135 mature tonnes food supplied		Reduction in revenue forecast for treasury of £102,000 Damage to government buildings £32,534 £20,000 government and voluntary aid, plus £26,000 overseas donations.
	1960	Tsunami	Some damage		
	1941	Gale	Havoc in unprotected plantations		
	1939 Jan.	Storm	Upolu devastated.		
	1936	Hurricane	All but strongest built houses demolished		
	1931	Cyclonic Storm	Flooding, Apia		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Western Samoa	1926	Intense Storm	Tug blown onto reef. Coastal vessel beached. Damage to plantations	3	£1000 property damaged
	1923	Cyclone	'Worst for 25 years'. Copra: considerably reduced.		
	1918	Tsunami	Much damage, Apia		
	1917 June	Earthquake	Considerable damage to buildings and contents. Fire in Apia. Landslides at Saluatata. Flooded houses and plantations - tsunami. Sea wall demolished.		
	1905-11	Volcano (Matavanu)	Evacuation. Plantation and agricultural damage.		
	1889	Gale	6 warships and 12 merchant ships destroyed. Severe damage to Apia district.		
	1883	Hurricane	Disastrous. 7 ships in harbour blown ashore.		
		Tsunami	Quake and tsunami at same time as hurricane		
	1850	Hurricane	Upolu devastated 'as if by fire.' Savai'i hardly suffered. All ships in harbour (?) foundered		
	1846	Hurricane	3 ships grounded, Apia.		
	1836	Gale	Some damage		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Solomon Islands	1972	Hurricane (Ida)	Destroyed valuable timber		
	1971	Hurricane (Ursula) Santa Anna	All houses destroyed. Killed animals. Birds went away - increase in crop pests (Secondary loss) 2500 homeless. Many gardens and coconut groves destroyed.	1	
	1971	Volcano (Tinakula)	160 people evacuated. Extensive damage. San Christobal bridge lost, recently completed.		
	1967	Hurricane	Deep water berth at Honiara damaged. Gardens damaged. Houses flooded. Ontong Java - one village destroyed and 50% of coconuts in 42 islands destroyed Gilbertese Settlement Wagina destroyed. Much flooding.		90,000 A$ from British Red Cross. Aid.
	1960	Tsunami (Chile 'quake)	Wharf damage		
	1952 Jan.	Hurricane	Considerable damage to property. Wharf destroyed Kukom. Food crops destroyed in Tikopia - relief sent to avoid famine. Tikopians resettled.		
	1939 Apr.	Tsunami		12	
	1931 Oct.	Tsunami	18 villages destroyed	50	
	1926	Tsunami	Guadalcanal island and port inundated. 2-6metres		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Solomon Islands	1899	Tsunami	Many native beach houses washed away		
Fiji	1975 Jan.	Hurricane (Val)	758 houses destroyed. 22,000 rationed for 6 months (1000 suffered 3rd hurricane in 3 years) 26 schools damaged		
	1973 Dec.	Hurricane (Lottie)	1373 houses destroyed. 40 schools damaged or destroyed. 15,000 people rationed (10,000 suffered 2nd disaster)	74 (2 ships sank)	Outstanding rebuilding programme at June 1975, F$1,500,000
	1973 Apr.	Hurricane (Juliette)	229 houses and 9 schools destroyed. Extensive crop damage, 1500 homeless. NB. Juliette, Tina and Betty. Notes on losses.		
	1972 Oct.	Hurricane (Bebe)	Worst for 20 years. Severe floods. Severe setback to development plan. 120,000 received rations - one-fifth population. 1697 bures) 980 houses) destroyed 28 schools) 2589 bures) 1553 houses) extensively 30 schools) damaged 695 bures) 444 houses) slightly 14 schools) damaged	19	Non-agricultural damage : US$20m Agricultural losses: US$2.5m PMHRC administered : F$500,000.00 incl. some assistance to Tonga

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Fiji	1972 Oct.	Hurricane (Bebe) / cont..	Rotuma: 90% population dependent on relief for 3-6 months. Yasawa: two-thirds houses destroyed. 80-90% coconut crop destroyed. Vanua & Viti Levu sugar wharf beyond repair. Severe sugar crop losses - flooding 85,000 people requested relief for 3 months. Lakeba coconut crop fell from 300 tons p.a. to 50 tons p.a. Destroyed 11,770 houses 250 schools 90% crops 120,000 fed for 6 months.		
	1968	Drought	Sugar cane 17.2% fall in production.		
	1967	Hurricane	Severe banana and rice losses Considerable damage to houses		
	1965	Hurricane			£900,000 crops and livestock destroyed incl. £¼m loss of copra production.
	1964 Mar.	Flood	Roads and bridges destroyed		£500,000 est. damage. £750,000 est. crops destroyed.
	1961	Earthquake	Minor damage to buildings		
	1959	Hurricane	Coastal villages destroyed by flooding		

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Fiji	1958 Nov/ Dec.	Hurricane	Reduction in crops bananas rice (copra) Total destruction of banana plantations		
	1958 Jan.	Hurricane	Damage to coconut plantations, Taveuni.		
	1957	Drought	Copra production dropped, rice depressed.		
	1956	Flood	Crop damage, cane, rice, banana: falls in sugar and banana exports.		
	1953	Earthquake and Tsunami	Much damage to property Cable damaged (submarine)	8	
	1952 Jan.	Hurricane	Suva wharf damaged severely Wiped out new banana plantations. Production dropped.		
	1950	Flood	Damage to bananas, sugar, and food crops.		
	1948	Hurricane	Rice and copra production fell Dwellings damaged.		
	1941	Hurricane	Many houses unroofed	3	
	1939	Hurricane	Damage to roads and power lines		
	1936	Hurricane	Extensive damage to huts and trees		
	1932	Earthquake	Port Alldin lighthouse. 3 feet out of perpendicular.		
	1931	Hurricane	Severe damage property and food crops. Lantolea demolished. Production of sugar, copra, bananas, cotton suffered. Sugar crop of 1932 improved from flood silt.	200	
	1930	Hurricane	Heavy crop damage	3	

Country	Date	Type and Name	Consequences	Deaths	Financial Estimates
Fiji	1930	Tornado	50 seconds duration.		£3000 structural damage
	1929 Dec.	Hurricane	Considerable property and livestock losses. Bananas, cotton, coconuts suffered considerably. 'Native' crops also.	12	£60,000 structural damage at Labasa.
	1926	Drought	Increased % of sugar in cane*. Decreased copra, rice, cotton and pineapples.		
	1923 Nov.	Hurricane	Native houses and crops suffered but plantations didn't.		
	1923	Hurricane	Very disastrous at Munia.		
	1918	Drought	Decrease in sugar exports		
	1915	Hurricane & Flood	Banana production decreased.		702,631 bunches bananas below previous year.
	1914	Hurricane	Sugar export decreased by 2598 tons.		
	1913	Hurricane	Copra production down.		
	1912	Hurricane	Annual decrease in exports.		
	1910	Hurricane	Coconuts, bananas and cane. Banana industry suspended for some months.		
	1905	Drought	Decrease in sugar exports		
	1893	Flood	Decrease in sugar and copra exports.		
	1889	Hurricane	Decrease in sugar exports		
	1886	Hurricane	Serious effects on copra production.		636 tons down.
	1879	Hurricane	Rotuma devastated		

APPENDIX 6

AN ANALYSIS TO DETERMINE THE DEGREE OF REPRESENTATIONAL SIGNIFICANCE OF ANY ONE OF NINE COUNTRIES.

There is no 'typical' country among the SPEC members. On the contrary, the number and extent of extremes between them is considerable. Therefore, in an attempt to assess how much each one may represent all, in a range of selected characteristics relevant to this Study, the following analysis has been prepared.

	Cook Is.	Fiji	Gilbert Is.	Nauru	Niue	Papua New Guinea	Solomon Is.	Tonga	Western Samoa	Total
Area sq. mls										
Over 150,000						x				1
1000 - 12,000		x					x		x	3
*Below 300	x		x	x	x			x		5
*Island group	x	x	x				x	x	x	6
Single island				x	x					2
Land mass						x				1
Population										
Over 2 million						x				1
*7,500 - 750,000		x	x				x	x	x	5
Below 25,000	x			x	x					3
*Melanesian		x		x		x	x			4
*Polynesian	x	x	x	x				x	x	6
Micronesian			x							1
Disaster Experience										
*Hurricane	x	x			x		x	x	x	6
Volcanic eruption						x	x	x		3
*Earthquake		x				x	x	x		4
*Tsunami						x	x		x	4
*Drought		x	x			x		x		4
Flood		x				x	x			3
*Volcanic	x	x				x	x		x	5
Atoll	x		x					x		3
Raised Coral	x			x	x					3
Aid Alliance										
Strong	x				x	x				3
Medium								x	x	2
*Mild		x	x	x			x			4
Disaster Precaution Awareness										
Strong		x								1
*Medium	x					x	x	x	x	5
Mild			x		x					2

Arranged in order of most frequently occurring, representational elements are thus:

Island group	6
Polynesian race	6
Hurricane experience	6
Below 300 sq. mls	5
7,500 - 750,000 population	5
Volcanic origin	5
Medium precaution awareness	5
Melanesian race	4
Earthquake experience	4
Tsunami experience	4
Drought experience	4
Mild aid alliance	4
1,000 - 12,000 sq. mls	3
Below 25,000 population	3
Volcanic eruption experience	3
Flood experience	3
Atoll	3
Raised coral	3
Strong aid alliance	3

The most significant representational elements are taken as those occurring before any serious 'contradiction' occurs, that is, excluding three occurrences and below.

Of the twelve most frequently recurring elements, the following countries possess most occurrences:

Cook Is.	6
Fiji	9
Gilbert Is.	6
Nauru	4
Niue	2
Papua New Guinea	6
Solomon Is.	9
Tonga	8
Western Samoa	7

When placed in numerical order these read:

Fiji	9 elements
Solomon Is.	9 elements
Tonga	8 elements
Western Samoa	7 elements
Papua New Guinea	6 elements
Gilbert Is.	6 elements
Cook Is.	6 elements

Either Fiji or the Solomon Islands can be taken as being the most representational of the nine countries. To examine most advantageous grouping an inspection for geographical proximity can now be applied amongst this penultimate group of seven countries and it can be concluded that Fiji, Tonga and Western Samoa could be grouped together; the Solomon Islands and Papua New Guinea could be grouped, leaving the Gilbert Islands and the Cook Islands on their own. This 'statistical' isolation of the Gilbert Islands and the Cook Islands is significant because of all island groups, the Gilbert Islands have special problems related to the occurrence of drought which demand special consideration and the Cook Islands are by far the most extensive group of islands (with distances between them greater than any extremity of Papua New Guinea for instance) which create problems of communication which demand special consideration. The extent of the Cook Islands is greater than the extent of the Fiji, Tonga, Western Samoa grouping and similar to that of the Papua New Guinea and Solomon Islands grouping.

APPENDIX 7

PRINCIPAL PERSONS INTERVIEWED

ALOLEA, Dr. Ministry of Health and Welfare. Chairman: Gilbert Islands Red Cross, Tarawa.

AMPUTCH, C. Ministry of Finance, Suva.

BAKOLES, Frank. Assistant Secretary for International Organisation, Ministry of Foreign Affairs. Port Moresby.

BAXTER, Prof. Quentin. Professor of Constitutional Law, Victoria University, Wellington.

BELL, G.J. Royal Observatory, Kowloon.

BETHAM, Richard. Director, Department of Statistics, Apia.

BLUMHARDT, Mrs. New Zealand High Commission, London.

BRADSHAW, Ken. Marine Superintendent, Ministry of Works, Honiara.

BROOKE, Barry. Deputy High Commissioner, New Zealand High Commission, Suva.

BROWN, Mr. General Manager, Gilbert Islands Development Authority, Tarawa.

BUADROMO, Lt. Col. M.V. Secretary, Home Affairs, Prime Ministers Office, Suva.

CAMPBELL, R.O. Secretary for Local Government and Rural Development, Tarawa.

CAVALEVU, Mr. Secretary Prime Ministers Office, Chairman: Hurricane Relief Committee, Suva.

CHADA, P.R. Senior Lecturer in Accounting, University of Papua New Guinea, Port Moresby.

CHAPMAN, Richard. Secretary tof Trade, Industry, Labour and Commerce, Hurricane Officer, Rarotonga.

CHAPMAN, Terry. Secretary to Government, Niue.

CHEEK, E.S. Secretary, Ministry of Communications, Works and Utilities. Director of Posts and Telecommunications, Director of Civil Aviation, Tarawa.

CHIN, Dr. Royal Observatory, Kowloon.

COE, Mr. Commercial Union Ass. Co. Ltd., London.

CROLL, Dr. R.D. Australian Scientific Liaison Office, London.

CUDMORE, Mr. Development Officer, Ministry of Finance, Nuku'Alofa.

DAHL, Dr. A.L. Regional Ecological Adviser, South Pacific Commission.

DANDY, Philip. Deputy Secretary. Ministry of Labour, Commerce and Industry, Port Moresby.

DAVIES, Mr. Queensland Insurance Co. Ltd., Suva.

EVERINGHAM, Ian B. Observer in Charge, Geophysical Observatory, Port Moresby.

FLINT. P.S. Mercantile & General Reinsurance Co. Ltd., London.

GABITES, Dr. J.F. Director, Fiji Meteorological Service, Nandi.

GINA, J. Statistics Office, Office of the Chief Minister, Honiara.

GOMBO, Kipling. Director, National Civil Defence and Emergency Services, Port Moresby.

GOODWIN, F. Superintendant of Police, Deputy Hurricane Officer, Rarotonga.

GOSSELIN, Jim. Director, Central Planning Bureau, Rarotonga.

GRESFORD, G.B. Senior Adviser on Science Technology and the Environment, Department of Foreign Affairs, Canberra.

GRIDGEMAN, Trevor. New Zealand Insurance Co. Ltd., Suva.

HARRIS, Geoffrey. Chairman, Economics Faculty. University of Papua New Guinea, Port Moresby.

HARRISON, David J. Managing Director, Nauru Insurance Corporation, Nauru.

HELU, Major Iteni. Tonga Defence Services, Secretary, Tonga Red Cross, Nuku'Alofa.

HENRY, The Hon. Sir Albert. Premier of the Cook Islands, Rarotonga.

HENRY, Howard. Director of External Affairs, Rarotonga.

HILL, John. Airport Superintendant, Niue.

HUGHES, Tony. Head, Central Planning Office, Honiara.

HUTCHISON, Alistair. Financial Secretary, Apia.

HYDE, Mr. Gilbert Islands Development Authority, Tarawa.

IRWIN, R.G. Deputy Director, South Pacific Bureau for Economic Co-operation, Suva.

JONES, J.P. Assistant Secretary, Chief Ministers Office, Tarawa.

KALAUNI, Sol. Registrar of Justice, Niue.

KAUTOKE, Busby. Assistant Secretary to Government, Nuku'Alofa, Tonga.

KAVALIKU, The Hon. Dr. S. Langi. Minister of Works Education and Aviation, Chairman, Hurricane Relief Committee, Nuku'Alofa.

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KING, George. Chief Architect, Public Works Department, Suva.

KING, Miss Marais. Deputy High Commissioner, Australian High Commission, Suva.

KIRATA Barbera. Secretary, Ministry of Finance, Tarawa.

KOTOBALAVU, J. Secretary, Ministry of Foreign Affairs, Suva.

KRUSE, Hans. Director of Economic Development, Apia.

LAPANI, Charles. Assistant Director, Central Planning Office, Port Moresby.

LEICESTER, Dr. R. CSIRO, Melbourne.

LEONARD, Gary. Agricultural Officer, Crops, Niue.

LEUNG WAI, Sam. Director of Agriculture, Apia.

LIVINGSTONE, Mrs. Laloma. Secretary-General, Fiji Red Cross Society, Suva.

McDONALD, A. Secretary for Commerce and Industry, Tarawa.

McDOWELL, David. Director, External Aid Division, Ministry of Foreign Affairs, New Zealand Government.

MacFADIEN, Mr. Head, Statistics Office, Office of the Chief Minister, Honiara.

MacKENDRICK, Dr. Director of Health, Apia.

MacKINLAY, Alex. Acting Chief Geologist, Geological Survey. Port Moresby.

MacNAMARA, N. Commissioner for Local Government, Port Moresby.

MAGARI, Kas. Meteorological Service, Port Moresby.

MARAJ, Dr. J.A. Vice Chancellor, University of the South Pacific, Suva.

MATOTA, Mr. Assistant Secretary, Ministry of Finance, Nuku'Alofa.

MEREDITH, George. Director of Works, Apia.

MICHIE, Mr. Government Agent, Central District, Honiara.

MILLER, His Excellency Brian. Acting High Commissioner, United Kingdom High Commission, Suva.

MULLER, Philip. Superintendant, Observatory, Apia.

MURRAY, Brian. New Zealand High Commission, Suva.

MURRAY, Owen. Radio Superintendant, Niue.

O'BRIEN, Danny. Agricultural Officer, Livestock, Niue.

O'BRIEN, Terrence. New Zealand Representative, Rarotonga.

PACKET, Neville. Sydney Packett & Sons Ltd., Bradford.

PICKERING, D.S. Acting Assistant Director-General, Director of Operations, Public Works Department, Suva.

RAWLINS, Miss Pat. Commercial Union Assurance Co. Ltd., London.

RICHARDS, Daniel. Deputy High Commissioner, New Zealand High Commission, Apia.

RICHELMAN, Jack. Acting Secretary to Government, Nuku'Alofa.

ROKOROI, Mr. Meteorological Office, Suva.

ROUGHAN, Jack. Director of Works, Niue.

SADORAKA, Mr. Secretary for External Affairs, Nauru.

SAEMALA, Frank J. Central Planning Office, Honiara.

SANDERS, Robert T. Secretary, Foreign Affairs, Prime Ministers Office, Suva.

SAWTELL, Gordon H. Secretary of the Premiers Department, Rarotonga.

SCADDON, Steve. Permanent Secretary Ministry of Home Affairs, Honiara.

SHIPLEY, Keith. Secretary to the Chief Minister, Tarawa.

SIGRIST, Ltnt. Dennis. International Tsunami Information Center, Honolulu, Hawaii.

SIMIKI, T.T. Ministry of Agriculture, Nuku'Alofa.

SINGH, Dr. Amer. Ministry of Finance, Suva.

SPRINGFORD, John. Acting New Zealand Representative Niue, Assistant Head, Pacific Division, Ministry of Foreign Affairs, New Zealand.

STEHLIN, Edmund. Trade & Development Commissioner of Western Samoa, Auckland.

STEWART, Don. Ministry of Foreign Affairs, Nauru.

TAGILALA, Mr. Controller of Supplies, Suva.

TANENTOA, The Hon. Otivea. Minister for Commerce and Industry, Tarawa.

TAYLOR, Chris. Under-Secretary, Ministry of Finance, Honiara.

THOMPSON, Dr. R.B. Chief Geologist, Ministry of Natural Resources, Honiara.

THOMSEN, H. Secretary Copra Board, Director, Thomsen Insurance, Apia.

TOMA, I. Secretary to Government, Apia.

TUFUI, Daniel. Secretary to Government, Tonga.

TUNI, D. Seismology Section, Ministry of Natural Resources, Honiara.

TUPOUNIUA, M.U. Director, South Pacific Bureau for Economic Co-operation, Suva.

VAGG, Mrs. Joy. Director, Red Cross, Honiara.

VIVIAN, The Hon. Young. Minister for Economic Development, Niue.

WARBURTON, Alf. Ministry of Works, Honiara.

WEBB, Mr. United Kingdom High Commission, Suva.

WILD, Dr. de. World Health Organisation, Suva.

APPENDIX 8

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