

The 1997 Drought and Frost in PNG: Overview and Policy Implications

Bryant J. Allen* and R. Michael Bourke*

Abstract

Major climatic events in 1997–98, including the most serious drought of the past century, significantly affected rural PNG. Widespread and repeated frosts occurred in the highlands, especially at very high altitude locations. In this paper, we give a summary of the impact of the drought and frost, focusing on disruption to village food and water supplies, health, bushfires, water supply for institutions and urban areas, power supply and the national economy. The vulnerability of poor people in certain remote locations is highlighted. The various responses to the drought and frost are summarised, including those of the PNG and Australian governments, other institutions and rural villagers. The assessments of the impacts are described. A series of implications for policy and program development are outlined.

In 1997–98, the Western Pacific was affected by a major climatic extreme. This led to a very severe drought in much of PNG, with various starting dates in different locations from March 1997. Most of the country received drought-breaking rains between December 1997 and February 1998. Frosts occurred in the highlands from as low as 1450 metres above sea level (masl). At above 2200 masl, repeated frosts caused severe damage to crops. The drought and frost severely disrupted the PNG economy and led to the collapse of normal subsistence food production systems in many places. Many people, from both within PNG and overseas, were involved in assessing the drought and frost impact, in providing relief to rural villagers and in assisting with rehabilitation.

A number of important policy implications have arisen from the events of 1997–98, and from the responses of the PNG people, the PNG national gov-

ernment and provincial administrations, nongovernment organisations (NGOs) and the international community. This paper gives an overview of these issues, together with some policy recommendations to reduce the impact of future climatic extremes. In this section, a series of 17 papers describe the impact of the drought and frost, each from a different perspective and scale.

Climate and Food Supply in PNG

Rainfall and temperature are the two most important influences on food production in PNG. Rainfall directly affects crop production, with both seasonal and between-year variation. The national network of rainfall observation stations in PNG has shrunk drastically from about 1000 in 1972 to less than 100 in 1997, and many records are broken by missing data. In addition, many clients of the National Weather Office encounter difficulties in accessing data and have to pay excessive amounts for information. Together, these factors mean that it is not possible to provide a detailed description of the changes in rainfall that occurred in 1997.

* Department of Human Geography, Research School of Pacific and Asian Studies, The Australian National University, Canberra, ACT 0200, Australia.
Email: bja406@coombs.anu.edu.au

Rainfall in PNG is heavily influenced by the El Niño Southern Oscillation (ENSO), which has an average return period of about 10 years. ENSO activity involves climatic events due to changes in the sea surface temperature and major air circulation over the Pacific and Indian Oceans. One outcome of moderate ENSO activity is a sequence of heavy rainfall followed by somewhat lower than normal rainfall over a 1–2 year period. Such rainfall patterns can reduce sweet potato production, especially where villagers produce sweet potato continuously (Bourke 1989). The association between rainfall pattern and sweet potato production is often not noticed by villagers due to a time lag of 4–8 months between the two events.

In the highlands of PNG, such food shortages are exacerbated by fluctuations in the sweet potato planting rate, as women vary the planting rate according to the current supply of sweet potato and men vary the amount of land cleared from fallow (Bourke 1988). These food shortages have commonly resulted in localised starvation, and sometimes in widespread famine, especially where people depend on a single major food source such as sweet potato in the highlands. In the lowlands, where regular rainfall seasonality occurs, agricultural systems are designed to ameliorate the effects of variable rainfall (for example, see *Food Aid and Traditional Strategies for Coping with Drought: Observations of Responses by Villagers to the 1997 Drought in Milne Bay Province* by Jane Mogina, in these proceedings). Today, most rural villagers use cash to buy rice and other food, which also evens out fluctuations in the supply of subsistence foods.

An ENSO event causes widespread, moderate to severe drought in PNG with an average return period of about 10 years. As well, lack of cloud and clear night skies associated with the drought cause frosts in areas above about 2000 masl.

However, once every 50–100 years, an ENSO event causes a drought of such significance that food production is disrupted over wide areas of PNG for periods of up to a year. These droughts are accompanied by bushfires and losses of drinking water supplies. In the past, such events have resulted in large numbers of deaths from starvation and disease. Oral historical and eyewitness accounts of such events have been collected by outside observers, such as patrol officers and missionaries in Southern Highlands, Enga, New Ireland, Milne Bay and Central provinces. Even today, a major drought and frost may overwhelm many people's food and water security.

The 1997 ENSO event was more severe than others recorded over the past 70 years, including those in

1987, 1982, 1972, 1965, 1942, 1941 and 1931. There have also been droughts earlier this century, but we have less information about them. There was a major and widespread drought in 1914, as well as apparently lesser events in 1905, 1902 and 1896 (Allen 1989). The 1997 event was at least as bad as that of 1914, and was probably more widespread and severe. However, we are unable to make more definite comparisons because of the limited records of 1914.

Impacts of the Drought and Frost

The 1997 ENSO event caused serious difficulties to both rural and urban people in PNG, and also affected the national economy. A brief summary of these major impacts follows, and they are discussed in more detail by Bourke (2000). Some of these issues are discussed in more detail in other papers in these proceedings.

Rural food supply

Most rural villagers had their food supply disrupted in 1997, some for many months. By the end of 1997, an estimated 1.2 million villagers (almost 40% of the total rural population) were suffering a severe food shortage, which was life-threatening in some cases. Many others were affected less severely, and some were unaffected (Allen and Bourke 1997b). Food shortages began in mid-1997, became serious by September 1997 for much of the country, and peaked in late 1997 to early 1998. They were largely over by April–June 1998 for most people (Wayi 1998). Recovery was delayed in the highlands to early to mid-1998, because many sweet potato crops that were planted with the return of the rains in late 1997 failed to give normally expected yields (see *Postdrought Agricultural Rehabilitation: the 1997–98 El Niño Drought in PNG* by Matthew Wela B. Kanua and Sergei Bang, in these proceedings).

Rural water supply

By December 1997, some 1.5% of rural villagers only had access to limited amounts of drinking water, which was also contaminated or brackish. A further 11.5% of rural people were drinking water of questionable quality or were carrying water for long distances, that is, for more than 30 minutes walk. Thus, over 400,000 people had a grossly inadequate supply of drinking water at the peak of the drought. The situation rapidly returned to normal following rains from December 1997 to January 1998.

Urban and institutional water supplies

The drought had a major impact on many institutions, mainly as a result of water supply problems. For example, four correctional institutions had to be closed in late 1997 because of lack of water. In some locations, almost all community schools were closed. The drought reduced the water supply of a number of small urban locations, including Kerema in Gulf Province and Kundiawa in Simbu Province. Other small urban centres with water supply problems included Balimo in Western Province, Rabaraba in Milne Bay Province and Tambul in Western Highlands Province.

Health

There was much anecdotal evidence from health professionals and villagers that the lack of food and water had an adverse effect on people's health. There were many reports of an increased incidence of diarrhoea, malaria, typhoid, skin diseases and respiratory ailments. There were also some reports of an increased incidence of dysentery.

Bushfires

Extensive fires occurred in forests and grassland. A large number of village houses were burnt by bushfires. There were several accounts of people burnt in these fires, but this was not a common cause of death. Fires were not confined to locations that normally experience a dry season. For example, in the Mt Karimui area in Simbu Province, which normally has a very wet and nonseasonal climate, bushfires had occurred over extensive areas by November 1997. Many airstrips, including Kundiawa in Simbu Province, were closed by smoke and haze in October–November 1997, some for as long as three weeks.

Power supply

Two hydroelectric stations generate most of the electricity in PNG. The Ramu Scheme at Yonki in the Eastern Highlands supplies power for seven provinces and for the industrial city of Lae, Morobe Province. The Surinumu reservoir near Port Moresby provides both power and water to Port Moresby. The water volume in both the Surinumu and Ramu storage reservoirs fell linearly from April 1997. Water levels in the Yonki reservoir declined, but there was still enough water to allow power generation until the rains returned in December 1997. In contrast, the level in the

Surinumu reservoir fell to about 20% of water holding capacity by December 1997. If water continued to be used for power generation, there was a high risk that the water supply for the city would become scarce, or could even stop. Thus power generation for Port Moresby was restricted from October 1997. Even with the use of a gas-powered generator and widespread use of private generators, there was an inadequate electricity supply and this caused considerable disruption in Port Moresby, which continued until late 1998.

The national economy

The temporary closure of two large mines as a result of the drought, and the consequent impact on export income, had a major negative impact on the national economy. The Ok Tedi Mine did not operate from August 1997 to March 1998, since the low water level of the Fly River made navigation by barges or small ships impossible and isolated Tabubil and Kiunga in Western Province, the township and port, respectively, for the Ok Tedi Mine. The Porgera Gold Mine also stopped producing in late 1997, but only for 45 days.

The drought did, however, lead to a significant increase in the coffee export crop in 1998, in contrast to predictions by the Coffee Industry Corporation (see *The Influence of Available Water in 1997 on Yield of Arabica Coffee in 1998* at Aiyura, Eastern Highlands Province by P.H. Hombunaka and J. von Enden, in these proceedings).

The drought was reported by the PNG Government to be a contributing factor in the massive slide in the value of the PNG kina (PGK), with the currency dropping against the US dollar from about PGK1=US\$0.72 in September 1997 to about PGK1=US\$0.40 by April 1998. Other analysts suggest that government mismanagement and the Asian economic crisis are likely to have been more important factors in this devaluation. The cost of many imported goods increased during 1997, increasing the cost of living mainly for urban people, even though Rice Industries Pty Ltd absorbed the cost increases in imported rice during 1997 (see *The Role of Rice in the 1997 PNG Drought* by Neville Whitecross and Philip Franklin, in these proceedings).

Despite the increased cost of imports, the weaker PGK also increased the prices received for export crops. The prices for coffee and cocoa in 1998 were higher than those of recent years, which both encouraged production and assisted rural people to recover from the drought.

Vulnerable areas

The severity of the ENSO climatic event in 1997 was clearly associated with distance from the equator, with greater rainfall deficits south of 5°South. Some locations north of this latitude were also severely affected. The severity of the impact was mediated by the social, economic and political circumstances that prevailed in different parts of the country. Villagers with access to cash or markets where they could earn cash, or to relatives and family with cash, were best able to reduce the impact of the drought and frost.

Conversely, people who had little or no savings, nor the means to earn cash, and had few or no relatives or family in employment suffered disproportionately (Bourke 1999). People falling into this category live in places with limited access to markets and services. These places are commonly located along provincial boundaries, in the zone between the central highlands and the coast, in isolated inland lowland areas on the mainland, in inland New Britain, and on many of the very small islands. In 'normal' times in these places, education and health services are poor, cash incomes are low and child malnutrition rates are well above the PNG average. In 1997, although the Australian Government targeted such people (in areas with no road access) for the supply of supplementary food by air, there is evidence that an unknown number of people in very isolated areas suffered severely and that death rates increased significantly in some such places.

Responses to the Drought and Frost

PNG Government

The response of the national government to the 1997 drought and frost was somewhat haphazard, due to various limitations (see Responses to the 1997–98 Drought in PNG by Peter Barter, in these proceedings). Before the drought, many parts of the government administration were barely functioning: the added pressures of 1997 exposed serious deficiencies in its political and administrative structures.

Two major factors made the administration of the country more difficult during 1997. Firstly, recent reforms contained in the Organic Law on Provincial Governments and Local-Level Governments in 1995 changed the relationship between the national and provincial governments. Secondly, there were changes to district boundaries, which made administrative districts and electorates into the same unit.

In 1997, some implications of these difficulties included:

- a National Disaster and Emergency Services (NDES) organisation, poorly managed for a number of years, that was unable to adequately respond to the crisis;
- all members of parliament being given money for relief based on the population of their electorate, irrespective of the seriousness of the impact of the drought and frost in their electorates;
- a period of almost three months from the time that the emergency was declared until a national trust fund was established to receive monetary aid from national and international donors;
- public expressions of mistrust, by the international aid community of the national government and by the national government of provincial governments; and
- the appointment of officials, followed by their almost immediate removal for reasons that had nothing to do with their competency.

This situation was confounded by a significant proportion of schools and health facilities being closed well before the drought began, due to lack of staff, funds or supplies, and a majority of schools and health centres at which roofs, gutters and tanks had not been maintained for years, so no drinking water had been collected or stored before the drought began. Recognition must be given, however, to those local school teachers and health staff who stayed at their posts and gave outstanding service to their local communities, who were suffering from a lack of drinking water and food. The staff of numerous missions also provided much assistance to needy villagers.

A national government relief effort finally got under way and around 5500 tonnes of rice was distributed using the NDES. How much of it reached people in need is unknown. In a number of provinces, it was reported that rice continued to be supplied long after the worst of the food shortage was over, mainly because, although it had been ordered during the height of the drought, funds for its purchase and distribution took months to reach the provinces.

Australian Government

The Australian Government's response was largely channelled through the Australian Agency for International Development (AusAID) (Allen 2000; see also Australia's Response to the 1997 PNG Drought by Allison Sudradjat, in these proceedings).

Australian–PNG relations were at a low ebb before the drought, due to the Bougainville conflict and Australia’s open disagreement with many national PNG Government decisions. Thus, the Australian Government saw an opportunity to show goodwill and concern to PNG during the drought.

Following a number of articles in Australian newspapers alleging deaths from starvation in PNG, PNG asked Australia for assistance to carry out an assessment of the dimensions of the food and water shortages. The Humanitarian Relief Section of AusAID was assigned the task. AusAID funded a national field assessment of food and water supplies in September and again in November (see below), then the Australian Defence Force (ADF) used Hercules and Caribou aircraft and Blackhawk helicopters to transport food. Meanwhile, PNG light aircraft operators were facing severe financial difficulties because passenger and charter flights had fallen off as villagers used their money to buy food rather than to travel. Staff of the Australian High Commission, including AusAID staff, worked extremely long days and up to seven days a week for a number of months. Without their dedication, the three national drought and frost impact assessments would not have been possible, and neither would the Australian relief program have been carried out so efficiently.

AusAID and the ADF entered into a competitive public relations exercise in the media, on television news in particular, and on the Internet, where both organisations set up web pages. By the end of the drought, the Australian and PNG public were left with no doubt that Australia had come to the rescue of PNG and had saved hundreds of thousands of people from starvation. The truth is more complicated.

Thousands of people in isolated areas, with limited cash resources of their own and few relatives living in towns and earning cash incomes, received food in a timely manner from the Australian program that they would not otherwise have received. This almost certainly reduced death rates in those areas. The PNG Government eventually bought and distributed twice the amount of food distributed by Australia. Furthermore, and most importantly, the private citizens of PNG bought and distributed 22 times more additional rice than the Australian program and 11 times as much relief rice as the PNG government program. It is not widely recognised that PNG commercial companies imported and distributed all the rice consumed during the drought, except for that provided as aid by the Japanese Government.

It is important that these facts become better known in PNG, because many citizens believe that they and their government were helpless in the face of natural disaster and administrative chaos. In fact, however, the great majority of people in PNG who needed food during the drought were ‘saved’ either by their own ingenuity and cash savings, or by their relatives and families.

Other organisations

Many other organisations were heavily involved in both drought relief and rehabilitation. Most provincial governments had a significant input (for example see *The El Niño Drought: an Overview of the Milne Bay Experience* by Allen Jonathon; and *The Experience of the 1997–98 Drought in Simbu Province: Lessons Learnt* by Edward Kiza and Mathias Kin, in these proceedings). Some of the experiences of provincial administrations have been documented (for example *Western Highlands Province 1998*). All of the major churches were involved, as were both the international and local NGOs that operate in PNG. Some of their involvement is summarised in another paper in these proceedings (*The Role of Humanitarian Organisations in PNG Drought Response* by Royden Howie). Other NGOs that do not normally operate in PNG, including *Medecins sans Frontieres*, also sent representatives to PNG. A number of people with extensive experience in famine situations elsewhere in the world participated in the impact assessment (see below) and advised local NGOs. All of the major aid donors to PNG were involved in relief and recovery operations, including Australia, the United States, Japan, New Zealand, the European Union, the World Bank and the United Nations Development Programme.

Rural villagers

In PNG, 85% of the population live in rural areas. This simple but very important statistic must not be overlooked. People affected by food and water shortages responded in a number of ways. At first they changed their diets to include more food not normally eaten in large amounts, including cassava, coconuts, mango, ferns, fig fruit, fig leaves, sea almond (*Terminalia catappa*) and tulip nuts (*Gnetum gnemon*). When these foods were depleted, they then began to eat what are commonly called ‘famine’ foods, including banana corms (the basal portion of the stem), self-sown yams, green pawpaw and *pueraria* roots. Some people moved locally, to be nearer water or to land with a higher water table. They tried to preserve planting

material by planting along river banks or in drying swamps. One of the first responses that many people made was to feed less food to their domestic livestock, especially pigs. Because of this, many pigs died from lack of food and heat exhaustion and were then eaten. People also killed their pigs in some locations, and ate or sold the meat.

There was significant migration from rural villages to other rural locations and to towns and cities. The decision to move to a particular place was made on the basis of traditional links that are used to cope with food shortages, or as to where relatives were living, including in towns. The rural to rural migration has occurred previously during subsistence food shortages in recent decades, but the large-scale movement into towns is unprecedented. In the badly frosted areas, people followed historical patterns and migrated to lower altitudes. However, in 1997, they found that conditions there were also marginal because of the drought. After relief food was provided, many moved back to their higher altitude homes.

The most important mediator of the impact of the drought was the amount of money that people had available with which to buy imported food, mainly rice and some flour. The money came from savings, the sale of crops, waged employment or small business. During 1997, rice imports into PNG increased over the predicted sales by 66,000 tonnes. Of this extra rice, the PNG Government purchased 5500 tonnes, the Australian Government purchased 2700 tonnes, the Japanese Government donated 8000 tonnes and 50,000 tonnes was sold through commercial outlets. This means that more than 75% of the extra rice imported during 1997, to make up the shortfall in food from gardens, was purchased by the people of PNG from savings or earnings (see *The Role of Rice in the 1997 PNG Drought* by Neville Whitecross and Philip Franklin, in these proceedings). A similar situation applied with flour sales, with the bulk of the extra flour purchased through normal commercial outlets (Jim Gregg, Associated Mills, Lae, Morobe Province, pers. comm. 1998). People either bought the additional food for themselves, or bought it for relatives who did not have the means to buy it for themselves.

If no food could be found and no relief food was forthcoming, then people died. Reports of deaths and symptoms of distress, fainting, vomiting and violent stomach pains received by assessment teams in the field became more common as time went on. In a number of locations where a local census had been conducted before and after the drought, there was strong evidence of a significant increase in the death

rate. This was documented for remote locations in inland Gulf Province (see *Drought, Famine and Epidemic Among the Ankave-Anga of Gulf Province in 1997–98* by Pierre Lemmonier, in these proceedings), the Lake Kapiago area of Southern Highlands Province (see *Subsistence at Lake Kapiago, Southern Highlands Province, During and Following the 1997–98 Drought* by Rebecca Robinson, in these proceedings) and the Hewa area of Southern Highlands Province (see *Impact of the 1997 Drought in the Hewa Area of Southern Highlands Province* by Nicole Haley, in these proceedings). Most credible accounts of increased death rates were recorded in isolated locations, where cash income was very limited, people had few relatives living in urban areas or with wage incomes, and there were no alternative food sources, such as coconuts, breadfruit or fish. In the central highlands, where many pigs were killed and eaten, a number of reported deaths of adults and children were associated with symptoms similar to those caused by *pigbel*, a gangrenous condition of the bowel caused by *Clostridium* toxins. This condition can be triggered by a sudden intake of meat protein by people on mainly vegetarian diets.

Assessments

Three national assessments, funded by AusAID, of the impact of the drought and frosts on food and water supplies were undertaken in September 1997, November–December 1997 and April 1998 (Allen and Bourke 1997ab; Wayi 1998; see also PNG Disaster Management: 1997–98 Drought and Frost Impact Assessment—Methods Used and Experiences by Sharryl Ivahupa; and *Personal Reflections on the Effect of the 1997 Drought and Frost in the Highlands of Central Province* by Passinghan Iguva, in these proceedings). Teams were rapidly put together, briefed and sent into the field. Reports were sent by telephone and fax to Port Moresby, where a database had been established at the Department of Provincial and Local Government Affairs. In order to assess the number of people affected, the database was based on the 1990 census divisions, and the assessment of food and water supplies was undertaken at the census division level. This was mapped using a geographic information system established during a previous project that has identified and mapped PNG agricultural systems (see *Dimensions of PNG Village Agriculture* by Bryant J. Allen, R. Michael Bourke and Luke Hanson, in these proceedings). Before they went into the field, teams were given information from this database about the agricultural systems that they would be assessing.

Team members were drawn from Department of Agriculture and Livestock (DAL) research scientists, provincial government departments, Ok Tedi Mining Limited, other agricultural institutions such as the Cocoa and Coconut Extension Agency, and a number of NGOs. The success of the assessments was an outcome of their training, professionalism, courage, determination and experience working in rural areas.

The assessments were criticised in an AusAID review of the Australian drought relief program as exaggerating the impact of the drought and frosts (Lea et al. 1999). The grounds for that judgment are unclear, except for the retrospective knowledge that PNG citizens bought most of the extra rice and flour imported into PNG in 1997. It is probable that the assessments did not take adequate account of the cash reserves or the ingenuity of village people in getting themselves through the shortages, but it is difficult to see how that could have been done at the scale at which the assessments were carried out. This review concluded that there were few, if any, deaths as a result of the drought. However, research in a number of remote locations has confirmed the evidence presented to the field teams: that is, that the death rate increased greatly in some places (see Impact of the 1997 Drought in the Hewa Area of Southern Highlands Province by Nicole Haley; Drought, Famine and Epidemic Among the Ankave-Anga of Gulf Province in 1997–98 by Pierre Lemmonier; and Subsistence at Lake Kapiago, Southern Highlands Province, During and Following the 1997–98 Drought by Rebecca Robinson, in these proceedings).

The assessment teams were troubled by how to deal with the often striking differences in the capacity between individuals and families in quite small communities to support themselves. Within a single community, some people were clearly in serious difficulties, while others appeared to be in a much better position. Thus, the overall assessment at the census division level was made to reflect the worst-affected people in the division.

However, the details of these local situations were recorded on the field forms used by the teams, together with lists of foods being eaten and the means of finding drinking water. At least one form was filled out for most census divisions in the country, and in some divisions up to four forms were completed. Some were filled in by local missionaries or other observers, since the assessment teams also distributed forms to other concerned people.

It was assumed by the coordinators of the assessments that the details on the forms would be used in

discussions with PNG and Australian officials to qualify the raw numbers of the estimated populations affected at the census division level before decisions were made about what the response should be. However, once these figures were given to the Australian relief program organisers, no further consultation took place and the decision to supply or not supply food and water were made on the crude five-point scale used in the overall assessment.

The forms also contained information on possible local resources and communications that could be used in the distribution of food, such as missions, the names of local administrators, radio facilities and airstrips to be used to get access to particular groups. None of this information was used by the relief program organisers. These field forms have been saved and copies are held within PNG. They are a rich and detailed source of information on how the drought and frost affected people at the local level.

An attempted assessment of the food shortages on the growth of children under five years old, using the 1982–83 National Nutrition Survey as a baseline, was seriously flawed by poor methodology, a lack of knowledge of the difficulties of carrying out anthropometric measurements in PNG and a lack of any recent baseline information. This survey did not take advantage of the large amount of knowledge of this subject that exists within PNG and Australia (see Some Methodological Problems with the Nutritional Assessment of the 1997–98 El Niño Drought in PNG by Robin Hide, in these proceedings).

Conclusions

The 1997 drought and associated frost had a major impact on food supply for many rural villagers and, to a lesser degree, on urban people. There are many lessons to be learnt from our combined experience during this event. We have drawn up some implications for policy and program development, as follows.

Climate and food supply in PNG

- The PNG National Weather Office must improve the quality and availability of its data.
- PNG should instigate or maintain membership of international weather organisations that monitor ENSO events. In particular, close relationships should be maintained with the Australian Bureau of Meteorology Research Centre, with a free exchange of data and professional development programs.

- PNG weather-observation stations must be stabilised and then increased in number to give good national coverage.
- An organisation within PNG (probably the National Agricultural Research Institute) should be funded to oversee the monitoring of the prices of key foods in local markets. Rises in prices can indicate a shortage in the surrounding area.
- The same organisation should bring together rainfall, temperature and food price information, possibly within a Food Insecurity and Vulnerability Information Mapping System (investigated by the Food and Agriculture Organization of the United Nations and AusAID in 1999), or something similar.

The impact

- ‘Poor’ areas, that is areas where villagers have poor access to services and markets and very low cash incomes, should be identified. Policies to assist people living in these areas should be developed.
- There should be a national roads policy. Roads already constructed should be maintained as a national priority. The temptation to build new roads into areas with low populations and difficult environments should be resisted. In many cases it is not economically feasible to improve road access, because of small population and rugged country that makes road building and, importantly, road maintenance very costly.
- Policy should stress the importance of educational and health services in such areas. A good education and good health are the best chances people in such areas will have in overcoming the disadvantages of their locations. Programs must give greatly improved support to teachers and health workers in isolated places.
- A policy on the construction and maintenance of light aircraft landing strips in such areas should be revised with the view to giving assistance in some areas.
- High value-to-weight cash crops that can be transported by air should be promoted in such areas, but government at all levels should stay out of purchasing or marketing. The involvement of private enterprise should be encouraged.

Responses by the PNG Government

- The difficulties of administration and governance under the current political reforms must be communicated to government. Of particular

importance is the inability of the national government to institute and implement national policies or to ensure that critical services such as education and health are delivered effectively across the whole country.

- NDES is being strengthened, but there remain indications that more has to be done to improve its effectiveness.
- Policies must recognise the importance of imported food in establishing food security in PNG. The great economic costs involved in becoming self-sufficient in rice and flour must also be acknowledged. The money that would be spent on becoming self-sufficient, notwithstanding the very high risk that the goal of self-sufficiency will not be achieved, could be better spent in other ways. These could include providing better health and education services in rural areas, and improving the production and marketing of locally grown fresh food, especially staple foods.
- The temptation to make political advantage out of disasters must be resisted at all levels because overall it reduces the capacity of people to cope on their own and increases their vulnerability.

Responses by the Australian Government

- AusAID must take seriously the lessons offered by the 1997 drought and frost in PNG. These include problems of how to deal with national sovereignty; and the need to use people with experience in PNG who can speak pidgin and who have a fundamental respect for PNG culture and people.
- Continued support is needed of research in agriculture and the social sciences by Australian organisations in PNG. The Australian Centre for International Agricultural Research (ACIAR) is a key organisation in this matter. ACIAR could consider widening its programs to include the relevant social sciences.
- Australian politicians and others must resist the temptation to make disasters in PNG into a public relations exercise.

Responses by rural villagers

- The ability of people to cope with extremely difficult conditions should be recognised and publicised. The people of PNG should be proud of their own efforts during 1997 and should not be left thinking that they were rescued from disaster by another country.

- The importance of imported food (in particular rice) and the logistical infrastructure associated with it must be acknowledged.
- The way in which people responded to the 1997 event should be properly documented and published. Similar information about previous events in 1982, 1972 and 1941 should be included.
- The role played by cash earnings and savings should be recognised. This has implications for policies on rural commercial and banking services; on rural telephone systems that allow rural people to communicate with family elsewhere in PNG; on cash crops; and on access to markets and services.
- The very low level of services to rural people, exposed by the 1997 drought and frosts, must not be forgotten.

The assessments

- The success of the assessments depended critically on the availability within PNG of well-educated, professional agricultural and social scientists, with experience in rural areas. Policies that continue to train young PNG people to top professional levels and to give them solid field experiences are very important. Some means must be found to fund the universities, or to train PNG scientists overseas, and then to bring them into organisations that operate at high levels of professionalism and competency in rural areas.
- The 1997 assessment was based on a good knowledge of PNG agricultural systems and some knowledge about what had happened in similar events in the past. This knowledge should be brought together and be made widely available. In 1997–98, many people involved in assessing the impacts and providing relief and rehabilitation drew on the published experiences during earlier climatic extremes, especially those in 1982 and in 1972. The 17 papers published in this section are a contribution towards improving responses to future climatic extremes for the welfare of all Papua New Guineans.

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